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THE RELATIONSHIP BETWEEN VITAMIN D DEFICIENCY DUE TO INDOOR ACTIVITY AGAINST OSTEOPOROSIS: SCOPING REVIEW

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ABSTRACT

Introduction: Lack of sun exposure due to lack of outdoor activities can lead to vitamin D deficiency. Vitamin D is an important regulator of calcium metabolism so its presence is very important for life and vitamin D deficiency is common throughout the world. Based on data from the International Osteoporosis Foundation (IOF), more than 200 million women in the world suffer from osteoporosis, with the majority of women aged over 60 years. The purpose of this scoping review was to determine the relationship between vitamin D deficiency due to indoor activity and the occurrence of osteoporosis. This research was conducted using the scoping review method, which was a database search for several articles from international journals related to vitamin D deficiency, indoor activity and osteoporosis. The databases used in this study were Pubmed, Science Direct and Google Scholar there were 664 articles obtained. After screening the articles with inclusion and exclusion criteria, 16 articles were deemed relevant. Then, the researchers reviewed and analysed the articles for the review article. The conclusion from this scoping review is that vitamin D deficiency can be caused by a lack of sun exposure due to indoor activities which are a lifestyle and daily activities at work. Meanwhile, vitamin D deficiency can lead to an increased risk of osteoporosis through less than optimal bone and muscle function and increased bone turnover as a result of increased levels of parathyroid hormone (PTH).

Keywords: Vitamin D deficiency, Indoor activity, Osteoporosis.

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INTRODUCTION

The progress of civilization today with many conveniences in living life and the demands of work has the potential to cause more people to be active indoors than outdoors. Lack of outdoor activity can actually have an impact on health. Lack of sun exposure due to many indoor activities can also cause vitamin D deficiency. Vitamin D is an important regulator of calcium metabolism, so its presence is very important for life and vitamin D deficiency is common throughout the world. Vitamin D began to be known in the health world since cases of rickets-related diseases arose in Europe and North America in the 19th and early 20th centuries, the disease became endemic until it was discovered that skin exposure to ultraviolet light and oral intake of vitamin D can prevent and reduce the incidence of disease caused by rickets.

Most health workers still think that health problems due to vitamin D deficiency are limited to diseases due to rickets, osteoporosis and osteomalacia. Osteoporosis is a metabolic bone disease that affects one in three women and one in five men (Ziebart et al., 2022). Osteoporosis is characterized by reduced bone mass and changes in bone microarchitecture, which result in decreased bone strength and an increased risk of fracture (Goswami & Nair, 2019). Based on data from the International Osteoporosis Foundation (IOF), more than 200 million women in the world suffer from osteoporosis, with the majority aged over 60 years. Knowledge about the etiology and risk factors for osteoporosis is very broad, recent epidemiological studies have shown that a night-shift work shift work can be a major factor that contributes to osteoporosis (Bukowska-Damska et al., 2019).

Vitamin D or cholecalciferol is a collective structure related to metabolites that can be obtained from dietary foods, supplements and sunlight. Vitamin D functions to regulate calcium and phosphorus levels in the blood by increasing their absorption from the intestines, besides that vitamin D also functions to stimulate bone formation and mineralization. 25(OH)D deficiency can lead to osteoporosis due to secondary hyperparathyroidism which induces increased calcium outflow from bone tissue. Several epidemiological reports have demonstrated the importance of Vitamin D for maintaining physical performance and preventing falls in the elderly population (Okuyama et al., 2020).

Reports (Mithal et al., 2014) stated that vitamin D deficiency that occurs in India is widespread at all ages and more than 80% of people living in urban areas have serum 25(OH)D levels below 20 ng/mL. It is experienced by pregnant women as well and includes their newborns, children and adolescents, young adults, and the elderly. Vitamin D deficiency during childhood and adolescence can lead to decreased bone mass in adulthood and can increase the risk of developing osteoporosis. Vitamin D deficiency cannot be ignored, because it can cause kidney and liver disease, hair loss in women, bone pain and muscle weakness, palpitations, sleeplessness, poor memory and general weakness (Ahmed et al., 2016). Based on the description of the background, the purpose of conducting research through this Scoping review is to determine the relationship between vitamin D deficiency due to indoor activity and the occurrence of osteoporosis.

METHOD

The method used in compiling this article review was the scoping review method. This is based on the reference sources used in the preparation of this article which vary from articles and journals. Scoping review is one method that can be used to identify literature in depth and comprehensively obtained through various sources with various research methods that are related to the topic of the article. The stages in conducting a scoping review include:

1. Searching data/articles that match the topic of the article to be compiled using several databases, namely, Pubmed, Science Direct and Google Scholar the researchers used Vitamin D deficiency, working indoor, indoor activity, and Osteoporosis as keywords.
2. Selecting articles that match the inclusion criteria, which include research articles published in international journals, research articles published within the last 10 years, research articles that can be accessed in full (full text), and articles in English.
3. Assessing of the quality and feasibility of literature articles through exclusion criteria, namely multiple articles, articles with inappropriate titles and abstracts and screening by reviewing all full text articles.

After completing these stages and obtaining relevant articles to the writing, the researches compiled and reported the results of the scoping review analysis. At this stage, the researchers analyzed, summarized, and compiled the selected literature. Then, the researchers reported the results in the results and discussions part. Moreover, the researchers also consulted the results with some experts.

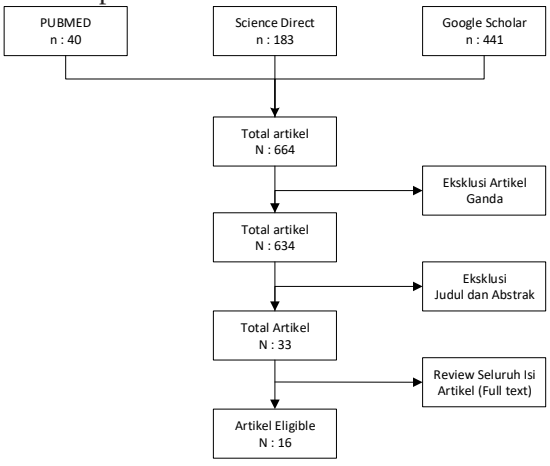

Figure 1. Flow Diagram of Research Article Selection

RESULT

The process of article gathering was carried out through three databases, namely, Pubmed, Science Direct and Google Scholar. Based on the search results using inclusion criteria which include research articles published in international journals, research articles published within the last 10 years, research articles that can be accessed in full (full text), and articles in English, 664 articles were found. Furthermore, through screening with the exclusion criteria of

multiple articles, 634 articles were obtained. The next article screening was carried out through the match between the title and abstract so that 33 articles were found. Those articles were considered relevant to the topic to be discussed which had been identified at the beginning of the article search with the keywords vitamin D deficiency, work indoors, indoor activity and Osteoporosis. Furthermore, screening was carried out with the method of reading all the articles that were considered relevant and then 16 articles were obtained that met the requirements to be used as references in the preparation of this article.

Based on the results of a Scoping review of 16 articles that are relevant to the topic of this article, which is about the effect of vitamin D deficiency due to indoor activity on osteoporosis, it is known that the articles obtained are articles published in the range of 2012-2021. The articles obtained include 2 systematic review articles, 1 report article from an international osteoporosis foundation and 13 articles from original articles using descriptive analysis research methods, observational studies and cross sectional studies. Previous research articles are research articles conducted in several countries in the world, including Saudi Arabia, Egypt, Japan, Italy, India, Korea, Sydney, Turkey and Malaysia. The results of the review of all relevant articles found 13 articles explaining the effect of vitamin D deficiency due to indoor activities, while 3 articles could explain the effect of vitamin D deficiency on osteoporosis. The results of the scoping review of previous research articles can be seen in table 1.Tabel 1. Hasil Scoping review Hubungan Antara Defisiensi Vitamin D Akibat Indoor Activity Terhadap Terjadinya Osteoporosis.

Discussion

Based on data from a scoping review of 16 articles in table 1, it shows that vitamin D deficiency can be caused by a lack of sun exposure to the skin caused by indoor activities. Several articles show that lack of vitamin D levels in the body causes health problems, one of which is osteoporosis. This is consistent with a study in Japan which showed that low 25(OH)D had some subclinical effect on bone health and lack of outdoor activity (lack of sun exposure in indoor workplaces) could negatively impact 25(OH)D production. in non-elderly which is the main reason for the decrease in serum 25(OH)D in young Japanese women (Okuyama et al., 2020). The main cause of vitamin D deficiency is a lack of natural sunlight. A person can take vitamin D supplements to meet the body's vitamin D needs, but natural sunlight is the best and healthiest source of vitamin D (Ahmed et al., 2016).

The National Institutes of Health (NIH) defines osteoporosis as a bone disorder characterized by weakening of bone strength that puts a person at risk for fractures (Bukowska-Damska et al., 2019). Vitamin D has an important role in maintaining normal blood calcium levels, therefore vitamin D is very important for bone health and other biological processes (Rizza et al., 2020). Adequate vitamin D is very important for normal bone development besides, vitamin D is also important for achieving and maintaining bone health in adults. Multiple regression analysis shows that sun exposure is the main determining factor for 25(OH)D status (IM, 2013). Thus, the lack of vitamin D due to indoor activity can be a cause of osteoporosis due to poor bone health. Increased prevalence of osteoporosis due to lifestyle changes, lower physical activity, increased indoor life, and lower sun exposure (Mithal et al., 2014).

Most of the studies presented in Table 1 show that indoor workers are consistently reported as the occupational group most likely to have 25(OH)D deficiency regardless of geographic location. In a previous study, it was shown that vitamin D deficiency is triggered by reduced sun exposure, lifestyle factors and inadequate diet patterns, which have the potential to reduce bone mineral density and cause several other diseases (Nang et al., 2019). It is generally agreed that the minimum concentration of 25(OH)D is at least 50 nmol/L, because if the concentration of vitamin D (25OHD) is below this concentration, it will increase parathyroid hormone (PTH) levels. In addition, a lack of 25(OH)D concentration has the potential to cause increased bone turnover and less than optimal bone and muscle function, this occurs at least in some groups (Fayet-Moore et al., 2019).

Vitamin D is synthesized in the skin through several mechanisms and more than 90% of vitamin D is synthesized through exposure to UVB radiation (sunlight). The level of vitamin D production depends on many factors including the area of skin exposed, pigmentation and UVB availability, as well as on geographic location, season, weather and time of day (Fayet-Moore et al., 2019). This study shows that sun exposure plays an important role in the formation of vitamin D that occurs in the skin, so that having longer indoor activity will affect the formation of vitamin D it is because the lack of sun exposure

to the skin.

CONCLUSION

Based on a study of all articles obtained through several databases, it can be concluded that vitamin D deficiency can be caused by a lack of exposure to sunlight due to the large number of indoor activities that become a pattern of life and daily activities at work. Meanwhile, vitamin D deficiency can lead to an increased risk of osteoporosis through less than optimal bone and muscle function and increased bone turnover as a result of increased levels of parathyroid hormone (PTH). Therefore, vitamin D deficiency due to indoor activity can increase the risk of osteoporosis.

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Table 1

No	Title	Researcher and Year	Purpose	Method	Result
1	Effect of Vitamin D Deficiency on Osteoporosis and Chronic Low Back Pain in Middle-aged Saudi Arabian Women in Riyadh City, MAY 2014	(Ahmed et al., 2016)	To find out whether vitamin D deficiency is a major cause of osteoporosis and chronic low back pain in Saudi Arabian women	Studi cross-sectional	Saudi women suffer from vitamin D deficiency and osteoporosis more than any other country, which is possible due to proper sun exposure, diet (daily consumption of milk). Nearly half of the Saudi women in the study had vitamin D deficiency without osteoporosis which may indicate that the deficiency is not severe.
2	Asia-Pacific Regional Audit Epidemiology, Costs and Burden of Osteoporosis in India 2013: International Osteoporosis Foundation Report	(Mithal et al., 2014)	Epidemiology Audit Report	Observational Report	The high rate of vitamin D deficiency may be due to several causes such as low sun exposure, inadequate vitamin D intake, lack of fortification of foods with vitamin D, pigmented skin, environmental pollution, and traditional dress code. Increased prevalence of osteoporosis due to lifestyle changes, lower physical activity, increased indoor living, and lower sun exposure.
3	Monthly fluctuations in 25 hydroxy vitamin D levels in day and night shift hospital worker rotation	(Rizza et al., 2020)	Describing the prevalence of vitamin D deficiency (25OHD) that occurs in hospital employees who work in a room with a shift system	Controlled Observational Study	Relatively young healthy hospital workers, who have rotating night shifts, without significant metabolic risk factors, have a high risk of 25(OH)D deficiency. 25(OH)D deficiency can lead to progression to more severe conditions such as osteoporosis or fractures.

4	Night shift work and osteoporosis: evidence and hypotheses	(Bukowska-Damska et al., 2019)	Conduct a review of epidemiological evidence on the association between night shift work and bone mineral density or fracture risk	Article Review	Three out of four studies support the hypothesis that working at night may lead to endocrine disorders and may have an indirect impact on bone physiology among night shift workers. Potential biological mechanisms linking night shift work and osteoporosis may involve altered clock gene expression, suppression of melatonin, sleep disturbances and possibly vitamin D deficiency.
5	Assessment of Vitamin D status among senior executive managers in large-scale industry in 10 Ramadhan city, Egypt	(IM, 2013)	Assessed vitamin D 25 (OH) status in apparently healthy senior executive managers and their impact on BMD, to determine the potential influence of several associated lifestyle and socioeconomic factors.	Cross-sectional study	Senior executive managers are prone to vitamin D deficiency, due to limited sun exposure
6	Impact of Low-dose Vitamin D Supplementation on Serum 25(OH)D in Indoor Workers in the Large-Scale Automotive Industry	(Elsheikh, 2018)	To investigate the nutritional status of vitamin D among indoor workers especially workers in the multinational automotive industry and to assess the efficiency of a low dose vitamin D intervention in indoor workers.	Cross-sectional study	Research shows a high prevalence of vitamin D deficiency among indoor workers. This study shows that a daily dose of 400 IU of oral vitamin D supplementation does not directly increase the serum 25(OH)D concentration and that prevention of vitamin D deficiency may require higher doses of vitamin D supplements or more sun exposure for indoor workers. .

7	Determinants of vitamin D status of healthy office workers in Sydney, Australia	(Fayet-Moore et al., 2019)	To evaluate the seasonal variation of 25(OH)D in a population of healthy office workers, and to assess the effects of behavioral sun exposure, skin pigmentation, physical activity (PA) and food intake on serum 25(OH)D concentrations.	Cross-sectional study	Sun exposure is beneficial for vitamin D status even with sunscreen use. Vitamin D supplements should be targeted at individuals who have darker skin or cannot get adequate sun exposure, especially during the winter months.
8	Serum 25-hydroxyvitamin D status in non-elderly adults (18-64 years) working indoors at 40° north latitude	(Okuyama et al., 2020)	To investigate whether there is an association between falls, related factors and 25(OH)D status in a non-elderly population working indoors at 40' North latitude in Japan.	Cross-sectional study	Lack of sun exposure in indoor workplaces can have a negative impact on 25[OH]D production in non-elderly.
9	Knowledge, Attitudes and Practices Regarding Vitamin D and Its Relationship with Vitamin D Status in Women Office Workers in Malaysia	(Jamil et al., 2019)	Assessing knowledge, attitudes and practices about vitamin D and its relationship to vitamin D status in female office workers in Kuala Lumpur, Malaysia.	Cross-sectional study	Malay female office workers in Kuala Lumpur generally have good knowledge but moderate attitudes and practices about vitamin D. Vitamin D status is related to sun exposure and vitamin D intake from food. Future studies should focus on strategies to improve their vitamin D status.
10	Vitamin D status and seasonal changes in plasma concentrations of 25-hydroxyvitamin D in office workers in Ankara	(Cinar et al., 2014)	Investigating vitamin D status and seasonal changes in summer and winter in office workers	Observational study	Vitamin D deficiency is very common in office workers who spend most of their daytime indoors in Turkey and vitamin D supplementation may be indicated for indoor workers.

11	An overview of the potential health effects of exposure to light and the environment in underground workplaces	(Nang et al., 2019)	Review the literature on possible environmental exposures and possible health effects on underground workplaces	Descriptive Analysis	Working underground can be associated with vitamin D deficiency, sick building syndrome, excessive noise, radon exposure, and negative psychological effects.
12	Vitamin D and Calcium Levels between Bahraini Workers and Expatriates in Exposed and Unexposed Sun	(Alshaibani et al., 2021)	Evaluating vitamin D and calcium levels in Bahraini workers and expatriates whether exposed to sunlight or not.	Observational Cross Sectional Study	Bahraini workers who were exposed to the sun had higher levels of vitamin D but the same levels of calcium as Bahraini workers who were not exposed. Unexpectedly, among the expatriate group, the exposed patriarchs had lower vitamin D than the unexposed but the calcium levels were the same,
13	Vitamin D and Parathyroid Hormone Status in Female Garment Workers: Case-Control Study in Bangladesh	(Mahmood et al., 2017)	Evaluating vitamin D, parathormone (PTH), calcium, and alkaline phosphatase (ALP) status among female garment workers in Bangladesh.	Observational Cross Sectional Study	The reasons for vitamin D deficiency in Bangladeshi women are assumed to be due to low sunlight intensity, air pollution, use of sunscreen, and a closed dress style and dark skin may be the possible reasons for inadequate vitamin D synthesis in the skin of Bangladeshi women.
14	Vitamin D levels and deficiencies by different occupations: a systematic review	(Sowah et al., 2017)	Evaluate vitamin D levels in different occupations and identify groups prone to vitamin D deficiency	Article Review	Shift workers, healthcare workers, and indoor workers are at high risk for vitamin D deficiency, which may reflect major lifestyle differences (eg sun exposure).

15	Widespread vitamin D deficiency among Indian healthcare professionals	(Beloyartseva et al., 2012)	Determining the prevalence of vitamin D deficiency among health care professionals in different regions of India.	Cross-sectional study	It is confirmed that there has been evidence of a high prevalence of vitamin D deficiency across India in apparently healthy middle-aged healthcare professionals. Therefore, there is a need for an integrated approach to detect vitamin D deficiency among health care professionals and treat it appropriately. One such approach could be an assessment of the vitamin D status of all hospital employees and appropriate care at work and on a regular basis.
16	Vitamin D deficiency among physicians: a comparison between inpatients and community-based physicians	(Munter et al., 2015)	Compare 25-hydroxyvitamin D(25(OH)D serum levels among hospital and community-based clinicians.	Observational Cross Sectional Study	This article shows that doctors who work in hospitals have lower levels of 25(OH)D compared to community-based doctors.