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A Cross Sectional Study on Association between Body Mass Index and Hypertension Status among above 40 years old in Rural South India

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Abstract
As per WHO report 69 million people worldwide have hypertension. Of these 31.6% are unaware of their high blood pressure. In industrialised nations the prevalence of high blood pressure ranged from 10-20%. India being a developing nation and there is rapid industrialisation has led to hypertension becoming a major public health problem. Industrialisation has led to change in the lifestyle and food habit of the population, coupled with physical inactivity has led to increased prevalence of obesity. The frequency of hypertension among overweight persons aged >40 years were 50% higher when compared with those in the normal-weight group and 100% higher among the underweight group. This was a cross sectional study on rural population above 40 years done for a period of 7 months, in Bhuvanagiri, Cuddalore district, Tamil Nadu. The study was carried out in a sub centre of Bhuvanagiri primary health centre. The total population of the sub centre was 5832 out of which 1127 were above 40 years of age. The correlation between hypertension and BMI was done and found to be statistically significant. Also, an association between obesity and hypertension was observed.
Keywords: *Hypertension, obesity, BMI, height, weight.*

Introduction

WHO has stated 'You protect it, you promote it, and you extend it' as the basic principles of preventive medicine. From a global point of view the relation between hypertension and cardiovascular health is well established. Hypertension is defined by WHO as SBP equal to or greater than 160 mm of Hg and or DBP equal to or greater than 90 mm of Hg. It has emerged as a worldwide health disorder[1].

Hypertension is an iceberg disease, i.e., it remains hidden during most of its clinical course, but continues doing immense harm to the body silently. Hypertension is a disease with much aetiology which is cumulative rather than a single aetiology disease. Some of the factors include genetics, salt intake, obesity and physical inaction. As per a WHO report globally 69 million people worldwide have hypertension[2]. Of these 31.6% are unaware of their high blood pressure[3]. In

industrialised nations the prevalence of high blood pressure ranged from 10-20%[4]. India being a developing nation and there is rapid industrialisation has led to hypertension becoming a major public health problem[5].

Industrialisation has led to change in the lifestyle and food habit of the population, coupled with physical inactivity has led to increased prevalence of obesity. The frequency of hypertension among overweight persons aged >40 years were 50% higher when compared with those in the normal-weight group and 100% higher among the underweight group[6].

Epidemiological studies carried out in urban and rural India reveals hypertension is on the rise[4]. The high prevalence can be explained by changing lifestyles and more exposure to stressful situations.

Several decades of epidemiological research has established that increased blood pressure is a significant contributor of cardiovascular diseases. There has been a significant increase in hypertension even among rural population, about 3%-15.2% of the rural population have hypertension and the prevalence of hypertension among persons >60 years has risen from 4% to 19% in recent years. This has contributed to high levels of morbidity and mortality and resulting in premature deaths[7].

Many studies in south India point towards a higher hypertensive population. The occurrence of hypertension a decade earlier among Indians has put the population at a greater risk[4]. Therefore, this study aims to find the relation between obesity and hypertension in rural South India.

Materials and Methods

This was a cross sectional study covering rural population above 40 years done for a period of 7 months from June 2001 to December 2001, in Bhuvanagiri, Cuddalore district, Tamil Nadu. The study was carried out in a sub centre of Bhuvanagiri primary health centre. The total population of the sub centre was 5832 out of which 1127 were above 40 years of age.

Three visits were made to cover the absentees. In spite of the three visits investigator could not contact 30% of the population, due to various seasons.

1. Non-cooperation
2. Locked houses
3. Houses are unoccupied
4. Adults went for jobs

The tools used in the study included a mercury sphygmomanometer, stethoscope, measuring tape and weighing machine. A semi-structured questionnaire containing details like age, sex, anthropometry (height, weight) was used.

Anthropometry

Weight: The weight was measured in kilograms using a standardized portable weighing machine, upto the accuracy of one kg which was calibrated regularly for adjusting zero error. The weighing apparatus was standardizes periodically using standard weight of 10 kg.

Height: The height was measured in centimetres in the standing position of the subject. It was measured by using a measuring tape up to 1 cm after marking the height of subject against a wall with a ruler.

Obesity: To measure obesity, the following formula was used:

Body Mass Index = Weight / Height^2 (kg/m^2)

Blood pressure was recorded using a mercury sphygmomanometer and stethoscope. The subject was asked to sit comfortably and quietly for 5 minutes. The arm relaxed and the forearm was comfortably supported with cubital fossa at heart level. The standard cuff (12.5cm) was applied evenly to the exposed right upper arm. The cuff was first inflated and stethoscope was place over the right brachial artery in the cubital fossa. The point at which the first Korotkoff's sound was heard was taken as SBP, and the point at which the sound disappeared was taken as the DBP. The respondents having systolic blood pressure of equal to or more than 160 mm Hg and diastolic blood pressure of equal to or more than 95 mm Hg were categorized as hypertensive. Subjects already

who were known hypertensive was also included in the study for calculating prevalence of hypertension, even if the blood pressure record was within normal range.

Results

Table no 1 shows that between 40-49 age group 82(19.2%) were hypertensives in 50-59 age group 119(40.5%) were hypertensives. In 60-69 age group 107(41%) were hypertensives. In more than 70 age group 71(48.6%) were hypertensives.

34(6.5%) males 417(69%) females were found to be <150cm of height, 351(67.1%) males, 185(30.6%) females were 151 to 165cm of height and 138(26.4%) males, 2(0.4%) females were found to be more than 166cm. (Table no.2)

Distribution of weight among above 40 years were showed in table no.3 in that 103 males and 254 females were found to be weight less than 50kg, 344males and 296 females were found to be between 51 to 69 kg, 76males and 54 females were found to be more than 70kg.

Prevalence of hypertension among male and female study participants were shown in table no.5 in that 523 were males and 603 were female participants, the prevalence of hypertension was found to be 29% and 37.5% respectively. Prevalence of hypertension in study population was found to be 33.6% (379).

Age wise distribution of hypertensives were shown in table no.4 in that between 40-49 age group 82(19.2%) were hypertensive, 50-59 age groups 119(40.5%) were hypertensive. In 60-69 age group 107 (41%) were hypertensive. In ≥ 70 age group 71(48.6%) were hypertensive. CHI SQUARE test was done and the value was 55.04, the difference was 2 and obtained a value of P<0.01. This shows that as age increases hypertension also increases.

Table no.4 and Table no.5 shows the correlation between hypertension and BMI among male and female, in that 84(22.9%) were found to be hypertensive with BMI <25, 57(43.5%) were found to be hypertensives in BMI group 25-30 and 11(44%) of hypertensives were having BMI >30.95(27.4%) were found to be hypertensive with BMI <25, 78(48.4%) were found to be hypertensives in BMI group 25-30 and 54(56.2%) of hypertensives were having BMI >30. Chi-square test was done and the value was found to be 37.7, with difference of 2and having P-value of <0.001. it shows the statistically significant association between BMI and hypertension.

To find out association between obesity and hypertension cross table was done (table no.6). in that out of 159 obese persons 86 were found to be hypertensive and out of 968 non-obese 293 were found to be hypertensive. With odd ratio of 2.71 and p-value of <0.05. it shows statistically significant association between hypertension and obesity.

Table: 1 Age wise distribution of hypertensives (N=1127)

AGE	TOTAL	HTN	%
40-49	426	82	19.2
50-59	294	119	40.5
60-69	261	107	41
≥70	146	71	48.6
TOTAL	1127	379	33.6

Table: 2 shows Distribution of Height above 40 years

Height in cm	Male		Female	
	No	%	No	%
<150	34	6.5	417	69
151-165	351	67.1	185	30.6
>166	138	26.4	2	0.4
Total	523	100	604	100

Table: 3 Distribution of weight among >40 years

Weight in kg	Male		Female	
	No	%	No	%
<50	103	19.6	254	42.0
51-69	344	65.7	296	49.0
>70	76	14.5	54	9.0
Total	523	100	604	100

Table 4: Correlation between BMI and Hypertension among males

BMI	(n)	Hypertensive		Normotensive		Chi-square value	P-value
		No	%	No	%		
<25	367	84	22.9	283	77.1	22.68	<0.001
25-30	131	57	43.5	74	56.4		
>30	25	11	44.0	14	56.0		
Total	523	152	29.1	371	70.9		

Table 5: Correlation between BMI and Hypertension among females

BMI	Hypertensive		Normotensive		Chi-square value	P-value
	No	%	No	%		
<25	95	27.4	252	72.6	37.7	<0.001
25-30	78	48.4	83	51.6		
>30	54	56.2	42	43.8		
Total	227	37.6	377	63.4		

Table 6: Association between hypertension and obesity

	Hypertensive	Non-Hypertensive	Total	Odds Ratio	P-value
Obese	86	73	159	2.71	**<0.05** (1.92-3.81)
Non-obese	293	675	968		
Total	379	748	1127		

Discussion

This study was conducted among rural population of 4116 in the sub-centre Kezh Bhuvanagiri, Chidambaram Taluk, Cuddalore District. The number of persons above 40 years of age were 1232. Out of which males were 48.9 % and females were 51.1%.

In this epidemiological study of hypertension, standardized methods were used in rural population. Up to 71% of the eligible subjects living in this area participated. This rural society, like many urban societies in developing countries, is undergoing a transition regarding pattern of diseases from traditionally infectious to chronic diseases which can be attributed to the adoption of westernized life style choices and increasing physical inactivity. The economic development and the consequent life style changes form the major reasons for the emergence of hypertension in the rural societies of developing countries. This study has attempted to show that the rural population has becomes obese. Hypertension compounded with obesity will become a major public health problem in these communities and can result in increased morbidity and mortality.

In females less than 50 kg, 71 (27.9%) were hypertensive. In 51-69 kg, 117 (39.5%) were hypertensive. In the more than 70 kg, 39 (72.2%) were hypertensive. This study shows that as weight increases hypertension also increases. As seen in the Table 4,5 and 6 it could be noted that in both the sex, prevalence of hypertension increases with increasing weight. This is in accordance with other studies carried out by Gupta[8], Joshi[9], Whelton[10], Kannel[11], and Chiang[12].

From Table 4,5 and 6 it was seen that as BMI increases prevalence of hypertension also increases. The relation between BMI and hypertension has been studied by many investigators, namely Shaper[13], Malhothra[14], Joshi[9] and they all concluded in the same way. In

males less than 25 BMI, 84 (22.9%) were hypertensive. Among 25 - 30 BMI, 57(43.5%) were hypertensive more than 30 BMI 11 (44%) were hypertensive. In females less than 25 BMI, 95 (27.4%) were hypertensive. In the range of 25-30 BMI, 78 (48.4%) were hypertensive. In more than 30 BMI, 54(56.2%) were hypertensive. This shows that as the BMI increases hypertension also increases.

Conclusion

The present study was a cross sectional study which was undertaken among rural population in the Kezh Bhuvanagiri, Chidambaram Taluk, Cuddalore District. This study confirms that hypertensionis emerging as an important public health problem among those who are 40 years and above. It has been well established that as the rural population becomes obese, physically inactive, with high sodium intake and stress levels, the problem is equally assuming importance in rural communities also. In the present study it has been noted that more number of females (37.5%) were hypertensive as compared to males (29.0 %). Further it has been found that as age increases hypertension also increases. It has been proved categorically that as BMI increases hypertension also increases.

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