

DOI: 10.30644/rik.v8i2.738

The association between vitamin D intake and sleep quality index within the 17-35 year age group

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Accepted: 31 January 2023; revision: 1 June 2023; published: 30 June 2023

Abstract

Background: Vitamin D deficiency is a common health problem in the world, even in tropical countries such as Indonesia. The Lack of vitamin D intake from food or supplements can increase the risk of having vitamin D deficiency. The association between vitamin D and sleep quality has been proven by the discovery of vitamin D receptors in the brain and brainstem, which are the sleep centers of the body. Vitamin D also takes part in the process of light transduction and melatonin production, which affects circadian rhythm and sleep quality. Poor sleep quality often causes health problems which will affect the quality of life, work productivity, and increases the risk of death. The purpose of this study is to determine the association between vitamin D intake and sleep quality index within the 17-35 year age group.

Method : This study is an observational analytic study using a cross-sectional approach. Data was collected using consecutive sampling methods. Vitamin D intake was measured by the Vitamin D Estimation Only - Food Frequency Questionnaire (VIDEO-FFQ) and sleep quality index was measured by the Pittsburgh Sleep Quality Index (PSQI). Data analysis is proceeded using the chi-square method.

Results: The total of respondents were 119. 68,1% of the respondents had inadequate vitamin D intake and 80.4% of the respondents had poor sleep quality index. The analysis shows that there was no significant association between vitamin D intake and sleep quality index (p value = 0.325).

Conclusion: Most of the respondents had inadequate vitamin intake and poor sleep quality index. There was no significant association between vitamin D intake and sleep quality index within the 17-35 year age group.

Key words: Vitamin D intake, food and supplement, sleep quality index, 17-35 year age group

Abstrak

Latar Belakang: Defisiensi vitamin D merupakan masalah kesehatan umum di dunia, bahkan terjadi pada negara tropis seperti Indonesia. Kurangnya asupan vitamin D dari makanan ataupun suplemen dapat meningkatkan risiko mengalami defisiensi vitamin D. Keterkaitan antara vitamin D terhadap kualitas tidur didukung dengan ditemukannya reseptor vitamin D pada otak dan batang otak yang pusat tidur serta berperan dalam proses transduksi cahaya dan produksi melatonin, sehingga mempengaruhi merupakan irama sirkadian dan kualitas tidur. Indeks kualitas tidur yang rendah seringkali menimbulkan masalah kesehatan, yang berdampak pada penurunan kualitas hidup, produktivitas kerja, serta meningkatkan risiko kematian. Penelitian ini bertujuan untuk mengetahui hubungan antara asupan vitamin D dan indeks kualitas tidur masyarakat Indonesia pada populasi usia 17-35 tahun.

Metode: Penelitian ini merupakan penelitian observasional analitik dengan pendekatan studi potong lintang. Pengambilan data dilakukan dengan metode consecutive sampling. Asupan

vitamin D diukur dengan *Vitamin D Estimation Only - Food Frequency Questionnaire (VIDEO-FFQ)* dan indeks kualitas tidur diukur dengan *Pittsburgh Sleep Quality Index (PSQI)*. Analisis data dilakukan dengan menggunakan analisis statistik *chi-square*.

Hasil: Total responden sebanyak 119, terdapat 68,1% responden memiliki asupan vitamin D tidak adekuat dan 73,1% responden memiliki kualitas tidur buruk. Hasil analisis bivariat menunjukkan bahwa tidak terdapat hubungan yang bermakna antara asupan vitamin D terhadap indeks kualitas tidur (*p value* = 0.325).

Kesimpulan: Sebagian besar responden memiliki asupan vitamin tidak adekuat dan indeks kualitas tidur yang buruk. Tidak terdapat hubungan yang signifikan antara asupan vitamin D terhadap indeks kualitas tidur pada populasi usia 17-35 tahun.

Kata kunci: Asupan vitamin D, makanan dan suplemen, indeks kualitas tidur, usia 17-35 tahun.

INTRODUCTION

Vitamin D deficiency is a worldwide public health issue; approximately one billion people are vitamin D deficient, and 50% of the world's population is vitamin D deficient(1). Vitamin D deficiency can occur even in tropical countries with year-round sun exposure, such as Indonesia. According to research by Rimahardika et al. (2017), 63% of Indonesians are vitamin D deficient(2). Vitamin D can be obtained through the synthesis in the skin, food consumption, and additional supplements. Although sunlight provides 50-90% of the vitamin D needed, a lack of vitamin D intake from food or supplements can increase the risk of experiencing vitamin D deficiency(3). According to a study of Polish women aged 20-30 years, 97% of respondents did not get enough vitamin D (<10 µg/day)(4).

Research by Muscogiuri et al. (2019) discovered a link between vitamin D and sleep quality. This is supported by the discovery of vitamin D receptors in the brain and brainstem, which serve as the brain and brainstem's centers of sleep(5). Other research has found that vitamin D influences circadian rhythms and sleep quality by playing a role in light transduction and melatonin production(3,5,6). Previous research found a link between vitamin D intake and the sleep quality index of older adults with heart failure, as well as that vitamin D supplementation could improve the sleep quality of respondents aged 20-50 with sleep disorders. (7,8).

Adequate and high-quality sleep is essential for maintaining physical and mental health. According to one study, 40% of young adults have poor sleep quality(9). A low sleep quality index frequently causes problems such as excessive daytime sleepiness (EDS), decreased academic achievement, psychological and mood disorders, and obesity, and increases the risk of developing chronic diseases, lowering the quality of life, and work productivity, and increasing the risk of death(10-12). The researchers are interested in examining the relationship between vitamin D intake and sleep quality index in a population aged 17-35 years due to the number of negative effects caused by a poor sleep quality index.

METHOD

An analytic observational method with a cross-sectional approach was used in this study. The study was conducted from March to December 2021. The participants in this study were students of Nursing at Atma Jaya Catholic University and their relatives aged 17 to 35. The sample was collected using the consecutive sampling method.

This study's inclusion criteria were Indonesians aged 17 to 35 who were willing to fill out a questionnaire. Respondents with a history of chronic diseases such as sarcoidosis, tuberculosis, chronic fungal infections, lymphoma, hyperparathyroidism, kidney disorders, liver disorders, and digestive disorders were excluded; respondents took drugs such as

phenobarbital, phenytoin, carbamazepine, nifedipine, spironolactone, clotrimazole, rifampin, corticosteroids drugs; respondents were obese (BMI > 25); exposed to sunlight for 10-30 minutes between 9.00-15.00 hours, 3x/week for the past year; and regularly consuming >400 mg of caffeine in the past month (coffee >2 cups/day, tea >4 cups/day)(1,3,13–16).

The Vitamin D Estimation Only – Food Frequency Questionnaire (VIDEO-FFQ) questionnaire was used to determine respondents with sufficient vitamin D intake (15 mcg/day) and respondents with insufficient vitamin D intake (15 mcg/day)(4). The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to determine respondents with a good sleep quality index (global PSQI score of ≤ 5) and respondents with a poor sleep quality index (global PSQI score > 5) (17). The Chi-Square test was used to analyze the data.

RESULTS

The demographic characteristics of the respondents were classified according to their age and gender. With 115 people (96.6%), the majority of respondents were between the ages of 17 and 24. The majority of respondents (71.4%) were female, with 85 respondents (71.4%) being female (Table 1).

Table 1. Demographic Characteristics of The Respondents

Variable	Frequency (n)	Percentage (%)
Age (years old)		
17-24	115	96.6
25-35	4	3.4
Gender		
Male	34	28.6
Female	85	71.4
Total	119	100

Table 2. Vitamin D Intake

Vitamin D Intake	Frequency (n)	Percentage (%)
Adequate (+)	38	31.9
Insufficiency (-)	81	68.1
Total	119	100

In this study, data describing vitamin D intake were divided into two groups: those with adequate vitamin D intake and those with insufficient vitamin D intake. According to the study results, 81 respondents (68.1%) had insufficient vitamin D intake (Table 2). The study found that 38 respondents (31.9%) had adequate vitamin D intake, with 36 meeting their needs through vitamin D supplements (Table 3).

Table 3. Vitamin D Intake and Supplementation

Variable	Vitamin D Supplements				Total
	With (+)		Without (-)		
	n	%	n	%	
Vitamin D Intake					
Adequate (+)	36	30.3	2	1.7	38 (31.9%)
Insufficiency (-)	6	5.0	75	63.0	81 (68.1%)
Total	42	35.3	77	64.7	119 (100%)

The sleep quality index description was divided into two groups: those with a good sleep quality index and those with a poor sleep quality index. With a total of 87 respondents (73.1%), the results revealed that the majority of respondents had a poor sleep quality index (Table 4).

Table 4. Sleep Quality Index

Sleep Quality Index	Frequency (n)	Percentage (%)
Good (+)	32	26.9
Poor (-)	87	73.1
Total	119	100

According to the data, 47.9% of respondents have a low vitamin D intake and a low sleep quality index. The Chi-Square test yielded a p-value of 0.325, indicating that

there was no significant relationship between vitamin D intake and the sleep quality index in the 17-35 years old population (Table 5).

Table 5. The Association Between Vitamin D and Sleep Quality Index

Characteristic	Sleep Quality Index				Total	P value
	Good (+)		Poor (-)			
	n	%	n	%		
Vitamin D Intake						
Adequate (+)	8	6.7	30	25.2	38 (31.9%)	0.325
Insufficiency (-)	24	20.3	57	47.9	81 (68.1%)	
Total	32	26.9	87	73.1	119 (100%)	

DISCUSSION

This study found that 81 respondents (68.1%) had insufficient vitamin D intake (15 g/day). This was consistent with the findings of Song et al (2018), who found that 55% of respondents consumed 15 g of vitamin D per day(8). This was because both studies calculated respondents' average daily vitamin D intake from food and vitamin D supplements.

The percentage of respondents who had inadequate vitamin D intake in this study was very different from a study on young women in Poland conducted by Gbska et al (2016), which found that 100% of respondents did not meet the Recommended Dietary Allowance (RDA) of Institute of Medicine (<15 µg/day)(4). This study's results may differ because it previously only considered the amount of vitamin D intake from food and did not calculate intake from supplements. Meeting vitamin D adequacy rates from food intake without supplementation is difficult, as evidenced by the study's findings, which revealed that 38 respondents (31.9%) had adequate vitamin D intake and 36 met their needs from vitamin D supplements.

The increased consumption of vitamin D supplements is due to new information about the role of vitamin D in the prevention and treatment of COVID-19 infection. [18] According to the findings of the 2021 Neurosensum survey, 73% of Indonesians took more supplements during the COVID-19 pandemic, and 42% took vitamin D supplements(19).

According to the findings, 87 respondents (73.1%) had a low sleep quality index. In this study, the percentage of people with poor sleep quality was quite high. The percentage of respondents with a poor sleep quality index is quite consistent with the findings of Benedict (2018)'s study on sleep quality in students at the Atma Jaya Catholic University Faculty of Medicine, which found that up to 69.6% of people have poor sleep quality(20). The obtained percentages are also consistent with the findings of Sondang's study (2021), which found that 60% of student respondents at the Faculty of Medicine, University of North Sumatra had poor sleep quality during the COVID-19 pandemic(21). The two studies produced quite consistent results because they used the PSQI questionnaire as a research instrument and chose medical faculty students as research subjects, whereas this study included all young adults aged 17 to 35 years old.

Bivariate analysis using the Chi-Square test revealed that there was no significant relationship between vitamin D intake and sleep quality index in the 17-35 years old population. Previous research by Prayitno (2021), which used a 2x24 hour questionnaire, found no significant correlation between vitamin D intake and sleep quality index in students of the Faculty of Medicine at The Islamic University of Indonesia(22).

In contrast Song et al. (2018), found a significant relationship between vitamin D deficiency and sleep quality in older adults with heart failure(8). According to research by Song et al., respondents were classified as vitamin D deficient if the 3-day results of the food diary and the respondent's consumption of vitamin D supplements were less than 15 mcg/day(8). This disparity in results could be

attributed to a difference in the questionnaire used. Song et al. used a 3-day food diary questionnaire to calculate respondents' vitamin D intake on two weekdays and one weekend, The VIDEO-FFQ questionnaire was used by the researchers in this study to calculate the study subjects' vitamin D intake over the previous year. Other factors that can influence differences in research results include the population of research subjects, as well as the location and timing of the study. The study by Song et al. chose a population of study subjects aged ≥ 65 years with heart failure in Korea, whereas the respondents in this study were young adults aged 17-35 years and it was conducted in Indonesia(8).

Previous research indicates that vitamin D can influence sleep quality by influencing the light transduction process and regulating melatonin production(5). The brainstem, which is the center of sleep, also contains vitamin D receptors. This is supported by previous research by Jung et al (2017) in Korea, which found that workers with poor sleep quality are more likely to be vitamin D deficient(23). Previous research yielded contradictory results to the findings of this study, which could be attributed to the data collection method. Jung et al measured the serum concentration of vitamin D in the blood so that vitamin D deficiency could be diagnosed(23). In this study, data was collected by filling out a questionnaire to determine the adequacy of the respondent's vitamin D intake, so the risk of deficiency due to a lack of vitamin D intake could only be estimated.

Majid et al. (2018) previously reported that vitamin D supplementation significantly improved sleep quality in adult subjects aged 20-50 years with sleep disorders(7). The difference in results could have occurred because it was unknown when the respondents began consuming vitamin D supplements and adherence in this study, whereas in experimental studies the provision of vitamin D supplements has a definite time.

Another factor that influences the study's findings is the numerous factors that influence a person's sleep quality index, such

as sleep hygiene. Sleep hygiene is a habit and an environmental condition that allows you to have a regular and uninterrupted bedtime(24). A consistent sleep schedule every night, comfortable sleeping environmental conditions, anything that can interfere with sleep continuity, bedtime routines, and habits all have an impact on sleep hygiene(24). Good sleep hygiene varies from person to person, making it difficult to quantify, and there is no ideal sleep hygiene that can be applied to everyone. As a result, sleep hygiene is both a confounding factor in this study and a determining indicator for the PSQI questionnaire's sleep quality index.

CONCLUSION

The majority of respondents had insufficient vitamin intake and a low sleep quality index. The study's findings revealed no significant relationship between vitamin D intake and sleep quality index in people aged 17 to 35. Given that the majority of respondents cannot meet their nutritional adequacy rate solely through food, taking vitamin D supplements may be an attempt to meet it.

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