

## THE RELATIONSHIP BETWEEN VITAMIN D LEVELS AND URIC ACID LEVELS IN THE ELDERLY AT SANTA ANNA NURSING HOME

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### ABSTRACT

As a person ages, the physiological function of the body decreases so that the risk of vitamin D deficiency and gout. The increasing elderly population can create a new era, namely *the aging population*. This study aims to see the relationship between vitamin D levels and uric acid levels in the elderly at Santa Anna Nursing Home. This study is an analytical observational study with a cross-sectional design with 70 elderly respondents living in Santa Anna Nursing Home, Jakarta. The correlation test is performed using the Pearson Correlation Test. There is a significant negative relationship between vitamin D levels and uric acid levels. In 23 elderly obtained average vitamin D levels of  $36.9 + 8.4$  ng / mL while high uric acid as many as 23 elderly (46%) with an average of  $6.24 \pm 1.9$  mg / mL. From bivariate analysis, vitamin D levels were significantly associated with uric acid levels ( $r: -0.295$ ,  $p: 0.037$ ). There was a significant relationship between vitamin D levels and uric acid levels in the elderly at Santa Anna Nursing Home with a value of  $p = 0.041$  ( $p < 0.05$ )

**Keywords:** Elderly, vitamin d, 25(oh)d, gout

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### INTRODUCTION

In 2021, Indonesia entered the era of population aging (Aruan, Lestari, & Pamungkasari, 2023). Aging in the elderly causes the physiological function of the body to decrease, raises degenerative problems, and increases health problems such as vitamin D deficiency and gout. According to Firdayanti, et al. in Indonesia, gout increases with a person's age and is a joint disease that ranks second after osteoarthritis (NURSAH, 2020). Magfira and Adnani's research, there is a distribution of the prevalence of gout reviewed based on age characteristics, namely 45% suffer from gout at the age of 55-64 years, 51.9% at the age of 65-74 years, and at the age equivalent or greater than 75 years found there are 54.8% (Magfira & Adnani, 2021). Vitamin D deficiency in the world is estimated at 1 billion which can cause adverse effects on health (Nimitphong, Saetung, Chailurkit, Chanprasertyothin, & Ongphiphadhanakul, 2021).

Vitamin D deficiency and gout can be treated non-pharmacologically, pharmacologically or surgically but this is still less effective and causes side effects. Then it is important to prevent vitamin D deficiency and gout in the body by looking at the influencing factors. Research by Nimitphong, et al. and Zhang, et al. explained that one of the factors increasing uric acid levels in the body is the occurrence of vitamin D deficiency (Zhang, Qiu, & Tian, 2020) (Shahi, Gupta, & Singh, 2023).

Based on the description above, the elderly are a vulnerable group suffering from vitamin D deficiency and gout and Indonesia is entering the phenomenon of *aging population*, so this study was conducted by linking vitamin D levels with uric acid levels in the elderly at the Santa Anna Nursing Home.

## **METHOD**

This study used a cross-sectional study design. This study used primary data taken through measuring vitamin D levels and uric acid levels in the elderly at Santa Anna Nursing Home in total sampling. The inclusion criteria of this study were respondents aged less than or equal to 60 years who lived in Santa Anna Nursing Home and were willing to take part in the examination by signing or thumbprint for informed consent. The exclusion criteria in this study were respondents who took diuretic drugs and pyrazinamide and had medical conditions such as heart and kidney disorders.

Vitamin levels were measured using an ELISA (Enzyme-linked Immunosorbent Assay) kit and uric acid measurements with a 1900i UV spectrophotometer.

Data analysis was performed using SPSS 22. The picture of each variable will be analyzed by a univariate analysis test. Furthermore, bivariate analysis will be carried out using the Spearman or Pearson correlation test to see the relationship between vitamin D levels and uric acid levels. If the probability value in the relationship between the two variables  $\leq 0.05$ , then there is a relationship between the two variables.

## **RESULTS AND DISCUSSION**

Based on the results of the study, as many as 50 elderly people have consented to informed consent and meet the inclusion criteria and are not categorized in the exclusion criteria. Blood was drawn by professionals to 69 elderly people while 1 other person did not agree to have their blood drawn for fear of needles. Other examinations and data collection are still carried out on 1 elderly person who does not want to have their blood drawn (Badar, 2017). Then after cleaning the data, there were 5 people under 60 years old so they did not meet the inclusion criteria and there were 14 elderly people who did not meet the exclusion criteria. These 14 people consisted of people suffering from heart problems and kidney disorders and illegible and excessively high vitamin D results. In the ELISA Kit troubleshooting guide, it is explained that vitamin D results using illegible ELISA Kit can be caused by horseradish peroxidase (HRP) contamination, lack of serum (antibodies) used, fetal calf serum (FCS) in the buffer rearranging antibodies, and antibodies not bound to the plate. In the results of high vitamin D levels can be caused by a lot of cytokines in the sample so it is necessary to dilute the sample (Anggraeni, 2022). Vitamin D levels are categorized as hypervitaminosis D if vitamin D levels in serum are  $\geq 150$  ng/mL. In this study there were 2 elderly with vitamin D levels of  $>150$  ng / mL but the 2 elderly concerned were still healthy and did not show symptoms of hypervitaminosis so that the 2 elderly were not included in this study.<sup>7</sup> The total who could not be included in the study was 20 elderly people. The characteristics of respondents can be seen in the following table.

**Table 1. Distribution of Age, Vitamin D and Uric Acid Respondents at Santa Anna Nursing Home**

Variable	Mean	SD	Min.	Max
Age (Year)	77,2	8,4	60	96
Vitamin D	36,9	28,4	4	128
Gout	6,2	2	3	12

Based on the results of the study, the youngest elderly was 60 years old and the oldest elderly was 96 years old, so the average age of the elderly in Santa Anna nursing home was 77.2 with a standard deviation of 8.4. The average vitamin D level in the elderly was 36.9 ng/mL with the lowest level 4 and the highest level 128 values and a standard deviation of 28.4. Uric acid levels in the elderly were obtained on average 6.2 with a standard deviation of 2 and the lowest level of 3 mg / dl and the highest level of 12 mg / dl.

**Table 2. Characteristics of the Elderly at Santa Anna Nursing Home, Vitamin D Levels and Uric Acid Levels**

Variable	Frequency (n)	%
Age	Mean 77,18 year	
Gender		
	Man	17 34%
	Woman	33 66%
Vitamin D		
	Sufficiency	23 46%
	Insufficiency / Deficiency	27 54%
Gout		
	Normal	27 54%
	Tall	23 46%

Santa Anna Nursing Home is a social institution that accepts the elderly with a minimum age of 60 years. Characteristically, the residents of the institution have various ethnic backgrounds, religions, and varying levels of economic ability (Sizar, Khare, Goyal, & Givler, 2018).

In this study, the number of respondents was 70 elderly who participated in the study, but those who had consented to informed consent and had been filtered by inclusion criteria and exclusion criteria were as many as 50 elderly people. Respondents at Santa Anna nursing home were mostly women as many as 33 elderly (66%) and men as many as 17 people (34%) with an average age of elderly 77.2.

The results showed that 23 elderly (46%) classified as sufficiency and 27 elderly (54%) classified as insufficiency or deficiency. In the research of Sizar O, et al. Explains that there is a global vitamin D deficiency. In the US, there are 50% -60% of the elderly who live in nursing homes and hospitals experiencing vitamin D deficiency. Vitamin D deficiency can be caused by high skin melanin and also extensive skin coverage exposed to sunlight (Ndede, Oroh, & Bidjuni, 2019). The results of vitamin D deficiency according to the exposure of Sizar O, et al. Compared to the results of vitamin D levels in the elderly living in Santa Anna Nursing Home had the same results.

Vitamin D deficiency is influenced by impaired absorption and decreased intake of vitamin D, disruption of endogenous synthesis that causes interference with 1-alpha 25-hydroxylation and reduced sun exposure to the skin directly can be caused by frequent indoor or personal protective equipment so that it is not exposed to sunlight. This vitamin deficiency can occur in tropical countries such as Indonesia. This happens because the lifestyle of Indonesians who avoid sunlight more by using personal protective equipment when in places where there is sunlight. They prefer to use umbrellas, clothes that cover the whole body, and sunblock that can reduce sunlight absorption so that vitamin D is reduced in the body (Y Han, Han, Zhang, & Zeng, 2022).

Based on observations and interviews with the elderly, 48% of the elderly are in the room without doing activities outside the room for several reasons, namely bedrest, need a wheelchair / walker and some are more comfortable doing activities in the room every day. There are 52% of the elderly who do outdoor activities such as walking, sunbathing and sports every day. In addition to sun exposure, vitamin D can be obtained through food as well as vitamin D supplements.

According to information from the caretaker of the orphanage that the diet intake for the elderly every day is the same, which is cooked and provided at the orphanage and there are also food donations from donors. The elderly can also still get food from outside other than

from orphanages or donors, for example, the elderly who have money are allowed to buy their own food or get it from family or friends of their acquaintances.

Food intake obtained by the elderly other than from orphanages or donors can affect vitamin D levels in each elderly (FARIDA, 2016). According to information from the staff of the orphanage, it was explained that the elderly were given vitamin D supplements which were donations given by donors.

Based on the results of checking uric acid levels using a UV-1900i spectrophotometer, 23 elderly people (46%) had high uric acid levels. The results of measuring uric acid levels are in accordance with Magfira and Adnani research data conducted on 34 elderly people at the Cinta Lansia Banguntapan Bantul posyandu with an analytical survey research design, there were 22 elderly (64.7%) experiencing hyperuricemia (Magfira & Adnani, 2021).

In the research of Vechya Z.L.P. Ndede, et al. Conducted at the Ranotana Weru health center with an experimental research design with a population of 106 people and respondents who met the inclusion criteria and were not included in the exclusion criteria, there were 16 people with 9 women (56.3%) and 7 men (43.8%) suffering from gout with an age range of 36-60 years (Yingdong Han, Zhang, & Zeng, 2022). The data generated from the study conducted by Vechya Z.L.P. Ndede, et al. are not the same as the results of uric acid levels at Santa Anna Nursing Home. This can be influenced by age. In Vechya Z.L.P. Ndede's study, et al. used respondents in the age range of 36-60 years while the respondents used in the study at the Santa Anna Nursing Home were elderly with the age of  $\geq 60$  years. Uric acid levels will increase according to a person's age<sup>2</sup> so when we see the results of uric acid levels at Santa Anna Nursing Home are higher (23 elderly) compared to Vechya Z.L.P. Ndede's research (16 people).

Based on health examination data per September 2021-March 2022 which is carried out every week for hypertension checks and every month for uric acid, glucose and cholesterol tests at the Santa Anna Nursing Home, it was found that 70% of the elderly have high uric acid levels. The number of gout patients obtained from the primary data of the institution did not match the results of the uric acid examination conducted using a UV 1900i spectrophotometer at the time of the study (BATUBARA, 2022). This difference in results is because the elderly residents of Santa Anna Nursing Home are always not settled (died or left the orphanage), then replaced by other new elderly.

**Table 1. Correlation Test The relationship between vitamin D and uric acid levels in the elderly at Santa Anna nursing home, Jakarta**

	Gout	
	r	p
Vitamin D	-0,3	0,04

The normality test with Kolmogorov-Smirnov showed normally distributed data ( $p > 0.05$ ) on the relationship of vitamin D levels with uric acid, so the data were presented in the form of "mean" and "standard deviation" so that for further analysis a Pearson correlation test was carried out. After bivariate analysis based on the Pearson test, it was found that the value of "Sig.(2-tailed)" was 0.037. The value of "Sig.(2-tailed)" is less than 0.05, which means that there is a significant relationship between vitamin D levels and uric acid levels. The correlation coefficient number of -0.295 indicates that the level of correlation strength or the relationship between the two variables is strong enough and the correlation is negative.

This study showed a significant correlation between the relationship between vitamin D levels and uric acid levels in the elderly ( $r = -0.295$ ). This negative correlation means that there is an inverse relationship between vitamin D levels and uric acid levels. The higher the level

of vitamin D in the body of each elderly, the lower the uric acid levels. This can happen because high vitamin D levels will cause a decrease in PTH concentrations (Aji & Fitriani, 2022). PTH functions to reduce the regulation of ABCG2 expression as an exporter of uric acid in the intestine and kidneys, as well as the excretion of uric acid so that its levels in the body can decrease. PTH and uric acid are positively correlated, meaning that if the concentration of PTH increases, uric acid levels in the body will increase as well. Vice versa, if the concentration of PTH decreases, it will cause uric acid in the body to decrease.

According to an analysis of the 2007–2014 National Health and Nutrition Examination Survey of U.S. adults, a negative correlation between vitamin D (serum 25(OH)D) was inversely correlated with hyperuricemia in U.S. adults in general, whose respondents were 18,596 (9096 men, 9500 women). The correlation of vitamin D with uric acid is nonlinear ( $P$  non-linearity = 0.0031) (Ramadhan, n.d.).

Research conducted by Yingdong Han, et al. found a negative causal relationship between vitamin D and uric acid. The occurrence of vitamin D deficiency causes an increase in PTH concentration so that uric acid concentration increases because both are positively correlated. The relationship described in the study is nonlinear ( $P$  non-linearity = 0.0031). This nonlinear relationship suggests that the decrease in high uric acid levels in the blood does not occur constantly with the increase in vitamin D levels due to a state in which the effect becomes more significant or less significant (Ardiana, 2023).

## CONCLUSION

The conclusion in this study is that the elderly in Santa Anna Nursing Home are classified as insufficiency and deficiency as many as 27 elderly (54%). Elderly at Santa Anna Nursing Home with high uric acid levels as many as 23 elderly (46%). This study showed that there was a significant relationship between vitamin D levels and uric acid levels in the elderly at Santa Anna Nursing Home with a value of  $p = 0.041$  ( $p < 0.05$ ). The results showed a negative relationship between vitamin D levels and uric acid levels in the elderly at Santa Anna Nursing Home.

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