ORIGINAL ARTICLE

PREVALENCE AND CORRELATES OF HYPERTENSION IN THE SLUM POPULATION OF SURAT CITY

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ABSTRACT

Background: High prevalence of hypertension has been reported in certain recent studies in India. However, information regarding prevalence of hypertension and its associated factors are scanty.

Methods: By the stratified random technique one thousand four hundred forty one men and one thousand seven hundred thirty nine women, above 30 years of age and from slum area of Surat city were selected. Personnel interview, anthropometric measurement and blood pressure measurement were carried out. JNC VII criteria were used to define hypertension.

Results: Prevalence of hypertension was found to be 33.3%. More than 20% are already aware of their hypertension status among the total patients with hypertension. By using backward elimination method of multiple regression BMI, high salt intake, advancing age and waist–hip ratio were found to be associated with hypertension. Multivariate analysis established that in comparison to male, female had higher risk of hypertension.

Conclusion: In the slum population of Surat city prevalence of hypertension is high. Primary preventive programme like lifestyle modification and exercise crucial along with secondary preventive efforts like screening and treatment are necessary to tackle the burden of hypertension and cardio vascular diseases.

Keywords: Hypertension, urban area, epidemiological factor, JNC VII, blood pressure

INTRODUCTION

Hypertension is a major cause of morbidity in developing countries which are in a state of epidemiological transition.[1] Hypertension, physical inactivity, increased level of blood lipids, obesity and faulty dietary habits are the primary risk factors for cardiovascular morbidity.[2] Hypertension has been shown to be a major risk factor not only for cerebrovascular morbidity and mortality but also for cognitive impairment and dementia.[3] A high prevalence of hypertension in both rural and urban areas of India has been reported in recent studies.[4,5]

Surat, a western city of India, has diverse ethnic groups with distinct cultures.[6] In the past few decades, the traditional dietary pattern has changed and their level of physical activity has also got modified. There are little epidemiological data to identify the factors responsible for cardiovascular disease in the population of Surat. We studied the prevalence of hypertension and the risk factors associated with it in the Surat city.

METHODOLOGY

Study area and study population

Five zone and five ward from each zone were selected by the stratified random technique. The sample size was determined on the basis of a prevalence of 11.8% determined in a pilot study (The JNC-VII criteria were used for diagnosing hypertension in the pilot study). Individuals >30 years of age were included in the study. Pregnant women, severely ill and bedridden elderly people were excluded from the survey. A total of 3180 individuals (1441 men and 1739 women) were interviewed and examined. The response rate was 80%–90% in the different study areas.

The participants were interviewed according to a specially designed, pretested questionnaire. Information was collected on sociodemographic variables as well as dietary habits such as history of extra salt intake (used as a side dish) and smoking (those who smoked daily were categorized as regular smokers while those who did not were categorized as occasional smokers). A history of hypertension as well as treatment for hypertension and other related diseases was also obtained.

The institutional ethics committee cleared this study and prior informed verbal consent of all the participants was obtained. The height, body weight, waist and hip circumferences of the subjects were measured using the standard protocol. The body mass index (BMI) and waist–hip ratio (WHR) were calculated.[7]

A temporary clinic was set up daily for 10–15 houses to avoid a long walk by the subjects. The blood pressure was measured by two doctors using a mercury column sphygmomanometer by a standardized technique in the sitting posture after the subject had rested for at least 15 minutes. It was recorded in the right arm using a cuff of standard size with the instrument at the level of the subject's heart. Three readings were taken at intervals of 10–15 minutes for each subject. Participants who had eaten, smoked or had had alcohol were made to rest for one hour before recording the blood pressure. The average of the three readings was used for data analysis. Whenever a high blood pressure was recorded, the reading was rechecked on the next day in the same manner. The average of the rechecked record was used for analysis. The same team of doctors recorded the blood pressure throughout the study. Hypertension was defined as systolic blood pressure (SBP) ³140 mmHg and/or diastolic blood pressure (DBP) ³90 mmHg or those on treatment with antihypertensive medication (Seventh Joint National Committee on prevention, detection, evaluation and treatment of hypertension; JNC-VII).[8]

All statistical analyses were performed using the Epi Info 6 and SPSS version 11.0 software. A p value <0.05 was considered significant.

RESULTS

The majority of subjects (67.5%; n=3180) had received primary education or more. While 78.8% of them were married, 13.9% were either widows or widowers. The habit of consuming extra salt as a side dish was present in 54.2% of the subjects. Of the subjects, 12.5% were smokers; 37.1% were underweight (BMI <18.5), 6% were overweight (BMI: 25–29.9) and only 0.9% were obese (BMI >30). The WHR was <0.9 in 60.8% of the subjects.

The age-adjusted mean SBP was 135.5 mmHg (95% CI: 134.6–136.5) in men and 137.1 mmHg (95% CI: 136.0–138.1) in women, and this difference was significant (p=0.03). The age-adjusted mean DBP was 83.6 mmHg (95% CI: 83.1–84.1) in men and 83.6 mmHg (95% CI: 83.0–84.1) in women, and this difference was not significant (p=0.97; Table 1).

Table 1: Mean blood pressure levels according to age group and gender

Age group (years)	Sex	n	Systolic	Diastolic
30–39	Men	500	127.4 (12.5)	80.4 (8.0)
	Women	771	127.3 (16.1)	79.6 (8.9)
40–49	Men	332	132.8 (18.3)	83.2 (10.6)
	Women	405	135.3 (20.0)	83.5 (10.9)
50–59	Men	267	136.0 (18.2)	84.0 (9.6)
	Women	269	138.8 (21.2)	84.3 (10.4)
³60	Men	342	146.0 (23.9)	86.7 (12.0)
	Women	294	146.8 (26.2)	86.8 (12.2)
All age groups	Men	1441	134.6 (19.4)	83.2 (10.2)
	Women	1739	134.2 (21.1)	82.5 (10.7)

The overall prevalence of hypertension in the subjects was 33.3% (95% CI: 31.3–34.7); 33.2% in men and 33.4% in women. There was a significant increase in the prevalence of hypertension with increasing age in both sexes. The categorization of subjects according to the JNC-VII criteria is shown in Table 2.

Table 2: Categorization of subjects according to the JNC-VII criteria

JNC-VII category (BP in mmHg)	Men (n=1441)	Women (n=1739)	Total (n=3180)
Normotensive			
Optimal (SBP <120 and DBP <80)	158 (10.9)	251 (14.4)	409 (12.9)
Normal (SBP <120–129 and DBP <80–84)	357 (24.8)	434 (25)	791 (24.9)
Total	515 (35.7)	685 (39.4)	1200 (37.8)
High-normal (SBP 130–139 or DBP 85–89) Hypertensive	448 (31.1)	474 (27.3)	922 (29)
Controlled (on antihypertensive and BP<140/90)	17 (1.2)	24 (1.4)	41 (1.3)
Stage 1 (SBP 140–159 and DBP 90–99)	232 (16.1)	275 (15.8)	41 (1.3)
Stage 2 (SBP 160–179 and DBP 100–109)	159 (11)	185 (10.6)	507 (15.9)
Stage 3 (SBP ³180 or DBP ³110)	70 (4.9)	96 (5.5)	344 (10.8)
Total	478 (33.2)	580 (33.4)	344 (10.8)

(Values in parentheses indicate percentages SBP systolic blood pressure DBP diastolic blood pressure. When SBP and DBP fell into different categories, the higher category was selected to classify the individual's blood pressure status.)

Two hundred and twenty-nine of the hypertensive subjects (21.6%) were aware that they had hypertension and a majority of them (21.4%) were under treatment. Of those undergoing treatment, the blood pressure was adequately controlled in only 18.1% as per the JNC-VII recommendations. On the other hand, 50.4% of the subjects on treatment had uncontrolled and severe hypertension (BP >180/110 mmHg; Table 3).

Table 3: Status of hypertension control among subjects who know they had hypertension

Hypertensives	Men (n=478)	Women (n=580)	Total (n=1058)
Aware	109 (22.8)	120 (20.7)	229 (21.6)
On treatment	107 (22.4)	119 (20.5)	226 (21.4)
Controlled	17 (15.9)	24 (20.2)	41 (18.1)
Severe*	64 (28.3)	50 (22.1)	114 (50.4)

* blood pressure >180/110 mmHg

On simple logistic regression analysis, the factors associated with an increase in the risk of hypertension were increasing age, marital status (living without spouse), sedentary type of work, extra salt intake, regular smoking, height >163.13 cm, weight >55 kg, BMI >25 and WHR >0.9. However, in both men and women, a BMI <18.5 was a protective factor (Table 4).

In the multivariate model derived by multiple logistic regression analysis with backward elimination of non-significant factors, the significant determinants of hypertension were age, sex, extra salt intake, BMI and WHR (Table 5). Gender-specific analysis showed that heavy drinking (adjusted OR: 1.62; 95% CI: 1.21–2.19) increased the risk of hypertension in men.

Table 4: Risk factors for hypertension in the slum population of Surat (unadjusted odds ratio estimated by unconditional logistic regression analysis)*

Variable	Hypertensive† (n=832)	Normotensive† (n=2122)	Odds ratio	95% CI	p value
Age (years)					
30–39	215 (25.8)	1029 (48.5)	1	Reference	
40–49	199 (23.9)	488 (23.0)	1.95	1.56–2.43	<0.0001
50–59	163 (19.6)	317 (14.9)	2.46	1.94–3.13	<0.0001
>60	255 (30.7)	288 (13.6)	4.24	3.39–5.30	<0.0001
Gender					
Men	371 (44.6)	963 (45.4)	1	Reference	
Women	461 (55.4)	1159 (54.6)	1.03	0.88–1.21	0.69
Literacy					
Illiterate	300 (36.1)	674 (31.8)	1	Reference	
Primary to higher secondary education	505 (60.7)	1365 (64.3)	0.83	0.70–0.99	0.03
Graduate and above	27 (3.2)	83 (3.9)	0.73	0.46–1.15	0.17
Marital status					
Married	625 (75.1)	1718 (81.0)	1	Reference	
Unmarried	41 (4.9)	186 (8.8)	0.61	0.43–0.86	0.005
Widow/ widower	166 (20.0)	218 (10.3)	2.09	1.68–2.61	<0.0001
Type of work					
Active	539 (64.8)	1420 (66.9)	1	Reference	
Sedentary	127 (15.3)	217 (10.2)	1.54	1.21–1.96	0.0004
Heavy	166 (20.0)	485 (22.9)	0.9	0.74–1.10	0.32
Extra salt intake					
No extra intake	335 (40.3)	1012 (47.7)	1	Reference	
One-fourth teaspoon	417 (50.1)	953 (44.9)	1.32	1.12–1.57	0.0012
>0.5 teaspoon	80 (9.6)	157 (7.4)	1.54	1.44–2.07	0.004
Smoking					
Non - smokers	701 (84.3)	1877 (88.4)	1	Reference	
Regular	100 (12.0)	167 (7.9)	1.6	1.23–2.08	0.0004
Occasional	31 (3.7)	78 (3.7)	1.06	0.70–1.63	0.77
Duration of smoking (years)					
Nil	701 (84.3)	1877 (88.4)	1	Reference	
<5	14 (1.7)	37 (1.7)	1.01	0.54–1.89	0.97
>5	117 (14.1)	208 (9.8)	1.51	1.18–1.92	0.0009
Tobacco chewing‡					
Nil	456 (54.8)	1213 (57.2)	1	Reference	
Daily	361 (43.4)	872 (41.1)	1.10	0.94–1.30	0.24
Occasional	15 (1.8)	37 (1.7)	1.08	0.59–1.98	0.80
Body mass index (BMI)					
<20	434 (52.2)	1298 (61.2)	1	Reference	
20–24.9	313 (37.6)	731 (34.4)	1.28	1.08–1.52	0.005
>25	85 (10.2)	93 (4.4)	2.73	1.20–3.74	<0.0001

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Variable	Hypertensive† (n=832)	Normotensive† (n=2122)	Odds ratio	95% CI	p value
Waist–hip ratio (truncal obesity)					
<0.90	553 (66.5)	1683 (79.3)	1	Reference	
>0.90	279 (33.5)	439 (20.7)	1.93	1.62–2.31	<0.0001
Height (cm)					
<149.5	228 (27.4)	514 (24.2)	1	Reference	
149.51– 155.99	214 (25.7)	513 (24.2)	0.94	0.75–1.18	0.58
156.0– 163.12	208 (25.0)	539 (25.4)	0.87	0.70–1.09	0.22
>163.13	182 (21.9)	556 (26.2)	0.74	0.59–0.93	0.0092
Weight (kg)					
<41.5	210 (25.2)	537 (25.3)	1	Reference	
41.5–47.9	181 (21.8)	561 (26.4)	0.83	0.65–1.04	0.10
48.0–54.9	188 (22.6)	534 (25.2)	0.90	0.72–1.33	0.37
>55.0	253 (30.4)	490 (23.1)	1.32	1.06–1.65	0.03

*Excludes those persons on antihypertensive medication at screening (n = 226) † as per JNC-VII criteria; normotensives include those with high-normal blood pressure ‡ in the form of mava, zarda pan, with betel nut CI confidence intervals

Table 5: Risk factors for hypertension in the slum population of Surat*

Determinants	Overall		Men		Women	
	Adjusted odds ratio (95% CI)	p value	Adjusted odds ratio (95% CI)	p value	Adjusted odds ratio (95% CI)	p value
Age (in years)						
30–39	1 (Reference)	-	1 (Reference)	–	1 (Reference)	-
40–49	1.94 (1.54–2.43)	<0.001	1.57 (1.09–2.25)	0.014	2.26 (1.68–3.04)	<0.001
50–59	2.62 (2.04–3.37)	<0.001	2.54 (1.76–3.69)	<0.001	2.71 (1.92–3.81)	<0.001
>60	5.02 (3.93–6.42)	<0.001	5.16 (3.57–7.45)	<0.001	4.97 (3.54–6.97)	<0.001
Gender						
Men	1 (Reference)	–	-	-	-	-
Women	1.37 (1.11–1.70)	0.004	-	-	-	-
Type of work						
Active	1 (Reference)	–	1 (Reference)	-	1 (Reference)	-
Heavy	0.83 (0.64–1.07)	0.146	0.84 (0.63–1.13)	0.248	1.01 (0.51–1.99)	0.978
Sedentary	1.13 (0.86–1.48)	0.381	1.29 (0.89–1.87)	0.181	0.99 (0.68–1.49)	0.962
Extra salt intake						
None	1 (Reference)	-	1 (Reference)	-	1 (Reference)	-
$^1/_4$ teaspoon or more	1.45 (1.21–1.73)	<0.001	1.36 (1.05–1.77)	0.022	1.51 (1.19–1.92)	0.001
Body mass index						
Normal (18.5–24.9)	1 (Reference)	-	1 (Reference)	-	1 (Reference)	–
Underweight (<18.5)	0.65 (0.53–0.78)	<0.001	0.54 (0.39–0.74)	<0.001	0.71 (0.55–0.91)	0.007
Overweight (25–29.9)	1.95 (1.37–2.78)	<0.001	1.84 (1.08–3.11)	0.024	2.06 (1.28–3.32)	0.003
Obese (>30)	3.10 (1.17–8.22)	0.023	4.04 (0.64–25.39)	0.137	2.66 (0.84–8.49)	0.09
Waist–hip ratio						
<0.90	1 (Reference)	-	1 (Reference)	-	1 (Reference)	-
^{3}0.90	1.54 (1.25–1.90)	<0.001	1.48 (1.12–1.97)	0.006	1.64 (1.18–2.28)	0.003

*Reduced multivariate models derived by multiple logistic regression analysis with backward elimination of non-significant determinants (cut-off p=0.10) Excludes cases on antihytensive medication at screening CI confidence intervals

DISCUSSION

Our study reveals that hypertension is prevalent in one-third of the urban inhabitants of Surat. Studies conducted elsewhere in India showed a lower prevalence (14%).[9] Perhaps changes in traditional dietary habits and lifestyle patterns have made them prone to hypertension. Besides other factors, extra salt intake (as a side dish, a habit among the urban people of this area) may have a role to play in the high prevalence of hypertension. A sizeable number of people are in service, business, etc., which has given rise to sedentary habits. The above-mentioned factors were significant determinants of hypertension in the subjects.

Among the subjects, 29% had high-normal blood pressure while 12.9% and 24.9% had optimal and normal blood pressure levels (JNC-VII classification), respectively. Men and women with a high-normal blood pressure have a higher incidence of cardiovascular disease on follow up than those with optimal blood pressure.[10] The elevated mean SBP (>146 mmHg) in elderly (>60 years of age) men and women is of public health concern. Uncontrolled hypertension in the elderly leads to target organ

damage, especially stroke.[11] This age group needs more attention as the prevalence of hypertension among them was 54.7%. An increase in the prevalence of hypertension with ageing has been observed in earlier studies also.[12] BMI and central obesity are two important risk factors for hypertension and cardiovascular disease.[13] Hypertension in our study population was also associated with increased values of BMI and WHR. This is contrary to the findings of our earlier study on hypertension among tea garden workers, where a high prevalence of hypertension was detected in a non-obese population.[14] In fact, in our study population BMI <18.5 (underweight) was found to be a protective factor. Extra salt intake, in both sexes, was associated with hypertension. Dietary salt intake is itself an important factor in raising blood pressure.[15] In our study, smoking was found to increase the risk of hypertension only on simple logistic regression analysis. However, after adjustment, smoking was not found to be a significant factor. Both direct and inverse relationships between smoking and increased blood pressure have been documented in earlier studies.[16,17] The adverse effects of smoking may add to major cardiovascular damage. A positive relationship between the use of smokeless tobacco and blood pressure in men has been reported previously.[18] Heavy work was found to be a protective factor for men, although this association did not reach statistical significance. Physically active people are less likely to develop hypertension and those with hypertension may lower their blood pressure by regular isotonic exercises.[19] The prevalence of hypertension was found to be 33.3% in the subjects and was found to increase with age. This is in conformity with other studies conducted in different parts of the world.[20]

One of the limitations of our study was that it had a cross-sectional design. Also, the blood pressure was recorded at only one point to assess the hypertensive status of the participants.

In our study sample, 21.6% of those with hypertension were aware of their disease and most were on treatment. However, in only 18.1% of them was the blood pressure adequately controlled (SBP <140 mmHg and DBP <90 mmHg). Therefore, for effectively combating the burden of hypertension in this population, education and awareness about hypertension needs to be given priority.

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