Resistance Training vs. Hormone Replacement Therapy: Can Training Offset Perimenopausal Hormonal Shifts?

Commentary

Antonella V. Schwarz[1], Anna L. Oelmann[2], Alyssa L. Parten [3]
[1]*Barry University, Miami Shores, Florida, United States*
[2]*University of South Florida, Tampa, Florida, United States*
[3]*The University of Alabama, Tuscaloosa, Alabama, United States*

Open Access

Published: September 14, 2025

Research in Strength and Performance: *2025, Volume 5 (Issue 1): 6*

ISSN: 2768-5187

Abstract

Perimenopause is a hormonally dynamic transition characterized by erratic declines in 17-β-estradiol, leading to a wide array of physiological and psychosocial symptoms that can significantly impact quality of life. While hormone replacement therapy (HRT) is effective for many, it is not a viable option for all due to medical contraindications and potential risks. This commentary explores resistance training (RT) as a non-pharmacological alternative for managing perimenopausal symptoms. RT has demonstrated benefits in mitigating metabolic dysfunction, improving mood and cognitive health, and potentially alleviating vasomotor symptoms through mechanisms that partially mimic estrogen's effects. Despite these promising outcomes, RT remains underrepresented in perimenopausal research compared to other exercise modalities. Future studies are needed to assess the effectiveness of RT alone and in combination with HRT to better inform evidence-based strategies for improving female health during this critical life stage.

Key Words: Menstrual cycle, female physiology, resistance training, estrogen

Corresponding author: Antonella V. Schwarz, aschwarz@barry.edu

Introduction

Females spend more than one-third of their lifespan in the postmenopausal state, following an average 7-year transition from pre- to post-menopause that typically occurs during midlife. This transition period, known as perimenopause, has been an area of focus in research due to the significant physiological and psychosocial burden it places on females. Perimenopause is marked by changes in female reproductive hormones, specifically the withdrawal of 17-β-estradiol (E2), in preparation for the permanent cessation of the menstrual cycle (i.e., menopause). During perimenopause, changes in E2 are associated with a multitude of physiological responses, including vasomotor and somatic disturbances (i.e., cyclic hot flushes, night sweats, insomnia, headaches, etc.), menstrual cycle irregularity, and metabolic alterations[1].

Evidence suggests that the postmenopausal state is strongly associated with increased adiposity, metabolic disorders (e.g., obesity, type II diabetes, insulin resistance, hyperlipidemia, and hypertension), and diminished vascular and endothelial function[2-5]. Many of these risk factors have been correlated with the reduction of E2 that takes place during perimenopause, and the subsequent effect this hormone has on various systems. Thus, perimenopause may represent a key window of time for initiating preventative strategies prior to the onset of full menopause. As such, our

commentary seeks to explore resistance training (RT; exercises involving free weights, e.g., dumbbells, barbells) as a non-pharmacological strategy to combat common perimenopausal symptoms.

The Female Menstrual Cycle in a Nutshell

Unlike males, who experience a diurnal hormonal cycle, naturally menstruating, eumenorrheic females undergo a 24–39-day cyclical hormonal pattern (i.e., menstrual cycle). This cycle consists of two primary phases, the follicular phase and luteal phase, separated by ovulation. The onset of the follicular phase is marked by menses (i.e., period), during which concentrations of the key sex hormones E2 and progesterone (P4) are low. As the follicular phase progresses, E2 rises in parallel with follicle development, ultimately peaking during the late follicular phase (approximately days 10-14) and triggering ovulation. Following the brief ovulatory window (24-72 hours), the luteal phase begins. In response to follicular rupture and oocyte release, E2 and P4 concentrations rise, peaking mid-luteal phase before declining if fertilization does not occur, ultimately repeating the cycle. As females approach midlife, this generally more tightly regulated hormonal cycle becomes increasingly unpredictable, marking the onset of perimenopause and its accompanying physiological changes.

How the Menstrual Cycle Changes during Perimenopause

Beginning around age 40, many females enter perimenopause, a transitional period marked by erratic, non-cyclical changes in E2 levels, contrasting the more predictable fluctuations seen in premenopausal years. These changes result in a wide range of physiological and psychosocial symptoms, often negatively impacting quality of life. Clinically, perimenopause is defined by changes in menstrual cycle length exceeding 7 days between cycles or the absence of menstruation (i.e., amenorrhea) for more than 60 days[6]. Due to the negative feedback nature of the hypothalamic-pituitary-ovarian axis, the decline in E2 contributes to disruptions in cycle length and frequency.

The effects of E2 withdrawal extend beyond reproduction and a regular menstrual cycle. Estrogen receptors are expressed in a majority of tissues, including skeletal muscle[7], adipose tissue[7], brain tissue[8], and endothelial cells[9], potentially contributing to the broad impact of hormonal decline. Hormone replacement therapy (HRT) is a pharmacological approach to mitigate perimenopausal symptoms and restore estrogenic influence[10]. However, not all females are eligible for HRT, and concerns about adverse effects persist. Given its wide-ranging physiological benefits, RT may offer a viable alternative to HRT for improving a variety of perimenopausal symptoms and supporting overall health during this transition.

Resistance Training vs. Hormone Replacement Therapy: How Resistance Training May Combat Perimenopausal Symptoms

Metabolic Symptoms

During perimenopause, declining E2 levels contribute to increased central adiposity, decreased lean mass, impaired glucose metabolism, and greater cardiometabolic risk[11]. These changes are partially driven by a shift in fat distribution and reduced lipolytic capacity due to the loss of E2's regulatory role in lipid and glucose metabolism[11]. HRT has been shown to preserve insulin sensitivity, maintain favorable lipid profiles, and reduce visceral fat accumulation in some populations[2,3]. However, individual responses to HRT can vary, and it may not be appropriate for all females due to potential risks, including thromboembolism and breast cancer[10]. In contrast, RT offers a safe, non-pharmacological strategy that directly targets many of the adverse metabolic consequences of perimenopause[12]. RT promotes increases in lean mass and resting metabolic rate, improves insulin sensitivity, and reduces abdominal adiposity, effects particularly critical during a period marked by E2 withdrawal and metabolic dysregulation. Importantly, RT is also associated with long-term reductions in blood pressure and improvements in lipid profiles, making it a cornerstone in managing cardiometabolic health across the menopausal transition[13,14].

Psychosocial Symptoms

From pre- to post-menopause, >30% of females reportedly suffer from depressive episodes and >50% anxiety[15]. In addition, perimenopausal females describe increased mood swings, irritability, and poor sleep, which are largely due to E2's neuromodulatory effects on serotonin, dopamine, and GABA systems[16]. These symptoms can impair quality of life and are often under-recognized in midlife females. While HRT may offer relief for mood instability and depressive symptoms, particularly in those with pronounced hormonal fluctuations, its effects are inconsistent, and it is not universally recommended for mental health management alone[10]. In contrast, RT has demonstrated consistently positive effects on mood, cognitive function, and overall psychological well-being in pre-, peri- and postmenopausal females[4,17]. These benefits from RT may be mediated by mechanisms such as endorphin release, reduced systemic inflammation, and enhanced neuroplasticity, all of which contribute to reductions in anxiety and depression[1,4,16].

Vasomotor Symptoms

Vasomotor symptoms, including hot flashes and night sweats, are among the most common and distressing experiences reported during perimenopause[4]. These symptoms arise as E2 levels begin to fluctuate and decline, disrupting the body's ability to regulate temperature. Under typical conditions, E2 supports the production of nitric oxide (NO), a molecule that relaxes blood vessels and promotes heat loss through the skin[5]. When E2 levels drop, NO production is impaired, blood vessels constrict, and the body struggles to dissipate heat efficiently, resulting in sudden spikes in core temperature and the classic hot flash response[5]. Among clinical options, HRT remains the most effective clinical treatment for alleviating vasomotor symptoms, with estrogen therapy often providing rapid and significant relief from hot flashes and night sweats[10]. For those who cannot or choose not to pursue hormonal therapy, RT stands out as a potentially powerful non-pharmacological strategy for this perimenopausal symptom as well. This form of exercise has been shown to stimulate NO production independently of E2, helping to restore the body's natural heat-dissipation mechanisms[18,19]. By enhancing vascular function and thermoregulation, RT may directly reduce the frequency and severity of hot flashes. Unlike walking, yoga, or light cardio, which do not meaningfully affect NO production[20,21], RT uniquely mimics some of the benefits once provided by E2, making it a particularly relevant intervention for females seeking non-hormonal relief during the menopausal transition.

Future Research Directions

Despite growing interest in non-pharmacological strategies, RT remains significantly understudied in the context of perimenopause. Existing research has largely focused on walking[22], aerobic and cardiovascular exercise modalities[23,24], and yoga[22,24,25]. While moderate levels of exercise and physical activity (e.g., 600 MET minutes per week) have been associated with reductions in general physical and psychosocial symptoms during this transition, they have shown limited impact on vasomotor symptoms[20,21].

Given the well-established effects of RT on systems affected by E2 decline, including metabolic, vascular, musculoskeletal, and neurological function, we encourage future research to investigate the role of RT across the perimenopausal transition. This includes evaluating both physiological outcomes and subjective symptom relief. Additionally, research comparing RT alone versus in combination with HRT is needed to determine whether synergistic or independent benefits exist for improving metabolic health and alleviating perimenopausal symptoms.

Conclusion

Perimenopause represents a critical window for addressing the physiological changes associated with declining reproductive hormone levels. The reduction in E2 contributes to a broad spectrum of symptoms across multiple systems, including metabolic, psychosocial, and vasomotor. While HRT remains the leading pharmacological approach to mitigate symptoms and restore E2 levels, not all females qualify for hormonal treatment, and concerns about adverse effects persist. Because RT elicits many of the same systemic benefits as E2, this exercise modality may be particularly valuable for females seeking alternatives to hormonal therapy. Future research is warranted to explore the full extent of RT's therapeutic potential, including how it may complement or serve as an alternative to HRT in supporting females through this pivotal life stage.

References

1. McCarthy M, Raval AP. The peri-menopause in a woman's life: a systemic inflammatory phase that enables later neurodegenerative disease. *Journal of neuroinflammation*. 2020;17(1):1-14.
2. De Paoli M, Zakharia A, Werstuck GH. The role of estrogen in insulin resistance: a review of clinical and preclinical data. *The American journal of pathology*. 2021;191(9):1490-1498.
3. Bitoska I, Krstevska B, Milenkovic T, et al. Effects of hormone replacement therapy on insulin resistance in diabetic women. *Open access macedonian journal of medical sciences*. 2016;4(1):83.
4. Philip AE, Singh H, Nanjundiah SY, et al. Impact of Exercise on Perimenopausal Syndrome: A Systematic Review of Randomized Controlled Trials. *Cureus*. 2025;17(3)
5. Tostes R, Nigro D, Fortes Z, Carvalho M. Effects of estrogen on the vascular system. *Brazilian Journal of Medical and Biological Research*. 2003;36:1143-1158.
6. Harlow SD, Gass M, Hall JE, et al. Executive summary of the Stages of Reproductive Aging Workshop+ 10: addressing the unfinished agenda of staging reproductive aging. *Climacteric*. 2012;15(2):105-114.
7. Foryst-Ludwig A, Kintscher U. Metabolic impact of estrogen signalling through ERalpha and ERbeta. *The Journal of steroid biochemistry and molecular biology*. 2010;122(1-3):74-81.
8. Biegon A, Kim SW, Alexoff DL, et al. Unique distribution of aromatase in the human brain: in vivo studies with PET and [N-methyl-11C] vorozole. *Synapse*. 2010;64(11):801-807.

9. Russell KS, Haynes MP, Sinha D, Clerisme E, Bender JR. Human vascular endothelial cells contain membrane binding sites for estradiol, which mediate rapid intracellular signaling. *Proceedings of the National Academy of Sciences*. 2000;97(11):5930-5935.
10. Harper-Harrison G, Carlson K, Shanahan MM. Hormone replacement therapy. *StatPearls [Internet]*. StatPearls Publishing; 2024.
11. Hao S, Tan S, Li J, et al. Dietary and exercise interventions for metabolic health in perimenopausal women in Beijing. *Asia Pacific Journal of Clinical Nutrition*. 2021;30(4):624-631.
12. Moore SR, Cabre HE, Smith-Ryan AE. Body composition, physical activity, and menopause symptoms: how do they relate? *Menopause*. 2024;31(4):336-341.
13. Banks NF, Rogers EM, Stanhewicz AE, Whitaker KM, Jenkins ND. Resistance exercise lowers blood pressure and improves vascular endothelial function in individuals with elevated blood pressure or stage-1 hypertension. *American Journal of Physiology-Heart and Circulatory Physiology*. 2024;326(1):H256-H269.
14. He M, Hu S, Wang J, et al. Effect of resistance training on lipid profile in postmenopausal women: A systematic review and meta-analysis of randomized controlled trials. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2023;288:18-28.
15. Vaziri-harami R, Kazemi SN, Vaziri-harami S, Hazari V, Farokh P, Valadbeigi T. The prevalence of depression and anxiety in premenopausal and menopausal women: A cross-sectional study. *Health Science Reports*. 2024;7(7):e2267.
16. Bendis PC, Zimmerman S, Onisiforou A, Zanos P, Georgiou P. The impact of estradiol on serotonin, glutamate, and dopamine systems. *Frontiers in neuroscience*. 2024;18:1348551.
17. ElDeeb AM, Atta HK, Osman DA. Effect of whole body vibration versus resistive exercise on premenstrual symptoms in adolescents with premenstrual syndrome. *Bulletin of Faculty of Physical Therapy*. 2020;25(1):1.
18. Salmanpour M, Soori R, H'mida C, et al. The effect of 8 weeks of combined interval (resistance-interval training) and combined endurance (endurance-resistance training) on plasma levels of adropin and nitric oxide in males with high blood pressure. *Irish Journal of Medical Science (1971-)*. 2022;191(6):2559-2568.
19. Behjati Ardakani A, Qassemian A, Koushki M, Shakour E, Mehrez A. The effect of a resistance training course on blood pressure and nitric oxide levels in elderly women. *Iranian Journal of Ageing*. 2018;13(1):16-27.
20. McAndrew LM, Napolitano MA, Albrecht A, Farrell NC, Marcus BH, Whiteley JA. When, why and for whom there is a relationship between physical activity and menopause symptoms. *Maturitas*. 2009;64(2):119-125.
21. Kim M-J, Cho J, Ahn Y, Yim G, Park H-Y. Association between physical activity and menopausal symptoms in perimenopausal women. *BMC women's health*. 2014;14(1):122.
22. Elavsky S, McAuley E. Physical activity and mental health outcomes during menopause: a randomized controlled trial. *Annals of Behavioral Medicine*. 2007;33(2):132-142.
23. Lindh-Åstrand L, Nedstrand E, Wyon Y, Hammar M. Vasomotor symptoms and quality of life in previously sedentary postmenopausal women randomised to physical activity or estrogen therapy. *Maturitas*. 2004;48(2):97-105.
24. Sternfeld B, Guthrie KA, Ensrud KE, et al. Efficacy of exercise for menopausal symptoms: a randomized controlled trial. *Menopause*. 2014;21(4):330-338.
25. Luoto R, Moilanen J, Heinonen R, et al. Effect of aerobic training on hot flushes and quality of life—a randomized controlled trial. *Annals of medicine*. 2012;44(6):616-626.