Whole-body vibration

Occupational exposure to whole-body vibration is associated with the development of musculoskeletal, neurological, and other ailments. Low back pain and other spine disorders are prevalent among those exposed to whole-body vibration in occupational and military settings. Although standards for limiting exposure to whole-body vibration have been in place for decades, there is a lack of understanding of whole-body vibration-associated risks among safety and healthcare professionals. Consequently, disorders associated with whole-body vibration exposure remain prevalent in the workforce and military. The relationship between whole-body vibration and low back pain in humans has been established largely through cohort studies, for which vibration inputs that lead to symptoms are rarely, if ever, quantified. This gap in knowledge highlights the need for the development of relevant in vivo, ex vivo, and in vitro models to study such pathologies. The parameters of vibrational stimuli (eg, frequency and direction) play critical roles in such pathologies, but the specific cause-and-effect relationships between whole-body vibration and spinal pathologies remain mostly unknown [1)]

The combination of WBV + EPO exerts no positive effects on hind limbs motor performance and bladder function after compressive SCI in rats [2)]

An established in vivo rat model of WBV was used to characterize the resonance of the spine using sinusoidal sweeps. The relationship between arms and fr was defined and implemented to assess behavioral sensitivity-a proxy for pain. Five groups were subjected to a single 30-min exposure, each with a different vibration profile, and a sham group underwent only anesthesia exposure. The behavioral sensitivity was assessed at baseline and for 7 days following WBV-exposure. Only WBV at 8 Hz induced behavioral sensitivity, and the higher arms exposure at 8 Hz led to a more robust pain response. These results suggest that the development of pain is frequency-dependent, but further research into the mechanisms leading to pain is warranted to fully understand which WBV profiles may be detrimental or beneficial [3)].

Whole-body vibration is known to be effective muscle training and may be an option in diminishing weakness and muscle wasting [4)].

[5)]

[1)]
Patterson F, Miralami R, Tansey KE, Prabhu RK, Priddy LB. Deleterious effects of whole-body vibration on the spine: A review of in vivo, ex vivo, and in vitro models. Animal Model Exp Med. 2021 Mar 23;4(2):77-86. doi: 10.1002/ame2.12163. PMID: 34179716; PMCID: PMC8212824.

[2)]
Rink S, Manthou ME, Arnold J, Grigo M, Dicken P, Abdulla DSY, Bendella H, Nohroudi K, Angelov DN. Motor, sensitive, and vegetative recovery in rats with compressive spinal-cord injury after combined treatment with erythropoietin and whole-body vibration. Restor Neurol Neurosci. 2021;39(2):85-100.

doi: 10.3233/RNN-201120. PMID: 33612500.
3)
Holsgrove TP, Zeeman ME, Welch WC, Winkelstein BA. Pain After Whole-Body Vibration Exposure Is Frequency Dependent and Independent of the Resonant Frequency: Lessons From an In Vivo Rat Model. J Biomech Eng. 2020 Jun 1;142(6):061005. doi: 10.1115/1.4044547. PMID: 31513714.
4)
Wollersheim T, Haas K, Wolf S, Mai K, Spies C, Steinhagen-Thiessen E, Wernecke KD, Spranger J, Weber-Carstens S. Whole-body vibration to prevent intensive care unit-acquired weakness: safety, feasibility, and metabolic response. Crit Care. 2017 Jan 9;21(1):9. doi: 10.1186/s13054-016-1576-y. PMID: 28065165; PMCID: PMC5220605.
5)
Lan F.Y., Liou Y.W., Huang K.Y., Guo H.R., Wang J.D. An investigation of a cluster of cervical herniated discs among container truck drivers with occupational exposure to whole-body vibration. J. Occup. Health. 2016;58:118–127. doi: 10.1539/joh.15-0050-FS.