



Risk of Vitamin D Deficiency in Medical Students Based on The Characteristics of Food Intake and Sun Exposure

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ABSTRACT

Introduction. The need for Vitamin D can be fulfilled through direct synthesis from Vitamin D stores in the skin with the help of ultraviolet B rays. Therefore, sufficient Vitamin D intake and sun exposure are needed. Most of the activities of medical students on campus are indoors from morning to evening, so it is suspected that there is a risk of Vitamin D deficiency. The purpose of this study was to identify the risk of Vitamin D deficiency based on the characteristics of Vitamin D from food intake and sun exposure in Faculty of Medicine students, at Sriwijaya University. **Methods.** This research was a descriptive study using a questionnaire and observation. Age, sex, BMI and use of related drugs were recorded. The food survey method used was the repeated food recall which was then analyzed using Nutrisurvey 2007. Subjects filled out a questionnaire to obtain data on exposure scores and sun protection scores. The research subjects were students of the Faculty of Medicine, Sriwijaya University who were willing to sign informed consent and were present at the time of sampling. **Results.** The results from the data of 259 subjects showed that 98.8% of the subjects did not meet their vitamin D intake needs, with an average consumption of 123 ± 142 IU. Types of food that contribute the most Vitamin D are catfish (40%) and eggs (20%). None of the subjects took supplements containing Vitamin D. Sun exposure was sufficient for most subjects (62.9%), but most subjects were at risk of deficiency due to the use of sun protection (62.2%) **Conclusion.** There is a risk of deficiency in most medical students due to a lack of Vitamin D intake and the use of sun protection.

1. Introduction

Indonesia is one of the Southeast Asian countries which abundant in sunlight. However, studies reveal that Vitamin D insufficiency affects 40–50% of Southeast Asian children, including Indonesia. Overall, the prevalence range of Vitamin D deficiency in Southeast Asia varies from 6–70%.^{1,2}

In addition to sunlight exposure, skin pigmentation, lifestyle, sun protection behaviors such as sunscreen use, and nutritional intake (especially Vitamin D) can influence an individual's Vitamin D status. Vitamin D synthesis occurs when an individual is exposed to sufficient sunlight. Adequate sunlight exposure is considered to be received for at least 25 minutes, a minimum of 3 times per week on the face, hands, and arms. However, many individuals have limited exposure to sunlight due to working or spending time indoors.²⁻⁴

Fulfillment of Vitamin D requirements through diet depends on dietary patterns, supplement use, and the availability of food sources containing Vitamin D. Previous studies indicate the failure of vitamin D intake in the dietary patterns of adults. Recommended supplement intake for women is 25% of the daily requirement, while for men, it is 12% of the daily intake. Food sources rich in Vitamin D include fish, fish oil, fortified cereals, eggs, and margarine.⁵⁻⁷

Vitamin D deficiency is commonly found among the elderly due to the aging process leading to decreased Vitamin D production in the skin. However, there are several studies indicating a higher prevalence of Vitamin D insufficiency among young adults aged 20–29 years, with a prevalence of 65% in males and 79.9% in females. This is because the current younger generation tends to work in urban

settings where work is predominantly indoors, including approximately 70% of students who spend more time within classroom settings.²⁻⁴

Women have a 2.9 times higher risk of experiencing Vitamin D deficiency than men. Because women tend to use protection, such as sunscreen when exposed to sunlight. In terms of dietary intake, women are more likely to have lower Vitamin D intake. Individuals with obesity tend to have 57% lower levels of Vitamin D compared to those without obesity.^{6,8,9}

There is currently no data regarding the adequacy of Vitamin D consumption from food sources among the students at the Faculty of Medicine, Universitas Sriwijaya. The risk of deficiency is increasing as the daily activities of students on campus are predominantly conducted indoors, resulting in minimal exposure to sunlight. This study aims to identify the risk of Vitamin D deficiency due to dietary intake and lack of sunlight exposure.

2. Methods

This research was a descriptive study conducted at the Faculty of Medicine, Sriwijaya University. The study was conducted from September to December 2017. The population studied was students of the Faculty of Medicine, Sriwijaya University who were selected based on a simple random sampling technique. The minimum sample size in this study is 254 samples.

The research data was taken through questionnaires and observation. Subject characteristics include age, sex, and body mass index. Subjects were then interviewed about Vitamin D food intake (using the 2x24-hour food recall form and was analyzed using the 2007 Nutrisurvey program), sun exposure scores, and sun protection scores. Vitamin

D intake is considered sufficient if ≥ 600 IU.¹⁰

The sun exposure score was calculated from the length of exposure (minutes per day) multiplied by the number of days exposed to sunlight in one week. If the score is ≥ 210 then sun exposure is sufficient and if the score is < 210 then sun exposure is insufficient.¹¹ The protection score against sun exposure was obtained by giving a value of 1 for each protection used (sunscreen, headscarves, hats, long-sleeved shirts, trousers, long skirts, and umbrellas). Items must be used at least 75% when exposed to sunlight. If the value is ≥ 3 then there is a risk of experiencing vitamin D deficiency.¹¹

The data were then analyzed univariately using the SPSS 22.0 for Windows program. The data were presented in the form of mean, frequency (percentage) and compared using cross-tabulation.

3. Results

Total number of subjects included in the study was 259 individuals. Most of the research subjects fell within the age range of 16 to 22 years, with the highest number at 18 years old (28.2%). The mean age of the research subjects was 19 ± 1.31 years. There were more female subjects (73%) compared to male subjects. The majority of subjects had a normal BMI, accounting for 179 individuals (69.1%). Those classified as obese were recorded as 34 individuals (13.1%). Further details are presented in Table 1.

The characteristics of sunlight exposure are presented in Table 2. Based on the sunlight exposure scores, the majority of subjects received sufficient sunlight exposure, comprising 163 individuals (62.9%). However, there were 161 individuals (62.2%) at risk of Vitamin D deficiency due to protection measures.

Table 1. Distribution of Demographic Characteristics of Study Subjects (N=259)

Characteristics	n	%
Age		
16 y.o	1	0,4
17 y.o	25	9,7
18 y.o	73	28,2
19 y.o	54	20,8
20 y.o	56	21,6
21 y.o	48	18,5
22 y.o	2	0,8
Gender		
Male	70	27
Female	189	73
IMT		
Severe Underweight	16	6,2
Underweight	17	6,6
Normal	179	69,1
Overweight	13	5,0
Obese	34	13,1

Table 2. Distribution of Sun Exposure and Protection Score Categories (N=259)

Score	n	%
Sun Exposure		
Low (<210)	96	37,1
Adequate (≥210)	163	62,9
Sun Protection		
No Risk (<3)	98	37,8
Risk (≥3)	161	62,2

Table 3. Distribution of Types of Protection Used by Study Subjects Based on Gender (N=259)

Protection Type	Gender	
	Male n(%)	Female n(%)
Sunscreen	9 (12,9)	92 (48,7)
Hijab	0 (0)	123 (65,1)
Hats	10 (14,3)	4 (2,1)
Long-sleeved shirts	43 (61,4)	168 (88,9)
Gloves	5 (5,7)	13 (6,9)
Long pants	64 (91,4)	142 (75,1)
Long skirts	0 (0)	92 (48,7)
Umbrellas	0 (0)	9 (4,8)

Table 4. Distribution of Vitamin D Dietary Intake Adequacy Based on Gender (N=259)

Gender	Vitamin D dietary intake		
	Low n(%)	Adequate n(%)	Total n(%)
Male	69 (98,6)	1 (1,4)	70 (100)
Female	187 (98,9)	2 (1,1)	189 (100)
Total	256 (98,8)	3 (1,2)	259 (100)

Subjects were also assessed based on the type of protection, categorized by gender (Table 3). Protection used included sunscreen, hijab, hats, long-sleeved shirts, gloves, long pants, long skirts, and umbrellas. Male subjects only used protection such as sunscreen, hats, long-sleeved shirts, gloves, and long pants, while female subjects utilized all types of protection. Among male subjects, the highest use was of long pants (91.4%), whereas among female subjects, the highest use was of long-sleeved shirts (88.9%).

The average intake of foods and beverages containing Vitamin D per day is 123±142 IU, only fulfilling 20.5% of the recommended dietary Vitamin D intake. The range of Vitamin D consumption from food is 0-800 IU per day in the study.

Table 4 presents the distribution of study subjects based on the adequacy of Vitamin D intake from food. Almost all individuals in this study have insufficient Vitamin D intake from food (98,8%). Only 3 individuals met their requirements with a daily Vitamin D intake exceeding >600 IU.

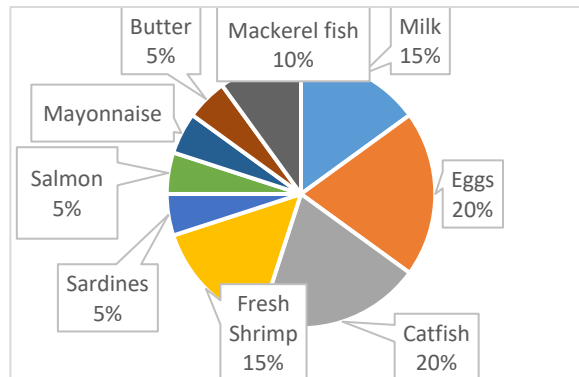
**Figure 1. Vitamin D-Containing Foods Consumed by Respondents**

Figure 1 illustrates several types of food containing Vitamin D commonly consumed by the study subjects. Catfish (20%) and chicken eggs (20%) are the most frequently consumed foods among the subjects. Other types of food often consumed by subjects meeting the requirements for Vitamin D intake include milk, fresh shrimp, pickled mackerel fish, butter, mayonnaise, salmon, and sardines fish.

4. Discussion

The study results indicate an age range of subjects between 16 to 22 years old, with a higher proportion of female subjects compared to male subjects. This age range and gender distribution align closely with the age demographics and gender ratios found in medical students in other locations.^{11,12}

The medical students in this study predominantly fell within the normal BMI range, with obesity ranking second. Research conducted on medical students at the University of Udayana found that 65.4% had a normal BMI, while at the University of Riau's Medical Faculty, there was a higher proportion of students classified as overweight or obese (45.7%). This research highlighted these was attributed to the sedentary nature of student activities, primarily spent indoors in classrooms. Individuals with obesity have a decrease in 25-hydroxyvitamin D concentration leading to Vitamin D deficiency.¹³⁻¹⁵

Most subjects reported adequate exposure to sunlight. Commuting to and from campus breaks between classes, all these offer opportunities to get sunlight exposure. Previous research comparing the duration of sunlight exposure between outdoor and indoor workers found significantly higher levels among outdoor workers.¹⁶

Despite having more students in the group with sufficient sunlight exposure, there were more students found to be at risk of Vitamin D deficiency due to sun protection practices. Regarding protective measures, male subjects predominantly used long pants (91.4%) and long-sleeved shirts (61.4%), while female subjects mostly used long-sleeved shirts (88.9%), long pants (75.1%), and hijab (65.1%). Overall, female subjects used more protective measures compared to male subjects, aligning with a study in Iran where females used protective measures more frequently than males.¹⁷

In this study, nearly all students (98.8%) did not meet the dietary requirements for Vitamin D intake. A study on Vitamin D intake among adults in Korea found that 74.6–95.9% of men and 84.5–96.3% of women did not meet the dietary requirements for Vitamin D intake.⁶

The recommended dietary allowance for Vitamin D intake is 600 IU. In this study, the average consumption of Vitamin D-containing foods was only 123 IU/day. This indicates that only 20.5% of the daily Vitamin D requirement is met by food intake. Findings for children aged 2–12 years in Indonesia, Malaysia, Thailand, and Vietnam showed an average

daily Vitamin D intake of 148 IU/day. Additionally, research on adult intake in Korea found an average intake of Vitamin D for men at 2.56 µg/day or 102 IU/day and women at 0.10 µg/day or 4 IU/day.^{6,10,17}

Commonly consumed food and beverages containing Vitamin D among subjects that can meet the Vitamin D requirements are fish products (40%) such as catfish, mackerel, sardines, and salmon. Another frequently consumed product is chicken eggs (20%). According to research on children aged 2–12 years in Indonesia, Malaysia, Thailand, and Vietnam, the types of food that commonly contribute to Vitamin D intake are from the fish group, shellfish, shrimp, and their processed products, accounting for 75.05%.¹⁷

From this data, the insufficiency in Vitamin D intake appears to stem from the inadequate portions and limited variety consumption of Vitamin D-rich foods. Various Vitamin D-containing foods such as other fish products, especially fatty fish, shrimp, and milk are rarely consumed by the subjects. Vitamin D is also abundant in fortified foods, yet there's limited consumption of fortified foods among the subjects. None of the subjects reported consuming Vitamin D-containing supplements. This study did not include serum Vitamin D level examinations, hence making it difficult to decide any insufficiency or deficiency.

5. Conclusion

Most students from the Faculty of Medicine, Sriwijaya University, are at risk of experiencing Vitamin D deficiency due to inadequate intake and the use of sun protection. Further research is needed to establish a correlation between these conditions and the status of Vitamin D levels in the body.

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