

Table S1: Summary of clinical studies of effects of WBV on muscles in healthy young adults (18 to 32 years of age)

Reference	Frequency (Hz)	Amplitude (mm)	Posture during WBV	Dosage/session and vibration sessions/week	Results
Chen et al. [65]	5, 10, 15	2	N/A	60 seconds of training, 3 repetitions.	Highest sEMG activity in lumbar-abdominal muscles at 15 Hz.
Dallas et al. [34]	30	2.5 (peak to peak).	Eccentric and concentric squatting	3 days/week for 6 weeks.	Improvement in jump performance and leg strength.
Morel et al. [76]	50	1.53	Squat at 50° knee flexion angle.	5 test sets, each of 30–60 seconds followed by 30 seconds rest.	Greater EMG signal at Flexor Digitorum Superficialis (FD) muscle than Wrist Extensor (ED) muscle.
Dallas et al. [33]	30	2.5 (peak to peak).	N/A	120 seconds to 240 seconds/session. 3 days/week for 8 weeks.	Improved balance and jump performance.
Stania et al. [70]	20, 40, 60	2, 4 (peak to peak).	Knee and hip joints bent at 90°.	1 minute of vibration, 1minute break, 5 repetitions. 3 sessions/week for 4 weeks.	60 Hz, 4 mm provides higher peak average torque.
Chung et al. [77]	3, 18, 32	1, 3, 114	90°–150°	60 seconds followed by 2 minutes of rest. 3 sessions/week for 8 weeks.	Higher isometric and isokinetic contraction strength at high frequency and low amplitude.
Annino et al. [36]	35	5	N/A	60 seconds of training followed by 60 seconds of rest, 5 repetitions. 2 sets separated by 5 minutes.	Reduced EMG activity in agonist muscle (Biceps Femoris). Increased antagonist/agonist ratio.
Yang et al. [65]	35, 45	2 (peak to peak).	Squatting at 60° knee flexion angle.	4 minutes.	Increased jump height in both groups.

Harwood et al. [78]	25, 35, 45	2	Isometric squat at 60° knee flexion angle.	1 minute of vibration followed by 1 minute of rest, 5 repetitions.	Increased muscle activity, decreased H-reflex/M-wave ratio, about the same for all frequencies.
Ezmaeilzadeh et al. [14]	30, 50	2–4 (peak to peak).	Semi-squat position, one-legged squat position.	20–60 minutes/session, 30–45 seconds/dose and 30–45 seconds of rest. 3 sessions/week for 8 weeks.	Peak torque for 30 Hz group is higher than 50 Hz group.
Bush et al. [19]	30	4 (peak to peak).	Dynamic and static squats; 100° knee flexion angle.	30 seconds/dose followed by 60 seconds of rest. 5 minutes of WBV with 10 repetitions.	WBV with dynamic squat can potentiate neuromuscular functioning at 30 Hz - 4 mm vibration.
Marin et al. [20]	30, 50	1.15, 2.51 (peak to peak).	Single leg static squat; 60° knee flexion angle.	30 seconds of WBV; rest time varies with tests.	50 Hz & 2.51 mm enhanced sEMG activity more than 30 Hz & 1.15 mm.
Ritzmann et al. [12]	5, 10, 15, 20, 25, and 30	4	5°, 30°, and 60° knee flexion angles.	10 seconds of WBV, 30 seconds of rest.	EMG activity was highest during side-alternating vibration of 30 Hz at 60° knee flexion angle.
Krol et al. [67]	20, 40, 60	2, 4	90° knee flexion angle.	30 seconds of WBV and 2 minutes of rest. In total, 8 trials.	EMG(rms) activity was maximum at 60 Hz - 4 mm.
Pollock et al. [64]	30	2.5, 5.5	15.1° knee flexion angle.	7 seconds of WBV followed by 30 seconds of rest.	Linear increase of EMG activity with amplitude and frequency except at Biceps Femoris and Gluteus Maximus.
Petit et al. [59]	30, 50	2, 4 (peak to peak)	Knee angle of 70°, 80°, and 90°	30 seconds of WBV, followed by 30 seconds of rest, 10 minutes/session. 3 sessions/week for 6 weeks.	Increased knee extensor muscle strength at high frequency and high peak to peak amplitude.
Abercromby et al. [9]	30	4	Dynamic squat; 5° - 40° knee flexion angle.	Each trial < 15 seconds, cumulative WBV for each subject.	Increased EMG values in muscles during rotational (R) and vertical (V) vibration.

Table S2: Summary of clinical studies of effects of WBV on muscle in elderly adults (54-82 years of age).

Reference	Frequency (Hz)	Amplitude (mm)	Posture during WBV	Dosage/ session and vibration sessions/week	Results
Wei and Ng [40]	40	4 (peak to peak).	60° knee flexion angle.	90 seconds per set, 4 sets per day. 36 training sessions, 3 sessions/week for 12 weeks.	WBV facilitates the central motor drive in elderly people with sarcopenia.
Miller et al. [47]	30	4	30° knee flexion angle.	Continuous WBV: 6 minutes/set; Intermittent WBV: six 1-minute/dose and 1 minute rest.	Intermittent WBV has better outcomes in performance tests (jump height, grip strength, timed up and go test, sit and reach test) than continuous WBV.
Goudarzian et al. [42]	30–35	5–8 (peak to peak).	Squatting at 120° knee angle.	30 minutes/session. 3 times/week for 8 weeks.	Improved performance among all performance tests (timed-up and go, 5-repetition chair raising, 10-m walking, and leg isometric tests) after WBV.
Wei et al. [58]	20, 40, 60	4 (peak to peak).	60° knee flexion angle.	240 seconds and 720 seconds /dose; 5 minutes of rest time. 3 sessions/week for 12 weeks.	40 Hz-360 s is more effective in performance tests (timed-up-and-go, 10-meter walking, five repetition sit-to-stand tests) than 20 Hz-720 s and 60 Hz-240 s.
Smith et al. [45]	30	1 (for the first 2 weeks) and 2 (for the rest).	N/A	1-minute WBV followed by 1 minute of rest for 5 minutes. 2 sessions/week for 12 weeks.	Improved muscle strength, static and dynamic balance.

Perchthaler et al. [31]	30	3.9	knee angle of 45°–60°.	12 training sessions for 6 weeks.	Increase in multi-joint strength, but no change in isokinetic muscle strength, power.
Osugi et al. [79]	20	N/A	45°–60° knee flexion angle.	4 minutes/session. 2 sessions/week for 6 months.	WBV along with squat training is more beneficial than WBV alone to balance and muscle power.
Cristi et al. [44]	Training frequency gradually increases from 30 Hz to 45 Hz.	2 (peak to peak).	30° and 60° knee flexion angle during squat.	30–60 seconds. 3 sessions/week for 9 weeks.	Significant increase in maximal voluntary contraction.
Perchthaler et al. [66]	6, 12, 18, 24, and 30.	1.3, 2.6, and 3.9.	Knee angles of 30°, 45°, and 60°.	15 seconds of vibration followed by 60 seconds of rest.	Highest muscle activity (% of maximal voluntary contraction) was found at 30 Hz – 3.9 mm WBV with 60° knee angle position.
Machado et al. [71]	Training frequency gradually increases from 20 Hz to 40 Hz.	Training amplitude gradually increases from 2 mm to 4 mm.	Knee angle of 90°–130°.	30–60 seconds/dose followed by 2–3 minutes of rest. 3–5 sessions/week for 10 weeks.	Significant increase in muscle cross-sectional area and muscle strength.
Rees et al. [80]	26	5–8 (peak to peak).	Squat at 100° knee flexion angle.	45 seconds–80 seconds/session; total of 6 sets. 3 sessions per week for 8 weeks.	Increased planter-flexor strength.

Table S3: Summary of clinical studies on the effects of vibration on muscle with postures other than standing

Study	Location of vibration source	Posture during WBV	Frequency (Hz)	Amplitude (mm)	Dosage/ session and vibration sessions/week	Results
Pujari et al. [49]	Feet	Sitting with 90° knee flexion angle.	30, 50	0.5, 1.5	5 interventions/session with 5 minutes of rest. Single session.	Greater sEMG activity at 50 Hz-0.5mm.
Yung et al. [81]	Feet	Physically demanding, mentally demanding, and concurrent work.	5.91	N/A	30 minutes of WBV/session, 4 sessions/day for 4 days.	Impairment to visual-motor skills, increased bodily discomfort, reduced postural sway, increase in muscle fatigue, and low-back pain.
Osawa and Oguma 2011 [82]	Lower extremity, trunk.	8 exercises in prone and supine positions during vibration.	35	2	60 minutes/session, 2 sessions/week for 7 weeks.	Improved maximal isometric and concentric knee extension strength, maximal isometric lumbar extension strength after WBV.
Osawa et al. [48]	Lower extremity, trunk.	8 body-weight exercises in semi-prone and supine positions during vibration.	30–40	2	30 seconds/set followed by 60 seconds of rest, 40 minutes/session, 2 sessions/week for 7 weeks.	Vibration along with bodyweight exercises have no impact on muscle power.

Blottner et al. [83]	Feet	Supine position during bed rest.	19–25	N/A	Two bouts (6 minutes each) per day, 89 exercise sessions within 56 days.	Unchanged size of the myofiber type I and II for Vastus Lateralis. The size increased for soleus muscle.
Park et al. [53]	Hand	Seated position with the armrest.	40, 80, 100, 120, 150	0.2, 0.3	45 seconds of vibration followed by 2 minutes of rest. Total 36 trials in 2 days.	Frequencies within 100 Hz-150 Hz produced higher Tonic Vibration Reflex (TVR).
Hansson et al. [46]	Hip	Seated with forwarding bent posture.	5	N/A	5 minutes/set.	Development of muscle fatigue.

Table S4. Summary of studies on the adverse effects of WBV.

Study	Frequency and acceleration	Duration	Posture	Effects
Yung et al. [81]	5.91 Hz.	30 minutes of WBV.	Sitting and standing.	Impairment to visual-motor skills, increased bodily discomfort, reduced postural sway, increase in muscle fatigue, and low-back pain.
Azizan et al. [84]	1–15 Hz (random vibration), acceleration 0.2 m/s ² .	20 minutes.	Sitting.	Drowsiness and impaired psychomotor performance.
Beard et al. [85]	0.025 Hz – 1 Hz (horizontal vibration).	N/A	Sitting with and without backrest.	Increased discomfort without backrest.
Azizan et al. [86]	1 Hz –15 Hz, acceleration 0.3 m/s ² .	20 minutes	Sitting.	A decrease in beta wave resulted in greater drowsiness.
Basri et al. [87]	20 Hz and 0.2 m/s ² – 2 m/s ² ; 8 Hz and acceleration 0.4 m/s ² .	Less than 45 minutes per session, 5 sessions.	Sitting with inclined backrest.	Increased discomfort.
Butler et al. [88]	0.1 Hz (transverse and pitch); acceleration 1.26 m/s ² .	Single session (30 minutes).	Sitting.	Motion sickness is caused by combined fore-and-aft and pitch oscillation.
Satou et al. [89]	10 Hz , acceleration 0.6 m/s ² .	12 minutes.	Sitting.	Reduction in wakefulness level.
Joseph et al. [90]	0.2 Hz (transverse and roll); acceleration 1.26 m/s ² .	Four 30–minutes exposure for 1 week	Sitting.	Higher motion sickness.
Park et al. [53]	40, 80, 120, 150, 180, and 200 Hz.	45 seconds.	Sitting.	Frequencies within 100 Hz -150 Hz produced higher TVR, which is responsible for higher muscle stress and fatigue.
Hansson et al. [46]	5 Hz.	5 minutes/set.	Sitting.	Development of muscle fatigue.
Landstrom et al. [91]	3 Hz (sinusoidal and longitudinal), 2 Hz – 20 Hz (random and longitudinal vibration, acceleration 0.3 m/s ² .	15 minutes.	Sitting.	Decrease in wakefulness.