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Hypovitaminosis D among athletes and its impact on athletic performance: Protocol for a scoping review

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ABSTRACT

Varying evidence shows a surge in the prevalence of insufficient serum Vitamin D levels among athletes. Further exploration is incumbent to identify the influence of Vitamin D on athletic performance and various factors such as recovery from musculoskeletal pain and fatigue, improving muscle strength, reducing frequency and duration of illness, and lowering the production of pro-inflammatory markers. This systematic scoping review will identify the rate of occurrence of lower levels of Vitamin D and analyze if it impacts athletic performance. The methodology prescribed by Arksey and O'Malley and the methodological advancement by Levac will be followed. The authors will search electronic databases PubMed, Cochrane Central Register of Controlled Trials, Embase (through Cochrane), Ovid Emcare, and Google Scholar for original research and will include studies published in English between 1981 and 2021. Two reviewers will screen the title and abstracts of the identified literature, and the studies that meet the inclusion criteria will be moved to full text screening. The same reviewers will screen the full text of the selected literature and studies that meet the inclusion criteria will be used for data extraction. Extracted data will be reported as a comprehensive summary. The final manuscript is intended for submission to an indexed journal in January 2023. The scoping review will help to address the prevalence of hypovitaminosis D and combine evidence on its impact on performance among athletes. This scoping review was registered with Open Science Framework.

Keywords: Vitamin D, Vitamin D insufficiency, Vitamin D deficiency, Hypovitaminosis D, Athletes

INTRODUCTION

Vitamin D is imperative in maintaining immune function,[1] signaling gene expression[2,3] optimal skeletal health,[4] and physical performance.[5] Hypovitaminosis D decreases muscle strength due to fatty degeneration of Type II muscle fibers and leads to muscle atrophy. Cholecalciferol plays a role in intestinal calcium absorption and renal reabsorption and positively affects bone mineral density; thus, hypovitaminosis is linked to increased stress fractures in athletes.[2,4,6] Increased risk of upper respiratory tract infections is also documented in athletes.[1,3,5,7]

The ubiquity of Vitamin D insufficiency and deficiency among western athletes is about 56%. The occurrence of hypovitaminosis D is documented as high during winter and spring. Athletes participating in indoor and mixed sports seem to have a higher risk of hypovitaminosis D.[2] A recent study by Bauer *et al.* identified 44.3% of handball athletes with Vitamin D insufficiency, even during summer months.[8] Approximately 25% of omnivores, Lacto-Ovo vegetarians, and vegan recreational German runners had insufficient Vitamin D levels.[9] Among 219 female athletes from various sports, 54.3% of participants had insufficient serum 25(OH)D levels.[10] In the retrospective cross-sectional study conducted on healthy recreational runners, Zeitler *et al.* identified that 66% of females and 76% of males had insufficient levels (<30 ng/mL).[11] It is noted that optimal Vitamin D serum levels are yet to be ascertained in athletic populations.[12,13]

The causes of Vitamin D deficiency in the athletic population can be multifactorial, but the diminishing absorption of ultraviolet B rays into the skin plays a pivotal role. The prevalence seems to be higher in athletes who train indoors, reside, and train in latitudes more than 35° North or South of the Equator, with dark or very light pigmented skin, regular sunscreen use, and protective clothing habits.[2-5,14]

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Objectives

Through this scoping review, we aim to provide an exhaustive recapitulation of the prevalence of hypovitaminosis D among athletes around the globe and gather evidence regarding the influence of serum Vitamin D status on athletic performance. The identified lacunae in the literature and the implications of Vitamin D insufficiency and deficiency concerning the performance and health of athletes will be discussed. Subsequently, this will help to optimize screening for athletes. The methodology followed for this protocol is specified in advance and documented on Open Sciences Framework registries.[15]

MATERIALS AND METHODS

Study design and ethics approval

The methodology prescribed by Arksey and O'Malley[16] and methodological advancement by Levac *et al*.[17] will be followed and Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) framework will be adhered to strictly.[18] Since this work involves reviewing and synthesizing published data, it does not require ethical approval.

Inclusion and exclusion criteria

Eligibility criteria were established a priori and the selection of studies will be per the following criteria.

Population

Studies that assessed the athlete's (elite and recreational athletes) serum Vitamin D levels with or without relating to performance and fitness will be included in the study. Studies that assess serum Vitamin D levels of only groups of non-athletic populations will not be included in the scoping review.

Concept

The conditions for inclusion are insufficiency or deficiency of serum Vitamin D levels and any impact on athletic performance and fitness.

Context

Studies conducted in any context and geographical location will be included to ensure thorough exploration of the prevalence of hypovitaminosis D and its implications on athletic performance.

Types of sources

Peer-reviewed studies with quantitative and mixed methods designs conducted on human subjects will be included in the study, while animal studies will be excluded from the study. Studies published in English since the 1980s until 2021 will be included in the study.

Search strategy

The preliminary search strategy will include terms that describe the context and population based on the inclusion criteria. The final strategy will include specific keywords identified in the preliminary search strategy [Appendix 1] and will be combined with Boolean terms to ensure maximum and accurate study selection. The search strategy will be developed and finalized on PubMed (the preliminary) and will be adapted for searches in other databases such as Cochrane Central Register of Controlled Trials, Embase (through Cochrane), Ovid Emcare, and Google Scholar.

Selection process

On completion of the literature search, identified records will be collated and imported to Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia (available at www.covidence.org).

Duplicate literature will be identified and removed automatically by the software. Two independent reviewers will screen the titles and abstracts. Screening differences between the two researchers will be resolved by a third reviewer if an agreement cannot be reached. The identified articles will be included for full-text screening. Full-text of the potential articles will be retrieved in total and will be reviewed by two independent reviewers. Reasons for excluding full-text papers will be recorded and reported in the scoping review. The search results will be reported and presented in a PRISMA-ScR flow diagram.[18]

Data extraction

Data extraction will be completed using a predetermined form [Appendix 2]. This data will be compared by a second reviewer for ensuring accuracy. Specific details from the identified articles that answer the research question and objectives will be extracted.

Data presentation

The data will be presented in a tabular or graphical format in line with the review objectives and key finding will be summarized.

CONCLUSION

A comprehensive analysis and interpretation of the available literature on the prevalence of hypovitaminosis D and its impact on athletic performance will be curated through this scoping review. This will act as an updated summary of the available evidence which will identify the research lacunae and act as a useful tool for sports nutritionists. This knowledge is essential to guide future studies on Vitamin D, especially in developing countries.

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Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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APPENDICES

Appendix 1: Search Strategy

Search	Query	Records retrieved
#1	"Vitamin D deficiency" OR "Vitamin D deficiency"	36,340
#2	"rickets" OR "rickets" OR "hypovitaminosis d"	19,105
#3	("Vitamin D" OR "Vitamin D" OR "ergocalciferols" OR "ergocalciferols") AND ("insufficiencies" OR "insufficiency" OR "insufficient" OR "insufficiently")	8,149
#4	"athletes" OR "athletes" OR "athletes" OR "athlete" OR "athletically" OR "athletes" OR "sports" OR "sports" OR "athletic" OR "athletics"	3,61,022
	#1 OR #2 OR #3 AND #4 Filters: Humans, English	446

PubMed search conducted on October 11, 2021. MeSH Terms from the search strategy will be applied for all fields

Appendix 2: Data Extraction Form

Study citation details
Country (Latitude)
Study objective
Participant demographics
Details extracted
  Prevalence of hypovitaminosis D
  Factors causing hypovitaminosis D
Cut off ranges
  1. Insufficiency
  2. Deficiency
  3. Sufficiency/Optimal
Performance parameters assessed
Correlation between hypovitaminosis D and performance parameter