

Whole-body vibration training improves physical function and increases bone and muscle mass in youngsters with mild cerebral palsy

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Background

- Adolescents with cerebral palsy have decreased mobility resulting in reduced muscle mass, muscle function, and bone mass.
- There is a lack of therapeutic interventions to increase muscle & bone mass, and muscle function in this group.
- We aimed to evaluate the effect of 20 weeks of whole-body vibration training (WBVT) on muscle and bone health in adolescents with cerebral palsy.

Methods

Inclusion criteria:

- Cerebral palsy (GMFCS II-III)
- 10-20 years of age

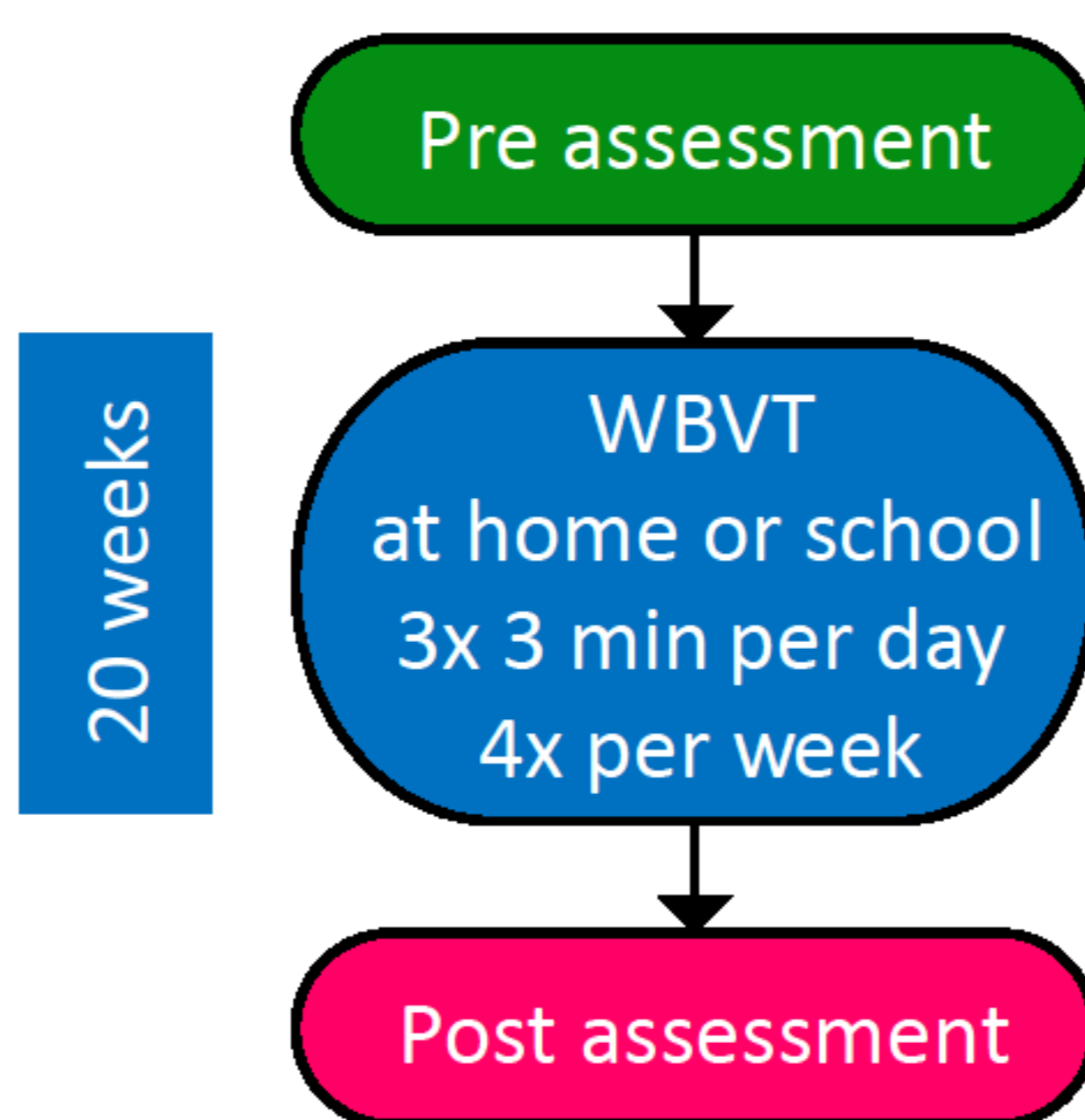
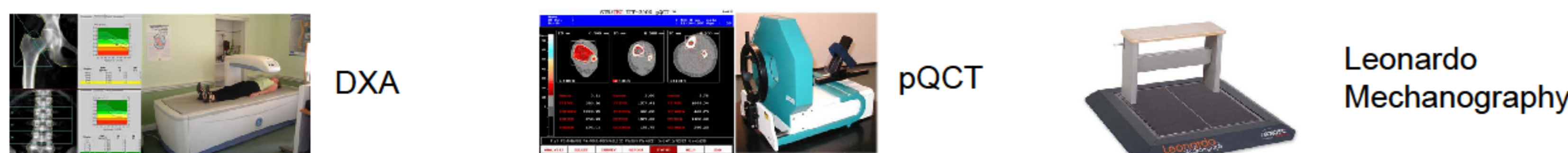
Exclusion criteria:

- Fracture within 8 weeks of enrolment
- Acute thrombosis, Nephrolithiasis, discopathy, arthritis
- Muscle or tendon inflammation
- Use of anabolic agents, glucocorticoids, bisphosphonates or GH

No participants received botulinum toxin injection during the study or in preceding 3 months

Assessments:

- Whole-body, dual femur and lumbar (L1-L4) spine DXA scans
- Peripheral quantitative computed tomography (pQCT- XCT 2000) of non-dominant tibia at 20% & 50% sites
- Six-minute walk test
- Muscle force and power using the Leonardo Mechanography Ground Reaction Force Plate
- Chair rising test
- Single two-leg jump
- Balance test



Results

- Participants:** 40 adolescents (34 GMFCS II and 6 GMFCS III)
- Age:** Mean age of 16.2 ± 2.1 years (23 males and 17 females)
- Compliance:** was high overall at 74%.
- Lean mass:** increased overall (+770 g), in trunk (+410 g), and in legs (+240 g).
- BMC:** improved in whole body (+48 g), spine (+2.7 g), and lower limbs (+13 g).
- BMD:** increased in whole body (+0.008 g/cm²), spine (+0.014 g/cm²), and lower limbs (+0.023 g/cm²).
- Muscle function:** faster chair rise test and greater distance in 6-minute walk test (+11% amongst GMFCS II and +35% in GMFCS III).



Conclusions

Whole-body vibration training :

- increases muscle mass
- increases bone health
- improves mobility

Thus, WBVT improves the health and well-being of children with cerebral palsy.

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Table 1. Data are means ± SEM. SSIP: polar stress-strain index.

		Pre	Post	P-value
DXA (n=39)				
BMI	(kg/m ²)	21.93 ± 0.79	21.97 ± 0.76	0.79
Weight	(kg)	53.13 ± 2.74	53.94 ± 2.66	0.013
Fat mass	Total (kg)	15.22 ± 1.87	15.23 ± 1.85	0.97
Lean mass	Total (kg)	36.00 ± 1.98	36.77 ± 1.96	0.0003
	Trunk (kg)	17.27 ± 0.95	17.68 ± 0.94	0.004
	Leg (kg)	10.74 ± 0.65	10.98 ± 0.63	0.012
BMC	Total (g)	2097 ± 120	2145 ± 120	0.0001
	Spine (g)	51.85 ± 3.39	54.51 ± 3.33	0.0003
	Lower limbs (g)	642 ± 39	655 ± 38	<0.0001
BMD	Total (g/cm ³)	1.060 ± 0.025	1.068 ± 0.024	0.013
	Spine (g/cm ³)	1.095 ± 0.042	1.109 ± 0.042	0.003
	Lower limbs (g/cm ³)	1.048 ± 0.033	1.071 ± 0.033	<0.0001
pQCT (n=26)				
BMD	Tibia 20% (mg/cm ³)	687 ± 34	686 ± 34	0.77
	Tibia 50% (mg/cm ³)	754 ± 28	755 ± 29	0.82
SSIP	Tibia 20% (mm ³)	854 ± 117	863 ± 116	0.11
	Tibia 50% (mm ³)	1274 ± 178	1280 ± 177	0.83
Muscle area	Tibia 20% (mm ²)	1442 ± 126	1523 ± 123	0.0006
	Tibia 50% (mm ²)	3538 ± 396	3672 ± 390	0.0009
Functional Tests				
Chair test (n=37)	Velocity (m/s)	0.56 ± 0.07	0.58 ± 0.07	0.57
	Time (s)	8.54 ± 0.82	7.03 ± 0.65	0.0004
	Power (kW)	6.18 ± 0.78	6.57 ± 0.83	0.060
Jump test (n=29)	Jump height (m)	0.22 ± 0.02	0.25 ± 0.02	0.33
	Maximum power (kW)	1.40 ± 0.12	1.46 ± 0.12	0.16
Balance test (n=35)	Both legs (cm ²)	2.55 ± 0.42	2.27 ± 0.34	0.18

Figure 1. Performance of GMFCS II participants in the 6-minute walk test. Data are means ± se. *p<0.05, **p<0.01, and ****p<0.0001 for baseline vs post-training.

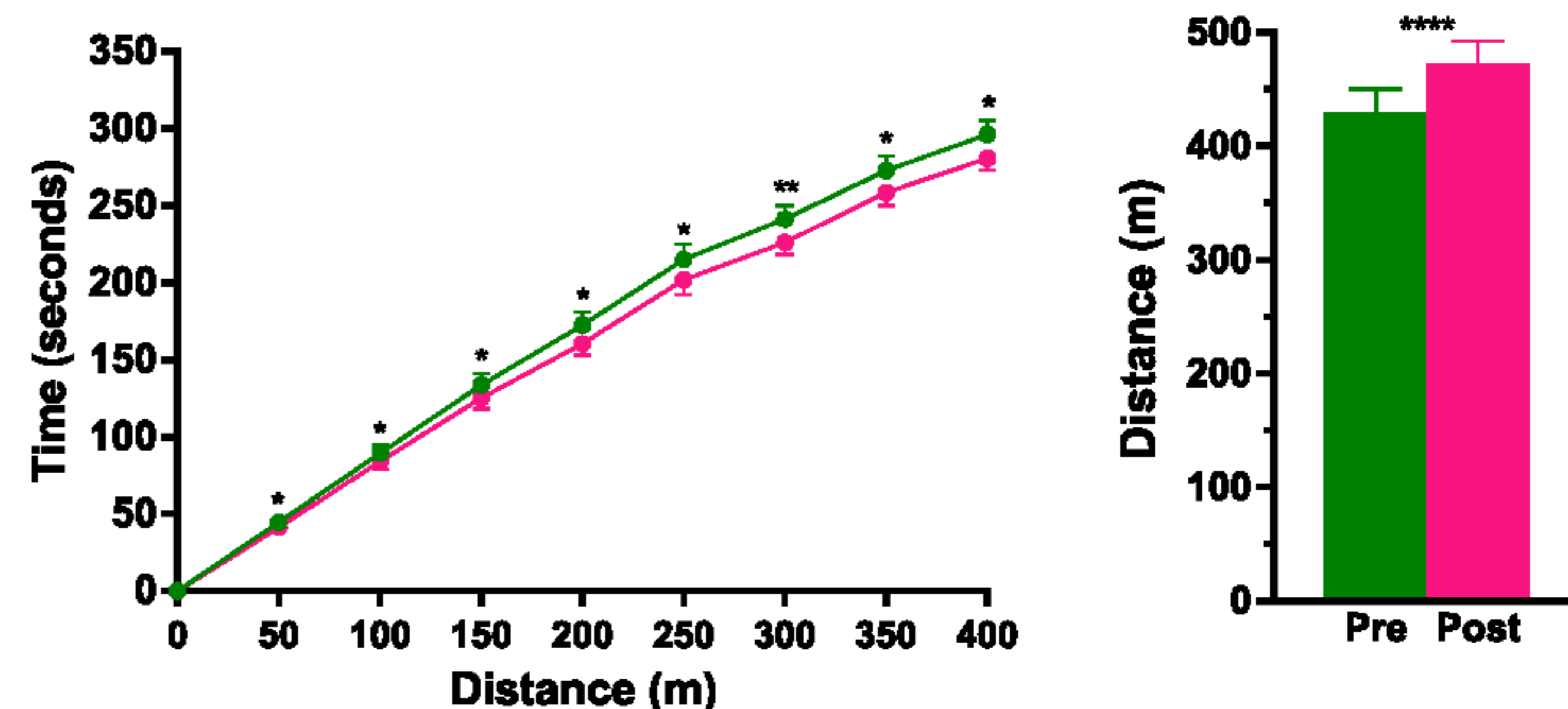


Figure 2. Performance of GMFCS III participants in the 6-minute walk test. Data are means ± se. *p<0.05 for baseline vs post-training.

