Jurnal Biosains Pascasarjana Vol. 25 (2023) pp

THE EFFECT OF CHOLECALCIFEROL (VITAMIN D3) LEVELS ON VARIOUS TIMES AND DURATIONS OF EXPOSURE TO ULTRAVIOLET LIGHT (SUN EXSPOSURES)

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Abstrak

Berjemur dibawah matahari memicu produksi vitamin D yang berfungsi untuk meningkatkan sistem kekebalan tubuh. Vitamin D sangat bermanfaat untuk kesehatan tubuh, paparan sinar matahari dalam waktu yang cukup tubuh akan mendapatkan vitamin D yang adekuat. Tujuan penelitian ini yaitu untuk menjelaskan tingkat kadar vitamin D3 yang sering ditemukan terjadi akibat paparan sinar ultraviolet matahari (Sun Exsposures). Metode penelitia ini merupakan penelitian eksperimental dengan rancangan penelitian Rangcangan Acak Lengkap (RAL). Desain penelitian digunakan adalah randomized post test only control group design. Data dianalisis dengan menggunakan uji kruskal wallis dengan hasil uji statistik diperoleh kadar Cholecalciferol (Vitamin D3) dengan nilai p = 0,675 (> 0.05) berarti tidak ada perbedaan pada setiap kelompok perlakuan.

Kata Kunci *Berjemur, Sinar Ultraviolet, Cholecalciferol (Vitamin D3)*

Abstract

Sunbathing triggers the vitamin D production, which functions to increase the immune system. Vitamin D is very beneficial for the health of the body, exposure to sunlight in sufficient time the body will get adequate vitamin D. The purpose of this study is to explain the level of vitamin D3 levels that are often found to occur due to exposure to ultraviolet rays of the sun (Sun Exposures). This research method is an experimental study with a completely randomized design (CRD). The research design used was a randomized post test only control group design. Data were analyzed using the Kruskal Wallis test with statistical test results obtained levels of Cholecalciferol (Vitamin D3) with p value = 0.675 (> 0.05) meaning there was no difference in each treatment group.

Keywords: Sunbathing, Ultraviolet Rays, Cholecalciferol (Vitamin D3)

1. INTRODUCTION

The COVID-19 pandemic, whose causal agent is SARS-CoV-2, has represented the primary global issue influencing lifestyle behaviors of people worldwide.(Scapaticci *et al*., 2022). Therefore, health precautions that can reduce infection, development and are indispensable. One of these lifestyle changes is activity in the sun**.** Sunlight triggers vitamin D production, which functions to increase the immune system. (Asyary & Veruswati, 2020).

In addition to increasing the production of Vitamin D, sunlight may protect against COVID-19 through the biological effects of radiation. UV light, which is present in sunlight, can be divided into three types based on their wavelengths, including Ultraviolet A (320-400 nm), ultraviolet B (280-320 nm), and ultraviolet C (200-280 nm) (Hussain *et al*., 2021).

UVB has several benefits during the COVID-19 pandemic, including playing a role in synthesizing vitamin D in the skin (stratum basal and stratum spinosum) through thermal reactions and inactivation of SARS CoV-2. The result of the metabolism and regulation of vitamin D from exposure to UVB rays in its active form is 25-OH vitamin D3 that acts as an immunomodulator with natural and adaptive immune system mechanisms, reduces the risk of infection and the rate of viral replication, and

diminishes proinflammatory cytokines (Fatimah & Ichsan, 2022).

Vitamin D deficiency is mostly found in elderly, obese,mand patients with long bed rest in hospital.3 Sunbathing can help the body to produce vitamin D, which in turn can optimize the body's immunity against viral infections.1-3 Ultra violet light obtained from sunlight, mespecially UVB, can help the formation of vitamin D in human skin (Nagara & Gonius, 2021).

Factors causing vitamin D deficiency are lack of exposure to sunlight (UVB) and low intake of vitamin D. Insufficient exposure to sunlight is caused by lack of outdoor activity or working indoors for a long time, a lifestyle that tends to avoid sunlight, the use of clothing materials that are difficult to absorb sunlight or the habit of wearing long clothes, the use of body protection such as hats, umbrellas, sunscreen/sunblock. In addition, the low intake of foods that contain lots of vitamin D such as fatty fish, milk and fortified foods, there is a tendency to reduce high-fat foods which ultimately lead to vitamin D deficiency. Deficiency of this vitamin can be overcome by increasing the synthesis of vitamin D through exposure to sunlight (UVB) (Rimahardika *et al*, 2017).

The intensity of UVB sunlight is low at 07.00 am, increasing in the following hours until 11.00, after 11.00 this intensity is relatively stable and high until 14.00 and then decreases, and at 16.00 it reaches the same intensity as at 07.00 (Holick, 2003).

Vitamin D has several mechanisms that can reduce the risk of viral and microbial infections. Basically the mechanism consists of 3 categories, namely physical barrier, natural cellular immunity, and adaptive/acquired immunity. Vitamin D enhances natural cellular immunity by inducing antimicrobial peptides, which include human cathelicidin, LL-37, by 1,25-dihdroxyvitamin D and defensins. Cathelicidin acts by directly inhibiting the activity of microbes including gram-positive, gram-negative bacteria, enveloped or uncoated viruses, and fungi (Mexitalia *et al*., 2020).

Vitamin D plays a role in increasing the efficiency of calcium absorption and optimizing bone mineral density (Suharyanisa *et al*., 2022). Vitamin D has long been recognized as a crucial element to the skeletal system in the human body. Recent evidence has indicated that vitamin D also plays an essential role in the immune response against viral infections and suggested that vitamin D deficiency increases susceptibility to viral infections as well as the risk of recurrent infections. (Siddiqui *et al*., 2020).

The classical actions of vitamin D are to promote calcium homeostasis and to promote bone health. Vitamin D enhances absorption of calcium in the small intestine and stimulates osteoclast differentiation and calcium reabsorption of bone. Vitamin D additionally promotes mineralization of the collagen matrix in bone. In humans, vitamin D is obtained from the diet or it is synthesized it in the skin. As vitamin D is cutaneously produced after exposure to UV B light, its synthesis is influenced by latitude, season, use of sunblock and skin pigmentation. Melanin absorbs UVB radiation inhibiting the synthesis of vitamin D from 7-dihydrocholesterol. This initial vitamin D compound is inactive and it is next hydroxylated in the liver to form 25 OH vitamin D3 (25 D) (Aranow & Md, 2011).

Along with the development of the era, not a few people who reduce sun exposure due to environmental changes and fear of skin cancer. The use of sunscreen, closed clothing, and working indoors will cause a decrease in the synthesis of vitamin D in the body. This widespread problem of vitamin D deficiency or deficiency is an urgent health problem that needs to be corrected immediately (Samefors *et al*., 2020). Vitamin D produced in the skin can last at least twice as long in the blood as vitamin D consumed (Mexitalia *et al*., 2020).

Based on this description, the researcher is interested in conducting research on the Effect of Cholecalciferol

(Vitamin D3) Levels on Various Times and Durations of Exposure to Ultraviolet Light (Sun Exsposures).

2. RESEARCH METHOD

This research is an experimental study with a completely randomized design (CRD). The research design used was a randomized post test only control group design. This study consisted of three groups selected randomly. The first group was not given any treatment, while the second group was exposed to ultraviolet light between 09.00 WIB and 10.00 WIB for 20 minutes and the third group was exposed to ultraviolet light from the sun between 10.00 to 11.00 WIB for 20 minutes.

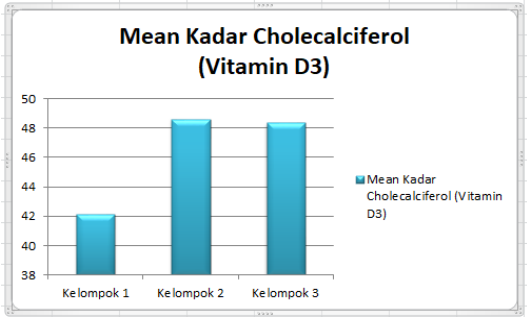
3. RESULTS

The data analysis test used to determine the effect of cholecalciferol (vitamin D3) levels on various times and durations of exposure to ultraviolet light (sun exsposures) was Kruskal Wallis. The selection of nonparametric test is because the normality test is not normally distributed.

Tabel 1. Mean and standard deviation (SD) of cholecalciferol (vitamin D3) levels

Group	Mean±SD
Group 1	42,1292±11,42169
Group 2	48,5925±23,52045
Group 3	48,3575±17,00813

Based on table 1, it was shown that the mean in group 1 was 42,1292 pg/mL, the mean the average in group 2 was 48,5925 pg/mL. the mean in group 3 was 48,3575 pg/mL. hese differences can be observed in the graph below:



Tabel 2. Analysis of different test mean levels of Cholecalciferol (Vitamin D3)

Variabels	Group	p Value
Cholecalciferol (Vitamin D3) levels	Group 1 Group 2 Group 3	0,675

Based on table 2, the results of the analysis of the difference in the average levels of Cholecalciferol (Vitamin D3) with p value = 0.675 (> 0.05) means that there is no difference in each treatment group.

4. DISCUSSION

Based on the results of statistical tests, the p value of 0,675 (> 0.05) means that there is no difference in each treatment group. A similar study was also conducted by Setiati, 2008 which shows the highest intensity of sun exposure is between 11.00 to 13.00, in which it is expected that the synthesis of 25(OH)D will proceed well. Exposure before and after this time span requires a longer time. A similar study was also conducted by Joewono, 2021 concluded that there was a difference in the optimum time and duration of sunbathing to meet the needs of vitamin D. A similar study was also conducted by Yosephin *et al.*, 2014 providing 30 minutes of sun exposure from 09.00 to 09.30, 3 times a week for 12 weeks can improve vitamin D status and blood pressure.

In this study, levels of Cholecalciferol (Vitamin D3) in group 2 and group 3 there was an increase in Cholecalciferol (Vitamin D3) levels compared with group 1. The increase was the best sunbathing time to increase vitamin D in the prevention of Coronavirus Disease 2019 (Covid-19) is between 09.00-10.00, a maximum of 15 minutes or until the skin starts to turn red 2-3 times per week. It is recommended to continue to use a hat and sunscreen to protect the head and neck area (Joewono, 2021).

Vitamin D can be called "sunshine vitamin".Highvitamin D serum levelare essential for normalskeletal mineralization and growth. Vitamin D is obtainedfrom dietary sources and photochemical transformationof 7-dehydrocholesterol (provitamin D3) to precholecalciferol (previtamin D3) in the skin,which is converted to either vitamin D3 (cholecalciferol) or inert photoproducts (Utomo *et al*, 2020).

Vitamin D is very beneficial for the health of the body, exposure to sunlight in sufficient time the body will get adequate vitamin D. Adequate levels of vitamin D in the body also play a role in the prevention of various diseases, ranging from degenerative diseases to malignancies. Vitamin D, which was previously known to play a role in improving bone health and calcium homeostasis, turns out to have potential as an immunomodulator for therapy in cases of infection (Fiannisa, 2019).

Vitamin D is unique because it can be made in the skin from exposure to sunlight. Vitamin D exists in two forms. Vitamin D2 is obtained from the UV irradiation of the yeast sterol ergosterol and is found naturally in sun-exposed mushrooms. UVB light from the sun strikes the skin, and humans synthesize vitamin D3, so it is the most "natural" form. Human beings do not make vitamin D2, and most oil-rich fish such as salmon, mackerel, and herring contain vitamin D3 (Nair & Maseeh, 2012).

Vitamin D produced in the skin may last at least twice as long in the blood compared with ingested vitamin D. When an adult wearing a bathing suit is exposed to one minimal erythemal dose of UV radiation (a slight pinkness to the skin 24 h after exposure), the amount of vitamin D produced is equivalent to ingesting between 10,000 and 25,000 IU. A variety of factors reduce the skin's production of vitamin D3, including increased skin pigmentation, aging, and the topical application of a sunscreen. An alteration in the zenith angle of the sun caused by a change in latitude, season of the year, or time of day dramatically influences the skin's production of vitamin D3 (Nair & Maseeh, 2012).

Various factors that affect vitamin D, including inadequate sun exposure (often indoors, wearing long clothes that cover all body surfaces, use of sunscreen, air pollution, living at high latitudes, winter), color type skin, malabsorption syndrome, obesity, impaired renal function, impaired liver function, exclusive breastfeeding, pregnancy, old age, low vitamin D intake (lactose intolerance, low socioeconomic status), drugs for epilepsy, glucocorticoids, rifampin, and antiretrovirals (Rahmawati *et al*. 2019).

Vitamin D is especially useful in terms of helping with calcification by regulating the availability of calcium and phosphorus in the blood to be deposited in the process of hardening of the bones. This is done by calcitriol increasing the active absorption of vitamin D in the gastrointestinal tract by stimulating the synthesis of calcium binding protein and phosphorus binding protein in the small intestine mucosa. Calcitriol together with parathyroid hormone stimulates the release of calcium from the bone surface into the blood. Calcitriol stimulates the reabsorption of calcium and phosphorus in the kidneys *(Mexitalia et al*., 2020).

Radiation of the body in the ultraviolet rays of the morning sun as a reliable and inexpensive source of vitamin D, the area of the arms / hands, feet and face is approximately until the skin turns red, not only meets the need for vitamin D as much as 200 IU / day or the equivalent of 2 glasses of milk. enriched with vitamin D, but also ensures its reserves in the body (Masulili *et al*., 2017).

5. CONCLUSIONS AND SUGGESTIONS

There was no difference in Cholecalciferol (Vitamin D3) levels in sunbathing activities between 09.00 - 10.00 WIB and 10.00 - 11.00 WIB for 20 minutes. Further research is needed to see differences

in vitamin D3 levels in the length of time in the sun.

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