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Association between dietary vitamin D and bone health in Caucasian and South Asian women aged 20–64 years: baseline preliminary results of the D2–D3 study

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Vitamin D is integral to skeletal health. Insufficiency precipitates osteoporosis, leading to increased bone fragility and fracture risk[1]. Whilst deficiency is a global issue, within the UK, the South Asian (SA) population are amongst the most vulnerable population groups[2]. When cutaneous synthesis is limited by lack of sun exposure or during winter months, dietary contributions become increasingly important, however few food sources exist[2]. The present study utilizes baseline data from the D2–D3 Study, a food fortification RCT comparing the relative efficacy of D_2 and D_3 vitamers in raising vitamin D status. The aims of this preliminary analysis were to compare indices of bone health between SA and Caucasian (Cn) women and to assess whether dietary vitamin D intakes may have contributed to any observed differences. The influence of anthropometrics and other dietary factors were taken into consideration. In an additional analysis, the potential impact of milk fortification with vitamin D upon dietary intakes was also estimated.

This was a cross-sectional study of 71 Cn and 17 SA women aged 20–64 from the Surrey area. Radial bone geometry and density were measured using peripheral quantitative computed tomography at diaphyseal (66%) and distal (4%) sites. Nutrient intakes were assessed using four day diet diaries. The potential contribution of "fortified" milk was estimated by assessing average milk consumption and calculating the projected vitamin D intake if fortification was at 1 µg of vitamin D per 100 ml. Independent t-tests and ANOVA (or non-parametric equivalents) were used for between-group comparisons whilst bivariate correlations analyses were conducted between energy-adjusted dietary intakes, anthropometrics and bone health indices.

The average age, weight and BMI of the participants was 40.3 ± 13.2 years, 64.6 ± 10.8 kg and 23.8 ± 3.5 kg/m^2 respectively; no significant differences in age, weight and BMI were found between the two ethnic groups. No inter-ethnic differences in any indices of bone health were found. A trend towards lower vitamin D intakes was observed within the SA cohort (Cn: 2.7 ± 1.9 µg/day, SA: 2.2 ± 2.7 µg/day, $p = 0.066$) whilst calcium intakes were significantly lower (Cn: 877 ± 257 mg/day, SA: 648 ± 195 mg/day, $p<0.01$). The estimated potential contribution of "fortified milk" increased intakes non-significantly to 4.2 ± 2.3 µg/day. Energy-adjusted vitamin D intakes were not associated with any bone health indices whereas energy-adjusted calcium intakes were positively associated with cortical volumetric bone mineral density (vBMD) ($p<0.05$). Weight was positively correlated to mass at the 4% site ($p<0.01$) and total cross-sectional area at both sites ($p<0.01$).

The results of the present study suggest that bone health is not influenced by dietary vitamin D. A previous inter-ethnic comparison has found weight to be the most significant predictor of BMD[3] whilst the present study has found positive associations with bone geometry and mass. Taken together, this suggests that there could be other non-dietary influences upon bone health and these may have contributed to the lack of inter-ethnic differences. In addition, vitamin D intake within this group was low and the estimates of the potential contribution of "fortified" milk showed the possibility of an improvement in vitamin D intakes. However, overall this had little impact on the attainment of optimal dietary levels, suggesting that milk fortification alone would not be sufficient to improve the vitamin D status of the population as a whole. The D2–D3 Study (currently underway at the University of Surrey) will therefore provide valuable insights, from a public health perspective, into the effectiveness of fortification of other commonly consumed food and drink items.

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