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Prevalence and risk factors of hypertension among Mizo population: a population-based epidemiological study from North East India

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The aim of the present study was to assess the prevalence and risk factors of hypertension (HTN) in the Mizo population from Mizoram, North East India. We carried out a cross-sectional study among urban and rural populations. Socio-demographic and clinical information, including blood pressure and anthropometric measurements were collected by house-to-house visits and recorded in a predesigned and pretested questionnaire. The study included a total of 12,313 subjects (male: 5707, female: 6606) from urban (n = 5853) and rural (n = 6460) localities. All information was analysed using the statistical package SPSS-17. Prevalence of HTN was 15.9% with significant urban–rural (18.9% versus 13.2%, $P < 0.001$) and gender variation (18.2% versus 13.9%, $P < 0.001$). Logistic regression analysis in the overall (rural and urban) model was carried out, which revealed that age, extra salt (salt as a side dish), tuibur (a special form of tobacco), high BMI and sedentary lifestyle were independently associated with HTN ($P < 0.05$). This study has public health implications, as community-based lifestyle intervention of these risk factors may alleviate the burden of HTN.

Keywords: Dietary salt, epidemiological study, hypertension, prevalence and risk factors.

HYPERTENSION (HTN) now seems to contribute significantly to the global burden of several non-communicable diseases and mortality[1]. It has been reported that HTN contributes to the highest percentage of attributable death (~13) and is the foremost cause of disability accounting for more than 4.4% of global disability-adjusted life years (DALYs) in middle-aged and old-aged people[2]. India is undergoing a rapid economic growth with changes in demographic and cultural norms, and lifestyle-related behaviours which have had a large impact on the health profile and epidemiological transition. This shift or transition may be associated with the emergence of

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non-communicable diseases such as HTN and its associated complications[3].

North East India is undergoing socio-economic and demographic transition with marked rise in the prevalence of HTN during the last few decades[4–6]. Among the three population groups, viz. Assamese, tea-garden workers and Mizos, the Mizos revealed the lowest prevalence of HTN in a pilot study conducted by Hazarika *et al.*[4] in 2000. Subsequent large population-based epidemiological studies carried out among Assamese and tea-garden workers indicated a marked rise in the prevalence of HTN[5]. Hence it is important to carry out epidemiological study among Mizo subjects to understand the prevalence of HTN and identify risk factors to initiate intervention strategies for its control. With this background the present study was carried out in Mizoram, North East India, representing both urban and rural populations.

The cross-sectional study was carried out in Aizawl district of Mizoram. For urban sampling, 6 out of 69 wards were selected using probability proportional to size (PPS) method. For rural areas, villages were the sampling units. A rural block was selected at random for rural sampling. The villages of the entire block were listed and stratified according to population size, e.g. 500–1000, 1000–1500, etc. and 14 villages were selected by PPS. Households from these wards/villages were selected by systematic random sampling and all individuals aged 18 years and above providing informed verbal consent were included. Detailed methodologies are described elsewhere[7].

A total of 12,313 (urban: 5853, rural: 6460) subjects were interviewed personally by trained staff, and socio-demographic and clinical information were recorded in a predesigned and pretested questionnaire. Blood pressure (BP) was recorded using mercury sphygmomanometer. For all subjects, BP was recorded in the sitting position, with feet on the floor, arm supported at heart level, with appropriate-sized cuff and after the subject had rested for at least 15 min. Participants who had eaten, smoked or consumed alcohol were allowed to rest for 1 h before recording their BP. Three readings of BP were taken to strengthen the accuracy of measurements. If the difference among the readings was more than 5 mm Hg, the extreme value was discarded and mean of the remaining two readings was taken for analysis. Otherwise, the mean of three readings was considered for data analysis. HTN was defined according to JNC VII criteria, viz. normal (SBP < 140 mm Hg and DBP < 90 mm Hg), or hypertensive (SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg or if he/she is taking antihypertensive medication)[8].

Anthropometric measurements such as height and body weight were made using anthropometric rod and platform balance (SECA) by trained technicians following standard techniques. Waist and hip circumference was measured to the nearest 0.5 cm. Body mass index (BMI) was calculated using the following formula: weight in kg/height in metre squared.

All information was analysed using statistical package SPSS-17. BP measurements (mmHg) for the study sample are described as mean (± standard deviation). Chi-square test was used for the categorical variables. Adjusted odds ratio (OR) and 95% confidence interval (CI) were calculated using univariate and multivariable analysis. In the present study HTN status was defined as dichotomous outcome, while age, sex, marital status, extra salt intake, alcohol intake, smoking, tuibur (a special form of tobacco extract) and BMI were defined as predictor variables. *P*-value less than or equal to 0.05 was considered statistically significant. The study was approved by the Institutional Ethics Committee of Regional Medical Research Centre, Dibrugarh, Assam.

The mean age of the study subjects was 41.16 ± 16.7 and 38.3 ± 16.1 years for rural and urban populations respectively. Male participation for this study was 46.7% from rural and 46% from urban areas. Analysis of the data revealed that salt as a side dish was taken by 79.2% of the rural and 89.3% of the urban population. Habit of smoking was significantly higher among the rural (41.8%) than urban population (34.6%). Mean systolic and diastolic BP of the subjects was 119.1 ± 17.5 and 77.1 ± 10.2 mm Hg respectively. Older subjects had higher mean BP. Prevalence of HTN was 15.9%, which showed significant gender variation (18.2% versus 13.9%, $P < 0.001$). Mean BP (SBP: 118.9 ± 17.9 mmHg versus 119.3 ± 17.1 mmHg; DBP: 76.9 ± 10.2 mmHg versus 77.3 ± 10.1 mmHg) and prevalence of HTN (18.9% versus 13.2%, $P < 0.001$) were significantly higher in urban than rural subjects.

We carried out logistic regression analysis of our dataset in overall (rural and urban subjects) and location-specific models. In both the models, male gender, older age, higher educational status, physical inactivity, extra salt, alcohol and tuibur consumption, and high BMI were found to be independently associated with HTN.

The prevalence and risk factors of HTN has been revealed in a representative Mizo population. Prevalence of HTN (15.9%) as observed in the present study was lower compared with earlier Indian studies[9–16]. However, prevalence was higher compared to a study conducted in the slums of Delhi[17], where a value of 12% was recorded. Differences in the population groups, including age of the participants, definition of HTN used and other socio-demographic characteristics might be the reason for the differences in HTN prevalence in these studies. The present study revealed significant gender and rural–urban difference in the prevalence of HTN. A recent meta-analysis also revealed such urban–rural difference (33% versus 25%)[18].

Older age and high BMI were found to be significant risk factors for HTN, which was also observed in an earlier study[19]. Consumption of extra salt as a side dish, tuibur and sedentary lifestyle were other risk factors for HTN identified in the study. Our findings are in conformity

with those of Devi *et al.*[20]. Physical inactivity identified as a risk factor for HTN was also confirmed in a meta-analysis of prospective cohort studies[21].

HTN leads to significant cardiovascular morbidity and mortality[22]. HTN is a preventable and treatable disease and can be managed by adopting healthy diet, lifestyles, alleviating risk factors with or without anti-hypertensive medications[8]. The World Health Report 2002 revealed that cardiovascular diseases will be the major cause of death and disability by 2020 in India. It is predicted that about 2.6 million Indians will die due to coronary heart disease by 2020 (ref. 23). The present study revealed significant rise in the prevalence of HTN since the earlier study by Hazarika *et al.*[4]. In this context, the risk factors for HTN identified in the present study must be targeted for initiating community-based intervention programmes for its control and prevention. Further, information, education and communication activities should be initiated to increase awareness about HTN and its complications.

The present study has some limitations. Measurement of BP was done at a given point of time instead of repeated measurements in different settings and time intervals. Overestimation of HTN due to white-coat effect cannot be ignored. In spite of these limitations, this study has public health implications and has assessed prevalence of HTN and its risk factors in a large representative Mizo population.

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