Effects of vitamin D supplementation on strength, physical performance, and falls in older persons: a systematic review

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CRD summary
This review examined whether vitamin D supplements improve muscle strength and physical function in older people and reduce falls. The authors concluded that there is insufficient evidence to show that vitamin D alone is effective, although it may be effective when combined with calcium supplements. Despite some weaknesses in the review, the conclusions are likely to be accurate.

Authors' objectives
To assess the effectiveness of vitamin D supplements on muscle strength, physical function and the number of falls in older people.

Searching
MEDLINE (from 1966 to May 2002), CINAHL (from 1982 to May 2002), EMBASE (from 1980 to April 2002) and the Cochrane Controlled Trials Register (Issue 2, 2002) were searched; some search terms were given. In addition, the reference lists of identified papers and relevant review articles were checked and recent conference proceedings were searched. Attempts were made to contact authors for further data where the necessary data were not reported.

Study selection
Study designs of evaluations included in the review
The inclusion criterion was randomised controlled trials.

Specific interventions included in the review
The inclusion criteria were vitamin D or vitamin D metabolites. Included in the review were vitamin D, 1,25 hydroxyvitamin D2, and 1 alpha-hydroxyvitamin D3. Vitamin D was administered either alone or in combination with calcium.

Participants included in the review
The inclusion criterion was older people. The participants in a trial had to have a mean age of at least 60 years. The trials included in the review looked at both older women and at groups of both genders, and those living in supported accommodation and hospital settings and those living independently.

Outcomes assessed in the review
The inclusion criteria were a measure of strength, physical function (physical performance measure or self-report of activity), or a measure of the frequency of falls. Many of the studies included in the review focused on measures of the frequency of falls and the occurrence of fractures.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The validity of the primary studies was assessed on the basis of double-blinding, intention-to-treat analysis and the number of participants (at least 100 participants was considered to indicate high quality). The authors also noted concealed randomisation, power, the number of withdrawals and drop-outs, and the method of randomisation. One reviewer assessed the papers for study quality.
Data extraction
One reviewer extracted the data.

Methods of synthesis
How were the studies combined?
A narrative synthesis of the studies was undertaken. A meta-analysis was performed on the number of people who fell in the 6 trials that were judged to be of sufficiently high quality. The authors pooled the relative risks (RRs) and associated 95% confidence intervals (CIs) in a fixed-effect model.

How were differences between studies investigated?
The studies were grouped into those judged to be of a high quality and those of lower quality. The high-quality studies were included in a meta-analysis. Differences between the studies were further explored in the narrative synthesis, where the studies were grouped according to the comparators employed and the outcomes reported.

Results of the review
Thirteen studies with 2,496 participants were included in the review.

Four trials compared vitamin D alone with placebo, of which two were considered to be of a high quality. One of these studies (n=354) found no difference between the groups in the risk of falling over a 28-week period; the odds ratio was 1.0 (95% CI: 0.6, 1.5). The second study (n=243) found no differences over 6 months between groups on any of the outcomes measured: falls, self-reported health, physical function and several measures of physical performance. Two other studies also found no difference between the treatment and placebo groups.

Two trials compared a vitamin D analog with placebo. One study (n=98) compared 1,25 hydroxyvitamin D2 with placebo in adults over 70 years. No differences were found on any of the measures of strength used. The other study (n=86) compared 1 alpha-hydroxyvitamin D3 with placebo over 18 months in patients with Parkinson's disease. There was no significant difference in the occurrence of falls, but a benefit of vitamin D was found in the incidence of fractures: one fracture in the intervention group versus eight in the placebo group.

Four trials compared vitamin D plus calcium with calcium supplementation alone, of which two were considered to be of a high quality. One study (n=148) looked at older women and found the combined supplement to be of significant benefit in terms of the number of participants falling and the total number of falls occurring after 8 weeks. An improvement in two of the three measures of body sway was also found. The second study (n=122) found a significant reduction in falls after 12 weeks of the combined supplement.

Three trials compared calcium plus vitamin D with placebo. The largest study (n=583) found a decreased risk of hip fracture in older women, but no difference in the number of participants experiencing falls. Another study (n=445) looked at healthy participants aged over 65 years and found significantly fewer nonvertebral fractures in the treatment group. However, there was no difference in the proportion of participants who fell, and the number of falls per person was slightly elevated in the supplementation group. The third study (n=139) also looked at older women and found no difference in clinical outcomes between the groups.

A meta-analysis of the 4 high-quality studies for which data were available pooled data on the number of participants who fell. The pooled estimate of the RR showed no benefit of vitamin D (RR 0.99, 95% CI: 0.89, 1.11) although one study comparing vitamin D plus calcium with calcium alone showed a trend towards fewer people falling in the combined group (RR 0.55, 95% CI: 0.29, 1.08).

Authors' conclusions
There was insufficient evidence to support a benefit from supplementation with vitamin D alone, but there was some evidence of a benefit from vitamin D combined with calcium supplementation.
**CRD commentary**
The review question and the inclusion criteria were clear. The search was adequate, although the lack of an attempt to include unpublished studies might have increased the probability of publication bias. The authors did not employ methods designed to minimise bias and error, such as decision-making by two reviewers, when selecting the studies for inclusion, extracting the data, or assessing study quality. The narrative synthesis was appropriate. However, the meta-analysis also used pooled data from studies that were clinically heterogeneous; this may have implications for the reliability of the pooled estimate obtained. The authors’ conclusions on both vitamin D alone and combined supplementation with calcium clearly reflect the evidence available. Their recommendation that further research be undertaken is reasonable.

**Implications of the review for practice and research**
Practice: The authors stated that supplementation with vitamin D alone cannot be recommended where the primary aim is to improve muscle strength or physical function, or to reduce the risk of falling in older people.

Research: The authors stated that large well-designed trials to assess the possible benefit from vitamin D combined with calcium supplementation, as found in this review, should be conducted.

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