

COMPARISON OF OBESITY INDICES AND BLOOD PRESSURE IN SAMPLE OF PRE-MENOPAUSAL AND POST-MENOPAUSAL WOMENSuguna S¹, Prashanth K. S²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: Menopause is accompanied by increased risk of cardiovascular morbidity. Withdrawal of protective effect of estrogen has been documented to produce changes in lipid and glucose metabolism, body weight and fat distribution, vascular resistance and host of other mechanisms. Several parameters have been proposed as markers for increased cardiovascular risk in post-menopausal women. But what are the simplest markers that can be easily measured and monitored? Study attempts to examine changes in Blood pressure, Body weight, Body Mass Index (BMI) and Waist-hip ratio (WHR) during menopausal transition. **METHOD:** A comparative study involving 30 pre-menopausal and 30 post-menopausal women. Anthropological measures (Height, Weight, BMI, WHR, Waist circumference, Hip circumference) and cardiovascular parameters (Systolic and Diastolic blood pressure) were recorded and compared between the two groups. **RESULTS:** Post-menopausal women had greater body weight (p 0.046), BMI (p 0.05), waist circumference (p 0.005), Hip circumference (p 0.002), compared to pre-menopausal women. More number of Post-menopausal women was hypertensive compared to pre-menopausal women (p 0.024). **CONCLUSION:** Post-menopausal women have greater propensity for obesity and hypertension. These conditions should be monitored and targeted for intervention in order to reduce cardiovascular risk in this population.

KEYWORDS: Pre-menopausal women, Post-menopausal women, Body Mass Index, Waist circumference, Waist-Hip ratio, Systolic Blood pressure, Diastolic Blood pressure, Hypertension, Obesity.

MeSHTERMS: Premenopause, Postmenopause, Obesity, Hypertension, Coronary disease.

INTRODUCTION: Menopause is not a disease but a physiological phase of a woman's life. However, due to the changing hormonal milieu, this phase is accompanied by several bodily changes affecting both physical and metabolic profile of the woman. These changes are known to predispose post-menopausal women to increased cardiovascular risk.

Women develop coronary heart disease relatively late in life, with menopause (Natural or surgical) making a precipitous climb in Coronary Heart Disease (CHD) rates.¹ After menopause, cardiovascular disease risk increases more steeply in women than in men. The accelerated risk around the age of menopause has been explained by the loss of a protective factor estrogen or unmasking of a risk factor androgen. Decline in estrogen levels doubles and triples the risk of Cardio Vascular Diseases (CVD) through its metabolic and vascular consequences.²

As the population ages, both the number of older women and the prevalence of CVD are expected to increase. With each decade of life, the death rate from CVD among women increases three to five fold.

Early identification and aggressive modification of CHD risk factors are critical in preventing the onset of coronary disease and reducing its mortality. Intervention can be done in the form of screening, counseling and initiation of remedial measures for primary prevention of CHD.

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Many factors could indicate possible high cardiovascular risk in women of menopausal age. Several physical, anthropological, clinical, hematological, and metabolic and serum inflammatory markers have been identified and studied as predictors of cardiovascular morbidity. But what are the simplest parameters that can be assessed even in a very basic setting that could indicate need for further evaluation and intervention?

Basic haemodynamic parameters such as blood pressure and obesity markers such as Body Mass Index and Waist-Hip ratio can be measured with great ease, with minimal equipment and basic training by even non-medical personnel. These could be of great value in the Indian setting considering the large population and paucity of resources especially in the peripheral centres.

The prevalence of risk factors for coronary heart disease has been inadequately studied in India. Hence this study was taken up to evaluate changes in blood pressure and obesity indices during menopausal transition in a sample of urban Indian menopausal women.

OBJECTIVES: To compare blood pressure, BMI and Waist-Hip ratio in a sample of postmenopausal women with those of premenopausal women.

To ascertain whether these parameters are significantly altered after menopause.

METHODOLOGY: A comparative study was conducted involving two groups of women selected from general population of Bengaluru city. One group (Group A: Pre-menopausal) consisted of 30 women who were still having their regular menstrual cycles. The other group (Group B: Post-menopausal) consisted of 30 women, who gave history of amenorrhoea for more than 12 months. Menopausal status was ascertained by estimation of serum levels of Follicle Stimulating Hormone. FSH > 30 mIU/ml was considered evidence of post-menopause status.

Excluded from the study were pregnant women and those with history of irregular menstrual cycles (among pre-menopausal women), pre-existing cardiac disease, chronic liver, jaundice, hormonal disorders, those on hormone therapy or oral contraceptives.

All subjects were explained about the study protocol and written informed consent was taken. Thorough history was obtained from each subject and clinical examination was done. Following measures were documented:

ANTHROPOMETRY

HEIGHT: Height was measured using a vertical board with an attached metric scale. It was measured to the nearest 0.1 cm with bare feet, body in close contact with the vertical board.

WEIGHT: Was recorded by making subjects stand (with minimal clothing and no footwear) on a dial type weighing machine. It was recorded to the nearest 0.1 kg.

BODY MASS INDEX: BMI was calculated as weight in kg/square of height in metres.

WAIST/HIP RATIO: using a non-elastic measuring tape, waist circumference was measured in centimetres, at the level of the mid-point between lower costal margin and iliac crest. Hip circumference was measured in centimetres around the maximal bulge of gluteus maximus. Ratio of the two was taken. If WHR was more than 0.85, it was considered android type obesity.³

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CARDIOVASCULAR PARAMETERS:

RADIAL PULSE: right hand radial pulse was measured for one minute and checked for rate, rhythm, volume and condition of vessel wall.

BLOOD PRESSURE: was recorded using a standard sphygmomanometer with subject in sitting posture, cuff applied to right upper arm. Subjects were labelled as follows:

| SBP (mm of Hg) | DBP (mm of Hg) | |
|----------------|----------------|-----------------------|
| <120 | <80 | Normal |
| 120-139 | 80-89 | pre-Hypertension |
| 140-159 | 90-99 | stage I Hypertension |
| >/= 160 | >/= 100 | stage II Hypertension |

HUMAN FOLLICLE STIMULATING HORMONE (hFSH) ASSAY: Chemiluminiscent immunoassay (CLIA) was used for the quantitative determination of hFSH levels. Levels more than 30 mIU/ml was considered evidence of post-menopausal status (5).

STATISTICAL ANALYSIS: Chi square test and Fisher exact test were used to test significance of proportions between pre and post-menopausal women. Student t test was used to find the significance of difference in anthropometry and cardiovascular parameters and FSH levels between the two groups.

RESULTS:

| Anthropometry parameters | Pre-menopause (Mean ± SD) | Post-menopause (Mean ± SD) | p value |
|----------------------------|------------------------------|-------------------------------|---------|
| Age in years | 40.80±5.92 | 50.00±5.68* | 0.050 |
| Height in meters | 1.53±0.05 | 1.51±0.06 | 0.060 |
| Weight in kg | 58.00±10.81 | 61.78±9.89* | 0.046 |
| HIP circumference in cm | 87.33±24.98 | 100.47±15.19** | 0.002 |
| Waist circumference in cm | 75.43±24.05 | 90.45±14.37** | 0.005 |
| Waist-Hip Ratio | 0.84±0.08 | 0.85±0.05 | 0.480 |
| BMI (kg/m ²) | 24.84±4.56 | 27.29±4.90* | 0.050 |

Table 1: Comparison of Anthropometry parameters between two groups

* Significance at 5% ** Significance at 1% by student t test.

Table 1 depicts comparison of anthropometry parameters between pre and post-menopausal women. It is evident that weight, Hip circumference, waist circumference and BMI were significantly higher in post-menopausal women. Waist-Hip Ratio did not show statistically significant difference.

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| Follicle stimulating hormone (mg/L) | (Mean ± SD) |
|--|--------------------|
| Pre-menopause | 8.07±4.86 |
| Post-menopause | 50.50±14.82 |
| p value | <0.001 |

Table 2: Follicle stimulating hormone (hFSH)

** Significance at 1% student t test.

FSH level was significantly higher ($P<0.001$) in post-menopausal women.

| Presenting Factors | Pre menopause (n=30) | Post menopause (n=30) | p value |
|---|---------------------------------|----------------------------------|----------------|
| Hypertension | 5(16.7%) | 13(43.3%)* | 0.024 |
| Diabetes Mellitus | 4(13.3%) | 13(43.3%)* | 0.010 |
| Family history (Diabetes/Hypertension/Ischemic Heart disease) | 13(43.3%) | 10(33.3%) | 0.426 |

Table 3: Comparison of presenting factors between groups

* Significance at 5% ** Significance at 1% by Chi-square and Fisher Exact test.

Table 3, In their presenting history, 43.3% postmenopausal women were hypertensive and 43.3% were diabetic compared to 5% and 4% premenopausal women respectively. The difference was statistically significant.

| Cardiovascular Parameters | Pre-menopause (Mean ± SD) | Post-menopause (Mean ± SD) | p value |
|----------------------------------|--------------------------------------|---------------------------------------|----------------|
| Systolic Blood Pressure mm Hg | 121.70±13.23 | 122.86±12.66 | 0.246 |
| Diastolic Blood Pressure mm Hg | 80.43±10.13 | 81.67±8.63 | 0.060 |

Table 4: Comparison of Cardiovascular Parameters between two groups

* Significance at 5% ** Significance at 1% by student t test.

Table 4 shows that though mean Systolic blood pressure and Diastolic blood pressure were higher in post-menopausal women; the difference was not statistically significant.

DISCUSSION: The female cardiovascular system enjoys special protection during her fertile period. However, menopause results in drastic changes in her hormonal milieu, most important being decrease in Estrogen levels. Changes in lipid profile, obesity, hypertension, glucose intolerance and diabetes mellitus may intervene as severe risk factors.² Data from our cross sectional study involving random populations of pre and post-menopausal women has revealed changes in body composition and rise in cardiovascular risk factors during menopausal transition.

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CHANGES IN BMI AND WHR: In our study, it was observed that post-menopause, women tend to gain weight, had higher BMI and larger waist and hip circumference, though WHR was not significantly higher. In a study by Green KA et al, the factor that had the most far reaching adverse influence on CVD risk in menopausal women was high BMI.⁴

Though Waist-Hip ratio did not differ significantly, waist circumference was significantly larger in post-menopausal women. Waist circumference is considered by some, a more specific marker of visceral obesity which is known to be associated with more adverse metabolic profile. Hwu Chii-Min, et al, concluded that WC larger than 80 cm is a marker to recognise post-menopausal Asian women at risk for insulin resistance syndrome, even among women with similar age and body weight.³

Nese Ozbey et al found that menopause is associated with detrimental changes in body composition and risk factors even if BMI and body weight are maintained during menopause.⁵

Hernandez-Ono et al, found that post-menopausal women with more visceral adipose tissue accumulation were characterized by a less favourable metabolic profile.⁶ Brochu et al, found that obese post-menopausal women with higher levels of visceral adipose tissue had lower insulin-mediated glucose disposal than those with less visceral adipose tissue.⁷ This propensity of visceral adipose tissue to cause insulin resistance may be the underlying cause for greater cardiovascular risk.

In a study similar to ours, Parvatha Rani and Neelambikai found that post- menopausal women had higher BMI, had a higher waist and hip circumference as compared with the pre-menopausal women. WHR showed no significant difference between pre- menopausal and post-menopausal; Blood pressure was elevated among postmenopausal women when compared with Pre -menopausal women.⁸

L. N. Achie et al, found in their study that menopausal women had a higher waist circumference as compared with the premenopausal women. Only 73.86% of the postmenopausal women had a BMI ≥ 25 kg/m² whereas the prevalence of central obesity was 79%. However, there was a significant positive correlation observed between waist circumference and the body mass index. These findings suggest that obesity is prevalent among the menopausal women while the waist circumference can be a better measure in assessing obesity and thus cardiovascular risk among menopausal women. They also recommend the establishment of menopause clinics for early identification of women at risk and hence commencement of intervention.⁹

CHANGES IN BLOOD PRESSURE: In our study, systolic and diastolic blood pressures were not significantly different in the two groups. But a significantly higher proportion of post-menopausal women were hypertensive compared to pre-menopausal women. Post-menopausal hypertensive women were all on anti-hypertensive therapy which explains there being no significant difference in mean blood pressures of the two groups.

Green KA et al, in their longitudinal study of risk factors for coronary artery disease across menopausal transition, found higher diastolic pressure among overweight post-menopausal women.³

Chow et al found both systolic and diastolic blood pressures are higher in women after menopause than in men of the same age, suggesting that estrogen deficiency might influence the age-related increase in blood pressure.¹⁰

A study by A. Migneco, et al, showed a significant increase of blood pressure variability in menopausal women when compared to fertile women, even after exclusion of confounding factors,

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such as aging and BMI. They proposed that menopausal status, aging and BMI increase may all, independently, contribute to the enhanced blood pressure variability found in menopausal women.¹¹

Zaydun G et al concluded that menopause augments the age-related increase in arterial stiffness, and this effect is related at least in part to estrogen deficiency during the early post-menopausal phase.¹² During menopausal transition, due to decrease in estrogen levels, plasma renin activity and sympathetic activity are increased and prevention of conversion of Angiotensin I to Angiotensin II will be reduced. Decrease in sensitivity of angiotensin receptors will not take place and blood pressure reducing mechanism is lost. Additionally sensitivity to dietary sodium intake seems to be accentuated in post-menopausal women, contributing to increase in blood pressure. There is also increased smooth muscle proliferation which determines an increase in systemic vascular resistance.²

In a study similar to ours, Nimmy N John, et al. found that number of hypertensives was greater in postmenopausal compared to pre-menopausal age group. Also, mean BMI was higher in post-menopausal women than that of pre-menopausal women. Further, among hypertensive, those with greater BMI had higher systolic and diastolic pressures. They concluded that differences in BMI, Lean body mass, lean fat mass, cardiac risk percentage and atherogenic index between pre and post-menopausal women are the major risk factors for cardiac diseases.

OBESITY AND HYPERTENSION ACT TOGETHER TO FURTHER INCREASE CARDIOVASCULAR

RISK: Obesity is a major risk factor for CVD, since it predisposes to such risk factors as hypertension, diabetes, dyslipidemia and an increase in pro-inflammatory markers TNF- α and IL-6.¹⁴

Hypertension exposes to a four-fold increase in the risk of CVD in comparison with normotensive women and accounts for approximately 35% of all CV events. Hypertension tends to be associated with other atherogenic risk factors like obesity, dyslipidemia, insulin resistance and glucose intolerance.¹⁴

Since there is greater propensity for both obesity and hypertension in the post-menopausal period, and as both these conditions are closely linked with each other and also other cardiovascular risk factors of the metabolic syndrome, these two factors need special focus. As body weight, BMI, Waist circumference, WHR and blood pressure are easy to measure and monitor, they may be considered as basic tools to evaluate cardiovascular risk, especially in post-menopausal women. Addressing the issues of obesity and hypertension by suitable measures, both pharmacological and non-pharmacological, may go a long way in reducing cardiovascular morbidity in this population.

CONCLUSION: Our study showed that body weight, BMI, waist circumference, were all higher in post-menopausal women compared to pre-menopausal counterparts. Also, greater proportions of post-menopausal women were hypertensive. Obesity and Hypertension are two important targets for reduction of cardiovascular risk resulting from menopausal transition.

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