

OUTCOMES OF VITAMIN D SUPPLEMENTATION IN BPPV: A SYSTEMATIC REVIEW

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ABSTRACT

Background: The primary cause of peripheral vertigo is benign paroxysmal positional vertigo (BPPV), which is characterized by frequent episodes that have a major negative impact on quality of life. Due to vitamin D's role in calcium metabolism and otolith integrity, there is growing evidence linking vitamin D deficiency to BPPV recurrence. The aim is to evaluate the effect of vitamin D supplementation on treatment outcomes and recurrence in patients with BPPV. **Materials and Methods:** PRISMA guidelines were followed in conducting the systematic review. A thorough literature search was conducted up until April 2025 using PubMed and the Cochrane Library. ^[1] "Randomized controlled trials (RCTs)", cohort studies, and meta-analyses assessing vitamin D levels and/or supplementation in BPPV patients were included. **Results:** In the qualitative synthesis, 17 studies were included. There is a strong evidence "associating vitamin D deficiency with a higher chance of recurrent BPPV. Vitamin D supplementation (VDS) considerably" decreased recurrence rates, which were estimated to be between 40% and 80%, especially in patients with baseline deficiency. The supplemented patients also showed prolonged periods of no symptoms. **Conclusion:** "Vitamin D supplementation (VDS)" appears to reduce the risk of BPPV recurrence, particularly in deficient individuals. Further, non-homogeneity of the study designs, doses, and duration of follow-ups limits precise conclusions. To establish standardized treatment protocols, large-scale RCTs are required.

INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is the predominant etiology of peripheral vertigo, impacting about thirty percent (30%) of patients exhibiting vertigo symptoms. ^[2] The characteristics consist of short, recurrent episodes of vertigo induced by changes in head position relative to gravity. Otoconia displacement from the utricle into the semicircular canals, especially the posterior canal, is the cause of BPPV. ^[2] Recurrent BPPV is very common, ranging from 15% to 50% occurs within the first year, despite that, otolith repositioning techniques, such as the Epley maneuver, are more helpful in treating acute symptoms. Recurrent BPPV significantly increases the risk of falls, significantly, it has negative impact on quality of life, and necessitates frequent medical visits. The metabolic aspects of otolith dysfunction

have been the subject of recent studies. Inner ear diseases have been linked to vitamin D deficiency, which is important for calcium and bone metabolism. ^[3]

Otoliths are calcium carbonate crystals found in the utricle, and vitamin D deficiency-related poor calcium metabolism may cause otolith separation from the utricle and degeneration, most likely. ^[3] As a result, VDS was proposed as a tactic to lower recurrence and also to enhance long-term results in BPPV. This systematic review's purpose is to analyse the information currently available about vitamin D supplementation's effect on treatment outcomes and recurrence in patients with benign paroxysmal positional vertigo. With this systematic review, we would like to prove a strong correlation between the symptomatic improvement in BPPV patients receiving vitamin D supplementation, also to assess the impact of vitamin D supplementation

on recurrence rates of BPPV, by analysing the evidences from randomized controlled trials, observational studies, and meta-analyses.

MATERIALS AND METHODS

Study Design: “PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)” criteria have been followed in this systematic review.

Inclusion Criteria: Research related to BPPV, Research assessing the vitamin D levels and/or VDS. Also Meta-analyses, RCTs, cohort studies, and case-control studies.

Exclusion criteria: Articles dealing with Vestibular illnesses other than BPPV, Research without a vitamin D evaluation, also Non-English articles and the case reports.

Search Strategy: The following terms were used in a thorough search of “PubMed” and the “Cochrane Library” databases:^[1]

“benign paroxysmal positional vertigo” OR “BPPV”) AND (“vitamin D” OR “25-hydroxyvitamin D”).

Included the studies released up till April 2025.

Study selection: A full-text review was conducted after pertinent studies were filtered by title and abstract.

Data Extraction

The following data were extracted:

- Research design
- The size of sample
- Serum vitamin D levels
- Details of intervention
- Results of recurrence

Assessment of Bias Risk: A rigorous quantitative bias evaluation was not carried out due to study design variability; however, study quality was taken into account during interpretation.

Prisma flowchart (textual representation)

Identification:

- Records found by searching databases (Cochrane, PubMed): n = 142• Additional records found from references: n = 18 “Screening.
- Records with duplicates eliminated: n=120
- Records screened (abstract/title): n=120”
- Excluded records: n = 78 Eligibility:
- 42 full-text publications were evaluated.
- Full-text papers that did not fit the criteria were excluded (n = 25).

Research included in qualitative synthesis: n = 17.

RESULTS

Talaat et al conducted an interventional prospective study with sample size 100, in 2016, which proved decrease in recurrence of BPPV with Vitamin D3 supplementation. But the study did not use blinding.^[4] Jeong et al also did a RCT on 2020, having sample size of 348, proved decrease in the recurrence, however, concerns regarding the randomization process have been noted by the journal publishers and should be considered when interpreting the findings. Caution should be used when assessing the quality of the evidence. Talaat et al. demonstrated that vitamin D supplementation had a beneficial effect on BPPV recurrence, though since the study lacked blinding, it is more probable to be prejudiced than a real randomised controlled trial. Similarly, although Jeong et al. published favourable results, the journal publishers have voiced reservations about the randomisation procedure, casting doubt on the findings' internal validity. Therefore, these results should be viewed as supporting data that has to be confirmed by carefully planned, appropriately blinded randomised controlled trials rather than as conclusive evidence of efficacy.^[5]

Yang conducted a Meta-analysis in 2021 with multiple sample size which showed RR 0.41. In 2022, Hong showed reduced recurrence of BPPV with Vitamin D supplementation in a systematic review consisting multiple sample size. Studies have reported reductions of recurrence ranging from roughly 40% to 80% on vitamin D supplementation, in individuals who had baseline deficit. The recurrence appearance is more predictable in association with the deficit. Patients using vitamin D supplements have longer intervals without symptoms

Patient with low vitamin D3 levels has higher risk of BPPV recurrence since it compromises the calcium metabolism and the otolith integrity. Vitamin D Supplementation seems to reduce the BPPV recurrence, especially in people who are deficient and it supports the significance of screening vitamin D3 levels in recurrent cases. A RCT study of Chua in 2025 with 120 sample size substantiated reduced recurrence of BPPV with vitamin D3 supplementation.

In general, vitamin D supplement is well tolerated and safe, cost effective adjustment of the traditional repositioning techniques. However, Ideal therapy regime is difficult to determine because some studies used maintenance doses, and others used high-dose supplements.

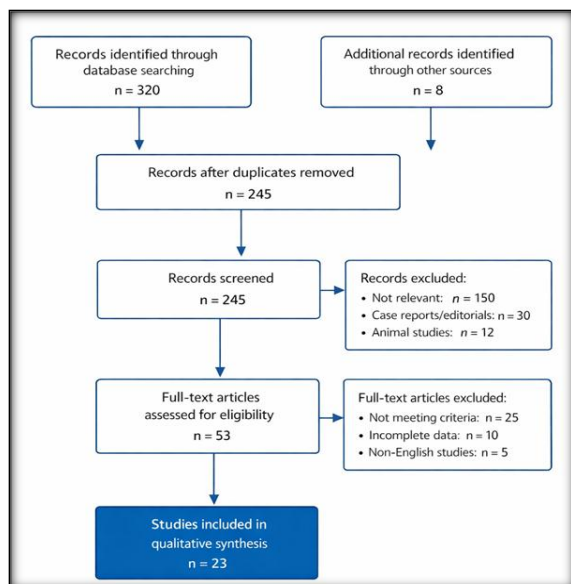


Figure 1: Prisma flowchart showing number of records identified through database searching and the number of studies included in qualitative synthesis.

Table 1: Study Characteristics

Author	Year	Study Type	Sample Size	Key Findings
Talaat	2016	Prospective interventional study (non blinded)	100	↓ Recurrence
Jeong	2020	RCT	348	↓ Recurrence
Yang	2021	Meta-analysis	Multiple	RR 0.41
Hong	2022	Systematic Review	Multiple	↓ Recurrence
Chua	2025	RCT	120	↓ Recurrence

Table 2: Risk of Bias Assessment

Study	Risk of Bias
Talaat 2016	High
Jeong 2020	Moderate
Yang 2021	Moderate
Hong 2022	Moderate
Chua 2025	Low

DISCUSSION

Vitamin D plays a key role in calcium metabolism and otolith stability. [3,6] Deficiency may lead to degeneration or displacement of otoconia, increasing recurrence risk. [6] According to this review, vitamin D could be included in the etiology and recurrence of BPPV. A compromised calcium metabolism caused by vitamin D deficiency that affects otolith stability could be the underlying mechanism. [3,6,2]

Patients with baseline vitamin D deficiency benefit more from supplementing, which supports the significance of screening vitamin D levels in situations of recurrent BPPV.

However, the robustness of conclusions is limited by variations in study design, dosage schedules, and follow-up time. [7,8,1]

Variability in the quality of the evidence is also introduced by inclusions of various study types. [7,9]

This relationship's biological validity roots from vitamin D's role in calcium metabolism. Calcium carbonate crystals make up otoconia, and the inner ear mainly controls calcium homeostasis, which is

essential to their structural integrity. [3,2] Vitamin D deficit can potentially inhibit this process, leading to otoconia degenerating, fragmenting, or separating, which increases the risk of recurrent BPPV episodes. [6,2] Additionally, vitamin D receptors have been found in the inner ear, suggesting a regulatory role. [3]

Correlation of BPPV and the presence of systemic diseases like osteoporosis as well as postmenopausal status is another factor to be considered. [10] The presence of correlation between bone metabolism and vestibular disorders is further supported by the fact that the two disorders share route owing to defective calcium metabolism. [10] This could be one of the reasons why the number of recurrent episodes was more among older individuals and postmenopausal women. [9,10]

The current examination also indicates that patients who have been proven to have had vitamin D deficiencies are the ones who are most benefited by vitamin D treatment. [4,11,1] With such serious clinical implications, this finding demonstrates that regular assessment of serum vitamin D3 levels can be used by those with recurring BPPV. [12,13] The targeted supplementation would be an easy, cost-

effective adjustment of the traditional repositioning techniques to the deficient ones. ^[14,8]

Ideal therapy regime is difficult to determine because some studies used maintenance doses, and others used high-dose supplements. Inclusion of an observational study and randomized controlled trials also introduces diversity in the quality of evidence. ^[9,10]

Another limitation of the study is the lack of standardized outcome measurements. Even though the recurrence rate is the most commonly reported outcome, various studies have given different definitions of recurrence and follow-up intervals. ^[7,9,8] This makes the comprehensive, quantitative synthesis impossible and restricts direct comparison. Besides, other trials failed to adequately manage confounding variables such as age, comorbidities, and baseline bone. ^[9,10]

Moreover, it is important to remember that not all studies disclose the direct correlation between level of vitamin D and occurrence of BPPV ^[7,12] Contribution of vitamin D to initial stages of BPPV development is not completely known, but recurrence appears more predictable in association with a deficit. This difference mattered due to the fact that it suggests that vitamin D does not have to be the most important etiological factor, but a moderator of the disease. ^[11,6,1]

Future research needs to focus on properly designed, multi-centre randomized controlled trials including long follow-ups and uniform dosage schedules. ^[14,15,1] Especially helpful would have been the studies that compared different forms of VDS and identified ideal serum vitamin D thresholds during BPPV prophylaxis. Additionally, the analysis of the therapies and the utilization of the bone mineral density assessment might assist in clarifying the interaction between the vestibular and bone metabolism. ^[10]

Limitations

Limitations include demographic and study design variation. Also lack of proper vitamin D dosage guidelines in the studies. Different studies got different follow-up times, leading to difficulty in comparing the results. Inclusion of different study designs

Combining meta-analyses and observational studies leads to difference in quality of evidence.

Absence of quantitative meta-analysis leads to limiting the quality and generalizability of the results.

CONCLUSION

Based on the available “data, the administration of vitamin D can possibly increase the reduction of recurrence of BPPV, particularly in patients with known vitamin deficiency. However,” it cannot be regarded as conclusive due to the disparities in the study design, blinding and randomisation which reduces the certainty of the evidence.

More extensive and carefully planned randomized controlled trials are required to generate standardized recommendations regarding the use of vitamin D supplements.

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