

Cholecalciferol supplementation in pregnancy is associated with greater offspring bone and lean mass at 4 years: findings from the MAVIDOS randomised controlled trial

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Abstract

Objectives: In MAVIDOS, a multi-centre randomised trial, vitamin D supplementation in pregnancy led to greater neonatal bone mass amongst winter-born babies. We investigated whether this beneficial effect is sustained, with offspring bone indices assessed at 4 years old.

Materials and Methods: 1134 pregnant women were randomised in Southampton, Oxford and Sheffield, in a double-blind design, to 1000 IU/day cholecalciferol or matched placebo from 14 weeks gestation to birth. At age 4 years (Southampton participants only, n=723 births), offspring assessments included anthropometry, whole-body dual-energy x-ray absorptiometry (DXA) [yielding whole body less head (WBLH) bone mineral content (BMC), bone mineral density (BMD), bone area (BA) and lean mass (LM)], and a maternal questionnaire. Linear regression was used to estimate the mean difference (represented by β) in outcomes between the two randomisation arms, adjusted for sex and age at DXA. In further models, adjustment for gestational age, maternal BMI and the child's milk intake was performed. Outcomes were standardised to a standard deviation scale, for ease of comparison. Full ethics and MHRA approval was granted.

Results: 564 children attended the 4-year visit; 452 had a useable DXA with little movement artefact. Pregnancy vitamin D supplementation led to greater offspring indices of bone mass compared with placebo, irrespective of season of birth, for example WBLH BMD at age 4 years, [mean(95%CI): supplemented group: 0.477(0.472,0.481)g/cm²; placebo group: 0.470(0.466,0.475)g/cm²; $\beta=0.18(0.00,0.35)$ SD, p=0.047], and evidence of associated greater LM [supplemented group, 9.25(9.08,9.42)kg; placebo group 9.01(8.83,9.18)kg; $\beta=0.15(-0.02,0.31)$ SD, p=0.081]. Associations were consistent for BA and BMC, for lumbar spine indices and in the fully adjusted models. There was no difference in child weight, height or BMI between groups.

Conclusions: This novel evidence from a large placebo-controlled, double-blind randomised trial suggests that maternal pregnancy vitamin D supplementation leads to a sustained improvement in offspring bone and muscle mass.

Physical activity through adolescence and hip bone mineral density in young adults: prospective cohort and negative control study

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Abstract

Objectives We examined associations of moderate-to-vigorous (MVPA) and light intensity physical activity (LPA) from age 12, and vertical impacts at age 18, with femur-neck bone mineral density (FNBMD) at age 25, and whether these are likely to be causal.

Methods MVPA and LPA trajectories from ages 12 to 25 (min/day) were identified using group-based trajectory modelling of repeated accelerometry data from 2569 birth cohort participants (62% female). Vertical acceleration count and magnitude was recorded by accelerometry at age 18. FNBMD (g/cm²) was taken from hip DXA at age 25. Leg length at age 25 was used as a negative control to explore residual confounding.

Results Three MVPA trajectories were identified. Most males were in the 'Low Adolescent MVPA' subgroup, with 6% and 9% in the 'High Early-Adolescent MVPA' and 'High Mid-Adolescent MVPA' subgroups respectively. MVPA subgroups in females were 'Low Adolescent-Low Adult MVPA' (73%), 'Low Adolescent-High Adult MVPA' (8%), and 'High Adolescent MVPA' (19%). Compared to 'Low Adolescent MVPA', FNBMD was greater for 'High Early-Adolescent MVPA' (0.38SD, 95%CI: 0.11 to 0.66) and 'High Mid-Adolescent MVPA' (0.33SD, 95%CI: 0.07 to 0.60) subgroups. Compared to 'Low Adolescent-Low Adult MVPA', FNBMD was greater for 'High Adolescent MVPA' (0.28SD, 95%CI: 0.15 to 0.41) but not 'Low Adolescent-High Adult MVPA' (-0.12SD, 95%CI: -0.44 to 0.20). Despite being extremely rare (0.3%), impacts >5.1g were positively related to FNBMD. Differences in leg length for MVPA and impacts were between 3 and 10 times smaller. Assuming similar confounders for leg length/FNBMD and no plausible causal effects of MVPA/impacts on leg length, this suggests differences in FNBMD were robust to uncontrolled confounding. LPA was not clearly associated with FNBMD. Similar results were observed for hip geometry.

Conclusions High intensity and high impact physical activity in early life is likely to be important for maximising peak hip strength and protecting against osteoporosis in later life.

How does radiographic knee osteoarthritis impact musculoskeletal aging in midlife? Findings from the Hertfordshire Cohort study

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Abstract

Objectives

Osteoarthritis (OA) is the most common joint condition, and can be defined clinically or radiologically. The aim of this study was to investigate whether a diagnosis of radiological knee OA impacted involution in muscle or bone in the midlife in a group of community-dwelling older adults in the UK.

Materials and methods

Our study comprised 220 members of the Hertfordshire Cohort Study (118 males and 102 females), a group of community dwelling older adults in the United Kingdom. Knee radiographs were performed at baseline, with osteoarthritis defined as a Kellgren and Lawrence score ≥ 2 . Baseline and follow-up included questionnaires to assess physical activity and lifestyle factors, JAMAR dynamometry, walk test and DXA, both of whole body and hips. Linear regression was performed to analyse associations before and after adjustment for follow-up time, lifestyle factors and anthropometry and the development of hand osteoarthritis was adjusted for grip strength outcomes.

Results

The mean age of participants at baseline was 65.0 years. Median follow-up was 16.7 years (range 15.0-18.4 years). Knee osteoarthritis was present in 75 (34%) participants.

Radiographic knee osteoarthritis status at baseline was significantly associated with grip strength ($\beta = -3.2\text{kg}$, -5.3 to -1.1 , $p < 0.01$) at follow-up in females but not in males ($\beta = -2.9$, -5.8 to 0.1 , $p = 0.06$).

No significant associations between radiographic osteoarthritis status at baseline and other measures of sarcopenia (gait speed or lean mass) or bone mineral density were found in either sex.

Conclusions

The presence of knee osteoarthritis in midlife can have a substantial bearing on grip strength in women over 15 years later, independent of the presence of hand osteoarthritis. Grip strength has been shown to correlate closely with lower limb strength and so the demonstrated association between grip strength and knee osteoarthritis is representative of a global weakness resulting from the disease.

Vertebral fractures and daily pain are associated with lower physical activity in postmenopausal women with back pain

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Abstract

Around 12% of women have vertebral fractures (VFs), and many of these individuals also have back pain which limits physical activity (PA). PA is important for health, but little is known about how VFs affect PA, and if so how this compares with individuals with back pain due to other causes.

Therefore, we recruited 37 postmenopausal women from primary care with back pain, in whom the presence or absence of VFs was ascertained by spine radiographs. To provide an objective PA measure, vertical accelerations were recorded at 100 Hz for 7 days using a hip-worn GT3X+ accelerometer (Actigraph, USA). The number of low (0.5g-<1g), medium (1 g-<2g) and high impacts (>2g) was recorded. Participants also recorded their average back pain each day using a 10-point Likert scale. Linear mixed-effects models were used to assess group differences (fracture/no-fracture cases) in low, medium and high-impact PA, and associations between daily pain and different PA impact levels. Daily PA and pain data had non-normal distributions and were log-transformed.

12 women were found to have previously sustained VFs. These participants had lower levels of low-impact PA (regression coefficient -0.64, 95%CI -1.03 to -0.25, P=0.002) but not medium or high-impact PA (both P>0.2). Across all participants, higher daily pain was associated with lower high-impact PA levels (-0.08, 95%CI -0.14 to -0.02, P=0.014) and weakly with medium-impact PA (-0.1, 95%CI -0.22 to 0.02, P=0.081) but not low-impact PA (P=0.25).

These results suggest that VFs and daily pain are associated with lower levels of low and high-impact PA respectively, shown previously to differentially affect components of health. Low levels of low-impact PA in women with VFs may impair weight control in these women. In contrast, reduced PA, in particular high-impact PA, in women with higher daily pain levels may increase the risk of sarcopenia and osteoporosis.