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ASSOCIATION BETWEEN BODY MASS INDEX AND BLOOD PRESSURE AMONG HOUSEWIVES OF TIRUPATI TOWN, ANDHRA PRADESH

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ABSTRACT

In the present study an attempt has been made to know the association between body mass index and blood pressure in housewives from Tirupati town of Andhra Pradesh, India. Data on body mass index, waist and hip circumference, waist hip ratio, blood pressure, other demographic and life style measures are collected from 618 healthy housewives. The percentage prevalence is hypertensives 17%; overweight and obesity: 28.45% and 18.77%. Mean systolic and diastolic blood pressure show significant variation across the BMI quintiles in hypertensives. A clear cut of increase is seen in systolic, diastolic blood pressure and pulse rate from normal weight to obese ($p<0.05$) in hypertensives. In hypertensives a gradual increase is seen in blood pressure and BMI with increase in waist, hip circumferences and WHR values ($p<0.05$). This inference clearly demonstrates the magnitude of the effect exerted by body mass index in developing hypertension among housewives.

KEYWORDS: Body mass index. Blood pressure. WHR. Housewives.

INTRODUCTION

Overweight and obesity are the most prevalent nutritional disorders in developed and developing countries due to rapid urbanization. Obesity itself is not an acutely lethal disease, but is a significant risk factor associated with a range of serious non-communicable diseases. Obesity is a major risk factor responsible for increasing prevalence of diabetes mellitus, hypertension, CVD, cancer and lipid disorders (Saboo et al., 2016). Body mass index (BMI) is promulgated by the World Health Organization (WHO) as the most useful epidemiological measure of obesity. It is nevertheless a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals and populations (WHO, 2002). Waist circumference, waist-hip ratio (WHR) and waist-height ratio (WHtR) are commonly used to predict the risk of obesity related morbidity and mortality as they account for regional abdominal adiposity (Henrike et al., 2014).

Confounding factors that affect blood pressure (BP) elevation seems to be age, sex, body mass index, socioeconomic status and eating habits (Miyaki et al., 2013; Sorof et al., 2014). Research reports ascertained the importance of body weight in developing high blood pressure (Chukwunonso and Ejike, 2013). High blood pressure remains a leading risk factor for heart disease and stroke and a major cause of morbidity and mortality worldwide (Go et al., 2013). Globally, prevalence of hypertension among adults was 40 percent in 2008 (WHO, 2011), and ischemic heart disease and stroke were the first and third leading causes of premature death (Murray et al., 2010). Hypertension is increasing rapidly in most low and middle income countries driven by diverse health transitions (Mohan et al., 2013).

The relationship between BMI and BP has long been the subject of epidemiological research. Positive association BMI and BP have also been reported among Asian populations (Tandon et al., 2006). India in a process of rapid economic development and modernization with changing life style factors has an increasing trend of hypertension especially among urban population (Srikanth et al., 2011).

The findings of many studies have shown that the incidence and the prevalence of obesity in women is higher in many countries compared to men and surprisingly the ratio is higher by 10-15 percent in women than in men (Fouad et al., 2006). Number of studies revealed that the prevalence of obesity is higher in women compared to men and it's associated with socioeconomical status and lifestyle (Ersoy et al., 2005; Tiwari et al., 2009; Dinsa et al., 2012; Leilei Pei et al., 2014). Therefore, present study is carried out to see the association between BMI and blood pressure among housewives in Tirupati town of Chittoor district, Andhra Pradesh.

MATERIAL AND METHODS

The material selected for the present study is housewives from Tirupati town of Chittoor district, Andhra Pradesh state. A total of 618 women in the age range of 20 to above 60 years are selected for the present study. The

objectives of the study have been explained before taking the written consent. The exclusion criteria include subjects with suffering from any chronic disease or pregnant/ lactating women. The protocol and consent forms are duly approved by Departmental Ethics Committee, Sri Venkateswara University, Tirupati, Andhra Pradesh.

Subject's demographics (age, education and income), are recorded. Socioeconomic status (SES) is assessed as per the procedure specified by Singh et al. (1997), and classified them into SES-I to SES-V (SES-I is the highest and SES-V is lowest class). Subject's physical assessment included height, weight; waist & hip circumference are measured. Weight is recorded with the subject's wearing light clothing without shoes. Height is measured and rounded off to the nearest centimeter, with the subject's standing in erect posture. BMI is calculated as weight in kg divided by the height in meter square (kg/m^2). Based on the BMI, subjects are categorized as normal weight (17.9-24.9 kg/m^2), over weight (25.0-29.9 kg/m^2) and obese (≥30.0 kg/m^2).

Waist girth is measured at the level of umbilicus with person breathing silently and hip girth measured at inter-trochanteric girth while standing according to the method specified by Weiner and Lourie (1981). WHR is calculated as waist circumference/hip circumference and categorized the subjects into 0.7-0.79, 0.8-0.89, 0.9-0.99 and >1. Blood pressure is recorded with sphygmomanometer as per the procedure of Rose et al. (1982). Systolic hypertension (≥140 mmHg) and Diastolic hypertension (≥90 mmHg) is calculated as per JNC VII (2004) committee recommendations. Statistical analysis is carried out by SPSS 16.0 version (SPSS, 2007) and *p* values are set at 0.05 as significant. Percentages are calculated for discontinuous variables. Descriptive statistics are provided for continuous variables and test of significant is seen with *t*-test.

RESULTS

In order to assess the association between body mass index and blood pressure levels in housewives of Tirupati town of Chittoor district, a total of 618 women are screened. Data on demographic profile of the study population is shown in table 1. On the whole normotensives are 513 and hypertensives are 105. In normotensives 32 percent of the sample fall in the age group of 20-29 years; 26 percent in 30-39 years; 21 percent in 40-49 years; 13 percent in 50-59 years and 7 percent in ≥60 years age groups; in hypertensives 8 percent of the sample fall in the age group of 20-29 years; 24 percent in 30-39 years; 28 percent in 40-49 years; 23 percent in 50-59 years and 18 percent in ≥60 years age groups. In normotensives illiteracy account for about 24 percent, primary education is noticed to an extent of 47 percent and higher education is 29 percent; in hypertensives illiteracy is about 37 percent, primary education is noticed to an extent of 49 percent and higher education is 14 percent. Regarding socioeconomic status, in normotensives SES-V is 17 percent, SES-IV is 26 percent, SES-III is 35 percent and SES-II is 23 percent; whereas, in hypertensives SES-III is 33 percent, SES-II is 30 percent, SES-IV is 22 percent and SES-I is an extent of 15 percent. Regarding BMI, in normotensives 58 percent are normal weight, 28 percent are overweight and obesity is 15 percent; in hypertensives 39 percent are obese, 32 percent are overweight and normal weight is 29 percent.

One way analysis of variance is applied to see the mean values of blood pressure and pulse rate according to categories of body mass index and the results are shown in table 2. A clear cut of increase is seen in systolic blood pressure, diastolic blood pressure and pulse rate from normal weight to obese ($p<0.05$) in hypertensives. Mean values for blood pressure and body mass index according to waist circumference are shown in table 3. In normotensives no significant association is seen in blood pressure while BMI exhibit a steady increase with increase in waist circumference. On the contrary, in hypertensives a gradual increase is seen in blood pressure and BMI with increase in waist circumference values ($p<0.05$).

Mean values for blood pressure and body mass index according to hip circumference for normotensives and hypertensives are shown in table 4. In normotensives no significant association is seen in blood pressure while BMI exhibit a steady increase with increase in hip circumference. On the divergent, in hypertensives a gradual increase is seen in blood pressure and BMI with increase in hip circumference levels ($p<0.05$). Table 5 shows the mean values for body mass index and waist hip ratio for normo and hypertensives. Hypertensives possess significant elevation in body mass index and waist hip ratio when compared to normotensives ($p<0.05$).

DISCUSSION

In the present study the association of body mass index with blood pressure is evaluated among the residential housewives of Tirupati town, Andhra Pradesh. Understanding the association between BMI and BP among different cohorts of women is worthy, as the women folk is subjected more of metabolic stress due to hormonal changes in the recent past. Majority of the women in India are still confined to residential house wives only. This attitude has ample possibility for the accumulation of fat storage at different sites. Prospective studies have clearly ascertained that an elevation in fat may have adverse effects on cardiovascular health problems. However the extent of association between BMI and CHD risk factors varies from community to community and across different economic and activity patterns. The overall findings of the current study reveals that adiposity markers like BMI and WHR are having strong positive correlation with blood pressure levels in the housewives with sedentary activity. Our findings are in good agreement with the other studies

conducted on different population groups (Turconi et al., 2006; Atallah et al., 2007; Reddy et al., 2012).

In the present sample, 17 percent of the women are classified as hypertensives. Simultaneously the prevalence of overweight and obesity is 28 percent and 19 percent respectively. When the prevalence rate of hypertension visualized across BMI categories, almost 40 percent of the women with obesity are developing hypertension against 14 percent in normotensives. This inference clearly demonstrates the magnitude of the effect exerted by BMI in developing hypertension. Several research outputs highlighted that angiotension converting enzyme inhibitors will be disrupted due to the accumulation of body mass. This hypothesis is applicable to the sample in the present study. Hence possible intervention to reduce body mass may have sizable effect on reducing the blood pressure (Thuridur et al., 2016). Our studies are strongly supported by literature (Melanie et al., 2009; Hasan et al., 2012).

Recent advances in metabolic disorders highlight that waist circumference is a promising measure to understand the risk of CHD than overall obesity. Studies from our laboratory also highlighted this in different population groups (Reddy et al., 2012). A significant elevation in mean levels of both systolic and diastolic blood pressure is noticed when waist circumference increases. Similar elevation in blood pressure is noticed when hip circumference and waist hip ratio increases. Overweight/obesity and increased WHR are associated with peripheral hyperinsulinaemia due to altered insulin metabolism, which is present in centrally obese subjects (Christian et al., 2013; Arshad et al., 2014). The authors further attributed that hyperinsulinaemia may exert adverse outcomes on angiotension converging enzymes, thus possible increase in blood pressure.

In conclusion, results of the present study clearly show that an elevation in BMI and WHR are more likely to develop high blood pressure and thus cardiovascular risk. Hence promotion of measures that exhausts fat at different sites will be effective. As the present study is exploratory in nature further comparative studies throw more light on the phenomena of BMI and hypertension.

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Conflict of Interest

None of the authors has a personal or financial conflict that has an interest in the subject of this Manuscript.

Table 1: Demographic characters of the study population (618)

Variable	Normotensive (513)		Hypertensive (105)	
	No	%	No	%
Age groups (years)				
20-29	166	32.35	8	7.61
30-39	134	26.12	25	23.81
40-49	107	20.86	29	27.62
50-59	68	13.26	24	22.86
≥60	38	7.41	19	18.10
Education				
Illiterate	122	23.78	39	37.14
Primary Education	243	47.37	51	48.57
Higher Education	148	28.85	15	14.29
				SES
SES-V	85	16.57	16	15.24
SES-IV	132	25.73	23	21.90
SES-III	179	34.89	35	33.33
SES-II	117	22.81	31	29.53
BMI				
Normal weight	296	57.70	30	28.57
Overweight	142	27.68	34	32.38
Obese	75	14.62	41	39.05

Table 2: Mean values for blood pressure and pulse rate in relation to BMI

Variable	BMI	Normotensive (513)		Hypertensive (105)	
		Mean	SD	Mean	SD
Systolic Blood Pressure (mmHg)	Normal weight	129.19	14.22	137.52	11.91
	Overweight	131.69	17.09	146.00	12.60
	Obese	134.37	12.09	156.29	9.42
	F-ratio	1.75		2.16*	
Diastolic Blood Pressure (mmHg)	Normal weight	76.40	9.17	97.28	10.49
	Overweight	79.23	8.65	98.43	10.73
	Obese	80.24	9.16	100.73	10.80
	F-ratio	1.69		3.93*	
Pulse Rate	Normal weight	84.27	11.31	87.04	13.14
	Overweight	88.45	11.47	90.93	9.88
	Obese	89.65	12.01	93.55	7.81
	F-ratio	1.85		4.94*	

$p<0.05$

Table 3: Mean values for blood pressure and body mass index according to Waist circumference

Variable	Waist Circumference (cm)	Normotensive (513)		Hypertensive (105)	
		Mean	SD	Mean	SD
Systolic Blood Pressure (mmHg)	70-79	120.65	17.65	149.40	10.78
	80-89	123.21	16.34	154.88	12.56
	90-99	124.88	12.07	156.73	11.28
	100-109	127.12	13.21	158.00	7.13
	110-119	-	-	158.75	1.58
	F-ratio	1.36		2.09*	
Diastolic Blood Pressure (mmHg)	70-79	75.14	8.29	97.08	13.82
	80-89	77.55	9.32	94.10	9.28
	90-99	80.04	8.53	100.06	12.59
	100-109	79.99	10.62	101.20	1.82
	110-119	-	-	108.10	1.69
	F-ratio	1.76		3.96*	
Body Mass Index (kg/m^2)	70-79	20.17	1.38	20.48	1.23
	80-89	24.28	2.75	23.99	2.06
	90-99	29.58	3.19	29.47	2.51
	100-109	33.25	3.43	32.77	3.32
	110-119	-	-	35.98	2.21
	F-ratio	3.66*	4.73*		

$p<0.05$

Table 4: Mean values for blood pressure and body mass index according to hip circumference

Variable	Hip Circumference (cm)	Normotensive (513)		Hypertensive (105)	
		Mean	SD	Mean	SD
Systolic Blood Pressure (mmHg)	70-79	118.00	14.58	140.00	-
	80-89	119.12	15.64	150.11	10.78
	90-99	125.37	17.46	152.00	8.84
	100-109	125.92	13.15	154.38	14.00
	110-119	126.62	12.88	157.82	11.63
	120-129	128.36	8.18	158.00	7.07
	F-ratio	1.17		4.16*	
Diastolic Blood Pressure (mmHg)	70-79	73.18	8.54	91.00	-
	80-89	75.31	9.11	92.33	14.51
	90-99	77.97	8.94	92.50	11.27
	100-109	77.07	8.48	98.72	9.37
	110-119	79.80	8.67	99.62	2.16
	120-129	80.87	7.21	100.00	0.7
	F-ratio	1.60		4.99*	
Body Mass Index (kg/m^2)	70-79	22.31	1.94	19.12	-
	80-89	21.83	2.09	22.11	1.55
	90-99	24.41	2.84	25.06	2.28
	100-109	28.02	3.09	28.04	3.29
	110-119	29.89	3.02	30s.70	1.43
	120-129	39.47	2.63	35.27	2.23
	F-ratio	4.18*		5.59*	

$p<0.05$

Table 5: Mean values for body mass index and waist hip ratio for normotensive and hypertensive

Variable	Blood Pressure	Mean	SD	t-value
Body Mass Index (kg/m^2)	Normotensive	25.09	3.22	2.99*
	Hypertensive	28.98	4.10	
Waist-Hip Ratio	Normotensive	0.89	0.15	3.03*
	Hypertensive	0.97	0.07	

**p<0.05*

REFERENCES

1. Arshad Mohamed Channanath, Bassam Farran, Kazem Behbehani, Thangavel Alphonse Thanaraj. Impact of Hypertension on the Association of BMI with Risk and Age at Onset of Type 2 Diabetes Mellitus: Ageand Gender-Mediated Modifications. PLOS ONE, 2014; 9(4): e95308.
2. Atallah A, Inamo J, Lang T, Larabi L, Chatellier G, Rozet JE, De Gaudemaris R. Obesity and high blood pressure in French West Indies women: Some difference according to definition of obesity, BMI or abdominal obesity. Arch Mal Coeur Vaiss, 2007; 100: 609-614.
3. Christian KR, Andrea LH and James BR. Metabolic Syndrome and Insulin Resistance: Underlying Causes and Modification by Exercise Training. Compr. Physiol, 2013; 3(1): 1-58.
4. Chukwunonso E, Ejike CC Obesity and Hypertension in Children and Adolescents. Developing New Tools for the Diagnosis of Two Global Pediatric Challenges. J Med Sci., 2013; 13: 151-159.
5. Dinsa GD, Goryakin Y, Fumagalli E and Suhrcke M. Obesity and socioeconomic status in developing countries: a systematic review. Obesity reviews © 2012 International Association for the Study of Obesity, November, 2012; 1067–1079.
6. Ersoy C, Imamoglu S, Tuncel E, Erturk E, Ercan I. Comparison of the factors that influence obesity prevalence in three district municipalities of the same city with different socioeconomical status: A survey analysis in an urban Turkish population. Prev Med 2005;40:181-8.
7. Fouad M, Rastam S, Ward K, Maziak W. Prevalence of obesity and its associated factors in Aleppo, Syria. Prev Control, 2006; 2: 85-94.
8. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, et al. Heart disease and stroke statistics--2013 update: a report from the American Heart Association. Circulation, 2013; 127: e6-6e245.
9. Hasan M. Shihab, Lucy A. Meoni, Audrey Y. Chu, NaeYuh Wang, Daniel E. Ford, Kung-Yee Liang, Joseph J. Gallo, and Michael J. Klag. Body Mass Index and Risk of Incident Hypertension over the Life Course: The Johns Hopkins Precursors Study. Circulation. December, 2012: 18; 126(25): 2983-2989.
10. Henrike (Rianne) Joanna Cornelie Ravensbergen,1,2 Scott Alexander Lear,1,3,4 and Victoria Elizabeth Claydon1, Waist Circumference Is the Best Index for Obesity-Related Cardiovascular Disease Risk in Individuals with Spinal Cord Injury. JOURNAL OF NEUROTRAUMA, February 1, 2014; 31: 292–300.
11. JNC: Joint National Committee (VII). Recommendations on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, 2004.
12. Leilei Pei, Yue Cheng, Yijun Kang, Shuyi Yuan and Hong Yan. Association of obesity with socioeconomic status among adults of ages 18 to 80 years in rural Northwest China. BMC Public Health, 2015; 15: 160.
13. Melanie Warziski Turk, Kyeongra Yang, Marilyn Hravnak, Susan M. Sereika, Linda J. Ewing and Lora E. Burke. Randomized Clinical Trials of Weight-Loss Maintenance: A Review. J Cardiovasc Nurs, 2009; 24(1): 58–80.
14. Miyaki K, Song Y, Taneichi S, Tsutsumi A, Hashimoto H, et al. Socioeconomic status is significantly associated with dietary salt intakes and blood pressure in Japanese workers (J-HOPE Study). Int J Environ Res Public Health, 2013; 10: 980-993.
15. Mohan S, Campbell N, Chockalingam A. Time to effectively address hypertension in India. Indian J Med Res., 2013; 137: 627-631.
16. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, et al. Disability adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2000: a systematic analysis for the Global Burden of Disease Study 2010. The Lancet, 2010; 380: 2197–2223.
17. Reddy KK, Reddy KSN, Papa Rao A, Lalu Naik J and Anwar Basha D. Association of Anthropometric Parameters with Blood Pressure in Urban Adult Females of Andhra Pradesh. J Life Sci, 2012; 4(2): 107-111.
18. Rose GA, Blackburn HG, Gillum RF, Prineas RJ. 1982. Cardiovascular survey methods. WHO Publication, 2nd Edn., No. 56. Geneva: World Health Organization.
19. Saboo B, Talaviya P, Chandarana H, Shah S, Vyas C, Nayak H. Prevalence of obesity and overweight in housewives and its relation with household activities and socio-economical status. J Obes Metab Res., 2016; 1: 20-4.
20. Singh RB, Ghosh S, Niaz MA and Rastogi V. Validation of physical activity and socioeconomic status questionnaire in relation to food intakes for the five city study and proposed classifications for Indians. J. Assoc. Physicians. India, 1997; 45: 603-607.

21. Sorof JM, Lai D, Turner J, Poffenbarger T, Portman RJ Overweight, ethnicity, and the prevalence of hypertension in school-aged children. Pediatrics, 2004; 113: 475-482.
22. SPSS Inc. SPSS for Windows, Version 16.0. Chicago, 2007.
23. Srikanth J, Jayant Kumar K, Narasimha NS. Factors influencing obesity among urban high school children Bangalore City. Indian J Nutr Dietet. 2011; 48: 8–17.
24. Tandon T, Obesity, its distribution pattern and health implications among Khatri population, Ph.D. thesis, Department of Anthropology, University of Delhi, Delhi, India, 2006.
25. Thuridur A. Gudnadottir, Brian T. Bateman, Sonia Hernadez-Diaz, Miguel Angel Luque-Fernandez, Unnur Valdimarsdottir, Helga Zoega. Body Mass Index, Smoking and Hypertensive Disorders during Pregnancy: A Population Based Case-Control Study. PLOS ONE | DOI:10.1371/journal.pone.0152187 March 24, 2016.
26. Tiwari R, Srivastava D, Gour N. A cross-sectional study to determine prevalence of obesity in high income group colonies of Gwalior City. Indian J Community Med., 2009; 34: 218-22.
27. Turconi G, Guarcello M, Maccarini L, Bazzano R, Zaccardo A, Roggi C. BMI values and other anthropometric and functional measurements as predictors of obesity in a selected group of adolescents. Eur J Nutr, 2006; 45: 136-143.
28. Weiner JS and Lourie JA. General medical examinations, Techniques. Practical Human Biology. Academic press, London, 1981.
29. WHO. 2002. Consultation on Obesity. Obesity: Preventing and Managing the Global Epidemic. WHO Technical Report Series 894, Geneva: World Health Organization.
30. WHO. 2011. A comprehensive global monitoring framework and voluntary global targets for the prevention and control of NCDs. In WHO discussion paper. Geneva, World Health Organization.