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Effects of resistance training on peripheral bone mineral density and muscle strength in adolescents with motor difficulties

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**Introduction:** Maximum accrual of Bone Mineral Density (BMD) is reached during adolescence and is related to a lower risk of fracture and osteoporosis later in life. Adolescents with motor difficulties are at risk of not fully developing their BMD potential, and consequently have a higher fracture risk due to limited participation in high impact physical activities that improve BMD. Equipment constrained resistance training (RT) interventions may be an effective way to improve both muscle strength and BMD in this population. The aims of this study were to investigate the effect of a gym-based RT intervention on peripheral BMD, and to determine the extent of the relationship between BMD and muscle strength, among adolescents with motor difficulties.

**Methods:** Participants were 21 adolescents (13 intervention and 8 control) with motor difficulties, with a mean age of 14 (1.54) years. The participants were recruited from a larger research project (Adolescent Movement Program; AMPitup) and its wait list. The intervention was a 13-week aerobic and resistance exercise program that participants attended for 90-minutes twice a week. The exercise program included 5 pre-set exercises targeting the forearm and lower leg (Leg-press, push-ups, seated row, calf raises, and up-right rows) to be completed every session. Measures taken pre and post intervention included peripheral BMD scans (tibia and radius; trabecular and cortical density) using peripheral Quantitative Computer Tomography (pQCT), height, weight, upper (grip strength, chest pass) and lower (IRM leg press, distance and vertical jump) body muscle strength. General linear models, adjusting for physical maturity, and correlations were used to analyse the data.

**Results:** Improvements in muscle strength, in particular for the upper body (right hand grip strength \( p = .01 \); chest pass \( p = .01 \)) were observed in the intervention group but not the control group. Changes in BMD measures from pre to post test in the intervention group were less conclusive due to the small sample size and short time frame, however positive trends were apparent. Muscle strength and BMD was related as evidenced by moderate to strong correlations, particularly for the lower leg.

**Conclusion:** A targeted resistance training program may be effective in improving muscle strength and stimulating bone changes in adolescents with motor difficulties. Further research is needed to clarify the most effective exercises for site specific BMD improvements in this group.