ORIGINAL RESEARCH

Comparative cross-sectional research on the alterations in blood pressure between postmenopausal and premenopausal women

Dr. Sumit Arora

Assistant Professor, Department of Physiology, N C Medical College & Hospital, Panipat, India

Corresponding Author

Dr. Sumit Arora

Assistant Professor, Department of Physiology, N C Medical College & Hospital, Panipat, India

Received: 19 March, 2021 Accepted: 24 April, 2021

ABSTRACT

Aim: To investigate the alterations in blood pressure between postmenopausal and premenopausal women and evaluate the impact of menopause on cardiovascular parameters. Materials and Methods: This cross-sectional study included 60 postmenopausal and 60 premenopausal women with similar height and weight. Postmenopausal status was defined as a history of at least 12 months of amenorrhea. Participants with conditions such as dyslipidemia, surgical menopause, hypertension, or diabetes were excluded. Blood pressure measurements were taken using both palpatory and auscultatory methods with a mercury sphygmomanometer. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate were recorded and analyzed. Data were statistically evaluated using the Student'st-test. Results: The postmenopausal group showed significantly higher cardiovascular parameters compared to the premenopausal group. The pulse rate in postmenopausal women was 83.16 ± 1.45 beats/min compared to 80.76 ± 2.32 beats/min in premenopausal women (t = 3.35, p < 0.01). SBP was significantly elevated in postmenopausal women (120.54 ± 2.56 mmHg) compared to premenopausal women (118.45 \pm 3.23 mmHg) (t = 3.54, p < 0.0001). DBP was also higher in postmenopausal women (81.65 \pm 2.23 mmHg) than in premenopausal women (80.34 \pm 4.02 mmHg) (t = 2.21, p< 0.05). These findings suggest that menopause is associated with increased blood pressure and pulse rate, likely due to hormonal changes and vascular alterations. Conclusion: Postmenopausal women exhibited higher pulse rates, systolic blood pressure, and diastolic blood pressure compared to premenopausal women, indicating an increased cardiovascular risk post-menopause. These findings emphasize the importance of early identification and management of blood pressure changes in postmenopausal women to prevent long-term cardiovascular complications.

Keywords: Menopause, blood pressure, systolic blood pressure, diastolic blood pressure, cardiovascular risk. This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

INTRODUCTION

Blood pressure regulation is a complex physiological process influenced by a variety of factors, including hormonal changes, lifestyle habits, and aging. Among women, the transition from premenopause to postmenopause marks a significant phase in life, characterized by profound hormonal shifts that can have substantial effects on cardiovascular health. Estrogen, a hormone that plays a critical role in vascular function, declines dramatically after menopause, potentially leading to changes in blood pressure regulation. Understanding these variations in blood pressure between premenopausal and postmenopausal women is crucial for identifying cardiovascular risks and implementing effective prevention strategies.Premenopause is a phase where

women experience regular menstrual cycles, and estrogen levels remain stable. During this time, estrogen provides a protective effect on the cardiovascular system by promoting vasodilation, reducing oxidative stress, and maintaining endothelial function. However, as women transition into menopause, the cessation of ovarian function results in a steep decline in estrogen levels. This hormonal change is associated with several physiological alterations, including increased vascular stiffness, a shift in lipid profiles, and a rise in blood pressure. These changes can predispose postmenopausal women to hypertension and related cardiovascular diseases.¹ Hypertension, often referred to as a "silent killer," is a leading risk factor for cardiovascular morbidity and mortality worldwide. The prevalence of hypertension increases with age and is particularly high among postmenopausal women. Studies suggest that the loss of estrogen during menopause contributes to this increased risk by impairing vascular elasticity, enhancing the renin-angiotensin-aldosterone system (RAAS) activity, and promoting sympathetic nervous system activation. Additionally, other factors such as changes in body composition, weight gain, and reduced physical activity during menopause further exacerbate the risk of hypertension in postmenopausal women.On the other hand, premenopausal women typically exhibit lower blood pressure levels compared to their postmenopausal counterparts, largely due to the protective effects of estrogen. This hormone helps regulate vascular tone and maintain healthy blood vessel function. The relative absence of cardiovascular issues in premenopausal women underscores the significance of hormonal influences on blood pressure. However, individual variations in lifestyle, genetic predisposition, and comorbidities can still affect blood pressure even in this group.² A comparative analysis of blood pressure variations between premenopausal and postmenopausal women provides valuable insights into how hormonal changes impact cardiovascular health. Such studies not only help identify high-risk groups but also pave the way for tailored interventions aimed at mitigating hypertension and its complications. Blood pressure measurement, a simple yet critical diagnostic tool, serves as the cornerstone for such investigations, offering a non-invasive method to assess cardiovascular health.Several factors can influence blood pressure readings in both premenopausal and postmenopausal women, including physical activity levels, dietary habits, body weight, and psychological stress. In postmenopausal women, these factors often interact with hormonal changes, creating a multifaceted risk profile for hypertension. Weight gain, commonly observed during menopause, contributes to increased vascular resistance and higher blood pressure levels. Similarly, reduced physical activity during this phase can lead to decreased cardiovascular fitness and a heightened risk of hypertension.^{3,4} It is also important to consider the role of lifestyle modifications in managing blood pressure among women in both groups. Regular exercise, a balanced diet, and stress management have been shown to effectively reduce blood pressure and improve overall cardiovascular health. In postmenopausal women, hormone replacement therapy (HRT) has been explored as a potential intervention to mitigate the effects of estrogen decline. However, the use of HRT remains controversial due to its associated risks, highlighting the need for personalized approaches to blood pressure management.⁵ The present study aims to compare blood pressure variations between premenopausal and postmenopausal women of similar height and weight, focusing on the impact of hormonal changes and associated physiological

alterations. By analyzing these variations, this research seeks to provide a better understanding of how menopause influences blood pressure and to identify key factors that contribute to cardiovascular risks in women. This comparative approach offers an opportunity to explore not only the biological but also the lifestyle-related aspects of blood pressure regulation in these two distinct phases of life.The transition from premenopause to postmenopause critical period for represents а women's cardiovascular health, marked by significant changes in blood pressure regulation. Understanding the differences in blood pressure patterns between these groups is essential for developing targeted strategies to reduce the burden of hypertension and associated cardiovascular diseases. This study provides a comprehensive analysis of blood pressure variations, offering insights into the interplay between hormonal changes, lifestyle factors, and cardiovascular health in premenopausal and postmenopausal women.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Physiology. Data were collected from postmenopausal and premenopausal women with similar height and weight representative of the general population. Based on detailed medical history and inclusion/exclusion criteria, 60 postmenopausal and 60 premenopausal women were selected using a convenience sampling method, a type of non-probability sampling. Postmenopausal status was defined as a history of at least 12 months of amenorrhea.

Inclusion Criteria: The study included 60 postmenopausal women aged 50–55 years who had attained menopause naturally, maintained an active lifestyle, and weighed between 60–65 kg with heights ranging from 155–157.5 cm. The control group consisted of 60 healthy premenopausal women aged 35–40 years, with regular menstrual cycles, matched for height and weight.

Exclusion Criteria: Participants were excluded if they had any of the following conditions: dyslipidemia, blood disorders, surgical menopause, hypertension, diabetes mellitus, thyroid disorders, renal diseases, or if they had received estrogen therapy or other treatments for menopausal symptoms.

Measurements

- Height was measured using a stadiometer.
- Weight was recorded using a clinical weighing scale, with participants dressed in light clothing.
- **Blood Pressure (BP):** BP was measured three times in the sitting position. Initially, the palpatory method was used, followed by the auscultatory method with a mercury sphygmomanometer. The appearance of Korotkoff sounds (Phase I) was recorded as

respiratory,

the

systolic BP, and the disappearance of the sounds (Phase V) was recorded as diastolic BP.

Data Collection Methods: The study population was randomly selected from the Tokapal Block, ensuring height- and weight-matched premenopausal and postmenopausal women. A standardized proforma was distributed, and written informed consent was

RESULTS

Table 1 Demographic Table

Demographic Characteristics	Number (n)	Percentage (%)				
Postmenopausal	60	50.00				
Premenopausal	60	50.00				
Total	120	100.00				

The results in Table 2 highlight significant differences in cardiovascular parameters between postmenopausal and premenopausal women. The pulse rate was higher in the postmenopausal group (83.16 ± 1.45 beats/min) compared to the premenopausal group (80.76 ± 2.32 beats/min), with a *t*-value of 3.35 and a *p*-value <0.01, indicating a highly significant (HS) difference. Systolic blood pressure (SBP) was also significantly elevated in postmenopausal women (120.54 ± 2.56 mmHg) compared to premenopausal women (118.45 ± 3.23 mmHg), with a *t*-value of 3.54 and a *p*-value <0.0001, reflecting a highly significant difference. Similarly, diastolic blood pressure (DBP) was slightly higher in the postmenopausal group (81.65 ± 2.23 mmHg) than in the premenopausal group (80.34 ± 4.02 mmHg), yielding a *t*-value of 2.21 and a *p*-value <0.05, which is statistically significant (S). These findings suggest that postmenopausal women experience elevated pulse rates and blood pressure levels, likely due to the hormonal changes and vascular alterations associated with menopause.

obtained during face-to-face interviews. Participants

cardiovascular, and central nervous systems, along

Statistical Analysis: Data were analyzed using the

Student's *t*-test to compare the two groups.

underwent examinations of

with gynecological assessments.

Table 1: Blood Pressure Changes in Post-menopausal Group and Pre-menopausal Group

Parameter	Postmenopausal	Premenopausal	t Value	P value	Significance
	Mean±SD)	(Mean±SD)			
Pulse(beats/min)	83.16±1.45	80.76±2.32	3.35	< 0.01	HS
Systolic Blood	120.54±2.56	118.45±3.23	3.54	< 0.0001	HS
Pressure(mmHg)					
Diastolic Blood Pressure	81.65 ± 2.23	80.34±4.02	2.21	< 0.05	S
(mmHg)					

DISCUSSION

During menopausal transition blood pressure raises due to additive effect of other hormone related factors. Decrease in oestrogen levels around menopause causes an up regulation of the Renin Angiotensin System (RAS) with higher plasma renin activity. Sympathetic activity ishigher in postmenopausal women than in age-matchedmen, especially in women who are overweight.⁶ Sympathetic over activity is associated with abdominal visceral fat which is strongly related to higher inflammatory markers and oxidative stress.7 Zanchetti A et al (2005)8says premenopausal women have low blood pressure than in the postmenopausal women. Also, postmenopausal women develop arterial hypertensionoften together with changes in lipid and glucose metabolism.⁹Many studies convey that production of catecholamines is raised and a clear shift of the autonomic control towards a higher sympathetic activityof the cardiovascular system. This higher sympatheticdrive is closely related to the state of oestrogen deficiency as it occurs in a few days after surgical oophorectomy and is reversed by oestrogens. Metabolic changes with raised sympathetic drive occurring after the menopause, contribute to cause the metabolic syndrome. The physiological and structural changes, due to higher sympathetic drive leads to hypertension development.^{10,11}

CONCLUSION

This study demonstrates significant differences in cardiovascular parameters between postmenopausal and premenopausal women, highlighting the impact of hormonal changes associated with menopause. Postmenopausal women exhibited higher pulse rates, systolic blood pressure (SBP), and diastolic blood pressure (DBP) compared to their premenopausal counterparts. These findings underscore the heightened cardiovascular risk in postmenopausal women, likely due to estrogen deficiency and associated vascular changes. Early identification and management of blood pressure alterations in this population are crucial to mitigate long-term cardiovascular risks.

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