

CALCANEAL QUANTITATIVE ULTRASONOMETRY AS A FIELD-FRIENDLY TOOL FOR BONE QUALITY ASSESSMENT IN ITALIAN POSTMENOPAUSAL WOMEN: ASSOCIATIONS WITH BODY COMPOSITION AND MENOPAUSAL DURATION

*Federica De Luca¹, Federica Moro², Emanuela Gualdi-Russo¹, Stefania Toselli²,
Natascia Rinaldo² and Luciana Zaccagni¹*

¹University of Ferrara, Department of Neuroscience and Rehabilitation, Ferrara, Italy;

²University of Bologna, Department for Life Quality Studies, Bologna, Italy

Background: In postmenopausal women, bone quality assessment is essential for identifying skeletal fragility risk. The calcaneal Bone Quality Index (BQI), assessed via quantitative ultrasound (QUS), represents a non-invasive, field-friendly alternative to dual-energy X-ray absorptiometry (DXA).

Objective: To investigate the associations between BQI, body composition, menopausal duration and functional variables in Italian postmenopausal women.

Subjects and methods: A cross-sectional study design – in which all measurements were taken at a single point in time – was conducted on 138 Italian postmenopausal women (mean age: 61.1±5.3 years; mean years since menopause (YSM): 10.5±6.1 years). BQI was assessed using calcaneal QUS (SONOST 3000). Body composition was assessed through bioelectrical impedance analysis (BIA 101, Akern), providing fat-free mass (FFM), fat mass (FM) and fat percentage (%F). Handgrip strength (HGS) was measured bilaterally using a dynamometer. Pearson correlations and two multiple linear regression models were performed using BQI as the dependent variable: a background model (age, YSM, BMI) and a body composition model (%F, FFM, HGS). A simple linear regression with YSM alone was also conducted.

Results: BQI showed significant negative correlations with age ($r=-0.30$, $p=0.0003$) and YSM ($r=-0.34$, $p<0.0001$), and positive correlations with BMI, FFM and FM ($r=0.18$ for all, $p=0.033$). No significant correlations emerged for %F and HGS. The body composition model was not statistically significant ($F=1.864$, $R^2=0.040$, $p=0.139$), whereas the background model was statistically significant ($F=7.133$, $R^2=0.138$, $p=0.0002$), with YSM as the strongest predictor ($p<0.0001$). In simple linear regression, YSM alone explained 12% of BQI variance ($R^2=0.120$, $p<0.0001$).

Conclusions: Menopausal duration is the primary determinant of calcaneal bone quality in postmenopausal women, independent of body composition. These findings support the use of calcaneal QUS as a field-friendly pre-screening tool for bone quality monitoring in non-clinical and large-scale epidemiological settings.

Keywords: Postmenopause; Calcaneal QUS; Bone health; Body composition; Ageing.