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Prevalence and Predictors of Hypertension in an Ethnic Population of South India

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ABSTRACT The present study investigated the incidence and predictors of hypertension in the Mala community from rural areas of Chittoor district of Andhra Pradesh, South India. A sample of 286 subjects comprising 139 male and 147 female aged 20-70 years was drawn randomly. Blood pressure was recorded with sphygmomanometer in the right arm in sitting position after a rest period of five minutes. Details on age, sex, family history, smoking and alcohol intake were enquired. Hypertension was diagnosed if the blood pressure was $\geq$140/90 mmHg. Anthropometric variables like height, weight, waist and hip circumferences, skin fold thickness at six sites i.e. biceps, triceps, sub-scapular, suprailiac, abdomen and calf were measured. BMI $\geq$ 25 and WHR $\geq$ 0.9 (male), $\geq$ 0.8 (female) were considered as obese and central obese, respectively. Prevalence of hypertension in the present population was found to be 4.89% (5.7% in males and 4.08% in females). Smoking and alcoholism was observed in respectively 58% and 62% of males only. Higher prevalence of obesity was observed in males (10%) than females (8%), and central obesity was also hogher (64%) in males than in females (28%). The family history of hypertension was observed more in females (6%) than males (5%) but the difference was not statistically significant. A higher prevalence of smoking (35% vs 30%), alcoholism (35% vs 29%), obesity (70% vs 8%), central obesity (100% vs 45%) and family history of hypertension (71% vs 2%, $p<0.05$) was observed in hypertensive against normotensive. In multiple regression analysis, diastolic blood pressure (Odds ratio 1.072 95%, CI 1.005-1.143; $p<0.05$) and family history of hypertension (Odds ratio 43.155 95%, CI 6.577-283.28; $p<0.01$) were observed as predictors of hypertension. The present data indicate that family history of hypertension and diastolic blood pressure are predictors of hypertension in the Mala population.

INTRODUCTION

It is estimated that hypertension is responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths (Rodgers et al. 2000). One fourth of urban and 10% of rural people were reported to have hypertension in India (Gupta 2004). Though lower prevalence of hypertension was observed in rural areas compared with urban areas but steady increase in hypertension was observed over time (Gupta and Gupta 2009). Decrease in cardiovascular related mortality was observed due to reduction in systolic and diastolic blood pressures of hypertensives in a meta-analysis involving 61 studies covering one million patients for 12.7 years follow-up (Turnbull et al. 2005). Ethnic differences in the prevalence and pathogenesis of hypertension are well known (Cappuccio et al. 1997). To assess the effectiveness of health programmes aimed at hypertension it is important to establish the prevalence of hypertension in a population, particularly amongst the different ethnic groups, because small differences in its optimum management have large implications for health resources (Cappuccio et al. 2005; Lane and Lip 2001). Therefore, in this study an attempt has been made to find out the prevalence and predictors of hypertension in the Mala population, a backward ethnic group in the state of Andhra Pradesh, South India.

MATERIAL AND METHODS

A sample of 286 subjects, comprising 139 male and 147 female aged 20-70 years, of the Mala population, occupying the lowest stratum in the caste hierarchy in Andhra Pradesh, was studied randomly from V.M. Palli village in Chittoor district of the state after explaining the objectives of the study and getting informed consent. Most of them were dependent on agricultural labour, daily wage labour and few were employed in gov-

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ernment sector. Details on age, sex, family history of hypertension, smoking and alcohol intake, level of education and family income were enquired.

Blood pressure was recorded with sphygmomanometer in the right arm in sitting position after a rest period of five minutes. Systolic blood pressure was recorded at the first appearance of sounds and diastolic blood pressure was measured at the disappearance of sounds. Hypertension was diagnosed based on medical history or if the blood pressure was $\geq$140/90 mmHg. Anthropometric variables like height, weight, waist and hip circumferences, skinfold thickness at six sites that is, biceps, triceps, sub-scapular, suprailiac, abdomin and calf were measured following Singh and Bhasin (1967) and Weiner and Lourie (1969)., Height was measured using anthropometer and weight with calibrated weight box. Circumference measurements were recorded using tape and skinfold thickness using Lange skinfold caliper. Body mass index (BMI) was calculated using the formula weight (kg)/height (m^2) and waist- hip ratio (WHR) by dividing waist circumference by hip circumference. BMI $\geq$25 and WHR $\geq$0.9 (male), $\geq$0.8) (female) were considered as obese and central obese, respectively. The sum of the three trunk skinfolds (TSF3) that is, skinfolds at abdomen + sub-scapular + suprailiac), the sum of the six skinfolds (SF6) that is, skinfolds at abdomen + sub-scapular + suprailiac + calf + triceps + biceps) and a measure of fat patterning that is, the ratio of the sum of the trunk skinfolds to the sum of the extremity skinfolds (TE ratio) that is, TSF3 / [skinfolds at calf + triceps + biceps]) were calculated. All computations were carried out in SPSS version 16 Chicago, Inc. Probability (p) $\leq$0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

Among the Mala subjects of the present study, 50% were found to be illiterate; 18% had primary schooling and 31% were high school educated. Higher mean weight, waist circumference, waist-hip ratio, biceps skinfold thickness and SF3 were observed in the Mala males compared to females (p<0.05) and the prevalence of central obesity was more in females than males (p<0.05) (Table 1). Hypertensives had higher mean age, body weight, body mass index, waist and hip circumferences, skinfold thicknesses at biceps, triceps, subscapular, suprailiac and abdomen, higher, SF3, SF6 and higher systolic and diastolic blood pressures compared to normotensives (p<0.05) and the prevalence of general and central obesity and family history of hypertension was more in hypertensives than normotensives (Table 2). In multiple logistic regression analysis, diastolic blood pressure and family history of hypertension were found to be predic-

Table 1: Average values (± SD) of quantitative and qualitative variables studied in male and female Mala subjects

Variable	*Male (n=139)*	*Female (n=147)*
Age (yr)	38.92 ± 12.77	40.59 ± 14.25
Height (cm)	164.27 ± 5.87	150.55 ± 5.87
Weight (kg)	55.80 ± 9.58	45.31 ± 8.15*
Body mass index (BMI)	20.67 ± 3.41	19.98 ± 3.35
Waist circumference (cm)	77.96 ± 7.46	72.96 ± 9.29*
Hip circumference (cm)	88.22 ± 7.63	89.44 ± 9.31
Waist-hip ratio (WHR)	0.88 ± 0.061	0.81 ± 0.04*
Biceps skinfold (mm)	3.25 ± 1.34	4.01 ± 2.13*
Triceps skinfold (mm)	7.28 ± 2.75	8.24 ± 3.03
Subscapular skinfold (mm)	12.46 ± 4.27	11.57 ± 3.27
Suprailiac skinfold (mm)	13.89 ± 4.95	12.51 ± 3.42
Abdominal skinfold (mm)	15.78 ± 6.09	13.89 ± 4.00
Calf skinfold (mm)	10.11 ± 3.58	10.65 ± 2.60
SF3 (three trunk skinfolds)	42.15 ± 14.46	37.97 ± 9.59*
SF6 (sum of the six skinfolds)	62.79 ± 20.31	60.89 ± 14.87
TE ratio (TSF3/ [calf + triceps+ biceps])	2.08 ± 0.48	1.70 ± 0.40
Systolic blood pressure (mmHg)	118.80±14.68	116.22 ± 12.89
Diastolic blood pressure (mmHg)	75.74 ± 10.40	73.97 ± 11.42
Smoking (n)	81(58.27)	0 (0)
Alcoholism (n)	87(62.58)	0 (0)
Obesity (>25) (n)	14(10)	12 (8.16)
Central obesity (n)	39(28.05)	95 (64.62)*
Prevalence of hypertension (n)	8(5.7)	6 (4.08)
Family history of hypertension	7(5.03)	9 (6.12)

Figures in parentheses indicate percentages
* p <0.05

Table 2: Average values (± SD) of quantitative and qualitative variables studied in hypertensive and normotensive Mala subjects.

Variable	*Hypertensive (n=14)*	*Normotensive (n=272)*
Age (yr)	55.64 ± 7.75	38.97 ± 13.29*
Height (cm)	159.08 ± 12.22	157.12 ± 8.85
Weight (kg)	58.28 ±13.88	50.01 ± 9.94*
Body mass index (BMI)	22.74 ± 3.33	20.19 ± 3.36*
Waist circumference (cm)	82.78 ± 8.41	75.01 ± 8.66*
Hip circumference (cm)	95.02 ± 7.13	88.51 ± 8.50*
Waist-hip ratio (WHR)	0.87 ± 0.04	0.85 ± 0.06
Biceps skinfold (mm)	4.85 ± 2.07	3.58 ± 1.80*
Triceps skinfold (mm)	9.57 ± 3.89	7.68 ± 2.85*
Subscapular skinfold (mm)	14.07 ± 4.34	11.90 ± 3.76*
Suprailiac skinfold (mm)	16.28 ± 4.89	13.02 ± 4.20*
Abdominal skinfold (mm)	19.42 ± 6.13	14.57 ± 5.05*
Calf skinfold (mm)	11.35 ± 3.99	10.34 ± 3.07
SF3 (three trunk skinfolds)	49.78 ± 39.50	39.50 ± 12.05*
SF6 (sum of the six skinfolds)	75.57 ± 20.05	61.11 ± 17.31*
TE ratio (TSF3 / skinfolds [calf + triceps + biceps])	2.08 ± 0.74	1.88 ± 0.46
Systolic blood pressure (mmHg)	165.85 ± 19.74	114.98 ± 7.44*
Diastolic blood pressure (mmHg)	99.28 ± 31.47	73.57 ± 6.80
Smoking	5 (35.71)	82 (30.14)
Alcoholism	5 (35.71)	79 (29.04)
Obesity (>25)	8 (70.17)	23 (8.45)*
Central obesity	14 (100)	123 (45.22)
Family history of hypertension	10 (71.42)	6 (2.20)*

tors of hypertension in the Mala population (Table 3).

Ethnic differences in cardiovascular mortality have been reported in various studies. For example, the Afro-Caribbean and people of African descent were reported to have a higher incidence of stroke and end-stage renal failure compared to the Caucasians, whereas a higher incidence of coronary heart disease was observed in people of South Asian descent (Lane and Lip 2001; Balarajan 1996; Raleigh et al. 1997). Cardiovascular reactivity to stress and associated socio-cultural and psychological factors has been implicated in contributing to ethnic differences in blood pressure at rest or in response to stress. It has been reported that Black exhibit greater responses to vasoconstrictive mediated stressors and Whites to myocardial activating stressors (Anderson et al. 1991, Treiber et al. 1993). Ethnic differences in blood pressure suggest search for genetic variation to understand variation at physiological level (Brown 2006).

In Indian studies, the observed prevalence of hypertension in rural areas was from 0.5 to 7.8% (Gupta 2004) and the present figure of 4.89% in the Mala was well within this range. Gupta and Sharma (1994) have reported hypertension in 24% men and 17% women aged >20 years, whereas Malhotra et al. (1999) have observed hypertension in 3.5% men and 5.8% women aged 16-70 years. In the present population hypertension was observed in 5.7% men and 4.08% women aged 20-70 years but the bisexual difference was not found to be statistically significant.

Obesity, central or abdominal, smoking, alcohol intake, physical inactivity, dietary excess of sodium and fat and deficiency of potassium and fiber intake and psychosocial stress have been observed as risk factors for hypertension (Gupta and Gupta 2009). In the present study compared to normotensives, hypertenisves had higher mean age, body weight, body mass index, waist and hip circumferences, skinfold thicknesses at biceps, triceps, subscapular, suprailiac and abdomen regions, SF3 and SF6 and a higher prevalence of obesity (70% vs 8%), central obesity (100 vs 45%) and family history of hypertension (71% vs 2%) ($p<0.05$).

Increased prevalence of hypertension with age was reported in an earlier study by Jones et al. (2005) who opined that relative hazards for

Table 3: Predictors of hypertension in the Mala population

Variable	*Beta coefficient*	*Significance*	*Odds ratio*	*95% CI*
Diastolic blood pressure	0.069	0.03	1.072	1.005 - 1.143
Family history of hypertension	3.765	0.00	43.155	6.577 - 283.18
Central obesity	1.826	0.091	6.211	0.749 - 51.51

cardiovascular disease (CVD) events associated with hypertension do not decline with advancing age and the absolute risks increase markedly, especially among the oldest participants with hypertension. Excess weight and even modest adult weight gain substantially increase risk for hypertension. Increased sympathetic nervous system activity, insulin resistance and hyperinsulinemia, sodium retention, enhanced vascular reactivity and a decrease in plasma renin activity and plasma aldosterone levels after weight loss may play a role in causing hypertension in obese persons (Huang et al. 1998). Central obesity-associated hypertension is characterized by an endothelial dysfunction that may contribute to the higher cardiovascular risk detectable in these patients (Gaspare et al. 1996). Triceps, subscapular and suprailiac skinfold thickness was found to be associated with hypertension in the Caucasian T allele carrier women of the CYP11B2 gene (Casiglia et al. 2007).

To explore the independent predictors of hypertension in the Mala population, we carried out stepwise regression and the observed predictor variables were evaluated in multiple logistic regression analysis. Diastolic blood pressure (DBP) (Odds ratio 1.072, 95% CI 1.005-1.143; $p<0.05$) and family history of hypertension (Odds ratio 43.155, 95% CI 6.577-283.28; $p<0.01$) were observed as predictors of hypertension in the Mala. A continuum risk of stroke and coronary heart disease with increasing diastolic blood pressure was observed by Collins and MacMahon (1994). The MRFT trial proposed that for any level of DBP, SBP (systolic blood pressure) was the major determinant of cardiovascular risk (Leonetti et al. 2000). Another study reported that in subjects aged less than 40 years, pretreatment DBP was still a stronger predictor of cardiovascular risk than SBP (Perry et al. 2000).

Altered hemodynamic regulator mechanisms may exist prior to establishment of borderline hypertension in those at an increased risk for development of hypertension due to a significant family history of the disorder. Factors responsible for these baseline differences are unknown (Treiber et al. 1993). Subjects with a family history of essential hypertension (EH) also showed a stronger increase of SBP with age, suggesting that they are likely to develop EH at a younger age than subjects without such a genetic susceptibility (Dekkers et al. 2003). The results of the present study show that diastolic blood pressure and family history of hypertension are significant predictors of hypertension in the Mala population of Andhra Pradesh, South India..

RECOMMENDATIONS

As half of the Mala population is illiterate, besides increasing disease awareness, encouraging regular physical activity, abstaining from smoking and alcohol intake, increasing intake of fiber and potassium and promotion of literacy and screening programmes in those having family history of hypertension may go a long way in preventing the hypertension in this community.

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