

RESEARCH ARTICLE

**PROFILE OF VITAMIN D LEVELS AMONG ELDERLY
WOMEN WITH KNEE OSTEOARTHRITIS
IN SOUTH TANGERANG**

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ABSTRACT

Background: The number of older people over 60 in Indonesia has doubled in the last five decades (1971-2020). Knee osteoarthritis is one of the non-communicable diseases arising in the elderly population. One of the risk factors known is low levels of vitamin D. This study aims to describe the profile of vitamin D serum levels, especially in elderly women with knee osteoarthritis in South Tangerang City, in 2020.

Method: This study used a cross-sectional design from the medical records of female patients aged over 60 years who

had been diagnosed with knee osteoarthritis with a total sample of 110. The sample was selected using consecutive sampling and analyzed using univariate analysis.

Results: This study found that 80% of the elderly with knee osteoarthritis have low level vitamin D serum, with 63% had insufficient level, and 17% were deficient.

Conclusion: Most of the elderly women with knee osteoarthritis in South Tangerang in 2020 had a low level of vitamin D serum <50 nmol/L.

Keywords: Vitamin D, elderly women, knee osteoarthritis, South Tangerang

INTRODUCTION

Globally, based on the World Population Ageing 2019, there were 703 million people over the age of 65, which increased from 6% in 1990 to 9% in 2019.¹ By 2020, the number of older people over 60 in Indonesia has reached 10%, which has doubled in the last five decades (1971-2020).² Of the 26 million elderly population in Indonesia, there were more older women (10.43%) than men (9.42%). This higher proportion of the female elderly population was consistently recorded in Banten Province (6.75% vs 6.60%) and South Tangerang City (8.6% vs 8.4%).²

The increased number of elderly needs to be a concern because most degenerative diseases result from a decreased physiological state of the body system. Degenerative diseases are chronic, can have large treatment costs, and if not cured, they will cause an inability or disability to carry out daily activities. Data from *Badan Pusat Statistik*

Indonesia stated that almost half of the elderly (48.14%) experienced physical and psychological health complaints during November-December 2020. Non-communicable diseases arise along with a decrease in the physiological state of the elderly, one of which is osteoarthritis.²

Osteoarthritis is a chronic disease due to inflammation accompanied by progressive loss of articular cartilage, which can be caused by several risk factors such as age, obesity, muscle weakness, excessive physical activity, previous trauma, and hereditary factors suffering osteoarthritis.⁴ In the elderly, vitamin D deficiency is one of the risk factors that can cause patients to experience knee osteoarthritis (KOA).⁵ A cross-sectional study on 130 older people in Florida stated that there was an association between osteoarthritis patients with low vitamin D levels in the elderly, where vitamin D deficiency affected the occurrence of osteoarthritis.⁶

Based on several previous studies, vitamin D production decreases with age due to a decrease in metabolic

and physiological functions of organs that play a role in vitamin D biosyntheses, such as the small intestine and kidneys.⁷ In addition, a low vitamin D serum profile can also be influenced by food intake and sun exposure.^{7,8}

The state of vitamin D deficiency can disrupt the process of mineralization and cartilage maturation due to a vitamin D receptor (VDR), which is also located in the joint and can increase the production of pro-inflammatory cytokines and central sensitivity.^{9,10} A previous study in South Tangerang City in 2017 (n=44 elderly women and 16 elderly men) showed that 66% of the respondents had low vitamin D serum levels (<50 nmol/L), of which 50% were in the category of insufficiency and 16.7% were in the deficiency category.¹¹ Based on the previous study, this study aims to describe the profile of vitamin D serum levels, especially in older women with KOA in South Tangerang City, in 2020.

METHODS

This study design was cross-sectional, which used secondary data at the Public Health Care Clinic (*Klinik Pelayanan Kesehatan Masyarakat/KPKM*) Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, in Reni Jaya, Pamulang, South Tangerang City, Banten Province during July 2020-December 2020. The source population in this study were female patients aged

over 60 years until 80 years who had been diagnosed with knee osteoarthritis. Sample size determination in this study was based on the formula of estimating one population proportion by Lemeshow (1990) with α 5%, $P=50\%$, precision $d=0.1$, and tolerance of missing data was 10%. Therefore, the minimum sample size of this study was 106 respondents, who were selected by consecutive sampling technique.

Data on serum vitamin D concentrations in this study were obtained from medical records. Patients were categorized as sufficient if the serum levels of 25(OH)D was 51-125 nmol/l, insufficiency if 25-50 nmol/l, and deficient if <25 nmol/l.¹² Data analysis in this study was univariate with a frequency distribution based on age and serum vitamin D levels.

ETHICAL APPROVAL

This study was approved by the Ethics Committee of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta.

RESULTS

The total sample in this study was 110 elderly women diagnosed with KOA. The mean age was 66 years, with range of 60-79 years. The profile of vitamin D serum can be seen in the table below (Table 1).

Table 1. Profile of vitamin D levels in elderly women with knee osteoarthritis based on age group

Category	Profile of vitamin D levels			Total n, (%)
	Sufficient n, (%)	Insufficiency n, (%)	Deficient n, (%)	
Age group				
Young elderly (60-69 years)	17 (19)	55 (62)	17 (19)	89 (81)
Middle elderly (70-79 years)	5 (24)	14 (67)	2 (10)	21 (19)
Total	22 (20)	69 (63)	19 (17)	110 (100)

In this study, 80% of elderly women had low vitamin D levels, whereas the majority of young elderly (62%) and middle elderly (67%) were in the insufficiency group. The mean value of vitamin D serum was 39 nmol/L (range 15-82 nmol/L).

DISCUSSION

This study found that 80% of older women with KOA had low serum vitamin D levels, which was higher in the insufficiency group (63%). A previous study in South Tangerang in 2017 with female elderly subjects of 72,6% also found that the majority of the elderly with KOA had insufficient vitamin D serum levels (53,4%).¹³ In addition,

the high proportion of the insufficiency group in this study may provide the basis for the possibility that low levels of vitamin D are associated with KOA because, in a cross-sectional study with a large population of older people, low 25(OH)D levels in older women were associated with KOA (OR 1.22; 95% CI 1.09-1.37).¹⁴

As previously known, sources of vitamin D can come from food intake or vitamin D supplementation. Nevertheless, in the elderly, there will be a decrease in the physiological function of organs, one of which is a decrease in intestinal function. The decrease also impacts the response of vitamin D receptors (VDR) in the epithelium of the small intestine to the hormone 1,25(OH)₂D, which is associated with abnormalities of transport proteins that play a role in

calcium metabolism. In addition, kidney function in the elderly, which has an important role in the biosynthesis of vitamin D, decreases calcium reabsorption in the kidneys.⁸

In Indonesia, the average vitamin D intake of older women is low, ranging from 0,7 µg/day (28 IU/day), which can make serum vitamin D levels insufficient to deficiency.¹⁶ However, a recent study in Pasuruan Regency, Indonesia, in 2021 did not find a positive relationship between intake and vitamin D levels in older women.¹⁷

Another thing that needs to be considered is that older women in menopause will experience a drastic decrease in the estrogen hormone. As already known, estrogen can increase the activity of 1-hydroxylase, which is responsible for the conversion of 25(OH)D to 1,25(OH)₂D in the kidney, with the result that low estrogen levels in postmenopausal women can worsen the state of vitamin D deficiency experienced by the elderly as a result of the ageing process.¹⁸ Several previous studies also stated that women experienced more bone density loss than men because the decrease in estrogen will increase bone resorption rather than bone formation.¹⁹⁻²¹

However, a study stated that in postmenopausal women but not yet included in the elderly group, it was not shown to have an association with a decrease in active metabolites of vitamin D or 1,25(OH)₂D. That was because only the elderly group had a low 1,25(OH)₂D compared to non-elderly groups who had been in menopause and had not ($p=0.01$).²¹

Besides food intake, lack of sun exposure is one factor that can decrease vitamin D substrates because 80-90% of vitamin D levels are known to be the result of skin synthesis from sun exposure.^{16,22} Adequate sun exposure can activate vitamin D metabolism in the body, opening calcium channels in the intestine. This process can stimulate the absorption of calcium and phosphate in the small intestine so that it can support bone mineralization.¹⁶ A study conducted in Italy using a sun exposure score questionnaire found a significant relationship between sun exposure scores and serum 25(OH)D levels ($r=0.59$; $p=0.003$), and that was in line with the results of a study conducted in Indonesia which stated that sun exposure could increase serum 25(OH)D levels.^{16,23}

Thus, all age-related changes will decrease vitamin D metabolism because it limits the supply of substrates for 25(OH)D and 1,25(OH)₂D. However, in this study, the proportion of sufficient vitamin D was higher in the middle elderly with KOA, and the deficiency was higher in the young elderly. In the study with age classification <60 years and >60 years, the results also showed that the subjects under 60 years who had vitamin D deficiency were significantly associated with the incidence of KOA than those 60 years and older.²⁴ The study explained that in the younger age group with KOA, there was a higher bone remodeling activity and highly dependent on adequate levels of vitamin

D. This makes them more sensitive to vitamin D deficiency.²⁴

The mechanism of vitamin D deficiency in the incidence of osteoarthritis is through the loss in the volume of the knee joint cartilage in the medial and lateral tibia. In addition, several studies have shown that vitamin D deficiency was associated with narrowing the distal femoral cartilage.²⁵ However, further prospective studies are still needed to determine the causal relationship between vitamin D deficiency on reduced cartilage volume in the knee joint.

It is hoped that further research can be developed based on the results of this study with a better study design and a large sample size to see the risk of a low vitamin D profile on the incidence of KOA in elderly female patients. However, low vitamin D levels should still be a concern, especially for the elderly, to prevent various health problems such as degenerative diseases. Therefore, the elderly can increase their outdoor activities in the morning to get sufficient sun exposure and consume foods or supplements containing vitamin D to meet the needs of vitamin D in the body and prevent degenerative diseases, one of which is osteoarthritis.

CONCLUSION

Most of the older women had low vitamin D serum, whereas 81% of young elderly (60-69 years) had serum vitamin D levels <50 nmol/L, of which 62% belonged to the insufficiency group and 19% to the deficiency group. On the other hand, in middle-elderly (70-79 years), 77% of patients had a serum vitamin D concentration of <50 nmol/L, which was 67% in the insufficiency group and 10% in the deficient group.

CONFLICTS OF INTEREST

There is no conflicts of interest in this study

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