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Prevalence and Associated Risk Factors of Hypertension in Rural and Urban Areas of Punjab: A Cross Sectional Study

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ABSTRACT

Hypertension is the most common disease seen in primary care and leads to myocardial Infarction, stroke, renal failure and death, if not detected early and treated appropriately. Previous studies have shown higher prevalence of Hypertension in adult urban population. The present study has been planned to compare the prevalence of hypertension among the urban and rural population of ludhiana city of punjab. The study was executed in Ludhiana including 992 samples with almost equal distribution in urban and rural areas. Blood pressure was recorded as per guidelines of JNC 7. Average three readings were recorded at 5 min interval. Hypertension was diagnosed if systolic BP more than or equal to 140 mm Hg and diastolic BP more than or equal to 90 mm Hg. Total subjects enrolled was 992-492 in rural area and 500 in urban area. In rural area out of 492-248 (50.4%) were females and 244 (49.5%) were males. While in urban area total subjects were 500, out of which 265 (53%) were females and 235 (47%) were males. Overall prevalence of total hypertension in Ludhiana was 62%, out of which hypertensive was 32% and pre-hypertensive was 39%. Out of 32-22 % were aware of their hypertensive status and 12 % were new hypertensive. Prevalence of hypertension was 34 % in rural area and 35% in urban area. Total 21 % subjects from rural and 24% subjects from urban were aware of their hypertensive status. Awareness level was higher in urban area. Number of known hypertensives were higher in urban area (24%) than rural area (21%). However, new cases of hypertension observed were higher in rural area (13%) than urban area (11%). Prevalence of hypertension in punjab is higher than other states of India and is in rising trend. The prevalence of hypertension and its risk factors in rural area almost approaching or exceeding the prevalence seen in urban area. Worrisome finding in the present study is high prevalence of pre-hypertension.

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Key Words
Hypertension, risk factors, diagnosed, myocardial

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INTRODUCTION

Hypertension or elevated blood pressure is a silent and invisible killer that rarely causes symptoms and it is a risk factor for coronary artery disease, heart failure, cerebrovascular disease and chronic kidney disease. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart diseases deaths in India[1,2]. In 2016, an estimated 41 million deaths occurred due to non-communicable diseases (NCDs) accounting for 71% of overall total of 5 million deaths[3,4]. An estimated 1.13 billion people worldwide have hypertension, two-thirds of them are living in low- and middle-income countries[5]. 1-4 men and 1-5 women had hypertension. In 2019, hypertensive heart disease was the main cause of 1.16 million deaths and 21.5 million Dalys annually[4].

Global burden of diseases study reports that in India, Hypertension associated mortality and morbidity is one of the highest in the world and is increasing[6,7]. The prevalence hypertension was highest in punjab, Kerala and Tamil Nadu (which are in high epidemiological transition level state group)[8]. ICMR india study reported hypertension among 26.3 % of population[9]. Recently a study done in Chandigarh showed the prevalence of Hypertension was 40.1% and prehypertension was 40.8%[10].

According to the studies it was observed that hypertension as well as its risk factors are having an increasing trend even in rural areas of punjab. Most of studies conducted on prevalence hypertension in north India were done in union territory chandigarh which does not truly represent population of punjab[9]. In Punjab increase in prevalence of hypertension is attributed to social and economic and its consequence including change in dietary habits, physical inactivity and increased obesity and diabetes. Probably this the first study in punjab which is gives an estimate of burden of hypertension according to new classification of 2017 AHA/ACC guidelines. Therefore, this study was conducted in urban and rural population of district Ludhiana, punjab with the following objectives.

- To study the prevalence of hypertension
- To compare the prevalence of hypertension in urban and rural population
- To study the relationship of various risk factors with hypertension

MATERIALS AND METHODS

Study design and sampling: The present study was a community based cross sectional study was conducted from 1st January 30th May 2017-2018, on adults above 20 years, residing in urban and rural areas of district Ludhiana. List of areas to be studied was selected by random sampling. Study subjects were selected by systematic random sampling. Assuming a non-response of 20%, this is added to the sample which becomes a sample size of 461. Therefore, 475 subjects were included in each group i.e. 475 for urban population and 475 in for rural population. In urban area, three areas were selected and 709 houses were visited. Total of 644 subjects were interviewed and 144 subjects were excluded. In rural area, three villages were selected by random sampling. Among these 1000 houses were visited and 563 subjects were interviewed out of which 71 subjects were excluded.

Method of data collection: Area wise list of adults over 20 years was prepared. In the selected clusters, streets were randomly selected by using currency note method considering the last digit of currency note. All consecutive houses on the selected street were visited till required numbers of study subjects were obtained. If the house was locked and and/or subject was not willing to participate, next immediate house was selected. People enrolled were informed about the survey and its benefits. Confidentiality of information was assured. Informed consent was taken from all the study subjects in the language that the subject understood i.e. English, Punjabi or Hindi. All adults fitting into the study criteria were examined and interviewed using a structured questionnaire. Individuals who were below 20 years, interstate migrants, pregnant women and individual who were not available at time of visits or not willing were excluded. Socio-demographic profile was included in section I, non-modifiable and modifiable risk factors were included in section II and III respectively. Section IV included anthropometric measurements.

Blood pressure was measured using calibrated aneroid manometer, according to seventh report of joint national committee on prevention, detection, evaluation and treatment of high blood pressure. (JNC 7 guidelines)[11]. Two blood pressure readings were taken 5 min apart and average of two readings were taken as final BP. Height, weight and waist circumference were measured using standardized instruments which were calibrated routine throughout the survey. For subjects whom BP was in hypertensive range, next day again BP was checked and average BP was taken as final BP. Waist circumference was measured at the approximate midpoint between the lower margin of last palpable rib and top of the iliac crest. Hip circumference was taken around the widest portion of buttocks. Height and weight were measured in barefoot with light clothing. Physical activity was assessed by physical activity index[12]. Stress was calculated using presumptive stress full life events scale (PSLES)[13].

Operation definitions: According to seventh report of Joint National Committee (JNC VII) on prevention, detection, evaluation and treatment of high blood pressure, hypertension is defined as systolic blood

Table 1: Operation definitions

SBP (mm Hg)		DBP (mm Hg)	JNC 7 (2003)	2017 ACC/AHA
≤120	And	<80	Normal BP	Normal BP
120-129	And	<80	Prehypertension	Elevated BP
130-139	Or	80-89	Prehypertension	Stage 1 hypertension
140-159	Or	90-99	Stage 1 hypertension	Stage 2 hypertension
≥160	Or	≥100	Stage 2 hypertension	Stage 2 hypertension

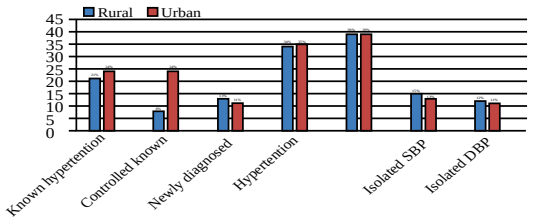

Fig 1: Prevalence of hypertension in rural and urban areas

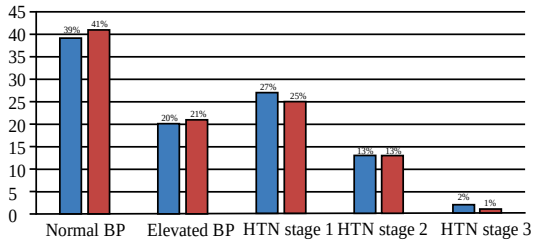

Fig 2: Prevalence of hypertension

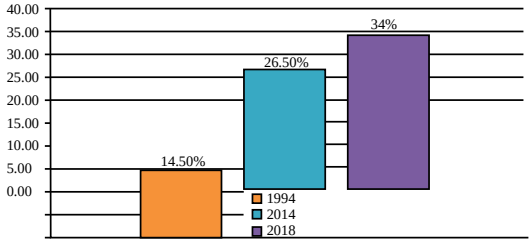

Fig 3: Trends of the prevalence of hypertension in rural area of district Ludhiana

pressure ≥140 mm of Hg /or diastolic blood pressure ≥90 mm of Hg. Systolic blood pressure 120-140 mm of Hg and/or diastolic blood pressure between 80-89 mm of Hg considered to be prehypertensionstage[11]. Blood pressure in present study was taken according to 2017 American college of Cardiology and American heart association for detection, prevention, management and treatment of high blood pressure (ACC/AHA)[14], in which hypertensive is defined as Systolic blood pressure equal to above 130 mm Hg and diastolic BP equal to or above 80 mm Hg Table 1.

Waist hip ration in males >0.90 and in females >0.85 was considered as high. Body mass Index (BMI) ≥25 kg m^2 was taken as overweight. Salt intake was calculated by salt in gms consumed by family per month divided by family members. Salt consumption >5gm day was taken as high salt intake. Current smokers were defined as those who self-reported of currently smoking cigarettes or Beedi and used it on daily basis anytime in

Last 12 months. Current alcohol drinkers were defined as those who self-reported consuming alcohol for more than 10 days per month, anytime in the past 12 months. Education status is divided into, up to primary school, middle class completed, high middle class completed and above graduation. Diabetes was diagnosed on the basis of history of DM. Hyper cholestrolemia individuals were confirmed by interview or previous investigation or prescription. Stress was calculated using PSLES scale, >45.01 considered as stressful. Socioeconomic status was calculated using Udai Pareek's revised scale in rural area in which for the analysis of data, upper class and upper middle class merged together to form upper class and lower middle class and lower class merged together to form lower class and middle class kept as middle class.

Socioeconomic status was calculated using Kuppuswami scale in urban area. For the analysis of data from present study upper class and upper middle class merged together to form upper class and upper lower class and lower class merged together to form lower class and lower middle class kept as middle class. Physical activity was calculated using physical activity index (PAI) and score b/w 24-28.9 were considered as mild physical activity b/w 29-36.9 were considered as moderate and >36.9 were considered as heavy physical activity.

The study was duly approved by the Institutional Ethics Committee of Dayanand Medical College and Hospital, Ludhiana, Punjab. Subjects were included in the study after obtaining. Written informed consent in the language that the subject understood i.e. English, Punjabi or Hindi.

Data analysis: The data collected was tabulated in MS Excel Spreadsheet and analysed by using appropriate statistical techniques in MS Excel, SPSS version 20 (statistical package for social science) and Epi-Info version 7. The association of Hypertension with its risk factors was determined by descriptive statistics, Chi Square test and other statistical tests. The probability value (p-value) of less than 0.05 was considered statistically significant.

RESULTS

Total Subjects enrolled was 992-492 in rural area and 500 in urban area. In rural area out of 492-248 (50.4%) were females and 244 (49.5%) were males. While in urban area total subjects were 500, out of which 265 (53%) were females and 235 (47%) were males.

Overall prevalence of hypertension: Overall prevalence of total hypertension in Ludhiana was 62%, out of which hypertensive was 32% and pre-hypertensive was 39%. Out of 32-22% were aware of their hypertensive status and 12% were new hypertensive. Isolated Systolic hypertension observed in 28% subjects while isolated diastolic hypertension was observed in 23% subjects. According to 2017 ACC/AHA classification 20% subjects were in elevated BP category and 40% subjects were in hypertension category.

Rural area: In rural area, 91 (18%) subjects were found to be hypertensive and 207(42%) subjects were pre-hypertensive with total hypertensive 298 (61%) subjects. In rural area, out of known hypertensive i.e. 101 (21%) only 8 (8%) subjects were having well controlled Blood pressure, 53 (52%) were pre-hypertensive and 40 (40%) were having poor control of BP and still hypertensive. In rural area total number of new cases of hypertension which we identified on examination were 51 (13%). Isolated systolic and isolated diastolic hypertension was observed in 15% and 12% subjects respectively. According to 2017 ACC/AHA classification 20% subjects were in elevated BP category and 42% subjects were in hypertension category.

Urban area: In urban area, 82 (16%) subjects were found to be hypertensive while 200 (40%) subjects were pre-hypertensive with total hypertensive 282 (56%) subjects. In urban area, out of known hypertensive 121 (24%) 29 (24%) subjects were having well controlled Blood pressure, 51 (42%) were pre-hypertensive and 41 (34%) were still hypertensive. In urban area total number of new cases of hypertension identified were 41 (11%). Isolated systolic and isolated diastolic hypertension was observed in 13% and 11% subject's respectively. According to 2017 ACC/AHA classification 21% subjects were in elevated BP category and 38% subjects were in hypertension category.

Comparison of rural and urban area: Prevalence of hypertension was 34% in rural area and 35% in urban area. Total 21% subjects from rural and 24% subjects from urban were aware of their hypertensive status. Awareness level was higher in urban area. Number of known hypertensives were higher in urban area (24%) than rural area (21%). However, new cases of hypertension observed were higher in rural area (13%) than urban area (11%). While newly diagnosed pre-hypertensive subjects were equal in both area (39%).

Risk factors of hypertension: In our study age was divided in three groups, 20-60 and >60 years. Prevalence of hypertension was found to steadily increase with age. In 20-40 years of age group prevalence was 40% both in rural and urban area, which gradually increased to 75% and 79% respectively in age group 40-60 years and further increased to 93% in both area in age group of >60 years. The prevalence of hypertension among males was 66% in rural and 63% in urban, while in females 55% in rural and 50% in urban. 65% of UMC in rural area and 68% of UMC in urban area were hypertensive as compared to 44% LM in rural area and 56% LM in urban area were hypertensive. In urban area education status was better than rural area with 24% in rural and 40% subjects in urban were graduated and above. Prevalence of hypertension was higher with lower education status in both areas. Hypertension was observed in 42% subjects in rural and 48% subjects in urban area who were post graduate in qualification. History of hypercholesterolemia was associated with higher prevalence of hypertension. 94% subjects in rural area and 85% subjects in urban area who were hypertensive had history of hypercholesterolemia. 77% subjects in rural and 53% subjects in urban area who were hypertensive had F/H/O Hypertension. Self-reported Diabetes was 11% in urban area and 9% in rural area. Among diabetics 58% subjects in rural and 63% in urban area were hypertensive. Alcohol use was more prevalent in rural area than urban, i.e. 38% male in rural and 21% male in urban area were consuming alcohol. Hypertension was observed in 70% subjects in rural area and 84% subjects in urban area who consume alcohol. Smoking was observed only in 3% of subjects in both rural and urban area. 75% subjects in rural area and 79% subjects in urban area who smokes were hypertensive. Obesity was higher in rural area with 55% subjects and 43% subjects in urban area were having BMI >25. Among obese subjects 75% in rural and 70% in urban were hypertensive. High salt consumption was observed in 94% subjects of rural and 84% subjects in urban area. In rural area stress was higher with 75% subjects were in stress while in urban area 72% subjects were in stress. Among stressed individuals 65% in rural and 64% in urban area were hypertensive. In rural area, 76% subjects were having mild physical activity and 23% subjects were having moderate physical activity. While in urban area 52%

subjects having mild and 48% subjects having moderate physical activity.

DISCUSSION

Results of the present study revealed that Hypertension is assuming a shape of epidemic in Punjab. Key findings in our study are-prevalence of hypertension in punjab is higher than other states of India and is in rising trend. The prevalence of hypertension and its risk factors in rural area almost approaching or exceeding the prevalence seen in urban area.

Worrisome finding in the present study is high prevalence of pre-hypertension. Poor control of hypertensive individuals seen which is a matter of concern. This is the first study in India which given prevalence of hypertension according to 2017 AHA/ACC guidelines of Hypertension.

In our study, we have observed that total prevalence of hypertension (hypertensive+ prehypertensive) in district Ludhiana was 62% in both rural and urban area, which very high and alarming. New classification given by ACC/AHA further increased the magnitude of hypertension by decreasing the hypertension limit to >130-80 mm HG. According to this definition burden of hypertension is 40%, which 8% higher than the burden according to JNC 7 classification (32%). China shares similar demographic trend as India. According to a 2019 population-based study done in China by Xing *et al.* it was reported that prevalence of hypertension is more in rural in comparison to urban region (rural 59% vs urban 50%). Hence, convergence in prevalence of urban and rural population can be seen in most emerging economies[15].

Prevalence of hypertension was 34% in rural area and 35% in urban area and prehypertensive were 39% in both rural and urban areas. Among study participants 21% subjects from rural and 24% subjects from urban were aware of their hypertensive status. Awareness level was higher in urban area. Which also means that previous prevalence of hypertension was higher in urban area (24%) than rural (21%). These results were comparable to the rates obtained by Gupta *et al.* in his study titled "trends in hypertension epidemiology in India" where the prevalence of hypertension has been reported to range between 20-40% in urban and 12-17% among rural adults[16]. In rural area, 21% were known hypertensive, out of which only 8% were having controlled blood pressure while 40% still having hypertensive. While in urban area out of 24% known hypertensive and 24% were having controlled BP and 34% still hypertensive and. Which suggest very poor control of BP in rural area. Similar observation was seen in Anchala et al. study in which only one-tenth of rural and one-fifth of urban Indian hypertensive population have their BP under control[17].

In present study, new cases of hypertension found was 12-13% in rural and 11% in urban. This observation shows that prevalence of hypertension is rising in rural area. Similar observation was given by Gupta *et al.* in "Convergence in urban-rural prevalence of hypertension in India" in which epidemiological studies from India in the last twenty years (1995-2015) have shown that prevalence of hypertension in urban locations has stabilized to about 25-30% but it has increased in rural populations from 15-25%[18].

In present study this urban-rural convergence of hypertension is very well proved. As previous prevalence of hypertension was higher in urban area (24%) than rural area (21%) but new cases of hypertension which we identified was higher in in rural area (13%) than urban area (11%). The reason of this urban-rural convergence of hypertension in India is due to rapid urbanization of rural populations with consequent changes in lifestyles (sedentariness, high dietary salt, sugar and fat intake) and increase in overweight and obesity[18]. Regarding the risk factors of hypertension similar results was observed in present study. Previously two studies were done in the same rural area for identification of risk factors of CAD. In 1994 a study by done by Wander *et al.*[19] showed the prevalence of hypertension in same rural area of Ludhiana was 14.5% and of diabetes 4.7% and obesity 16.6%. In 2014 a study was done in same rural area by Goyal *et al.*[20] in which change in prevalence of CAD and risk factors over 20 years in rural area was studied. It was shown that prevalence of hypertension increased from 14.5-26.5% over period of two decades. The present study conducted in 2018 showed prevalence of hypertension in rural area to be is 34%. There was significant increase in prevalence of other risk factors like Diabetes mellitus (4.7-9.7%) obesity (16.6-35.5%) and hypercholesterolemia (7-9.6%) and sedentary lifestyle in same rural area over 20 years. These findings suggest that rural population is also undergoing lifestyle transition due to socioeconomic growth and adopting urban lifestyle without migration to urban areas.

Bishav Mohan *et al.* study revealed the prevalence of sustained hypertension among rural and urban adolescents of Ludhiana was 5.7% and 8.4% in 2004 respectively and obesity in rural and urban children was 2.7% and 11% in 2017 respectively. This study showed rising trend of hypertension in adolescents from 2.6-5.7% in rural and from 6.7-8.4% in urban area. There was marked rise in hypertension in rural area. So our adolescent population in rural area is also at high risk[21,22]. Detection of hypertension during childhood is of potential value in identifying those, who are at

increased risk of primary hypertension as adults.

Worrisome finding in the present study is high prevalence of pre-hypertension (39%). Persons with prehypertension have greater risk of developing hypertension and are also associated with increased risk of major cardiovascular events[23,24]. In the present study we combined prehypertension and hypertension in hypertension category to know the exact burden of hypertension. So that the excess risk associated with prehypertension and progression to hypertension can be prevented by reducing BP through non pharmacological (dietary modification, weight loss, reduced salt intake, regular physical activity and moderate alcohol intake) and pharmacological intervention (if no pharmacological measures fail to control BP) as recommended by JNC8 guidelines. The JNC 8 also recommends routine blood pressure measurements at least once every two years for adults with prehypertension. In present study we found increasing age group to be an important non modifiable risk factor for the development of hypertension. In both rural and urban areas prevalence of hypertension was found to increase steadily with age. A sharp increase in hypertension prevalence was observed in 4-6th decade. Several studies have consistently demonstrated positive relation between age and hypertension. Pre-hypertensive Subjects who are above 40 years of age should be regularly monitored for early detection of hypertension. In all the government and private organisation annual check-up of all the employees of BP should be mandatory.

In the present study, we found that prevalence of hypertension was more in males than females both in rural and urban areas. A large number of epidemiological studies. Have inferred that prevalence of hypertension is more in males as compared to females. In both the areas, greater prevalence of hypertension was observed in higher socioeconomic class (SEC) groups. SES was higher in rural area as compared to urban area. In both area greater prevalence of hypertension was observed in higher SEC. Prevalence of hypertension was higher with lower education status in both areas. Education status observed in present study was lower in rural area, which might be one reason of increased prevalence and poor control of hypertension in rural area. Also, by improving awareness and education status, modifiable risk factors like obesity and dietary habits, alcohol and stress can be reduced in rural areas. History of hypercholesterolemia was associated with higher prevalence of hypertension. Prevalence of hypercholesterolemia was increased from 7-9.6% over two decades in same area[20].

Self-reported Diabetes was 11% in urban area and 9% in rural area. In Abhishek et al. study prevalence if Diabetes mellitus in rural area increased from 4.7-9.7% over two decades. in the present biochemical test was not done for diabetes. Identification of undiagnosed diabetes mellitus is required, because we have seen that diabetic patients have more prevalence for hypertension.

Obesity was higher in rural area with 55% subjects and 43% subjects in urban area were having BMI >25. Among obese subjects 75% in rural and 70% in urban were hypertensive. In Mohan *et al.* prevalence of obesity (defined as BMI >27 in man and BMI >27 in women) 16.6% in 1994 and 35.5% in[22]. In our study prevalence of obesity was 55% in rural area (BMI >25). In the current study prevalence of obesity was higher than most other studies from India, even for urban area. In the same geographical area obesity is rising even among adolescent's population as documented by Bishav Mohan *et al.*[21] study, in which obesity in rural school children of Ludhiana, increased from 2.3-11% while in urban school children there is reduction of obesity from 3.6-2.7%.

High salt consumption was observed in 94% subjects of rural and 84% subjects in urban area. Excessive salt intake (>2g day) is an important cause of high blood pressure[25]. Who recommended salt reduction as "best buy" recognizing as one the most cost-effective approach to prevent NCDs[26]. In rural area stress was higher with 75% subjects were in stress while in urban area 72% subjects were in stress.

Surprisingly sedentary lifestyle was more prevalent in rural area than urban area. In rural area, 76% subjects and 52% subjects in urban area having mild physical activity. Which might be reason for high obesity among rural area. In our study we have seen that risk factors for hypertension like, obesity, sedentary lifestyle, high SES, high salt intake, high level of stress, alcohol intake, hypercholesterolemia and low literacy rate was seen more in rural area, which results in higher prevalence of hypertension in rural area.

The difference in hypertension prevalence noted in our study could be explained by the socioeconomic condition, risk factors and quality of healthcare services provided. Rural parts of India have lower rates of literacy and wider disparity in access and quality of health services as compared to urban area. Lifestyle changes like harmful dietary habits, alcohol use and sedentary lifestyle occurring because if the results of present study show poor association of hypertension with health care availability. This suggest that primary healthcare system in our country needs to be significantly improved for better hypertension screening and control. The newly recommended blood pressure treatment goals to <130-80 mm Hg pose an enormous challenge and it has further

increased the disease burden. The study highlights a significant burden of undiagnosed cases of hypertension in the community. This indicate there is need of systematics screening and awareness program to identify hidden cases of hypertension, early recognition, early initiation of non-pharmacological and pharmacological measures and regular follow up is the key to prevent hypertension related mortality and morbidity.

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