

Editorial

Re-evaluating the Optimal Exercise for the Critical Peri and Postmenopausal Years

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Menopause is characterized by marked changes in the circulating estrogen of the female body.¹ As women age, progressively declines in ovarian function lead to a gradual reduction in estrogen secretion that ultimately ceases when menopause is reached. This transitional time is termed the perimenopausal period and it occurs approximately within one year of its commencement.² The perimenopausal years are crucial for the future health of females as the observed hormonal alterations can lead to a number of psychophysiological changes that can increase the risk of disease if not prevented early.² Specifically, during the perimenopausal years the diminished concentrations of estrogens, reduce their protective role on health and contribute to significant physiological disturbances.³ Adverse health effects such as reductions in fat-free mass (sarcopenia), accumulation of body fat and intra-abdominal visceral fat and associated adverse cardiovascular and metabolic impairments namely hypertension, atherosclerosis and insulin resistance are observed.¹ Consequently, there is a significantly increased risk in the development of obesity and its comorbidities namely cardiovascular disease and type 2 diabetes, that can reduce the quality of life and dramatically increase the risk of mortality in older women.³ In conjunction with the aforementioned conditions, significant impairments in cognitive and mood state are observed in the peri and postmenopausal years, further increasing the risk of morbidity and mortality in older women.⁴⁻⁶ An increased prevalence of anxiety and depression and cognitive declines such as loss of concentration, memory and a high risk of developing dementia and Alzheimer's disease have been noted, recognizing menopause not only as a reproductive but also as a neurological transitional state.⁷⁻⁹ These effects are exacerbated by the declines in physical activity participation and low exercise compliance observed in older women. The complex and multifaceted pathophysiology of the peri and postmenopausal years, makes the treatment of the

aforementioned comorbidities very difficult and challenging and warrants further research on identifying the ideal treatment plan for this population. Particularly, preventive treatment plans during the perimenopausal years are deemed essential in slowing down or delaying the development of chronic mental and non-mental diseases later in life and increasing the well-being and quality of life of older women.

It is well established that exercise is an essential treatment plan for the prevention of chronic diseases in older women.¹⁰ A number of research studies have demonstrated the central role that regular endurance exercise has on the health, well-being, and quality of life of older women by partly attenuating some of the physiological changes occurring with aging.^{11,12} In healthy postmenopausal women, participation in moderate intensity continuous exercise training alone has been shown to induce improvements in body fat and abdominal visceral adiposity, insulin resistance, lipid levels and inflammatory markers that can be further accelerated when exercise is combined with a balanced nutrition plan.^{13,14} In overweight and obese postmenopausal women, regular moderate-intensity endurance exercise for 3-4 months has been well documented to improve body mass index, body composition and insulin sensitivity.¹⁵ In type 2 diabetic obese postmenopausal women, moderate intensity endurance exercise can induce significant improvements in glycemic control, Hemoglobin A1c and inflammatory markers primarily due to reductions in intra-abdominal visceral adiposity and increases in exercise capacity.¹⁶⁻¹⁸ While, in hypertensive postmenopausal women there is strong evidence to support the important role of endurance exercise on reducing cardiovascular risk factors through significant improvements in blood pressure, autonomic tone, baroreflex sensitivity and oxidative stress.^{19,20} Finally, studies on the effects of regular endurance exercise on mood

state in women during the menopausal transition, demonstrate significant improvements in depressive symptoms and reduction in menopause-related anxiety and mood disorders after endurance exercise training.^{4,21}

Despite the accumulated evidence on the effects of endurance exercise on the postmenopausal years, there is a scarcity of data on the effects of exercise on the critical time period of the perimenopausal years. The limited studies conducted demonstrate the promising effects of endurance exercise training on the health and exercise capacity of perimenopausal women but also stress the need for more studies to be conducted in this understudied population.^{11,22-25} In the few studies that have been conducted, it is evident that moderate-intensity endurance exercise primarily in the form of walking can induce significant improvements in body weight, body fat, aerobic fitness and overall exercise capacity in perimenopausal women.^{11,23} Moreover, endurance exercise has been shown to induce significant improvements in independent cardiovascular risk factors such as glucose and lipid levels and overall quality of life in pre and perimenopausal women.^{22,24,25} However, no research studies have investigated the effects of exercise on the mood and cognitive state of perimenopausal women, leaving a gap in the literature on a crucial time period for women's mental health. There is an urgent need to conduct more research studies on the perimenopausal years in order to identify optimal lifestyle treatment plans that can prevent the development of mental and non-mental health problems at an early stage.

High-intensity interval exercise (HIIE) has recently emerged as a favourable exercise modality for clinical populations with obesity, type 2 diabetes and cardiovascular disease leading to comparable or even faster improvements in exercise capacity, body composition and cardiometabolic health parameters.²⁶⁻²⁹ Specifically, similar or faster improvements in exercise capacity, insulin resistance, blood pressure and cardiac function have been documented in older clinical populations with metabolic syndrome, cardiovascular disease and type 2 diabetes when training with HIIE compared to continuous exercise.^{29,30} In older male and female obese populations, HIIE has been documented to have similar effectiveness with moderate intensity continuous exercise across all body composition measures but in a more time-efficient way, by requiring less than 40% training time compared to continuous exercise.²⁷ Furthermore, HIIE has been reported to lead to similar enjoyment and exercise adherence levels in overweight and obese older males and females with continuous exercise, demonstrating the important role that it might have on exercise compliance in this population.³¹ However, limited evidence exists on the effects of HIIE on the exercise capacity and health on the specific high-risk time periods of peri and menopause. In postmenopausal women, 16-weeks of HIIE have been shown to lead to greater weight loss and improvements in body composition compared to continuous moderate intensity exercise in healthy postmenopausal women³² and greater reductions in intra-abdominal adiposity in obese postmenopausal type 2 diabetic women.^{12,33,34} Moreover, Mandrup et al¹² has demonstrated significant improvements in body composition as observed by increases in lean body mass and reductions in

fat mass and improvements in cardiometabolic risk factors in postmenopausal women after HIIE training. Finally, Egelund et al³⁵ studied the effects of HIIE on early postmenopausal women and found marked improvements in cardiac function in terms of systolic and diastolic function after 12 weeks of cycle interval training.

The effects of HIIE on the perimenopausal years is largely understudied. In younger overweight and obese women, HIIE has been shown to be a potentially more effective mode of exercise compared to continuous exercise, in terms of time-efficiency and perception of effort while significantly improving aerobic fitness, blood glucose and lipid levels.³⁶ In a recent study that our research group conducted investigating the effects of an acute bout of interval exercise on psychophysiological adaptations in overweight perimenopausal women, we found that one acute bout of HIIE alone was effective in inducing significant improvements in the systolic and diastolic blood pressure of this population.³⁷ Moreover, it led to improvements in mood, exercise enjoyment and exercise tolerance, especially when combined with high carbohydrate *versus* high protein pre-exercise feedings, while no changes were noted in cognitive capacity.³⁷ Further, in unpublished preliminary data from our research group, we have found that one bout of interval exercise can induce similar fat oxidation rates and exercise enjoyment compared to continuous exercise in a group of overweight perimenopausal women, mimicking the findings of an earlier study in younger women where 7 sessions of HIIE over a two-week period resulted in marked elevations in whole body and skeletal muscle fatty acid oxidation.³⁸ It is important to note that the improvements seen in our group of perimenopausal women with HIIE were achieved in approximately half the exercise duration compared to continuous exercise, suggesting significant practical training applications for this population, given that "lack of time" is the most commonly cited barrier to regular exercise participation. Research on the effects of long-term HIIE have also shed some light on the potential advantageous effects of this mode of exercise for older women. Seidelin et al³⁹ recently demonstrated improvements in aerobic capacity in late pre-menopausal women after intermittent exercise training for 12 weeks. Moreover, the group of Mandrup et al¹² reported that a 3-month high-intensity aerobic training intervention induced similar levels of improvements in cardiovascular disease and type 2 diabetes risk factors in pre-menopausal women. Finally, Egelund et al³⁵ showed that a 12-week HIIE intervention on pre-menopausal women led to significant positive adaptations in cardiac function such as left ventricle mass and left atrial end-diastolic and end-systolic volumes.⁴⁰ More evidence is required to further investigate and establish the effectiveness of HIIE on the perimenopausal years, especially in terms of neurological and cognitive health disturbances in this population.⁴¹

It is evident that additional investigations are needed to assess the effects of exercise on the critical perimenopausal years. Perimenopause offers the unique opportunity for chronic disease risk reduction in women at an early stage, prior to menopause, at which time point the development of chronic diseases is accentuated.⁴² More studies need to be conducted on clinical exercise modalities such as high-intensity interval exercise clinical proto-

cols that can optimally counteract the effects of menopause on women's health and reduce the risk of developing mental health-related comorbidities. Re-evaluating the optimal exercise mode for this population could lead to a more effective exercise prescription that could enhance exercise adherence and enjoyment while allowing women to exercise in a more time-efficient manner compared to the traditionally prescribed exercise programs.

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