



Physical Activity Effects on Bone Mass Density in Postmenopausal women” (*A Review*)

¹Genti Pano, ²Blend Hoxholli

¹Sports University of Tirana, Faculty of Rehabilitation Sciences, Department of Biomedical and Health Sciences. Tirana, Albania

²University of Elbasan, “Aleksandër Xhuvani”, Faculty of Technical Medical Sciences, Department of Paraclinics Subjects. Elbasan, Albania

Abstract

Postmenopausal women are at a very high risk of experiencing a number of health issues that have a big impact on their life. This study sought to find research on how physical exercise affected postmenopausal women's bone mass density. We searched "PubMed," using the following filters and study selection criteria: free full texts studies, randomized controlled trials, studies completed within the last five years (2019–2024) and studies that included exercise interventions focusing on bone mass density in postmenopausal women. Seven papers out of 39 were chosen to be included in this review, where participated 693 women aged 45 to 75. Strength/resistance training, aerobic exercise, vibration platforms in combination with other exercises regimens were among the many types of exercise used to improve bone mass density and other bone-related characteristics. Regular exercise is one of the most cost-effective and efficient ways to address bone mass-related health issues in postmenopausal women, according to all reviewed studies. However, more research with a larger sample size is required to determine the most beneficial exercise program.

Keywords: bone mass density, physical activity, post-menopause, women

1. Introduction

A range of health issues that profoundly impact a woman's life are particularly probable in postmenopausal women, including the early decline of estradiol (E2), which frequently precipitates clinical health alterations such as psychosocial effects (Hoga et al., 2015), deterioration of bone density and strength (Finkelstein et al., 2008), and modifications in body

composition (Aloia et al., 1995; Sowers et al., 2007). Moreover, various studies indicate that post-menopause correlates with a reduction in functional parameters (Maltais et al., 2007; Sirola & Rikkonen, 2005), a decline in bone strength, a decrease in bone mineral density (BMD), and a deterioration of bone microstructure, which are characteristic of osteoporosis and elevate the risk of fractures (Lorentzon & Cummings, 2015; NIH, 2001). Exercise training and physical activity are essential for the treatment and prevention of osteoporosis, as well as for reducing fracture risk (Beck et al., 2017; Tarantino et al., 2017). Physical activity is globally acknowledged as the most effective non-pharmaceutical approach to prevent bone fractures in postmenopausal women (Kemmler et al., 2013; Kemmler et al., 2015), particularly in mitigating bone and muscular disorders such as osteoporosis and sarcopenia (Sipilä et al., 2020). It is crucial for patients diagnosed with osteoporosis to incorporate alternative non-pharmacological interventions into their rehabilitation therapy, including appropriate physical exercises and risk factor management (Cosman et al., 2014; Giangregorio et al., 2015; Karlsson & Rosengren, 2012; Senderovich et al., 2017; Dizdar et al., 2018). Balancing exercises, strength training, and weightlifting are suggested forms of exercise to be performed during the rehabilitation of those diagnosed with osteoporosis. While such training influences the functional status of these patients by diminishing fall risk and enhancing bone health, their resolve throughout exercise performance ultimately determines their progress (Varahra et al., 2018; Nikander et al., 2010; Kovács et al., 2013). This review examines current research assessing the effects of several physical activity treatments on bone mineral density in postmenopausal women to determine effective ways for enhancing bone health.

Objectives

The primary objective of this review is to examine and synthesize findings from recent randomized controlled trials that evaluated the impact of exercise intervention programs on bone mineral density in postmenopausal women.

2. Methodology

A comprehensive search was conducted on the PubMed database. The inclusion criteria for study selection were as follows:

- Free full-text availability
- Randomized controlled trial (RCT) design
- Publication between 2019 and 2024
- Focus on physical activity or exercise interventions targeting bone mineral density in postmenopausal women

Out of 39 initially identified studies, 7 met all the eligibility criteria and were selected for final analysis.

3. Results

The final sample consisted of 7 studies encompassing 693 postmenopausal women aged between 45 and 75. These studies implemented a range of exercise modalities, including strength/resistance training, aerobic activity, vibration therapy, and hybrid approaches. The interventions varied in duration (10 weeks to 18 months) and intensity (low to high), offering valuable insights into diverse training regimens.

Selected studies were:

1. Cascales et al., 2019
2. Filipovic et al., 2020
3. Hettchen et al., 2021
4. Jamka et al., 2021
5. Riaz et al., 2022
6. Fernandez et al., 2022
7. Isenmann et al., 2023

Table 1. Summary of selected studies

Nr	Author & Year	Topic	Sample Size & Age	Duration	Intervention Type
1	Cascales et al., 2019	Neuromuscular training protocols and bone mass	38 women	24 weeks	Whole-body vibration vs. multi-component training
2	Filipovic et al., 2020	Functional status and exercise	103 women (65–70 yrs)	12 weeks	Strength, balance, and aerobic training
3	Hettchen et al., 2021	High-intensity training and menopausal risk	54 women	13 months	High-impact resistance vs. low-intensity exercise
4	Jamka et al., 2021	Endurance/strength and bone metrics	101 women	12 weeks	Endurance and strength training
5	Riaz et al., 2022	HIT-MMEX and BMD	101 women (45–70 yrs)	8 months	Supervised high-intensity training vs. low-mod. intensity
6	Fernandez et al., 2022	Vibration therapy and osteopenia	255 women (55–75 yrs)	18 months	Progressive WBV using PowerPlate
7	Isenmann et al., 2023	Resistance training and body composition	41 women (avg. 52 yrs)	10 weeks	Moderate vs. low-intensity free-weight training

4. Discussion

These studies collectively affirm the efficacy of structured exercise interventions in improving bone health outcomes in postmenopausal women. For example, Cascales et al. (2019) demonstrated that both whole-body vibration and multi-component training significantly improved BMD in key skeletal regions. Filipovic et al. (2020) showed that a 12-week regimen combining strength, balance, and aerobic exercises led to enhanced functional capacity in osteoporotic women.

Longer-duration programs such as those by Hettchen et al. (2021) and Fernandez et al. (2022) emphasize the benefits of consistent, high-intensity activity over time. Hettchen's study linked high-intensity resistance training with improvements in postmenopausal risk factors, while Fernandez's use of vibration therapy provided a unique, low-impact alternative especially suitable for sedentary women or those with limited mobility.

Jamka et al. (2021) and Riaz et al. (2022) further substantiated the role of combined endurance and strength exercises in improving not just BMD but also muscle mass and functional performance.

Lastly, Isenmann et al. (2023) highlighted that even a relatively short 10-week program could meaningfully improve body composition and muscular strength, underscoring the adaptability of resistance-based interventions.

Despite variability in protocols, sample sizes, and outcome measures, a unifying finding across these studies is that consistent and appropriately tailored physical activity significantly benefits skeletal health in postmenopausal populations.

6. Conclusions and Recommendations

Regular, structured exercise is a highly effective and economically viable strategy to mitigate the decline in bone mass density associated with menopause. Interventions such as resistance training, aerobic activity, vibration therapy, or multi-modal programs can improve both skeletal integrity and functional mobility.

To enhance the evidentiary foundation, further research must to:

- Engage bigger and more heterogeneous participant samples.
- Utilize extended follow-up periods to evaluate enduring effects.
- Evaluate exercise methods to identify the most effective or synergistic combinations.
- Investigate individualized methods according to the degree of bone loss, physical fitness, and concomitant conditions.

Healthcare professionals need to include evidence-based exercise protocols into rehabilitative and preventative treatment for postmenopausal women. This would improve quality of life, decrease healthcare expenses associated with osteoporotic fractures, and enable women to maintain independence in later age.

References

- Aloia, J. F., McGowan, D. E., Vaswani, A., Ross, P., & Cohn, S. H. (1991). Relationship of menopause to skeletal and muscle mass. *The American Journal of Clinical Nutrition*, 53(6), 1378–1383. <https://doi.org/10.1093/ajcn/53.6.1378>
- Beck, B. R., Daly, R. M., Singh, M. a. F., & Taaffe, D. R. (2017). Exercise and Sports Science Australia (ESSA) position statement on exercise prescription for the prevention and management of osteoporosis. *Journal of Science and Medicine in Sport (Online)*, 20(5), 438–445. <https://doi.org/10.1016/j.jsams.2016.10.001>
- Cosman, F., De Beur, S. J., LeBoff, M. S., Lewiecki, E. M., Tanner, B., Randall, S., & Lindsay, R. (2014). Clinician's Guide to Prevention and Treatment of Osteoporosis. *Osteoporosis International*, 25(10), 2359–2381. <https://doi.org/10.1007/s00198-014-2794-2>
- Dizdar, M., Irdesel, J. F., Dizdar, O. S., & Topsaç, M. (2017). Effects of Balance-Coordination, strengthening, and aerobic exercises to prevent falls in postmenopausal patients with osteoporosis: a 6-Month randomized parallel prospective study. *Journal of Aging and Physical Activity*, 26(1), 41–51. <https://doi.org/10.1123/japa.2016-0284>
- Finkelstein, J. S., Brockwell, S., Mehta, V., Greendale, G. A., Sowers, M., Ettinger, B., Lo, J. C., Johnston, J. M., Cauley, J. A., Danielson, M. E., & Neer, R. M. (2008b). Bone Mineral Density Changes during the Menopause Transition in a Multiethnic Cohort of Women. *The Journal of Clinical Endocrinology & Metabolism*, 93(3), 861–868. <https://doi.org/10.1210/jc.2007-1876>
- Giangregorio, L. M., McGill, S., Wark, J. D., Laprade, J., Heinonen, A., Ashe, M. C., MacIntyre, N. J., Cheung, A. M., Shipp, K., Keller, H., Jain, R., & Papaioannou, A. (2014). Too Fit To Fracture: outcomes of a Delphi consensus process on physical activity and exercise recommendations for adults with osteoporosis with or without vertebral fractures. *Osteoporosis International*, 26(3), 891–910. <https://doi.org/10.1007/s00198-014-2881-4>
- Hoga, L. A. K., Rodolpho, J. R. C., Gonçalves, B. G., & Quirino, B. (2015). Women's experience of menopause: a systematic review of qualitative evidence. *JBIC Database of Systematic Reviews and Implementation Reports*, 13(8), 250–337. <https://doi.org/10.11124/jbisrir-2015-1948>
- Karlsson, M. K., & Rosengren, B. E. (2012). Physical activity as a strategy to reduce the risk of osteoporosis and fragility fractures. *International Journal of Endocrinology and Metabolism*, 10(3), 527–563. <https://doi.org/10.5812/ijem.3309>
- Kemmler, W., Bebenek, M., Kohl, M., & Von Stengel, S. (2015). Exercise and fractures in postmenopausal women. Final results of the controlled Erlangen Fitness and Osteoporosis Prevention Study (EFOPS). *Osteoporosis International*, 26(10), 2491–2499. <https://doi.org/10.1007/s00198-015-3165-3>
- Kemmler, W., Bebenek, M., Von Stengel, S., Engelke, K., & Kalender, W. A. (2011). Effect of block- periodized exercise training on bone and coronary heart disease risk factors in early post- menopausal women: a randomized controlled study. *Scandinavian Journal of Medicine and Science in Sports*, 23(1), 121–129. <https://doi.org/10.1111/j.1600-0838.2011.01335.x>
- Kovács, E., Prókai, L., Mészáros, L., & Gondos, T. (2013). Adapted physical activity is beneficial on balance, functional mobility, quality of life and fall risk in community-dwelling older women: a randomized single-blinded controlled trial. *PubMed*, 49(3), 301–310. <https://pubmed.ncbi.nlm.nih.gov/23486300>

- Lorentzon, M., & Cummings, S. R. (2015). Osteoporosis: the evolution of a diagnosis. *Journal of Internal Medicine*, 277(6), 650–661. <https://doi.org/10.1111/joim.12369>
- Maltais, M., Desroches, J., & Dionne, I. J. (2009). Changes in muscle mass and strength after menopause. *PubMed*, 9(4), 186–197. <https://pubmed.ncbi.nlm.nih.gov/19949277>
- NIH (2001). Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, March 7-29, 2000: Highlights of the Conference*. *Southern Medical Journal*, 94(6), 569–573. <https://doi.org/10.1097/00007611-200106000-00005>
- Nikander, R., Sievänen, H., Heinonen, A., Daly, R. M., Uusi-Rasi, K., & Kannus, P. (2010). Targeted exercise against osteoporosis: A systematic review and meta-analysis for optimising bone strength throughout life. *BMC Medicine*, 8(1). <https://doi.org/10.1186/1741-7015-8-47>
- Senderovich, H., Tang, H., & Belmont, S. (2017). The role of exercises in osteoporotic fracture prevention and current care gaps: where are we now? Recent updates. *F1000Research*, 6. <https://doi.org/10.7490/f1000research.1114100.1>
- Sirola, J., & Rikkinen, T. (2005). Muscle performance after the menopause. *The Journal of the British Menopause Society*, 11(2), 45–50. <https://doi.org/10.1258/136218005775544561>
- Sipilä, S., Törmäkangas, T., Sillanpää, E., Aukee, P., Kujala, U. M., Kovanen, V., & Laakkonen, E. K. (2020). Muscle and bone mass in middle-aged women: role of menopausal status and physical activity. *Journal of Cachexia Sarcopenia and Muscle*, 11(3), 698–709. <https://doi.org/10.1002/jcsm.12547>
- Sowers, M. F., Zheng, H., Tomey, K., Karvonen-Gutierrez, C., Jannausch, M., Li, X., Yosef, M., & Symons, J. P. (2007). Changes in Body Composition in Women over Six Years at Midlife: Ovarian and Chronological Aging. *The Journal of Clinical Endocrinology & Metabolism*, 92(3), 895–901. <https://doi.org/10.1210/jc.2006-1393>
- Tarantino, U., Iolascon, G., Cianferotti, L., Masi, L., Marcucci, G., Giusti, F., Marini, F., Parri, S., Feola, M., Rao, C., Piccirilli, E., Zanetti, E. B., Cittadini, N., Alvaro, R., Moretti, A., Calafiore, D., Toro, G., Gimigliano, F., Resmini, G., & Brandi, M. L. (2017). Clinical guidelines for the prevention and treatment of osteoporosis: summary statements and recommendations from the Italian Society for Orthopaedics and Traumatology. *Journal of Orthopaedics and Traumatology*, 18(S1), 3–36. <https://doi.org/10.1007/s10195-017-0474-7>
- Varahra, A., Rodrigues, I. B., MacDermid, J. C., Bryant, D., & Birmingham, T. (2018). Exercise to improve functional outcomes in persons with osteoporosis: a systematic review and meta-analysis. *Osteoporosis International*, 29(2), 265–286. <https://doi.org/10.1007/s00198-017-4339-y>