



## The Correlation between Vitamin D Intake and Quality of Life in the 17-35 Age Group

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### ABSTRACT

Vitamin D testing increased significantly during the Coronavirus Disease-19 (COVID-19) pandemics due to its role in regulating the immune system. Therefore, vitamin D deficiency is associated with susceptibility to various diseases that may affect the quality of life regarding physical health, psychological well-being, social and environmental aspects. The study aimed to determine whether there is an association between vitamin D intake and quality of life in the 17 to 35-year-old age group. A cross-sectional study was conducted from April to November 2021. The sample consisted of students from the School of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia, and their relatives in the same age group, who were selected using a consecutive sampling. Vitamin D intake was measured using Vitamin D Estimation Only - Food Frequency Questionnaire (VIDEO-FFQ). At the same time, the quality of life was assessed using the World Health Organization Quality of Life (WHOQOL)-BREF questionnaire. Data analysis was performed using the *Chi-square* test. Of the 127 respondents, the results showed that most of respondents had inadequate vitamin D intake and good quality of life (68.50%;59.10%). The highest mean of the four quality of life domains belongs to the environmental domain (3.94) with a standard deviation (SD) of  $\pm 0.83$ . Data analysis showed no significant correlation between vitamin D intake and quality of life ( $p>0.05$ ). The conclusion shows that there was no correlation between vitamin D intake and quality of life in the 17-35-year age group.

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## INTRODUCTION

Vitamin D test has increased exponentially in recent years.<sup>1</sup> The role of vitamin D in preventing and treating various diseases, especially during the Coronavirus Disease-19 (COVID-19) pandemic, has caused many discussions so that vitamin D's benefits are increasingly popular among public.<sup>2</sup> Vitamin D deficiency affects nearly half of the population worldwide.<sup>3,4</sup> According to a Canadian study, 30.00%-50.00% of children and adults have vitamin D deficiency.<sup>5</sup> The 2001-2006 National Health and Nutrition Examination Survey also showed a prevalence of vitamin D deficiency by 33.00%.<sup>5</sup> Research in Indonesia has had few reports on vitamin D status. *Persatuan Ahli Gizi Indonesia (PERSAGI)* research shows that vitamin D status is insufficient and inadequate, especially in children aged 2.0-12.9.<sup>5</sup> In addition, a study in Indonesia in 2013 with samples aged 18-40 years also showed that the prevalence of vitamin D deficiency was 63.00%.<sup>6</sup>

Vitamin D reduces the risk of developing cardiovascular disease, bone health, infections, autoimmunity, type 2 diabetes, cancer, and depression.<sup>3,7</sup> It is lesser-known, but the essential roles of vitamin D include its effects in modulating the innate and adaptive immune system.<sup>3,4</sup> Vitamin D enhances innate cellular immunity by inducing antimicrobial peptides, human cathelicidin (LL-37) by 1,25-dihydroxy vitamin D and defensins.<sup>7</sup> These host-derived peptides kill invading pathogens by disrupting their cell membranes and can neutralize the biological activity of endotoxins. In adaptive immunity, vitamin D suppresses the response mediated by type 1 helper T cells (Th1) and promotes cytokine production by type 2 helper T cells (Th2), thereby suppressing the production of inflammatory cytokines as well as promoting the induction of regulatory T cells that can inhibit the inflammatory process.<sup>7</sup> Therefore, lack of Vitamin D is related to increased susceptibility to various diseases, which absolutely can affect the quality of life in terms of physical health, psychological well-being, social and environmental aspects.<sup>3,4,8</sup>

Vitamin D is a fat-soluble vitamin and contains a steroidal molecular structure that needed for various metabolic processes in the body.<sup>8,9,10</sup> The primary source of vitamin D comes from sunlight.<sup>10,11</sup> There are two general

forms of vitamin D, namely D-2 (ergocalciferol) and D-3 (cholecalciferol) which can be obtained from foods such as fish oil, eggs, butter, liver, fish such as mackerel, salmon, sardines and tuna. Vitamin D deficiency can be caused by several things, such as decreased intake or absorption of foods containing vitamin D and reduced exposure to sunlight.<sup>12</sup> As the correlation between vitamin D and various diseases or health conditions have been recognized, interest in the contribution of vitamin D to overall health-related quality of life has increased.<sup>13</sup>

This age group of 17-35 years was chosen because there are still very few studies on vitamin D intake in this age group. The researcher also wants to use it as a medium to show the prevalence of vitamin D nutrition in Indonesia and hope that the results of this study can be useful to improve the quality of life on 17-35-year-old age of group, thereby increasing the standard of living until elderly with a better quality of life.

## MATERIAL AND METHOD

This research is a cross-sectional study design. Sampling was done by consecutive sampling. The research subjects were the students of the School of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia and their relatives in the age group of 17-35 years who met the inclusion criteria. The inclusion criteria for this study were FKIK UAJ students and their relatives who live in Indonesia in the age group of 17-35 years and willing to sign an informed consent. The exclusion criteria for this study were FKIK UAJ students and their relatives who did not fill out the questionnaire completely, were exposed to direct sunlight for 10-30 minutes between 09.00-15.00, at least three times a week in the last year and who were in conditions of fat malabsorption and obesity. The implementation of this research was carried out in April - November 2021 via online due to COVID-19 pandemic that was hitting when this research was carried out and has received approval from the Ethics Commission of FKIK UAJ with an Ethics Approval Letter No. 13/05/KEP-FKIKUJ/2021.

The measuring instrument used to assess vitamin D intake is the Vitamin D Estimation Only - Food Frequency Questionnaire (VIDEO - FFQ).<sup>14</sup> This questionnaire asked respondents to remember the number of servings on several

types of food in the frequency of months, weeks or days within the last one year; the calculation on the amount of vitamin D supplements consumed was also taken into account in this questionnaire. Vitamin D intake is considered adequate if the respondent's daily vitamin D intake is  $\geq 15$  mcg/day or inadequate if the respondent's daily vitamin D intake is  $< 15$  mcg/day.<sup>14</sup> Quality of life was assessed through filling out The World Health Organization Quality of Life (WHOQOL)-BREF questionnaire which has been adapted into the Indonesian version to determine the respondent's quality of life.<sup>15</sup> This questionnaire consisted of 26 questions.<sup>16</sup> Two of them measure the overall quality of life and general health while the other 24 questions were divided into four domains, namely physical health (7 items), psychological well-being (6 items), social correlations (3 items) and environmental health (8 items).<sup>16</sup> Each item is scored on a scale from 1 to 5; the score was then converted into a linear scale between 0 and 100.<sup>15</sup> Determination of the measurement results was determined by calculating the score from the questionnaire that the respondents have filled out. Quality of life is considered poor if the WHOQOL-BREF score is  $< 60$  and quality of life is considered good if the WHOQOL-BREF score is  $\geq 60$ .<sup>17</sup> The data were analyzed by *Chi-square* test using SPSS version 22.0 program to determine whether there was a significant correlation between vitamin D intake and quality of life in 17–35-year age group.

## RESULTS

The total participants who filled out the questionnaire were 153 people, but 26 people did not meet the inclusion criteria or meet the research exclusion criteria, so the number of respondents involved in this study was 127 people. Most of the respondents were in their late teens (17-24 years) and were female (Table 1).

The distribution of vitamin D intake was divided into two categories, namely adequate ( $\geq 15$  mcg/day) and inadequate ( $< 15$  mcg/day). This categorization is based on the calculation of the estimated daily vitamin D intake from the Vitamin D Estimation Only - Food Frequency Questionnaire (VIDEO - FFQ) which was measured by remembering various types of vitamin

D - rich foods and supplements in the last 1 year, then calculating the estimated daily vitamin D . In the research data, it was found that most of respondents had an estimated intake of vitamin D in the inadequate category (Table 1).

The distribution of people's perception regarding their quality of life in general, it is divided into two categories, namely bad (0-60) and good (61-100). This categorization is based on the results of calculating the quality of life from The World Health Organization Quality of Life (WHOQOL)-BREF, which has been adapted in Indonesia. This questionnaire is a valid and reliable instrument. Respondents were asked to fill out a questionnaire by remembering their feeling in the last 4 weeks related to 4 domains of quality of life, namely physical health, psychological, social relations, and the environment. The description of the data from this study shows that most of the respondents had good quality of life category (Table 1).

Quality of life has several domains. The domain is divided into 4 categories, namely physical, psychological, social and environmental health. This categorization is based on the division of the quality of life domain from The World Health Organization Quality of Life (WHOQOL)-BREF. The highest mean of the 4 quality of life domains is owned by domain 4 or the environmental health domain (3.94) with a standard deviation (SD) of  $\pm 0.83$ .

Based on the results of the *Chi-squared* test of vitamin D intake and quality of life, it was shown that there was no significant correlation between vitamin D intake and quality of life in the 17-35 year age group.

**Table 1. Characteristics of Respondents**

Characteristics	n = 127	%
<b>Age (Year)</b>		
17-24	119	93.70
25-35	8	6.30
<b>Sex</b>		
Male	37	29.20
Female	90	70.80
<b>Vitamin D intake</b>		
Adequate ( $\geq 15$ mcg/day)	40	31.50
Inadequate ( $< 15$ mcg/day)	87	68.50
<b>Perception on Quality of Life</b>		
Bad ( $< 60$ )	52	40.90
Good ( $\geq 60$ )	75	59.10

Source: Primary Data, 2021

**Table 2. Overview of 4 Domains of Quality of Life Among 17–35-year Age Group**

Dependent Variable	Mean	Median	Score		
			SD	Min	Max
<b>Domain</b>					
Physical Health	2.91	3	0.73	1	5
Psychological	3.43	3	0.67	2	5
Social Relations	3.59	4	0.69	2	5
Environmental	3.94	4	0.83	2	5

Source: Primary Data, 2021

## DISCUSSION

Based on research data, it was found that as many as 87 respondents (68.50%) had inadequate vitamin D intake while the number of respondents in the adequate category was 40 people (31.50%). This percentage is quite in accordance with research conducted by Suryadinata in 2020, the results obtained 93.18% of the respondents had inadequate vitamin D intake.<sup>18</sup> However, this percentage is still relatively low when compared to research conducted by Desrida in 2018 with the results that 100.00% of the respondents had inadequate vitamin D intake.<sup>19</sup>

This can happen because the main source of vitamin D is sun exposure, while the food consumed daily except for food products fortified with vitamin D contains less vitamin D. In addition, vitamin D intake may be influenced by socioeconomic and lifestyle factors which with low intake of vitamin D in research samples due to a lack of variety in daily food consumption. This study describes most of the subjects consuming foods such as eggs, egg yolks and ice cream. This is because eggs, egg yolks and ice cream are quite easy to obtain and economically affordable. In addition, sources of vitamin D from fish are consumed mostly by

salmon and tuna which are easier to find in restaurants. Other food sources of vitamin D can be classified as difficult to obtain and reach because they are economically expensive which becomes one of the causes of lack of vitamin D intake in research samples.

The results of this study describe the number of respondents in the category of adequate vitamin D intake for 40 people (31.50%) who are all known to take vitamin D supplements. Many Indonesians who take vitamin D supplements can be caused by a lot of information about the effect of vitamin D on its role in preventing and curing COVID-19 infection. According to a survey conducted by Neurosum in 2021 which stated that 73.00% of Indonesian consumed supplements during the COVID-19 pandemic, and there were 47.00% of respondents took vitamin D supplements.<sup>20</sup> In addition, vitamin D has been known to modulate the immune system, so it is recommended for consumption to reduce the transmission of SARS-CoV-2 by enhancing antiviral immunity as well as reducing mortality by reducing the likelihood on the occurrence of a cytokine storm that related to severe COVID-19.<sup>21,22,23</sup>

Based on the research data, it was found that 52 people (40.90%) had a poor quality of life category and 75 people (59.10%) with a good quality of life category. The data from this research can be concluded that of 127 people who become respondents 59.10% had good perception on quality of life. The results of this study are similar to the research conducted by Antoni Hezkia in 2018 which found 56.10% of respondents had a good perception on quality of life as well.<sup>24</sup> Research on evaluating the quality of life among Dental Professionals conducted by Nabras Alrayes in 2020 also showed that most of respondents had good quality of life for 75.00%.<sup>25</sup>

**Table 3. The Correlation between Vitamin D Intake and Quality of Life Among 17–35-year Age Group**

Variable	Quality of Life				Total		p-value
	Bad		Good		n	%	
	n	%	n	%			
<b>Vitamin D intake</b>							
Adequate ( $\geq 15$ mcg/day)	15	37.50	25	62.50	40	100	0.592
Inadequate ( $< 15$ mcg/day)	37	42.50	50	57.50	87	100	
<b>Total</b>	52	40.90	75	59.10	127	100	

Source: Primary Data, 2021

This can be due to several factors that can affect the quality of life that includes 4 domains on quality of life which are physical health, psychological, social relations, and the environment. Aspects of physical health and functional ability are factors that come from the internal condition of the biological health of the individual's body. Good physical health will help individuals in carrying out their daily functions and activities as well as the ability to interact with the surrounding community so that they can improve the quality of life in the individual.<sup>26</sup> Psychological health, personal well-being, and life satisfaction are internal human factors that are subjective and emphasize psychological factors. Good psychological health will bring individuals into positive thoughts which in the end, they have an impact on the assessment that they have a good quality of life.<sup>26</sup> Social networks, activities, and participation are external factors that come from individual interactions with the surrounding community. Individuals who have good quality and quantity of interaction with the people around them will experience satisfaction in their life.<sup>26,27</sup>

Environmental conditions and socio-economic conditions are external factors that come from the general state of the surrounding environment. Individual with good life and environmental condition will support their activities in them and create positive feelings and will have an impact in improving the quality of life.<sup>26</sup>

The data of this study show that most of samples are still in their productive age, so they may have a minimal chronic disease and still have good health. This is one of the important factors directly related to the quality of life.<sup>28</sup> The calculation of the total score for each domain was checked using the Kolmogorov-Smirnov normality test. Based on the data found in this study that was not normally distributed ( $p < 0.05$ ), the results were presented in the form of mean, median, standard deviation, minimum score, and maximum score.<sup>17</sup> In addition, the highest mean of the 4 quality of life domains was owned by domain 4 (3.94) with a standard deviation of  $\pm 0.83$  indicates that the environmental dimension in the form of infrastructure and residence of the subject strongly supports the quality of life of the research samples.<sup>29</sup>

Based on the data obtained, the group of respondents who had adequate vitamin D intake showed that there were more people had a good quality of life with a total of 25 people (62.50%). Then, the group of respondents who had inadequate vitamin D intake also showed more people who had a good quality of life with a total of 50 people (57.50%).

The correlation between vitamin D intake and quality of life in this study was not significant. This result is similar to a study by Edith Fitriyana Girsang in 2018, which also stated that there was no significant correlation between serum vitamin D levels and quality of life in epilepsy patients ( $p\text{-value} = 0.342$ ).<sup>30</sup> This is reinforced by research conducted by Ji Sun Kim in 2016 also stated that vitamin D status was not significantly related to the dimensions on quality of life in Korean adults ( $p = 0.42$ ).<sup>31</sup> This insignificant result may be due to the complex range of clinical and social factors that related to quality of life, making it difficult to conclude a clear correlation based on measurements of both intake and vitamin D level. The fact that vitamin D intake was measured only once by considering the amount of dietary intake in a year, sun exposure, and the amount of exposure which was not considered may have influenced the study results. In addition, the arrangement of places in low-income countries can be a factor because the level of quality of life is also influenced by factors related to the culture, physical and social environment of the community in society.<sup>32</sup> The limitation during COVID-19 pandemic is a major factor affecting the level of quality of life.<sup>33</sup> The impact of the limitations given by this pandemic such as difficulty in carrying out religious activities outside the home, the risk of stress and anxiety due to poor health, loss of work and lack of direct social activities with other people.<sup>33,34</sup>

However, this is different from the research conducted by Ivan Panji Teguh in 2021 which stated that adequate protein and vitamin D intake had a significant correlation with quality of life ( $p\text{-value} = 0.001$ ).<sup>35</sup> Vitamin D is related to better muscle strength, if it is known that the vitamin in the body is reduced, it can be related to weakened muscle strength and performance.<sup>36</sup> Increasing a person's need for vitamin D can be done by fortifying food, giving vita-

min D capsules, calcium and regular exposure to sunlight.<sup>37</sup> People with good nutritional needs will have good nutritional and health status so that their quality of life will also increase.<sup>38</sup>

## CONCLUSION AND RECOMMENDATION

Vitamin D intake and quality of life in the 17–35-year age group are generally adequate and good. It can be concluded that there was no significant correlation between vitamin D intake and quality of life in the 17–35 year age group. In this study, the researcher suggests that future researchers use other research design so that it is possible to measure vitamin D intake and the factors that influence it more continuously and reduce bias when filling out online questionnaires. In addition, further research can use wider population scope and collect important information related to research needs.

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## AUTHOR CONTRIBUTIONS

SP, VMS, and KAW conceived and designed the experiments; SP wrote the paper, analyzed the data, and prepared figures and/or tables. YA and ISH analyzed the data and improve the discussion. All authors read, reviewed drafts of the paper, and approved the final manuscript. SP = Suci Prasetyo; VMS = Veronika M. Sidharta; KAW = Komang A. Wahyuningsih; YA = Yunisa Astiarani; In Sil Huh

## CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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