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We conducted a cross-sectional study on twin pairs discordant for cigarette smoking seeking mechanisms of smoking-associated BMD deficits. We used the co-twin difference method of analysis on 69 volunteer pairs (13 male and 56 female) aged 40–76 (mean ± SD 53 ± 8.9) years. DXA was used to measure BMD, lean and fat mass; height, weight and lifestyle factors, including smoking history, menopausal status, exercise and dietary intake were recorded. Blood and urine samples were taken to measure bone biochemical markers and hormones. Percentage within-pair difference (WPD) results shown are for [(smoking twin−non-smoking twin)/ mean] × 100.

WPD were seen (95% confidence interval, p value): Lumbar Spine (LS) −3.5% (−7.0 to −0.0, p = .058), Femoral Neck (FN) −5.6% (−9.0 to −2.2, p = .002), Total Hip (TH) −6.2% (−9.4 to −2.9, p < .000), Forearm (FA) −0.8% (−2.6 to 1.0, p = .290), Whole Body BMC (BMC) −4.1% (−7.2 to −1.1, p = .012). Fat mass was also lower in smoking twins, −12.8% (−20.7 to −4.8, p = .005), and lean mass marginally so −2.8% (−5.9 to 0.3, p = .083). Findings persisted after adjusting for age, height, and further adjustment with weight (except FA). Previous research indicated different mechanisms according to gender and menopausal status, thus these subgroups were studied. WPD in subgroups remained similar to group results, with largest WPD seen in post-menopausal women. We found significant WPD in serum 25 OHD (42.8 v 73.3 nmol/L; −46.8%, p = .02) in pre-menopausal women and this WPD strongly correlated (r = −.47 to −.68, p < .05) with LS, FN, TH and Whole Body WPD. Post-menopause women did not show significant differences in calcium or indices of bone metabolism, so BMD deficits in smokers may be due to WPD in Leptin (−18.2%, p = .04) and fat mass (−11.3, p = .05). Males showed no significant differences in biochemical markers or hormones.

The findings provide new and important insights into smoking-associated bone deficits. They suggest differing mechanisms in men and women and that relative deficiency of vitamin D may play an important deleterious role in female smokers.

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Mechanisms of bone loss in twins discordant for cigarette smoking
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Although smoking is recognised as an independent lifestyle determinant of bone mineral density (BMD) and fracture risk, the responsible mechanisms are unclear.