



Correlation of blood pressure with anthropometric measurements among postmenopausal women

Abstract:

Introduction: Oestrogen deficiency has been linked to the rapid increase in cardiovascular disease in women who have undergone natural or surgical menopause. Menopause is also a significant factor in designating cut-off values for female central obesity as it brings sudden bodily changes that induce central obesity.

Objectives: The objectives of the study was to assess correlation of blood pressure with anthropometric measurements (body mass index and waist to hip circumference ratio) among postmenopausal women.

Methods and Materials: This was a community based cross-sectional study conducted among women residing at Sanjaynagar, Bangalore, India. A Correlational descriptive survey design was used. 100 postmenopausal women who fulfilled the selection criteria were selected by using non-probability convenient sampling technique. The instruments included socio-demographic data and bio-physiological measurements. Subject were interviewed and socio-demographic data was collected. BMI, waist circumference, hip circumference and blood pressure were measured.

Results: The study showed no correlation between BMI and systolic blood pressure whereas there was a positive correlation [correlation coefficient ($r = 0.199$), table value ($r = 0.165$), degree of freedom ($df = 98$)] between BMI and diastolic blood pressure. There was a significant association between systolic blood pressure and the socio-demographic variables such as age in years [$\chi^2 = 12.833$, table value = 12.592, $df = 6$, ($p = 0.049$)] and monthly family income [$\chi^2 = 21.712$, table value = 21.026, $df = 12$ ($p = 0.049$)]. There was a significant association between BMI and the socio-demographic variables such as educational status [$\chi^2 = 47.866$, table value = 46.979, $df = 30$, ($p = 0.025$)], non-vegetarian diet [$\chi^2 = 12.601$, table value = 11.070, $df = 5$, ($p = 0.05$)] and exercise [$\chi^2 = 16.154$, table value = 15.086, $df = 5$, ($p = 0.01$)].

Conclusion: Changes in anthropometric measurements like Body mass index and waist to hip circumference ratio may act as indicators for alteration in blood pressure among postmenopausal women.

Key Words: Body mass Index; Waist to hip circumference ratio; Blood pressure; Postmenopausal women; Anthropometric measurement.

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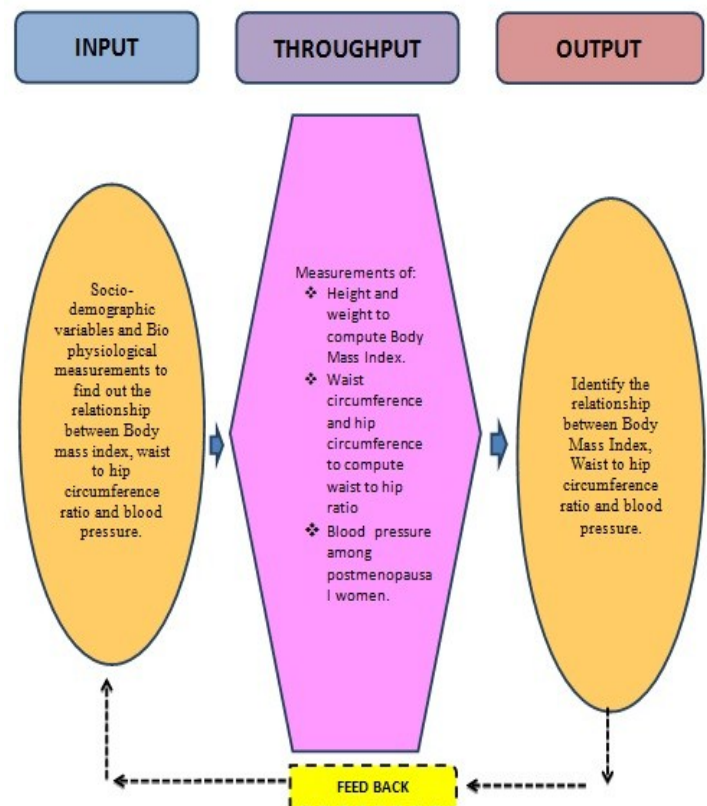
70% of women ≥ 70 years, had hypertension.⁶

According to World Health Organization (2010), there were 1.8 billion overweight adults and 450 million adults who were obese worldwide. India is also similar in the trend of obesity. Currently one in five men and over one in six women are overweight. This rate is even higher, up to 40% in urban areas. The prevalence of obesity in Indian women has elevated from 10.6% (conducted by National family health survey in 1998-1999) to 12.6% (National family health survey in 2005-2006), which is an increase by 24.5%. This prevalence is more profound in women in the age between 40-49 years (23.7%).⁷

Based on the above statistics, the researcher felt the need to conduct the study on correlation of blood pressure with body mass index and waist to hip ratio among postmenopausal women.

Conceptual Framework

Figure 1: Conceptual Framework based on Ludwig Von Bertalanffy General System Model.



Introduction

Cardiovascular diseases are the leading cause of death in women claiming the lives of more than half a million women every year and hypertension is one of the major cardiovascular risk factors for the excess mortality and morbidity in postmenopausal women.¹

Oestrogen deficiency has been linked to the rapid increase in cardiovascular disease in women who have undergone natural or surgical menopause.² Menopause is a significant factor in designating cut-off values for female central obesity as it brings sudden bodily changes that induce central obesity.³

Central obesity is also recognised to be strongly correlated with cardiovascular disease including hypertension and waist to hip circumference ratio is essentially one of the commonly used anthropometric measurements for central obesity. WHO Expert Consultation on Obesity recognized the importance of abdominal fat mass which can vary considerably within a narrow range of total body fat and body mass index. Specifically, individuals who have large deposits of abdominal fat tissue are at increased risk for hypertension. Waist-hip ratio was suggested as an additional measure of body fat distribution. The ratio can be measured more precisely than skin folds, and it provides an index of both subcutaneous and intra-abdominal adipose tissue.⁴

The demographic profile of India boasts a larger population of elderly women than older men as the life expectancy for women is 67.57 against 65.46 for men. With that perspective, it is essential to note that cardiovascular diseases and its related risk factors like hypertension and obesity are quite prevalent in postmenopausal women.⁵

According to the Analysis of 'Global Burden Of Hypertension' published in 2005, 39.1% of women in the age group of 50-59 years, 53.4% of women in the age group of 60-69 years and

Methodology

This descriptive correlational study was done among 100 postmenopausal women aged 45 to 52 years conducted at Sanjaynagar, Bangalore, India by using non-probability convenient sampling technique in 2014. The instruments included socio-demographic data and bio-physiological measurements. Content validity of socio-demographic data was done prior to the pilot study period established by 12 experts. The weighing machine and sphygmomanometer were calibrated using standards with accuracy guidelines traceable to the National Institute of Standards and Technology (NIST) at Telematics and Biomedical Services PVT. LTD, Mittal Towers, M G Road, # 6, Bangalore.

BMI was calculated by measuring height (in cm) using a standardized non-stretchable measuring tape and weight (in kg) was measured using a calibrated weighing machine. For waist circumference and hip circumference, the subjects were convinced to be on single layer clothing and stand with feet close together and relaxed, arms at the side and body weight evenly distributed. The measurements were taken at the end of an expiration. The waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, using a standardized non-stretchable measuring tape. Similarly, hip circumference was measured around the widest portion of the buttocks.

Likewise, the auscultatory method of blood pressure measurement was used. Researcher ensured that the patient had not taken caffeine, not exercised and had not been smoking for at least 30 minutes prior to measurement. Patient seated quietly for at least 5 minutes in a chair with feet on the floor and arm supported at heart level. Average of three blood pressure readings was recorded with an interval of 2 minutes on the same arm.

Data collection was carried out from 1st November 2014 to 30th November 2014. The collected data were reviewed daily for completeness and accuracy.

Criteria of Interpretation:

Table 1: Blood pressure measurements.⁸

BLOOD PRESSURE VALUES (mm of Hg)		CATEGORIES
Systolic blood pressure	Diastolic blood pressure	BP Classification
< 120	<80	Normal
120-139	80-89	Prehypertension
140-159	90-99	Stage-I HTN
≥ 160	≥ 100	Stage –II HTN

Table 2: Body Mass Index (BMI):⁹

BMI VALUES (kg/m ²)	CATEGORIES
< 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0-34.9	Obese- class I
35.0-39.9	Obese- class II
> 40.0	Extremely obese

Table 3: Waist to hip circumference ratio:⁴

WAIST TO HIP RATIO VALUES	CATEGORIES
< 0.80	Low risk
0.81 to 0.85	Moderate risk
≥ 0.85	High risk

Data analysis was done by using SPSS version 17 for descriptive as well as inferential statistics.

Result

Among 100 subjects, majority (48%) of the subjects belonged to the age group of 57-62 years, 27% were of 45-50 years and 25% were of 51-56 years. With regard to age at menopause, majority (36%) of the subjects had menopause at 46-50 years, 29% at 51 years and above, 27% at 41-45 years and only 8% of subjects

had menopause at 40 years and below. 76% of subjects were non-vegetarian and 24% of subjects were vegetarian. Majority (57%) of subjects were exercising regularly.

Table 4: Frequency and percentage distribution of bio-physiological measurements. n=100

Sl. no	Bio-physiological measurements	f	%
1.	Systolic blood pressure (mm Hg)		
a.	< 120	25	25
b.	120-139	49	49
c.	140-159	22	22
d.	≥ 160	4	4
2.	Diastolic blood pressure (mm Hg)		
a.	< 80	30	30
b.	80-89	44	44
c.	90-99	24	24
d.	≥100	2	2
3.	Body Mass Index Values (kg/m²)		
a.	< 18.5	3	3
b.	18.5-24.9	33	33
c.	25.0-29.9	42	42
d.	30.0-34.9	14	14
e.	35.0-39.9	5	5
f.	> 40.0	3	3
4.	Waist to hip circumference ratio (WHR)		
a.	< 0.80	3	3
b.	0.81 to 0.85	10	10
c.	> 0.85	87	87

Table 4 depicts that 75% of the subjects had systolic blood pressure (SBP) of 120 mmHg and above (pre hypertension and above). Likewise, 70% of the subjects had diastolic blood pressure (DBP) of 80 mm Hg and above (pre hypertension and above). Similarly, 64% of the subjects had BMI of 25 and above (over weight and above). Majority (87%) of the subjects had WHR >0.85 shows high risk for cardiovascular disease.

Table 5: Correlation between bio physiological measurements and blood pressure n=100

SN	Bio-physiological measurements	Mean	SD	r value	P value
1)	Systolic blood pressure (mm of Hg)	130.58	±17.730	0.077	0.5
	Body mass index	26.92	±5.280		
2)	Diastolic blood pressure	82.51	±10.324	0.199*	0.05
	Body mass index	26.923	±5.280		
3)	Systolic blood pressure	130.58	±17.730	0.015	0.8
	Waist to hip circumference ratio	0.901	±0.048		
4)	Diastolic blood pressure	82.51	±10.324	0.05	0.6
	Waist to hip circumference ratio	0.901	±0.048		

* Significant at p=0.05 level

Table 5 depicts a positive correlation between diastolic blood pressure and body mass index (p = 0.05).

Table 6: Association of systolic blood pressure with selected socio-demographic variables n=100

S N	Demographic Variables	Systolic Blood Pressure (mm of Hg)				χ ²	p value
		<120	120-139	140-159	≥ 160		
1.	Age in years					12.833 (df=6)	0.049*
a.	45-50	11	12	4	0		
b.	51-56	8	13	4	0		
c.	57-62	6	24	14	4		
2.	Monthly family income (in rupees)					21.712 (df=12)	0.049*
a.	≤ 10,000	19	17	8	1		
b.	10,001-20,000	1	20	8	1		
c.	20,001-30,000	2	6	2	0		
d.	30,001-40,000	1	1	1	0		
e.	> 40,001	2	5	3	2		

* Significant at 0.05 level of significant

Table 6 depicts that there was a significant association between systolic blood pressure (p=0.049) and the socio-demographic variables (p=0.049).

Table 7: Association of BMI with selected socio-demographic variables. n=100

S N	Demo- graphic Variables	Body Mass Index						X ² Value	P value
		< 18.5	18.5- 24.9	25.0-29.9	30.0- 34.9	35.0- 39.9	>40.0		
1	Educational status								
A	Primary education	1	13	19	6	1	1	47.866 (df=30)	0.025*
B	Secondary education	0	5	5	6	4	2		
C	Higher secondary education	0	0	2	0	0	0		
D	Diploma	0	0	1	0	0	0		
E	Graduate	0	1	9	0	0	0		
F	Post-graduation and above	0	0	2	0	0	0		
G	No formal education	2	14	4	2	0	0		
2	Type of diet								
A	Vegetarian	0	3	14	5	0	2	12.601 (df=5)	0.049*
B	Non-vegetarian	3	30	28	9	5	1		
3	Do you exercise regularly?								
A	Yes	0	12	28	12	3	2	16.154 (df=5)	0.01*
B	No	3	21	14	2	2	1		

Table 7 depicts that there was a significant association between BMI and the socio-demographic variables such as educational status ($p=0.025$), non-vegetarian diet ($p=0.049$) and exercise ($p=0.01$).

Discussion

One of the objectives of the study was to find the relationship between body mass index (BMI) and blood pressure among postmenopausal women. The correlation coefficient value between BMI and systolic blood pressure revealed no correlation but a positive correlation between BMI and diastolic blood pressure. The results were compatible with the results of the study conducted by Tyagi R et al which showed that among postmenopausal women there was a significant difference between the group with increased diastolic blood pressure and normal diastolic blood pressure when compared for Body mass Index (BMI).¹⁰

Similarly, significant associations between systolic blood

pressure and the socio-demographic variables such as age in years ($p=0.049$) and monthly family income ($p=0.049$) were observed in the study. These results regarding age were in agreement with the findings in a similar study conducted on "The influence of menopause on blood pressure" at Hammersmith hospital, London, UK where in a random sample of 278 pre and 184 postmenopausal women, after adjustment of BP for significant covariates, such as body mass index, pulse rate and contraceptive pill intake, the slope of SBP on age was 0.5 mmHg/year steeper in women with natural and surgical menopause than in pre-menopausal subjects.¹¹

There were also significant associations between BMI and the socio-demographic variables such as educational status ($p=0.025$), non-vegetarian diet ($p=0.05$) and exercise ($p=0.01$) as well. These results related to diet were similar to the study conducted on "Oestradiol and sex hormone-binding globulin in premenopausal and postmenopausal meat-eaters, vegetarians and vegans." by Thomas HV et al which revealed that Vegetarians and vegans had lower mean body mass indices compared to non-vegetarians.¹²

Likewise, the results regarding exercise were similar to the findings in a cross-sectional study conducted to assess the physical activity and pattern of blood pressure in postmenopausal women with hypertension at tertiary hospital in Ibadan, Oyo State, Nigeria. The Nigerian study showed that mean values of Systolic blood pressure, Diastolic blood pressure, BMI and Waist to hip circumference ration were higher among participants with low physical activity compared to those with moderate to vigorous even though the difference was not statistically significant.¹³

Conclusion

Despite a weak correlation between anthropometric measurements and blood pressure among postmenopausal

women in the study, these results may well represent the alteration in blood pressure that changes in body fat distribution bring with menopause. Because anthropometric measurements like Body mass index and waist to hip circumference ratio are easy to measure in community settings, these may be used as efficient tools to screen for alteration in blood pressure among postmenopausal women.

Recommendation

- The study can be replicated in different settings with larger samples, thereby the findings could be generalized better.
- A comparative study can be conducted between pre and post-menopausal women to assess body mass index, waist to hip circumference with blood pressure.

Acknowledgement

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Ethical Clearance

Formal permission was obtained from Rajiv Gandhi University of Health Sciences, Karnataka, India as well as from the Joint Commissioner, Bruhat Bengaluru Mahanagar Palika (BBMP), Bangalore and the concerned authority of sanjaynagar PHC, Bangalore. Written consent was obtained from the subjects to participate in the study after explanation. The goal of ethics was to ensure that no one is harmed or suffers adverse consequences from the research activities. Privacy, confidentiality and anonymity of the respondents were

maintained. The respondents were clearly informed about their right to voluntarily withdraw from the study at any time.

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