The bone-specific physical activity questionnaire (BPAQ) was developed to account for the influence of habitual mechanical loading on the skeleton. A simple questionnaire is scored using algorithms incorporating load data for common activities. We have previously shown that the BPAQ predicts DXA-derived bone mass at clinically important sites in young adults better than other more generic measures of physical activity. The ability of the BPAQ to predict important indices of bone strength such as peripheral quantitative computed tomography (pQCT)-derived volumetric, geometric or composite strength parameters, however, was unknown.

PURPOSE: The aim of the current study was to determine the ability of the BPAQ to predict pQCT-derived bone strength parameters of the tibia.

METHODS: We recruited 427 healthy males and females between the ages of 5 and 77 years. Participants completed the BPAQ and a current (previous 12 months), past (birth to 12 months prior) and total physical activity score was calculated. Dominant tibiae were scanned using pQCT (XCT-3000, Stratec, Germany) at the 4% and 38% sites. Total density, cortical density, and trabecular density were calculated using host software. Additional composite and density-weighted strength parameters including strength-strain index (SSI) and fracture load were derived. Correlation and regression analyses were performed to determine relationships between BPAQ scores and parameters of tibial bone strength. Additionally, BPAQ predictors of bone strength were determined for young, middle, and older age groups.

RESULTS: Positive relationships were found between BPAQ scores and fracture load and SSI at the 38% sites for bending and torsional loads (r = 0.17-0.36, p<0.05). Current and past BPAQ scores predicted 4-19% of the variance in strength parameters (p<0.05). Alone, past BPAQ score predicted around 12% of the variance in bone strength parameters, and current BPAQ score added an additional 8% predictive ability to the model. Stratified by age group, the ability of the BPAQ to predict strength was greater for older subjects (R² = 0.20-0.53; p<0.05) than younger subjects (R² = 0.04-0.06; p<0.05).

CONCLUSIONS: Lifetime habitual mechanical loading determined by BPAQ predicts pQCT-derived bone strength indices of the tibia, and predictions strengthen with age.