

Association Between Muscle Power and Bone Strength in Healthy Populations: A Systematic Review and Meta-Analysis

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ABSTRACT

Optimal bone strength may reduce fracture risk, yet there is no easy to administer field measurement for bone health. The simplicity of testing lower limb power and the relationship between muscle and bone make it a potential choice for a screening tool. **PURPOSE:** To analyze the association between muscle power and bone strength in healthy children, adolescents, and adults. **METHODS:** The meta-analysis protocol was conducted in accordance with the PRISMA-2020 guidelines. A modified PICO strategy, including population, measurement tool, and outcome measures, was used to develop the research question and guide eligibility criteria. Searches using 4 key concepts; "muscle power", "bone strength", "pQCT" or "3D DXA", and "human", including the MeSH terms, were completed on the databases including CINAHL, Web of Science, SportDiscus, PubMed, and Cochrane library. Four reviewers then used the inclusion and exclusion criteria to review the articles. **RESULTS:** 761 studies were screened and only 14 met the criteria for data extraction. A preliminary analysis of 9 articles using R software and the random-effects model included 1,136 total participants. Heterogeneity values for this pilot dataset, $I^2=89.0438$ [74.7645-96.8668], indicated high heterogeneity. Rank Correlation Test for Funnel Plot Asymmetry tested for publication bias yielding a non-significant Kendall's tau = 0.3333, $p=0.2595$. Correlation coefficients between bone strength (polar strength strain index (SSIp)), and muscle power from a vertical jump test revealed a correlation coefficient of (0.687 [0.47, 0.927]). **CONCLUSION:** The standard clinical tool for determining bone health is currently DXA which is not capable of assessing bone architecture, a key determinant of bone strength. If muscle power is an adequate predictor of 3D bone strength, which is an easily testable parameter identifiable through common equipment such as vertical jump using a vertec, then a simple, cheap, and efficient field test could be developed.