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DIET, LIFESTYLE AND HYPERLIPIDEMIA AS POSSIBLE RISK FACTORS AMONG HYPERTENSIVE ADULTS

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ABSTRACT: Hypertension is one of the most prevalent and powerful contributor to cardiovascular diseases, the leading cause of death worldwide. The objective of the present study is to examine the relationship of the closely knit risk factors of cardiovascular diseases that can coexist along with hypertension which are likely to influence the blood pressure levels among adults with a history of hypertension. This study was conducted to examine the risk factors of hypertension among 1640 adults aged 40 to 65 years with a history of hypertension in six hospitals specializing in cardiovascular disease in Madurai city. They were categorized according to the stage of hypertension based on JNC-7 criteria (2004). Background and dietary data were recorded using a structured interview schedule. Anthropometric measurements, blood pressure and lipid profile were measured using standardized procedures. The findings of the present study revealed that vegetarianism could be more associated with normal or pre hypertension and non vegetarianism with stage I and stage II hypertension. Body weight and BMI of the adults also showed a correlating effect with the level of hypertension. Lifestyle pattern of the adults revealed that habits such as smoking, alcohol, tobacco and lack of exercise were more common among adults with higher levels of blood pressure. Adults with normal blood pressure had more favourable lipid levels when compared to the other groups. Best results in the prevention of chronic diseases can only be achieved by fully recognizing the essential role of diet, nutrition and physical activity along with managing various other principal risk factors for chronic disease, namely, tobacco use and alcohol consumption.

Key words: Hypertension, Blood pressure, Diet, Cardiovascular disease, Anthropometry, Lifestyle, Lipid profile.

Abbreviations used: CVD (cardiovascular disease), WHR (Waist Hip Ratio), WHtR (Waist Height Ratio), MUAC (Mid Upper Arm Circumference), BMI (Body Mass Index).

INTRODUCTION

Elevated blood pressure is a major modifiable risk factor for cardiovascular disease (CVD) and the leading cause of preventable deaths worldwide. One-quarter of the world's adult population has hypertension, and this is likely to increase to 29 % by 2025. The absolute prevalence of hypertension in economically developed nations is 37.3% compared with 22.9% in developing nations (Kearney et al., 2005). Hypertension contributes to all of the major atherosclerotic cardiovascular disease outcomes increasing the risk on an average from two to three folds. Hypertension clusters with dyslipidemia, insulin resistance, glucose intolerance, and obesity, occurring in isolation in less than 20 % (Kannel, 1996). In addition, this risk increases with progressive elevations in blood pressure, beginning at even normal levels of blood pressure (Stamler, et.al., 1983).

Furthermore, rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development and market globalization have accelerated over the past decade. Because of these changes in dietary and lifestyle patterns, chronic diseases like hypertension are becoming increasingly significant causes of disability and premature death.

Against this backdrop of increasing CVD burden worldwide, the gap between what we know and what we do in hypertension prevention and management is a major cause for concern. A careful insight into the existing determinants of hypertension can aid in providing a platform for the understanding of the concept of human organism's subtle and complex relationship to its environment in relation to chronic diseases which are largely preventable. Although more basic research may be needed on some aspects of the mechanisms that link diet to health, the currently available scientific evidence provides a sufficiently strong and plausible basis to justify taking action now. In addition to the appropriate medical treatment for those already affected, the public health approach of primary prevention is considered to be the most cost-effective, affordable and sustainable course of action to cope with the chronic disease epidemic worldwide (WHO, 2003).

The objective of the present study is to examine the relationship between the closely knit risk factors of cardiovascular diseases that co exist along with hypertension which are likely to influence the blood pressure levels among adults with a history of hypertension. This project is an attempt to explore the prevalent scenario among hypertensive individuals in order to understand better the influence of diet, lifestyle, anthropometry and lipid profile on blood pressure.

MATERIALS AND METHODS

This is a randomized case-controlled clinical trial conducted in six hospitals specializing in cardiovascular disease in Madurai city, Tamilnadu, India in order to examine the risk factors of hypertension among a population of 1640 adults with a previous history of hypertension. Adults aged 40 to 65 years visiting the hospital for checkup, were selected for the study. Adults were classified as hypertensive following the Joint National Committee VII (2004), guidelines for defining hypertension (any patient above 18 years with Systolic Blood Pressure (SBP) >140 mmHg and Diastolic Blood Pressure (DBP) > 90 mmHg in the absence of acute illness confirmed by at least two recordings on different days). Informed consent was obtained from each adult and the study protocol was approved by the Institution's Ethical Committee (HEC.2010.No.19). Method of assessment of the prevalent cardiovascular disease was based on hospital records, physicians' reports and baseline examination data.

Data collection - A validated structured interview schedule was administered to all the adults. The interview schedule was framed to assess the background information, symptoms felt, and occurrence of cardiovascular events, family disease history and dietary preferences of the patients. The schedules were filled by the investigator after interviewing the adults at the centre itself.

Measurement of anthropometry - Standing height without slippers to the nearest 0.1 cm was measured with a fixed stadiometer. Each participant stood with heels, back and shoulders resting lightly against the back board. Weight was measured to the nearest 0.1 Kg with a platform beam balance with subjects wearing light clothing and no slippers. Body Mass Index (BMI) was defined as weight (kg) / height (m^2) and was expressed in kilograms per square meter. The BMI of all the adults was calculated accordingly. Waist and hip circumferences were measured and the resultant waist hip ratio (WHR) and waist height ratio (WHtR) were determined. Mid upper arm circumference (MUAC) of each adult was also accurately recorded.

Measurement of blood pressure - Blood pressure was measured for all the adults by auscultatory method using sphygmomanometer as recommended by the American Heart Association (1986) with the help of a trained technician in the hospital premises. All the 1640 adults were then classified according to their blood pressure based on the Joint National Committee VII (2004) criteria as follows.

Classification	Blood pressure (mm Hg)	
	Systolic	Diastolic
Normal	<120	>80
Pre Hypertension	120- 139	80-89
Stage I Hypertension	140-159	90-99
Stage II Hypertension	>160	>100

Biochemical estimation - Biochemical assessment is considered to be a more objective and precise methodology due to its consistency and accuracy. In order to assess the biochemical profile, venous blood was drawn from all the 1640 adults with the help of a trained technician. Lipid profile that includes total cholesterol, triglycerides, low, high and very low density lipoproteins were estimated for all the adults using Toshiba (Japan) auto analyzer using Roche kits. From the values obtained, VLDL, LDL and HDL were calculated using the Friedwald's formula (1972).

Statistical analysis - Continuous variables are presented as mean values ± standard deviation. The categorical variables are presented as absolute and relative (%) frequencies. Associations between different variables and hypertension levels were evaluated through the analysis of variance (ANOVA).

RESULTS AND DISCUSSION

From Table I, sedentary behaviour was seen to be most common among adults with stage I hypertension while moderate activity patterns were more common among normal and pre hypertensive subjects. This indicates that lower levels of physical activity could be more associated with higher blood pressure levels. A substantial reduction in blood pressure has been reported to be associated with regular physical activity in a study by Cutler et al (2008). Mora et al. (2007) have predicted that the inverse association between physical activity and cardiovascular risk is mediated by the known risk factors namely inflammatory factors and blood pressure. In the present study, there was also a positive association observed between hypertension and income with a large number of adults receiving a high income falling under stage II hypertension category. Most of the adults participating in the present study were non vegetarians. It was further seen that majority of the adults following a vegetarian diet had either normal or pre hypertensive blood pressure levels while most of the adults following a non vegetarian diet had stage I or stage II hypertension levels, proposing that vegetarianism could be more associated with normal or pre hypertension and non vegetarianism with stage I and stage II hypertension. The results correlate with the findings of David et al. (2009) who reported that the consumption of a diet containing vegetable proteins was associated significantly with reduced systolic and diastolic blood pressures, as against diets of animal origin. Consumption of non vegetarian foods among the adults largely involved deep frying and the use of common salt as a preservative and a decreased consumption of fibrous vegetables. This could probably be the reason for such an effect.

Analysis of the health behaviour of the adults revealed that habits such as smoking, alcohol, tobacco and lack of exercise were more common among adults with higher levels of blood pressure. A similar trend of high levels of systolic and diastolic blood pressure levels were reported by Hishida et al. (2009) among Japanese smokers. Sundell et al. (2008) reported that heavy alcohol consumption triggers cardiac arrhythmias which increased the risk for ischemic stroke due to cardiogenic embolism with a predisposing high-risk referring to atrial fibrillation, myocardial infarction together with cardiomyopathy. Studies by Hillbom et al. (2011) found that alcohol induced transient peaks in systolic blood pressure may predispose to stroke. Both family size and health behaviour were also seemed to affect hypertension as revealed from the present study. All the associations were found to be significant at one per cent level.

From Table II it is found that, normal and pre hypertensive adults were seen to be taller and lighter than the hypertensive adults. All the other anthropometric parameters such as BMI, waist and hip circumference, WHR, WHtR and MUAC were seen to increase as the level of hypertension increased. All the parameters except WHR and WHtR were seen to be significant at one per cent level. In the present study, the body weight and BMI of the adults also show a correlating effect with the level of hypertension. These findings echo the statement by the U.S. Department of Health and Human Services (2003) that losing weight has the biggest effect on those who already have hypertension and are overweight.

Table I : Relationship between lifestyle variables and degree of hypertension

Variables	Normal (n=304)	Prehypertension (n=615)	Hypertension Stage I (n=502)	Hypertension Stage II (n=219)	x2
Activity					
Sedentary	121(39.8)	297(48.3)	419(83.5)	199(90.9)	
Moderate	119(39.1)	272(44.2)	68(13.5)	14(6.4)	95.64**
Heavy	64(21.0)	46(7.5)	15(3.0)	6(2.7)	
Income					
Low	148(48.7)	49(8.0)	54(10.8)	31(14.2)	
Middle	92(30.3)	23(3.7)	41(8.2)	57(26.0)	126.82**
High	64(21.1)	543(88.3)	407(81.1)	131(59.8)	
Diet pattern					
Vegetarian	48(15.8)	238(38.7)	5 (1.0)	6(2.7)	
Ova vegetarian	44(14.5)	39(6.4)	43(8.6)	58(26.5)	89.798**
Non vegetarian	212(69.7)	338(54.9)	454(90.4)	155(70.8)	
Family size					
2- 4	126(41.4)	408(66.3)	430(85.7)	96(43.8)	
5 – 7	162(53.3)	201(32.7)	34(6.8)	74(33.8)	85.330**
Above 7	16(5.3)	6(0.9)	38(7.6)	49(22.4)	
Health behavior					
Lack of exercise	246(80.9)	461(74.1)	474(94.4)	192(87.7)	
Smoking	61(20.1)	62(10.1)	142(28.3)	141(64.4)	
Alcohol	16(5.3)	131(21.3)	219(43.7)	34(15.5)	129.04**
Tobacco	35(11.5)	163(26.5)	246(1.0)	157(71.7)	

* Figures in parenthesis indicate percentage; ** significant at 1 % level

This link between hypertension and increased body weight can be explained by the fact that the blood volume increases with excess body fat, and the heart works harder to pump the blood through a longer and constricted network of blood vessels (Hoeger and Hoeger, 2010). Considering the ratios between the waist and hip measurements and between the waist circumference and height, small increments in blood pressure levels could be observed with an increase in these values, though the significance of this association could not be established. Studies by Rhéaume et al. (2009), also predicted that visceral adipose tissue may represent an important clinical target in the management of elevated blood pressure. A significant relationship was also observed between the MUAC and blood pressure among the study population. Mazicioglu et al. (2010) also reported significant relationship between various anthropometric parameters and blood pressure values among Turkish adolescents.

Relationship between lipid profile and hypertension as presented in Table III revealed that as the blood pressure levels of the adults increased, there was also an increase in the total cholesterol, triglyceride, low and very low density lipoprotein levels of the adults and a decrease in the high density lipoprotein levels indicating that there may be a significant influence (1 % level) between the various lipid parameters and blood pressure levels. It can be inferred from the above data that all the four groups showed elevated levels of serum lipoproteins with reference to normal levels. Analysis of variance between the four groups revealed that higher levels of blood lipid parameters corresponded with higher levels of blood pressure. Adults with normal blood pressure had more favourable lipid levels when compared to the other groups.

Table II : Relationship between anthropometric parameters and degree of hypertension

Variables	Normal (n=304)	Prehypertension (n=615)	Hypertension Stage I (n=502)	Hypertension Stage II (n=219)	't' value
Height (cm)	158.18±8.42	158.47±9.17	157.23±7.84	156.95±8.36	4.64**
Weight (kg)	73.81±7.49	74.29±8.63	76.12±6.16	77.83±9.47	17.39**
BMI (kg/m^2)	28.44±3.60	30.23±4.18	30.58±3.55	1.17±3.84	3.53**
WC (cm)	100.86±7.83	101.72±7.94	103.06±8.27	103.32±9.31	7.48**
HC (cm)	104.42±5.78	106.05±6.85	106.31±5.38	107.57±6.60	16.26**
WHR	0.87±0.93	0.92±0.86	0.97±0.74	1.04±0.77	0.54^{NS}
WHtR	0.59±0.04	0.63±0.15	0.63±0.09	0.65±0.11	1.51^{NS}
MUAC (cm)	29.13±4.02	30.13±3.79	30.37±4.05	30.96±3.65	4.28**

*WC-waist circumference, HC-Hip circumference; ** significant at 1% level; NS- not significant

Table III : Relationship between lipid profile and degree of hypertension

Parameters (mg/dl)	Normal (n=304)	Pre hypertension (n=615)	Hypertension Stage I (n=502)	Hypertension Stage II (n=219)	't' value
Total cholesterol	225.82±33.42	237.47±26.84	259.84±21.79	278.49±29.53	54.75**
Triglyceride	164.96±20.51	169.59±17.48	177.28±19.62	185.94±19.67	59.46**
HDL	43.29±6.37	40.65±6.11	38.57±7.83	38.46±7.37	31.55**
LDL	162.85±25.83	164.36±22.06	173.52±28.47	177.39±28.68	9.42**
VLDL	31.97±17.46	33.64±14.60	33.53±15.39	34.16±15.57	8.59**

** Significant at 1% level

An analysis of the food choice pattern of the adults presented in Table IV revealed that healthy food preferences such as the inclusion of salads, greens, oats, whole grains and green tea; restricted intake of fats, sugar, salt, meat and coconut and avoiding fried snacks, sweets and visible oil were on the whole seen to be more closely associated with decreased blood pressure levels. When the food preferences of the adults were considered, it was observed that more number of adults who modified their diets towards a healthier pattern had lower levels of blood pressure. Majority of the adults with stage II hypertension had a minimum or no dietary restrictions and were comparatively more liberal eaters. A change towards a more favorable diet pattern has also been reported to be associated with improved blood pressure levels by Jacobs et al. (2009).

Table IV: Relationship between food choices and degree of hypertension

Foods	Normal (n=304)		Prehypertension (n=615)		Hypertension Stage I n=502)		Hypertension Stage II (n=219)	
	No.	%	No.	%	No.	%	No.	%
Included								
Salads and greens	10	3.3	11	1.8	7	1.4	6	2.7
Oats	57	18.8	53	8.6	41	8.2	27	12.3
Whole grains	34	11.2	19	3.1	11	2.2	7	3.2
Green tea	49	16.1	28	4.6	16	3.2	9	4.1
Restricted								
Fats and oils	34	11.2	24	3.9	20	4.0	16	7.3
Sugar/sweets	76	25.0	32	5.2	28	5.6	21	9.6
Salt	83	27.3	23	3.7	11	2.2	8	3.7
Meat	127	41.8	106	17.2	17	3.4	14	6.4
Pulses	41	13.5	38	6.2	30	6.0	14	6.4
Egg	51	16.8	17	2.8	13	2.6	4	1.8
Coconut	41	13.5	12	2.0	4	0.8	6	2.7
Avoided								
Fried snacks	72	23.7	14	2.3	21	4.2	12	5.5
Sweets	17	5.6	29	4.7	8	1.6	4	1.8
Visible oil	41	13.5	26	4.2	13	2.6	9	4.1

CONCLUSION

This study provides evidence among adults with a history of hypertension living in Madurai city of India that there is an association between diet, lifestyle and hyperlipidemia with the level of hypertension. The health status of a community or people - whether it is high or low is governed by a complex set of relationships. The health status can be enhanced by preventing the occurrence of illness or by promoting a good life and health or by curing illness. Education, healthcare, coupled with healthy practices and an environmental change to support optimal nutrition and physical activity, are essential to this health strategy. Best results in the prevention of chronic diseases can only be achieved by fully recognizing the essential role of diet, nutrition and physical activity along with managing various other principal risk factors for chronic disease

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