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Non-Dominant Arm Bone Loading Index Predicts Grip Strength in Adolescent Females

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Mechanical loading from exercise may increase bone strength, particularly during puberty. The same exercise is not necessarily associated with growth in muscular strength. We investigated associations between a validated osteogenic exercise index and grip strength in circum-menarcheal females. **PURPOSE:** We aimed to determine whether our validated bone loading index predicts independent changes in grip strength for the non-dominant arm in the same cohort of adolescent females. **METHODS:** Forty-nine adolescent females met inclusion criteria. Detailed physical activity records were collected for the three years prior to the circum-menarcheal study visit, with height and non-dominant arm grip strength measured at study visit. We calculated our previously reported bone-loading index to represent exercise loading doses over 50 physical activities, reflecting magnitude, frequency, and velocity of loading (arm totBLI). Regression models were run to determine the predictive value of arm totBLI on non-dominant arm grip strength, accounting for height (Ht) and non-dominant arm fat free mass (NONarmFFM). **RESULTS:** The overall model was significant, including Ht, arm totBLI and NONarmFFM ($R^2 = 0.315$, $p < 0.001$). Within the model, arm totBLI showed independent negative predictive value for non-dominant arm grip strength (unstandardized B coefficient = -0.201; zero order r = -0.272; semi-partial r = -0.283, $p<0.05$). **CONCLUSION:** Our bone loading index reflects many high-impact sports, as well as recreational physical activities. The current study indicates that forces reflected by arm totBLI may have a negative influence on non-dominant arm grip strength, as seen through a zero-order correlation and persisting after accounting for height and fat-free mass. This finding contrasts with our prior work showing positive correlations of totBLI with DXA bone properties and arm non-bone lean mass. Further research is needed to confirm this pattern and identify why increased bone loading may be associated with inhibited development in grip strength. **SIGNIFANCE/NOVELTY:** Our study uses a unique bone-loading index variable that was previously created and validated by our research team to indicate osteogenic loading; it has not been tested as an indicator of exercise to promote muscle function. Here, we demonstrate the negative predictive value of this exercise loading index for circum-menarcheal grip strength in adolescent females.

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