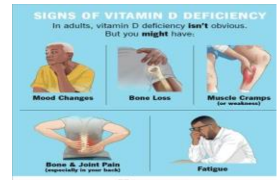
Prevalence, Biomarkers, and Cut-Offs for Assessing Vitamin D Deficiency (VDD) in Ethiopia: *A systematic Review and Meta-Analysis*



EXECUTIVE SUMMARY

We aimed to identify and validate commonly used biomarkers and diagnostic methods for assessing vitamin D deficiency (VDD) in various population groups in Ethiopia. Additionally, we provided a pooled prevalence of VDD at national and subnational levels. Analyzing data from 19 unique studies, we found that most used 25(OH)D and 25(OH)D3 biomarkers, aligning with international recommendations. However, despite liquid chromatography-tandem mass spectrometry (LC-MS/MS) being the gold standard, many Ethiopian studies relied on ELISA or inferior test kits. The commonly reported cutoff for VDD was < 50 nmol/L (20 ng/mL). The overall pooled prevalence of VDD in Ethiopia was 56% (40–72%), with Addis Ababa having the highest prevalence at 74%, followed by Amhara (42%) and Oromia (41%). We recommend recognizing VDD as a significant public health issue in Ethiopia, especially in Addis Ababa. Caution is advised when interpreting results from many Ethiopian studies, as they often utilize non-gold standard methods like ELISA instead of the preferred LC-MS/MS.

THE PROBLEM

The deficiency of vitamin D is a significant global public health concern, affecting nearly half (48%) of the global population. This means that a large proportion of the world's population has serum 25(OH)D levels below 30 or 50 nmol/L. Tropical countries, particularly children, have a high prevalence of vitamin D deficiency. Studies conducted in Ethiopia have also shown that VDD is a significant nutritional problem that affects women, children, school children, and other population groups.

Methodology

We conducted a systematic search in March 2022 on PubMed (MEDLINE), Scopus, Google databases, and other studies from gray literature without any language restrictions. We used Rayyan software to facilitate our review process. We performed a random-effects meta-analysis to estimate both the national and sub-national (regional) prevalence of vitamin D deficiency.

KEY FINDINGS

- The most common biomarker for assessing vitamin D deficiency (VDD) in Ethiopia was 25(OH)D, used by 11 of 19 studies, followed by 25(OH)D3 in 4 studies.
- Most studies employed ELISA kits as their diagnostic method, with twelve studies (63.16%) defining VDD using a cutoff of <20 ng/ml.
- Results should be interpreted cautiously due to reliance on ELISA kits, which are less accurate than the gold-standard LC-MS/MS, leading to potential misclassification.

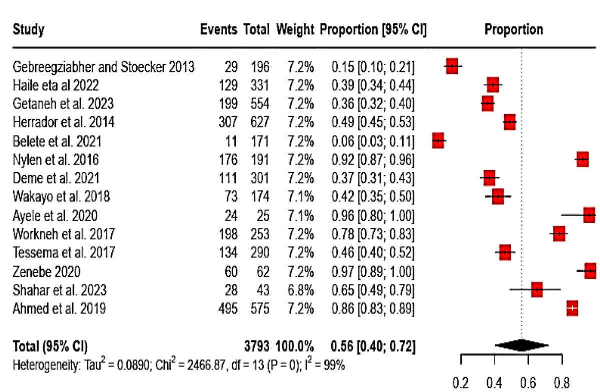


Figure 1: Forest plot showing pooled prevalence of vitamin D deficiency from the included studies.

The overall prevalence of vitamin D deficiency across different populations was 56% (95% CI: 40% - 72%), with a high level of heterogeneity (I2 = 99%), as shown in **Figure 1**.

Sub-national prevalence analysis: Sub-national analysis showed that the highest prevalence of VDD was found in Addis Ababa (74%), followed by the Amhara (42%), and Oromia (41%) regions, while the SNNPR had the lowest (27%) prevalence of VDD, (**Figure 2).**

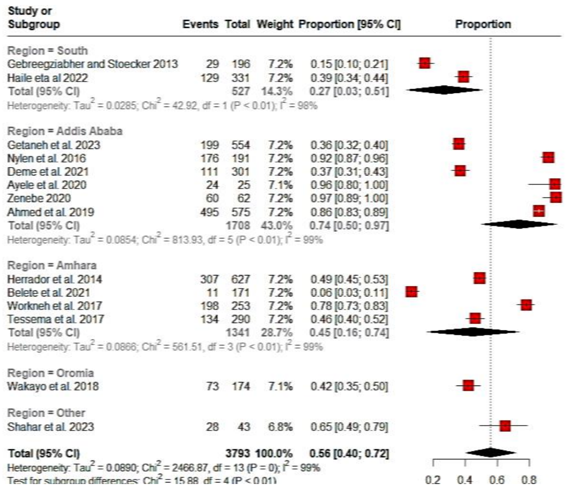


Figure 2: Forest plot showing pooled prevalence of vitamin D deficiency disaggregated by region in Ethiopia.

KEY RECOMMENDATIONS

- Policy makers and concerned stakeholders should recognize the urgent need to address Vitamin D deficiency (VDD) as a significant public health issue in Ethiopia, particularly in Addis Ababa.
- Special initiatives should be implemented to raise awareness about the importance of sunlight exposure and Vitamin D in Addis Ababa City Administration.
- Regulators should consider enforcing mandatory fortification of edible oil and other vehicles. Additionally, they should also consider implementing targeted and carefully planned vitamin D supplementation for vulnerable population groups.
- Researchers and clinicians who employ diagnostic methods other than LC-MS/MS should exercise caution when interpreting results obtained through these alternative methods, such as ELISA.
- Consistent with the World Medical Association (WMA), the best biomarker is 25-hydroxyvitamin D or 25(OH)D, with a cutoff level of below 50 nmol/L (20 ng/ml). It is essential to clearly communicate this information with researchers and other relevant stakeholders.

FURTHER INFORMATION

The research report from which information for this policy brief was drawn from is available on the NIPN website (http://www.nipn.ephi.gov.et/). Detailed descriptions of findings and statistical methods used are included in the research report.

AUTHORS

Tadsse Zerfu[1], Meron Girma[2], Tirsit Genye[1], Amare Abera[1], Anbissa Muleta[2], Masresha Tessema[2], Aregash Samuel[2]

1. International Food Policy Research Institute (IFPRI)/NIPN
2. Ethiopian Public Health Institute (EPHI)/National Information Platforms for Nutrition (NIPN)

CONTACT: Please address any queries to NIPN Ethiopia at ephi.nipn@gmail.com

Selected References

1. Thandrayen K, Pettifor JM. The roles of vitamin D and dietary calcium in nutritional rickets. *Bone Rep*. 2018;8:81-89. doi:10.1016/j.bonr.2018.01.005
2. Sahay M, Sahay R. Rickets-vitamin D deficiency and dependency. *Indian J Endocrinol Metab*. 2012;16(2):164-176. doi:10.4103/2230-8210.9373
3. Zhang R, Naughton DP. Vitamin D in health and disease: current perspectives. *Nutr J*. 2010; 9:65. doi:10.1186/1475-2891-9-65
4. Kheiri B, Abdalla A, Osman M, Ahmed S, Hassan M, Bachuwa G. Vitamin D deficiency and risk of cardiovascular diseases: a narrative review. *Clin Hypertens*. 2018;24(1):9. doi:10.1186/s40885-018-0