Calcium, vitamin D, or combined supplementation to prevent fractures and falls: systematic review and meta-analysis

Objective To assess the effect of calcium, vitamin D, or combined supplementation on fractures and falls in adults.

Design Systematic review and meta-analysis.

Data sources Trials included in systematic reviews from 2014, three databases (Medline, Embase, CENTRAL) to 19 February 2025, clinical trial registries, abstracts from scientific meetings, and references from included studies.

Eligibility criteria Randomised controlled trials comparing calcium, vitamin D, or combined supplementation with placebo or no treatment in adults (≥18 years) not receiving drug treatment for osteoporosis.

Data extraction and synthesis The primary outcome was the risk of any fracture. Secondary outcomes included the risk of hip fracture, non-vertebral fracture, vertebral fracture, and falling, as well as the total number of falls. Pairs of reviewers independently screened trials, extracted data, and assessed risk of bias using the second version of Cochrane's risk of bias tool. Findings were synthesised using random effects meta-analyses and appraised using Grading of Recommendations Assessment, Development and Evaluation, with application of thresholds for absolute effects considered important.

Results This review included 69 trials involving 153 902 participants. Participants in most of the trials were community dwelling (87%) and not at high risk of fractures or falls (73%). For the primary outcome of any fracture, little to no effect was found from use of calcium supplements (11 trials, 9067 participants; risk ratio 0.91, 95% confidence interval 0.81 to 1.01; moderate certainty), vitamin D supplements (36 trials, 92 045 participants; 1.00, 0.95 to 1.06; high certainty), or combined supplementation (15 trials, 51 126 participants; 0.91, 0.84 to 0.99; high certainty). Calcium, vitamin D, or combined supplementation appeared to have little to no effect on other fracture and fall outcomes, based largely on moderate to high certainty of evidence. The findings remained robust after an extensive exploration of heterogeneity across multiple subgroup analyses. Evidence for high risk patients or those requiring residential care was limited for many outcomes for calcium monotherapy and for combined supplementation.

Conclusion Based on absolute risk reductions and thresholds considered clinically meaningful, this review found little to no benefits from use of calcium, vitamin D, or combined supplementation on the prevention of fractures and falls.

LIVEWORKSHEETS

Read and choose the correct option.

1. What was the primary objective of the review?

- To compare different osteoporosis medications
- To evaluate whether supplementation prevents fractures and falls

2. Who were the participants included in the trials?

- Adults not receiving drug treatment for osteoporosis
- Only patients living in residential care facilities

3. How many trials were included in the review?

- 69
- 153,902

4. Most participants were described as:

- Hospitalized patient
- Community dwelling

5. What did the review find regarding vitamin D supplementation and fractures?

- Little to no effect was found
- A substantial reduction was consistently observed

6. What happened when researchers performed subgroup analyses?

- The findings changed considerably
- The findings remained robust

7. Evidence was particularly limited for:

- Community-dwelling adults
- High-risk patients and those requiring residential care

8. According to the conclusion, supplementation produced:

- Strong protection against falls and fractures
- Little to no clinically meaningful benefit

Language Focus – What Are Reporting Verbs?

Reporting verbs are verbs used to describe what someone said, wrote, found, concluded, or recommended. They are especially common in academic and medical writing because they help us present information from studies, researchers, patients, or other sources.

In research articles, reporting verbs allow us to communicate findings and interpretations accurately:

- **show** → presents evidence or results
  The study showed a reduction in fracture risk.
- **indicate** → suggests that evidence points toward a conclusion
  The results indicated an association between age and falls.
- **suggest** → expresses a possible interpretation or explanation
  The findings suggest that exercise improves bone health.
- **report** → communicates observations, data, or findings
  The authors reported no significant differences between groups.

Using the appropriate reporting verb helps convey the **strength and certainty of the evidence**, an essential skill in scientific and clinical communication.

LIVEWORKSHEETS

+ TO + INFINITIVE

*AGREE: They agreed to lend him the money.
*CLAIM: They claim to be the best in the market.
OFFER: She offered to help.
*PROMISE: You promised to come with us.
REFUSE: He refused to answer any questions.
SWEAR: She swore to serve her country.
THREATEN: They threatened to kill me.

+ THAT + CLAUSE

*ADMIT: He admitted (that) it was his fault.
*AGREE: I agree (that) it's going to be difficult.
ANSWER: She answered (that) she was OK.
*CLAIM: They claim (that) they are innocent.
*COMPLAIN: He complains (that) he has too much work.
*CONFESS: He confessed (that) he was scared.
*DENY: They deny (that) they had any involvement.
EXPLAIN: She explained (that) new facts had emerged.
*INSIST: I insisted (that) we needed a break.
*PROMISE: You promised (that) you'd be there.
*REGRET: I regret (that) I didn't help him.
SAY: John said (that) he wouldn't do it again.
*SUGGEST: She suggested (that) I should stay until May.

+ PERSON + TO + INFINITIVE

ADVISE: He advised me to change my diet.
ASK: They asked him to resign.
BEG: He begged me to forgive him.
CONVINCE: He convinced me to take the job.
ENCOURAGE: We encouraged her to continue.
FORBID: They forbade me to go out.
INVITE: She invited us to be at the meeting.
ORDER: The judge ordered him to sit down.
PERSUADE: She persuaded me to sign up.
RECOMMEND: I recommend you to go.
REMIND: Can you remind me to lock the door?
TELL: Nobody told me to be quiet.
WARN: He warned us not to drink the water.

+ (PREPOSITION) + -ING

ACCUSE SB OF: They accused me of cheating.
*ADMIT: She admitted making a mistake.
APOLOGISE (TO SB) FOR: He apologised (to her) for not calling.
BLAME: I don't blame you for getting angry.
*COMPLAIN ABOUT: He complained about being insulted.
*CONFESS TO: I confessed to murdering him.
*DENY: They denied doing anything wrong.
*INSIST ON: She insisted on calling a taxi.
*RECOMMEND: She recommended taking a taxi.
*REGRET: I regret not paying more attention.

Choose the most appropriate reporting verb.

1. The researchers reported / threatened **that calcium supplementation had little effect on fracture prevention.**

2. The findings promised / showed **no clinically meaningful benefit from vitamin D supplementation.**

3. The evidence explained / suggested **that supplementation was not highly effective in preventing falls.**

4. The subgroup analyses indicated / blamed **that the results were consistent across different groups.**

5. The authors reported including / to include **69 trials in the review.**

6. The researchers suggested to conduct / conducting **further studies in high-risk populations.**

7. The review showed that vitamin D had / to have **little to no effect on fracture prevention.**

8. The authors recommended not to use / not using **supplementation solely for fracture prevention.**

LIVEWORKSHEETS

Listen to this Research Conference Presentation

A **research conference presentation** is a short summary in which a researcher presents the objectives, methods, results, and implications of a study to a professional audience.

1. The study followed participants for **three years / five years.**

2. Researchers monitored fracture incidence and **blood glucose levels / bone mineral density.**

3. Vitamin D deficiency was particularly common among people with **excessive protein intake / limited sun exposure.**

4. The results showed a clear association between low vitamin D levels and **reduced bone mineral density / increased muscle mass.**

5. The relationship between vitamin D deficiency and fractures was described as **completely established / less straightforward**.

6. The data suggested that fracture risk is influenced by **multiple factors / vitamin D alone.**

7. Supplementation alone was considered **unlikely / certain** to eliminate fracture risk.

8. Participants who combined supplementation with exercise achieved **identical outcomes / better overall bone health outcomes.**

LIVEWORKSHEETS