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Original Article

Effect of Whole Body Vibration in Improving Vitamin D Absorption in Women

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Abstract

Background: Numerous disorders have been connected to vitamin D deficiency, vitamin D's nutritional status is determined by exposure to sunshine as well as dietary or supplemental consumption. Exercise, however, has been shown in recent research to affect circulating 25(OH) D levels.

Purpose: This study was conducted to explore the influence of whole body vibration in improving vitamin D absorption in women.

Materials and Methods: Initially, 40 women with vitamin D deficiency were randomly divided into two groups: Control group A (n = 20) received vitamin D supplement and group B (n = 20) received Whole Body Vibration (WBV) trained three times a week for 8 weeks plus vitamin D supplement. Both groups receiving a conventional dose (880 IU/day) of vitamin D for two months. The optimal circulating vitamin D concentration was preliminarily assessed based on the parathyroid hormone response so concentration of vitamin D and parathyroid hormone were measured pre- and post-eight-weeks intervention timeframe.

Results: There was a notable improvement in concentration of vitamin D and parathyroid hormone of both groups post treatment compared with that pretreatment ($p < 0.025$). Also, there was a significant increase in vitamin D and significant decrease in parathyroid hormone of WBV group compared with that of control group post treatment ($p < 0.05$).

Conclusions: Combining WBV with vitamin D supplements may improve vitamin D status overall.

Keywords: Whole body vibration; Vitamin D; Absorption; Women.

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Introduction:

Vitamin D has been the subject of more research recently, which is explained by its many functions in human health, such as its impact on immunological, cardiovascular, and musculoskeletal health **(1).**

Vitamin D deficiency is currently recognized as a common public health problem **(2).** Vitamin D has long been known to play a part in maintaining calcium and phosphate balance as well as skeletal and non-skeletal health. Along with other causes, vitamin D insufficiency is a significant contributor to metabolic bone abnormalities that cause rickets in children and osteomalacia in adults **(3).** A lack of vitamin D is linked to a number of chronic illnesses, such as cancer, autoimmune disorders, heart disease, high blood pressure, diabetes, metabolic syndrome, depression, neurocognitive function, and an increased risk of infection **(4-8).**

Vitamin D is a unique pro-hormone that is not classified as a "vital amine" since it is obtained primarily by subcutaneous exposure to ultraviolet B light. Following exposure, a chain reaction within the skin produces cholecalciferol (vitamin D3), which is then hydroxylated to produce the circulating metabolite 25-hydroxyvitamin D (25(OH)D). This is most typically improved vitamin D absorption **(1).**

Almost 90% of the human endogenous vitamin D is synthesized primarily in the skin by activation of 7-dehydrocholesterol triggered by the exposure to ultraviolet (UVB) sunlight, so limited exposure to the sunlight might lead to vitamin D deficiency. The remaining 10% is acquired from nutritional sources such as codfish, mushrooms, milk, eggs, and fortified food. Although vitamin D synthesis depends on UVB sunlight exposure, many other factors such as age, obesity, skin color, dress style, and sunscreen-use might affect vitamin D level **(9).**

Recent studies have found that physical inactivity is an important risk factor for morbidity and mortality from chronic non-communicable diseases **(10)** and for vitamin D deficiency **(11).** Many observational studies have indicated that the maintenance of vitamin D nutritional status is associated with physical activity/exercise behaviors **(12,13),** and physical activity levels are significantly positively correlated with 25(OH)D levels **(14,15).**

In addition to the recognized impact of vitamin D and calcium supplementation, load-bearing training, such as whole-body vibration (WBV) training, may prevent or perhaps partially reverse sarcopenia and osteoporosis in postmenopausal women **(16-19).**

An assessment of Jordanian university students selected from non-health-related faculties revealed that there is a need for improvement in their knowledge, attitudes, and practices regarding vitamin D, its relationship to sun exposure, and their consumption of vitamin D-rich foods or supplements. They found a discrepancy between attitudes, practices, and knowledge of vitamin D that can be closed by raising awareness of the vitamin **(3).**

Whole-body vibration treatment has an impact on bone metabolism, muscular function, muscle training, and the endocrine system. Vibration treatment sends anabolic mechanical impulses to the bone and muscle tissue. It promotes blood circulation to the bones, ensuring an increased nourishment supply and the absorption of vitamin D **(20).**

Whole body vibration (WBV) exercise uses an oscillating platform as a stimulus, transmitting forced mechanical oscillation through the legs of an individual standing on the platform (21) and stimulating subcutaneous proprioceptors, muscle spindles and Golgi tendon organs (22,23). It has been suggested that WBV exercise can have beneficial effects on absorption of vitamin D **(24).**

Materials and Methods:

Study design:

The study was carried out from October 2024 to January 2025, and approved by the Research Ethics Committee at the institution under the number (IRB#18\11\2024-2025). All participants received comprehensive information regarding the aims and methodologies involved

in the study and provided written consent, indicating their voluntary participation. The study's procedures conformed to the ethical criteria set by the 1964 Declaration of Helsinki, along with its subsequent updates. Additionally, this research was registered in the ClinicalTrials.gov registry under the number: NCT 06721637

Participants:

The research was conducted at the Physical Therapy Department of Al-Zaytoonah University. Forty female patients who had vitamin D deficiency were enrolled in this study according to specific criteria: vitamin D concentration was preliminarily assessed based on the parathyroid hormone response so concentration of vitamin D and parathyroid hormone were measured pre- and post-two month's intervention. Vitamin D concentration was less than 12ng/ml and age between 20 and 50 years and Their BMI less than 30. The study excluded participants if Vitamin D concentration was greater than 20ng/ml, Their BMI greater than 30 and exhibited a history of significant medical diseases such as rheumatoid diseases, uncontrolled high blood pressure, serious heart or lung issues, chronic viral infections including herpes and hepatitis.

Evaluative equipment:

Recording data sheet: Name, gender, age, address, Work status, weight and height, vitamin D concentration was preliminarily assessed based on the parathyroid hormone response so concentration of vitamin D and parathyroid hormone were measured pre- and post-two months' intervention and Weight and height measured while the woman wearing a thin layer of clothes to calculate the BMI according to the following equation: BMI= weight/height2 (Kg/m2), for both groups (A&B).

Intervention

The intervention was administered three times weekly for a duration of eight weeks, totaling 24 sessions. The two groups received either a conventional dose (880 IU/day) of vitamin D for two months.

Control Group:

Group (A) (n = 20): received vitamin D supplement for 8 weeks.

Whole body vibration (WBV) Group:

Group B (n = 20): received whole body vibration trained three times a week for 8 weeks plus vitamin D supplement.

The woman assumed a full squat position on a vibration platform. The apparatus was set at a frequency of 30 Hz, amplitude of 2 mm, and duration of 5 min. The women were instructed to remain in the squatting position with holding hand rail after turning on the vibration and to report any discomfort that might arise. At the end of 5 min, the vibration turned off automatically. Thereafter, the women took a 1-min rest. They were then asked to stand on the vibration platform for 5 min, with the same parameters as those used in the squatting position. Thus, the total time for the application of WBV in each session was 10 min **(25).**

Results:

Statistical analysis

Paired t-test was conducted for comparison of subject characteristics between groups. Chi-squared package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).test was conducted for comparison of marital status between groups. Normal distribution of data was checked using the Shapiro-Wilk test and Kolmogorov-Smirnov test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical.

Subject characteristics:

There was no significant difference between groups in age, weight, height and BMI ($p > 0.05$) (**Table 1).**

There is enough evidence at the 5% level of significance to support the increase in concentration of vitamin D and decrease in parathyroid hormone of both groups post treatment compared with that pretreatment

As $t_{value} > 2.093$ we reject H_0 and accept H_1.This result is confirmed by the fact the P value is less than 0.025. There is thus a significant difference at the 0.05 level of significance between the paired samples difference and zero, and the result indicate that the increase in concentration of vitamin D and decrease in parathyroid hormone of both groups post treatment compared with that pretreatment

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Table 1. Subject characteristics.

	Group A	Group B	p-value
	Mean ± SD	Mean ± SD	
Age (years)	26.05±6.236	25.95±6.320	0.330
Weight (kg)	71.80±8.237	71.60±8.356	0.330
Height (cm)	164.40±8.744	164.15±8.493	0.330
BMI (kg/m²)	26.51±2.204	26.30±2.202	0.164

SD, standard deviation; p-value, level of significance.

Table2. Comparison between the two groups.

	Group A	Group B	
	Mean ± SD	Mean ±SD	P value
Vitamin D			
Pre treatment	10.45 ± 2.685	10.10± 2.245	0.167
Post treatment	19.20± 1.673	22.05± 3.120	0.000
Paired difference	27.250±10.264	11.600±2.891	
95% C.I for μ_d	7.742-10.457	10.247-12.953	
t_{value}	14.033	17.944	
Parathyroid hormone			
Pre treatment	46.20± 7.367	45.60± 5.235	0.047
Post treatment	33.25± 6.927	30.20± 6.178	0.000
Paired difference	8.950±2.523	16.650±8.922	
95% C.I for μ_d	7.769-10.131	3.140-7.659	
t_{value}	15.864	5.002	

SD, Standard Deviation; μ_d, Mean Difference; CI, Confidence Interval; P-value, Level of significance.

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Discussion:

The objective of current research was to explore the influence of whole body vibration in improving vitamin D absorption in women. The outcomes of current research suggested that there was a significant improvement of all measured parameters (Vitamin D concentration and parathyroid hormone concentration). The significant improvement in Vitamin D concentration in both groups might be due to vitamin D supplement and WBV.

In related research, WBV training was investigated for its possible advantages on muscle strength and bone mineral density (BMD) when combined with vitamin D supplementation. A randomized controlled trial of institutionalized old women looked at the effects of six months of WBV training paired with either standard (880 IU) or high-dose (1600 IU) vitamin D supplementation. The results showed that all groups saw substantial increases in dynamic muscular strength, hip BMD, and blood vitamin D levels. However, WBV did not show any substantial advantages above vitamin D therapy alone. Furthermore, increasing vitamin D did not yield better musculoskeletal results than the standard dose **(26).**

The outcomes of current research were consistent with **Li et al (2024)** who emphasized that the combination of whole-body vibration exercise and vitamin D administration has been shown to improve bone density. Furthermore, vitamin D indirectly increased muscular strength, which helps enhance general body strength, allowing people to conduct everyday tasks more readily and lowering the chance of falling. Furthermore, the study revealed the significant influence of whole-body vibration exercise on increasing vitamin D levels through supplementation **(27).**

This study focused on women who had undergone menopause, investigating the impact of vibration devices on their health. According to the findings, whole-body vibration training was effective in reducing weight gain, reduced bone density, and psychological alterations associated with menopause. One of the device's most noticeable impacts was its capacity to considerably boost bone density and improve vitamin D absorption, which helped minimize the risk of osteoporosis, a condition that is especially serious for postmenopausal women **(28).**

The outcomes of current research were consistent with **Newhart et al (2019)** who emphasized that improve neuromuscular performance, vitamin D absorption, muscular strength, balance, gait mechanics, and quality of life is whole body vibration. The method consists of standing and maintaining positions on a platform that vibrates at a predetermined oscillation frequency, amplitude, and magnitude. When a WBV training device comes into contact with the body, the vibratory wave travels through the limb, contacts the platform, and travels up the body to the joint. A transient contraction and relaxation of the musculature results from the modest and quick shifting of the muscles and tendons at the joint caused by the vibratory wave. When the muscle is stretched quickly, the muscle spindle engages, triggering the stretch reflex and causing the muscle to contract reflexively **(29).**

According to **Gian et al. (2020),** who proposed that whole-body vibration (WBV) training is an efficient means of enhancing physical fitness, vitamin D absorption in obese women, obese postmenopausal women showed greater improvement after applying WBV **(30).**

According to **Rigamonti et al. (2018),** WBV has become more popular as an alternative form of exercise for boosting physical performance and fitness in both obese and non-obese participants, which supported the improvement of all indicators in group B. Furthermore, it is widely known that a single WBV session increases anabolic hormones in persons who are fat and elderly **(31).**

Our findings supported those of **Wilms et al. (2017),** who found that WBV and endurance training can significantly increase body composition, Vitamin D absorption and resting energy expenditure. Exercise with vibration has garnered a lot of interest as a way to increase

metabolic rate and trigger muscle adaptation **(32).**

Conclusion: Combining WBV with vitamin D supplements may improve vitamin D status overall.

Author Contribution Statement: All authors developed the theoretical formalism, performed the analytic calculations and performed the numerical simulations, contributed to the final version of the manuscript and supervised the project.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Conflicts of Interest: There are no competing interests to declare.

References

1. Owens DJ, Allison R, Close GL. Vitamin D and the Athlete: Current Perspectives and New Challenges. Sport Med. 2018; 48: 3–16. https://doi.org/10.1007/s40279-017-0841-9
2. Manson JE, Brannon PM, Rosen CJ, et al. Vitamin D deficiency—is there really a pandemic? New Engl J Med 2016; 375(19): 1817–1820. https://doi.org/10.1056/nejmp1608005
3. Mohamed NA, Al Qerem W, Gassar ES, Hailat M, Elhamdy FA and Ling J. A Need for Improvement in the Knowledge, Attitudes and Practice Toward Vitamin D Among University Students, Bahrain Medical Bulletin 2021;43(2): 482-490.https://www.bahrainmedicalbulletin.com/JUNE_2021/BMB-21-15.pdf
4. Sahay M and Sahay R. Rickets-vitamin D deficiency and dependency. Indian J Endocrinol Metab 2012; 16(2): 164– 176. https://doi.org/10.4103/2230-8210.93732
5. Rosen CJ, Adams JS, Bikle DD, et al. The nonskeletal effects of vitamin D: an endocrine society scientific statement. Endocr Rev 2012; 33(3): 456–492. https://doi.org/10.1210/er.2012-1000
6. Wrzosek M, Łukaszkiewicz J, Wrzosek M, et al. Vitamin D and the central nervous system. Pharmacological Reports 2013; 65(2): 271–278. https://doi.org/10.1016/s1734-1140(13)71003-x
7. Feldman D, Krishnan AV, Swami S, et al. The role of vitamin D in reducing cancer risk and progression. Nat Rev Cancer 2014; 14(5): 342. https://doi.org/10.1038/nrc3691
8. Wang L, Song Y, Manson JE, et al. Circulating 25-hydroxyvitamin D and risk of cardiovascular disease: a meta-analysis of prospective studies. Circ Cardiovasc Qual Outcomes 2012; 5(6): 819–829. https://doi.org/10.1161/circoutcomes.112.967604
9. Prietl B, Treiber G, Pieber TR, et al. Vitamin D and immune function. Nutrients 2013; 5(7): 2502–2521. https://doi.org/10.3390/nu5072502
10. Hoteit Hoteit M, Al-Shaar L, Yazbeck C, et al. Hypovitaminosis D in a sunny country: time trends, predictors, and implications for practice guidelines. Metabolism 2014; 63(7): 968–978. https://doi.org/10.1016/j.metabol.2014.04.009

11. O'Sullivan F, van Geffen J, van Weele M and Zgaga L. Annual Ambient UVB at Wavelengths that Induce Vitamin D Synthesis is Associated with Reduced Esophageal and Gastric Cancer Risk: A Nested Case-Control Study 2018, Photochem. Photobiol, 94, 797–806. https://doi.org/10.1111/php.12915
12. Budhathoki S, Hidaka A, Yamaji T, Sawada N, Tanaka-Mizuno S, Kuchiba A, Charvat H, Goto A, Kojima S, Sudo N, Shimazu T, Sasazuki S, Inoue M, Tsugane S and Iwasaki M . Plasma 25-hydroxyvitamin D concentration and subsequent risk of total and site specific cancers in Japanese population: large case-cohort study within Japan Public Health Center-based Prospective Study cohort, 2018, B.M.J, 360. https://doi.org/10.1136/bmj.k671
13. Yildirim O, Yildirim T, Seckin Y, Osanmaz P, Bilgic Y and Mete R. The influence of vitamin D deficiency on eradication rates of Helicobacter pylori. 2017, Adv. Clin. Exp. Med, 26, 1377–1381. https://doi.org/10.17219/acem/65430
14. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc 2006; 81(3): 353– 373. https://doi.org/10.4065/81.3.353
15. Palacios C and Gonzalez L. Is vitamin D deficiency a major global public health problem? J Steroid Biochem Mol Biol 2014; 144(PtA): 138–145. https://doi.org/10.1016/j.jsbmb.2013.11.003
16. Batieha A, Khader Y, Jaddou H, et al. Vitamin D status in Jordan: dress style and gender discrepancies. Ann Nutr Metab 2011; 58(1): 10–18. https://doi.org/10.1159/000323097
17. Wacker M, Holick MF. Sunlight and Vitamin D: A global perspective for health. Dermatoendocrinol. 2013; 5: 51–108. https://doi.org/10.4161/derm.24494
18. Scientific Advisory Committee on Nutrition and Department of Health. Vitamin D and Health. London; 2016. Available: https://www.gov.uk/government/publications/sacn-vitamin-d-and-health-report.
19. Jääskeläinen T, Itkonen ST, Lundqvist A, et al. The positive impact of general vitamin D food fortification policy on vitamin D status in a representative adult Finnish population: evidence from an 11-y follow-up based on standardized 25-hydroxyvitamin D data. Am J Clin Nutr. 2017; 105(6):1512–1520. https://doi.org/10.3945/ajcn.116.151415
20. Cattaruzza MS, Pisani D, Fidanza L, Gandini S, Marmo G, Narcisi A, Bartolazzi A and Carlesimo M . 25-Hydroxyvitamin D serum levels and melanoma risk: a case–control study and evidence synthesis of clinical epidemiological studies. 2018, Eur. J. Cancer Prev, Epub 2018/02/14. https://doi.org/10.1097/cej.0000000000000437
21. Cerciello S, Rossi S, Visonà E, Corona K, Oliva F: Clinical applications of vibration therapy in orthopaedic practice. Muscles Ligaments Tendons J. 2016, 6:147-56. https://doi.org/10.11138/mltj/2016.6.1.147
22. Rittweger J. Vibration as an exercise modality: how it may work, and what its potential might be. Eur J Appl Physiol 2010; 108: 877–904. https://doi.org/10.1007/s00421-009-1303-3

23. Rogan S, Hilfiker R, Herren K, Radlinger L, de Bruin ED. Effects of whole-body vibration on postural control in elderly: a systematic review and meta-analysis. BMC Geriatrics 2011; 11: 72. https://doi.org/10.1016/j.archger.2017.07.022

24. Sonza A, Maurer C, Achaval M, Zaro MA, Nigg BM. Human cutaneous sensors on the sole of the foot: altered sensitivity and recovery time after whole body vibration. Neurosci Lett 2013; 533: 81–85. https://doi.org/10.1016/j.neulet.2012.11.036

25. Park SY, Son WM, Kwon OS. Effects of whole body vibration training on body composition, skeletal muscle strength, and cardiovascular health. J Exerc Rehabil 2015; 11: 289–295. https://doi.org/10.12965/jer.150254

26. Ali, S M., Awad, SA., Elassal, IM. (2019). The effect of two therapeutic interventions on balance in children withspastic cerebral palsy: A comparative study, Journal of Taibah University Medical Sciences, 14(4):350-356. https://dx.doi.org/10.1016/j.jtumed.2019.05.005.

27. Verschueren S, Bogaerts A, Delecluse C, Claessens A, Haentjens P, Vanderschueren D, Steven B. The effects of whole-body vibration training and vitamin D supplementation on muscle strength, muscle mass, and bone density in institutionalized elderly women: A 6-month randomized, controlled trial." Journal of bone and mineral research,2011; 26(1): 42-49. https://doi.org/10.1002/jbmr.181

28. Li, W., Chen, M., Chen, F., Li, Y., Zhong, Y., Lu, Y., Zhang, K., & Yang, F. (2024). Vitamin D combined with whole-body vibration training for the treatment of osteo-sarcopenia: study protocol for a randomized controlled trial. Trials, 25(1). https://doi.org/10.1186/s13063-024-08498-8

29. Tsai, S., Tseng, Y., Chiou, W., Chen, S., Chung, Y., Wei, W., & Huang, W. The effects of Whole-Body vibration exercise combined with an isocaloric High-Fructose diet on osteoporosis and immunomodulation in ovariectomized mice. Frontiers in Nutrition, 2022; 9. https://doi.org/10.3389/fnut.2022.915483

30. Newhart, S., Pearson, A., Salas, E., et al. Whole Body Vibration: Potential Benefits in the Management of Pain and Physical Function. Pract Pain Manag, 2019. 19 (1)https://www.medcentral.com/pain/pt-rehab/whole-body-vibration-potential-benefits-management-pain-physical-function

31. Gian Pietro, E., Dafne, F., Simona, F., et al. Effects of Acute Whole-Body Vibration Practice On Maximal Fat Oxidation in Adult Obese Males: A Pilot Study. Randomized Controlled Trial: Obes. Facts, 2020, 13 (2): 117-129. https://doi.org/10.1159/000505665

32. Wilms, B., Frick, J., Ernst, B., et al. Whole Body Vibration Added to Endurance Training in Obese Women - A Pilot Study. Int. J. Sports Med, 2017, 33 (9): 740-743. https://dx.doi.org/10.1055/s-0032-1306284