

The Role of Vitamin D in Bone Health: A Clinical Perspective

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INTRODUCTION & AIM

Vitamin D plays a crucial role in **calcium homeostasis** and **bone metabolism**.

Deficiency in vitamin D is linked to impaired **bone mineralization**, increased **fracture risk**, and **osteoporosis**.

Despite growing global awareness, **vitamin D insufficiency** remains highly prevalent across different **age groups**, particularly in the **elderly** and **postmenopausal women**.

This study aims to evaluate the impact of **vitamin D levels** on **bone health outcomes**, investigate the **effectiveness of supplementation** in **at-risk populations**, and highlight the importance of **preventive strategies** in **clinical practice**.

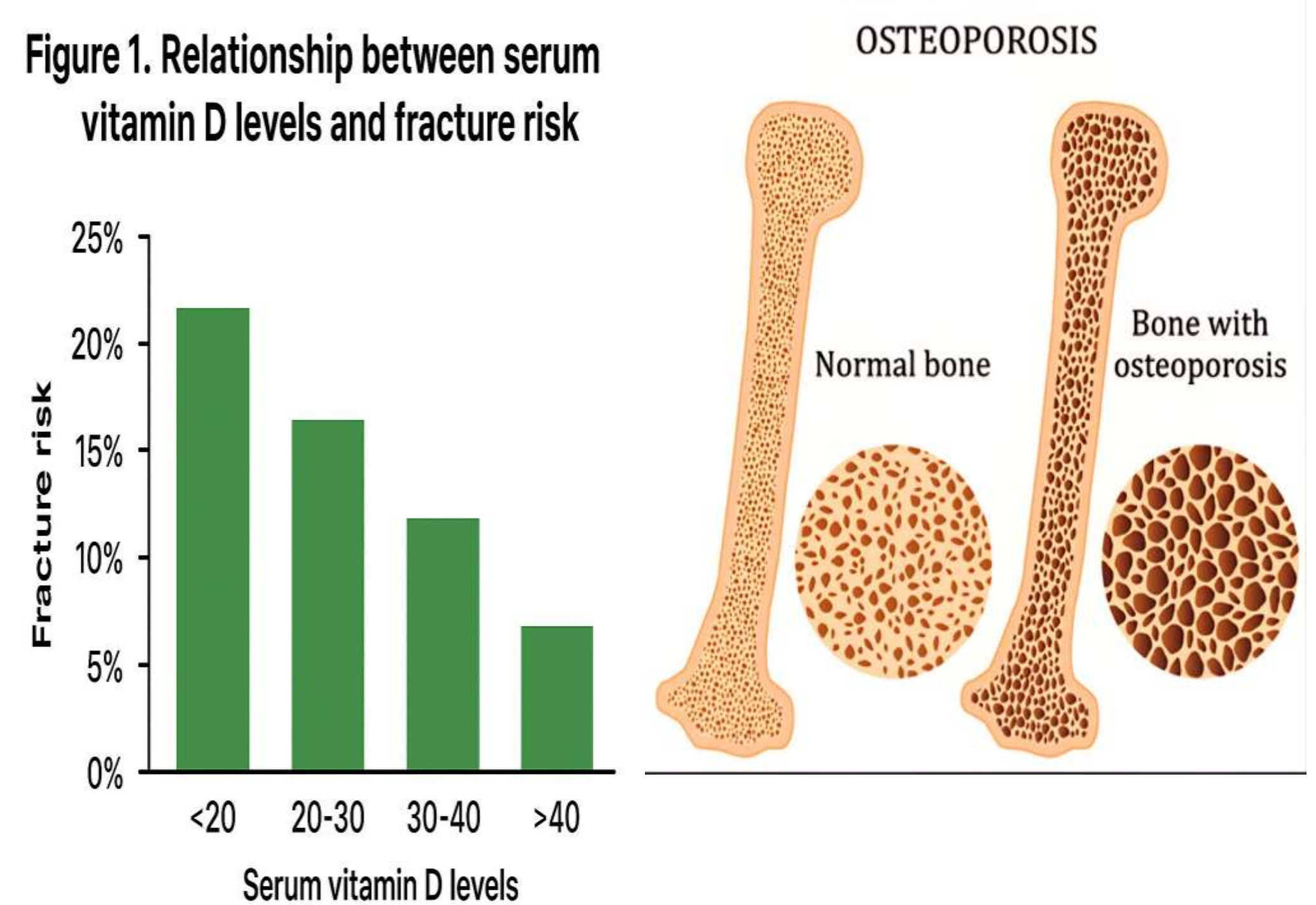
METHOD

A **systematic review** was conducted, including **randomized controlled trials (RCTs)** and **observational studies** published between **2015 and 2024**. **Databases** searched included **PubMed**, **Scopus**, and **Cochrane Library**. **Studies assessing serum 25-hydroxyvitamin D levels** and outcomes such as **bone mineral density (BMD)**, **fracture incidence**, or **bone turnover markers** were included. **Data were extracted** on **participant demographics**, **intervention type**, **duration**, **baseline vitamin D status**, and **clinical outcomes**. A **qualitative synthesis** was performed to identify **trends** and evaluate **clinical significance**.

RESULTS & DISCUSSION

Twenty-eight studies with a total of **15,342 participants** were included. **Low serum vitamin D (<20 ng/mL)** was consistently associated with reduced **BMD** and a higher risk of **osteoporotic fractures**. **Supplementation**, particularly when combined with **calcium**, significantly improved **BMD** in **postmenopausal women** and **elderly men**. **Fracture risk reduction** ranged from **12% to 25%**, especially in participants with **baseline deficiency**. **Compliance, dosage, duration of supplementation**, and **initial vitamin D status** were key determinants of **efficacy**.

Figure 1. Relationship between serum vitamin D levels and fracture risk



CONCLUSION

Maintaining adequate vitamin D status is essential for **bone health**, particularly in **high-risk populations**.

Vitamin D supplementation effectively improves **BMD** and reduces **fracture risk** when appropriately administered.

Early detection of deficiency and **individualized supplementation strategies** are recommended to optimize **skeletal outcomes** and support long-term **musculoskeletal health**.

FUTURE WORK / REFERENCES

Future Work:

- Explore optimal vitamin D dosing strategies.
- Investigate genetic and environmental factors influencing vitamin D metabolism.

References:

1. Holick MF et al. Vitamin D Deficiency. N Engl J Med. 2007;357:266–281.
2. Bischoff-Ferrari HA et al. Fracture Prevention with Vitamin D Supplementation: A Meta-analysis. JAMA. 2005;293:2257–2264.