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# CORRELATION STUDY OF ACNE VULGARIS AND SERUM VITAMIN D LEVELS IN ADOLESCENTS

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**ABSTRACT**

**Objective:** Approximately 9.4% of the world population is affected by acne during adolescence. Several previous studies have shown a significant relationship between acne vulgaris (AV) and serum vitamin D levels. The purpose of this study was to determine the correlation between AV and serum vitamin D levels in adolescents.

**Methods:** This cross-sectional study included 60 healthy students with AV aged 15-18 y from three high schools in Depok, which were selected via simple random selection, and the selection of participants was based on consecutive sampling selection after screening with the inclusion criteria. Serum vitamin D levels were evaluated using a direct Chemiluminescence immunoassay (CLIA) method. The lesions of AV were counted by a dermatologist. Dietary vitamin D and fat intake were assessed using a semiquantitative Food Frequency Questionnaire and 24-hour dietary recall. The data were processed using SPSS Statistics 20.0 and analyzed using Pearson or Spearman correlation tests.

**Results:** The mean serum vitamin D level was 17.29±6.77 ng/ml. The mean number of non-inflammatory lesions was 20.5±12.08, and the median number of inflammatory lesions was 6 (range 0-28). The correlation between the number of non-inflammatory lesion and serum vitamin D levels was r = 0.25 (p = 0.052) and the correlation between the number of inflammatory lesions and serum vitamin D levels was r = 0.047 (p = 0.72).

**Conclusion:** Serum vitamin D levels are not significantly correlated with AV despite whether the lesions are inflammatory or non-inflammatory.

**Keywords:** Adolescent, Acne vulgaris, Serum vitamin D levels


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## INTRODUCTION

Acne vulgaris (AV) is a chronic inflammation of the pilosebaceous unit; the cause is multifactorial with symptoms of blackheads, papules, cysts, and pustules [1]. Ghodsi *et al.* stated that the prevalence of AV in adolescents who are exposed to AV is 85% and currently exceeds that of three major skin diseases in the community at large [2]. AV occurs most often in early adolescence when sebum production begins. Vitamin D is a nutrient that is closely related to the skin because the skin is where vitamin D is synthesized through sun exposure. Vitamin D has important roles in the skin, such as differentiation and proliferation of sebocytes and keratinocytes, antimicrobial effects, natural immune and skin adaptive functions, regulation of the sebaceous glands, protection against light, and participation in wound healing [3].

Using a cut-off of<20 ng/ml, the prevalence of hypovitaminosis D ranges between 6% and 70% in Southeast Asia [4]. Vitamin D deficiency often occurs in South Asia and Southeast Asia. The results of a study in Malaysia demonstrated more than half (580%) of adolescents had a serum vitamin D level (calcitriol)<20 ng/ml [5].

Vitamin D also has antimicrobial effects on the skin. Calcitriol (1,25(OH)2D3) and its receptors also regulate long-chain glucosylceramide processes that play a role in the formation of important skin barriers to protect the skin [6]. The metabolism of vitamin D is important for the regulation of growth and other cellular functions in the sebaceous glands [7].

Research conducted by Lim SK [6] and Yildizgoren [8] demonstrated a significant relationship between vitamin D and AV. However, research conducted by toosi [9] and Al Taiar [7] revealed no relationship between vitamin D and AV in adolescents. Therefore, we will attempt to resolve this inconsistency in this study.

## MATERIALS AND METHODS

This study was a cross-sectional study to determine the correlation between the number of acne lesions (both non-inflammatory lesions and inflammatory lesions) and serum vitamin D levels among high school students who had acne. The number of participants was calculated based on a correlation formula [6]. Data collection began at the end of July 2018 and concluded at the end of September 2018 and was conducted in three high schools in Depok that were selected via simple random selection. The selection of participants was based on consecutive sampling after screening for the inclusion criteria, which were adolescents aged 15-18 y who had acne and were willing to sign a research consent form. Blinding was not performed because of problems obtaining participant approval for blood testing and problems with parental consent for the participants.

Students who met the exclusion criteria, which included being treated for facial acne by a doctor, using oral or topical anti-acne drugs, sunblock, taking vitamin D or calcium supplements, taking drugs that can change the vitamin D levels, taking drugs that inhibit fat absorption, and having a history of kidney, liver, or thyroid disorders, were not included in the study.

The data were collected from examining anthropometric measurements, including body weight and height, to assess the nutrition status by calculating body mass index (BMI), and interviewing participants about their intake of food that consists of fat and vitamin D using: two 24-hour dietary recalls and the food frequency questionnaire (FFQ). Serum vitamin D (25(OH)D) concentrations were evaluated using the direct competitive chemiluminescence immunoassay (CLIA) method, and the severity of AV was examined by a count of AV lesions by a dermatologist.

The examination of vitamin D levels in this study used the direct CLIA method with the LIAISON® 25 OH Vitamin D TOTAL reagents. Calcidiol is another form of vitamin D that has a long half-life of approximately 10 d to 3 w. This study used a cut-off serum vitamin D levels for two categories of vitamin D status: sufficiency and insufficiency-deficiency. These categories were based on the limits issued by the American Academy of Pediatrics (AAP) [10], which separate three categories: deficiency<15 ng/ml, insufficiency 15-20 ng/ml, and sufficiency 20-100 ng/ml.

Categorical data were analyzed descriptively and presented in the form of a frequency distribution, n (%), while continuous data were tested for normality using the Kolmogorov–Smirnov test. Non-inflammatory lesions, which had a normal distribution (p>0.05), are

presented as mean±standard deviation, and their correlation with serum vitamin D levels was analyzed with the Pearson correlation test. Inflammatory lesions, which did not have a normal distribution ($p<0.05$), are presented as median (range) and their correlation with serum vitamin D levels was analyzed with the Spearman correlation test. P values<0.05 were considered statistically significant.

**RESULTS**

The median age of participants in this study was 16 y old (15-18), 45% were female and 55% were male. The median BMI of participants was 19.67 (14.22-36.98) kg/m$^2$, and 60% of the participants had a normal BMI (table 1). The median fat intake was 42.10 (8.75-100.58) g/d, which only fulfilled approximately 59.6% of the recommended dietary allowance (RDA), and 80% had low fat intake. Most participants (91.7%) had low vitamin D intake, and the mean intake was 5.47 µg/day, which only met approximately 36.52% of the RDA. The mean serum vitamin D level was 17.29±6.77 ng/ml; 65% of the participants had vitamin D insufficiency-deficiency, and 35% had vitamin D sufficiency (table 1).

The mean number of non-inflammatory lesions of the participants was 20.5±12.08, and the median of inflammatory lesions was 6 (0-28). The correlation between non-inflammatory lesions and serum vitamin D levels was r = 0.25 (p = 0.052) and the correlation between inflammatory lesions and serum vitamin D levels was r = 0.047 (p = 0.72) neither non-inflammatory nor inflammatory lesions were significantly correlated with serum vitamin D levels (table 2).

**Table 1: Distribution of the basic characteristics, fat intake, vitamin D intake, mean serum vitamin D level, and status of vitamin D of participants**

| Variable | Value |
|---|---|
| Age (year) | 16 (15–18)** |
| Gender, n (%) | |
| Male | 33 (55) |
| Female | 27 (45) |
| Body Mass Index (kg/m$^2$) | 19.67 (14.22–36.98)** |
| Male | 19.34 (15.4–26.98)** |
| Female | 22.76±6.1* |
| Nutritional status, n (%) | |
| Underweight | 8 (13.3) |
| Normal | 36 (60) |
| Overweight | 9 (15) |
| Obese | 7 (11.7) |
| Fat Intake (g/day) | 42.10 (8.75–100.58)** |
| Fat Intake (% RDA) | 59.6±26.30* |
| Fat Intake Adequacy Based on RDA, n (%) | |
| Low (<80% RDA) | 48 (80) |
| Adequate (80-120% RDA) | 11 (18.3) |
| Excessive (>120% RDA) | 1 (1.7) |
| Vitamin D Intake (µg/day) | 5.47±3.96* |
| Vitamin D Intake (% RDA) | 36.52±26.43* |
| Vitamin D Intake Adequacy Based on RDA, n (%) | |
| Low (<80% RDA) | 55 (91.7) |
| Adequate (80-120% RDA) | 5 (8.3) |
| Serum Vitamin D Level (ng/ml) | 17.29±6.77* |
| Sufficiency, n (%) | 21 (35) |
| Insufficiency-deficiency, n (%) | 39 (65) |

*mean±standard deviation, **median (range)

**Table 2: The correlation between acne lesions and serum vitamin D levels**

| Variable | Acne lesions | |
|---|---|---|
| | Non-inflammatory | Inflammatory |
| | r p | r p |
| Serum Vitamin D Level (µg/ml) | 0.25$^p$ 0.052 | 0.047$^s$ 0.72 |

$^p$Pearson test, $^s$Spearman test.

**DISCUSSION**

The age of participants in this study is in accordance with a study by Ghodsi *et al.* [2] that examined 1002 high school students in Tehran, Iran, with an average age of 16±0.9 y. Similarly, in a study by Bagatin *et al.* [11] in 452 adolescents, 83% of female participants were 16 y old, and 95% of male participants were 16 y old. Yahya [12] researched 418 Nigerian adolescent junior high school students, and their average age was 16 y. The results of their study, which are almost the same as those in our study, were also obtained in a study conducted by Jain *et al.* [13], with 46.4% female participants and 53.6% male participants.

BMI results similar to those in our study. Similar results were obtained in a study by Neupane *et al.* [14] that investigated the relationship between acne and BMI in participants aged 15-26 y old and demonstrated a mean BMI of 20.82±5.9 kg/m$^2$ among the participants. A proportion of 65% of these participants had a normal BMI, and there was no relationship between BMI and acne or the severity of acne.

In our study, according to the RDA, 18.3% of participants had adequate fat intake; 80% had a low fat intake, and 1.7% had excessive fat intake. Manik [15] discovered that most of the participants in their study had fat intake of less than 81.2%, and the average percentage of fat intake on the participant's RDA was 56.92%. Adequate vitamin D intake based on the RDA in this study was 36.52%. Most of the participants (91.7%) had vitamin D insufficiency-deficiency, and 8.3% had vitamin D sufficiency. According to the food intake interview, most participants had rarely consumed food that contained vitamin D in the prior month. Some participants were allergic to fish or eggs; others stated that they do not like fish.

In our study, 39 participants (65%) had vitamin D insufficiency-deficiency (serum 25(OH)D<20 ng/ml), and 21 participants (35%) had vitamin D sufficiency (serum 25(OH)D>20ng/ml). Similar to Stagi *et al.* [16], who examined serum vitamin D levels in Italian adolescents (with limits of severe deficiency ≤ 10 ng/ml, deficiency 11-20 ng/ml, insufficiency 21-30 ng/ml, and sufficiency>30 ng/ml), observed 58.7% of the participants had vitamin D deficiency; 30% had vitamin D insufficiency, and 11.3% had vitamin D sufficiency. The mean serum vitamin D level in their study was 19.08±8.44 ng/ml. In our study, 45% of the participants were female. All of them wore clothes that covered everything except their hands and faces, which could cause a lack of sun exposure and, thus, a lower serum vitamin D level.

The correlation test results between inflammatory lesions and non-inflammatory lesions (as part of the determination of the degree of acne) showed that neither was significantly correlated with serum vitamin D levels. In the calculation of acne lesions, there were more non-inflammatory lesions than inflammatory lesions. Lim *et al.* [6] found a significant negative correlation in the number of inflammatory lesions and serum vitamin D concentrations (r =-0.512 and p<0.002). Toossi *et al.* [9] examined 39 acne patients and 40 controls and concluded that there was no correlation between serum vitamin D levels and the degree of acne (r=-0.12 and p=0.45). Al Taiar *et al.* [7] explored the association of serum vitamin D levels and acne in countries with abundant sunlight. By a cross-sectional method, they examined 714 adolescents who were selected from their schools using simple random selection, and AV was detected in 479 adolescents (67.1%). The results showed no relationship between vitamin D levels and acne assessed clinically both before and after multivariate testing with potential confounding factors.

Lang [17] discovered a relationship between serum vitamin D levels and acne in participants with inflammatory acne lesions. Lim *et al.* [6] reported a relationship between serum vitamin D levels and the degree of acne in participants with inflammatory acne lesions, and there was no significant relationship in patients with non-inflammatory acne lesions.

The lack of a correlation between serum vitamin D levels and acne, according to Al Taiar *et al.* [7], can be attributed to most of the adolescent participants (65%) having vitamin D insufficiency-deficiency (i.e.<20 ng/ml according to the AAP [10]). This circumstance could cause the statistical analysis to be ineffective in the evaluation of a correlation of serum vitamin D levels with acne. The examination of serum vitamin D levels was only performed at one point in time, which cannot reflect the long term status of vitamin D. This method might weaken the relationship of serum vitamin D levels and acne [7].

## CONCLUSION

Vitamin D, as a nutrient that theoretically has anti-inflammatory, anti-microbial, and anti-proliferative effects on acne, is apparently not suitable for the participants of this study. There may be other factors that influence AV more strongly than vitamin D status.

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Nil

## AUTHORS CONTRIBUTIONS

All authors have contributed equally.

## CONFLICT OF INTERESTS

All authors have none to declare.

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