

RESEARCH ARTICLE

Effect of Physical Activity and Vitamin D Status on Geriatrics Obesity**Rivan Virlando Suryadinata,¹ Amelia Lorensia,² Elisabeth Carolina Tangkilisan²**¹Department of Public Health, Faculty of Medicine, Universitas Surabaya, Surabaya, Indonesia,²Department of Clinical-Community Pharmacy, Faculty of Pharmacy, Universitas Surabaya, Surabaya, Indonesia**Abstract**

Vitamin D levels in the body are decreased in tropical countries. This may be due to a decrease in physical activity, age and obesity to be a risk factor for decreased vitamin D levels. This study aims to determine differences in the level of physical activity in geriatrics obesity and non-obesity to vitamin D. This research method is observational with case-control study design. The study was conducted at Public Health Center Taman, Sidoarjo district, East Java in March–July 2017. Geriatric were grouped into 2 groups of obese and non-obese by using body mass index (BMI) calculations. Respondents were given a questionnaire to assess the level of physical activity and vitamin D status. Furthermore, an assessment of physical activity and vitamin D status were performed on each respondent. The first questionnaire was given to 30 people for the validity test ($r > 0.361$) and reliability test (Cronbach alpha = 0.731). The results showed no significant differences in physical activity levels between the two groups (chi-square, $p = 0.883$). The assessment of vitamin D status can be seen as a significant difference (chi-square, $p = 0.042$). In conclusion, geriatrics with obesity and non-obesity had similar levels of physical activity, but vitamin D status in obesity tended to be lower than non-obese.

Key words: Geriatrics, obesity, physical activity, vitamin D**Pengaruh Aktivitas Fisik dan Status Vitamin D terhadap Obesitas Geriatri****Abstrak**

Kadar vitamin D dalam tubuh semakin menurun di negara yang beriklim tropis. Hal ini dapat disebabkan oleh penurunan aktivitas fisik, usia, dan obesitas menjadi faktor risiko penurunan kadar vitamin D. Penelitian ini bertujuan mengetahui perbedaan tingkat aktivitas fisik pada geriatri obesitas dan nonobesitas terhadap status vitamin D. Metode penelitian ini adalah observasional dengan desain penelitian kasus kontrol. Penelitian dilakukan di Puskesmas Taman, Kabupaten Sidoarjo, Jawa Timur pada bulan Maret–Juli 2017. Responden geriatri dilakukan penimbangan berat badan dan pengukuran tinggi badan untuk dikelompokkan menjadi 2 kelompok, yaitu kelompok obesitas dan nonobesitas dengan menggunakan perhitungan indeks massa tubuh (IMT). Responden diberikan kuesioner untuk menilai tingkat aktivitas fisik dan status vitamin D. Selanjutnya, dilakukan penilaian aktivitas fisik dan status vitamin D pada tiap-tiap responden. Kuesioner telah diberikan kepada 30 orang untuk dilakukan uji validitas ($r > 0,361$) dan uji reliabilitas (Cronbach alfa = 0,731). Hasil penelitian memperlihatkan tidak terdapat perbedaan tingkat aktivitas fisik yang signifikan antara kedua kelompok (chi-kuadrat, $p = 0,883$). Pada penilaian status vitamin D dapat terlihat perbedaan yang signifikan (chi-kuadrat, $p = 0,042$). Simpulan, geriatri dengan obesitas dan nonobesitas memiliki tingkat aktivitas fisik yang sama, sedangkan kadar vitamin D pada obesitas cenderung lebih rendah dibanding dengan nonobesitas.

Kata kunci: Aktivitas fisik, geriatri, obesitas, vitamin D

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Introduction

The decrease of vitamin D levels in society is increasing and is almost spread worldwide regardless of age, gender, origin, location, and food. The increasing rate of declining vitamin D levels not only occurs in developing countries but also in developed countries. Several developed countries in America, Europe, Australia, Africa, the Middle East, and South Asia are also affected. The highest number of vitamin D deficiency is mostly found in China, South America, India and the Middle East with a prevalence that varies from 30% to 100%.¹ The decreasing of vitamin D levels to below 20 µg/mL reaches 90.5% in the Malay ethnics while in the Chinese ethnics, it only reaches 55%.²

Various kinds of risks can be caused by vitamin D deficiency because the body's system does not work optimally, so that it will trigger various diseases. Vitamin D can also be categorized as an antioxidant, so free radicals that enter the body can be neutralized.³ Free radicals and antioxidant imbalances in the body can also increase the incidence of disease.⁴ Many diseases can result from vitamin D deficiency such as cardiovascular disease, diabetes, chronic kidney failure, and asthma.⁵⁻⁷

The cause of the decrease in vitamin D levels in the body is less sun exposure caused by various factors, namely obesity, age, and decreased physical activity.⁸⁻¹⁰ Weight gain may be associated with a decrease in vitamin D levels. It is probably because of the relation of vitamin D gene receptor (VDR) polymorphism which gives a difference in VDR expression so that it can inhibit adiposity differentiation and increase adipose mass. In addition, increased adiposity may lead to increasing levels of parathyroid hormone and changes calcium to adipocytes, which increases lipogenesis.¹¹ Another triggering factor is a decrease in the leptin hormone in obese patients because vitamin D is an important factor in producing leptin. Inhibition of leptin synthesis will result in increased appetite and obesity.⁸

Age factors can trigger a decrease in vitamin D levels. Physically, geriatrics are less mobile and have poor nutritional status. In addition, there are physiological processes that aggravate the decline in vitamin D levels in the body such as a decrease in vitamin D production in the skin after the exposure to sunlight caused by skin atrophy, eating foods that are low in vitamin

D, gastrointestinal absorption disorders, and a decrease in production 1,25(OH)₂D in kidney.⁹

Physical activity is also associated with a decrease in vitamin D levels. This is because the previous risk factors, namely age, and obsession, can directly affect the level of physical activity. Increased physical activity is related to the 25OHD increase caused by muscle movements during exercise. Physical activities carried out in the daily activities allow sufficient amounts of sunlight exposure to produce vitamin D.¹² This study aims to compare vitamin D status and physical activity using questionnaire so that it can predict the risk of vitamin D deficiency in obese geriatrics.

Methods

This research was an observational study with a case-control design. The study was conducted in the geriatric age group at Public Health Center Taman, Sidoarjo, East Java (No.: 070/5099/209.4/2017). The selection process was carried out according to the inclusion criteria in the elderly age group such as disability, kidney failure, consumption of anti-seizure drugs and visual impairments, while the exclusion criteria if the respondent resigns as a study sample.¹³

Geriatric respondents who have been interviewed will be divided into 2 groups: 52 obese people and 60 non-obese people by weighing and height measurement, to be assessed by calculating the body mass index (BMI). Sampling used was non-random sampling with purposive sampling technique with a significance level of 5% and a test strength of 95%. Then the two groups were given a question regarding physical activity and vitamin D status.

The physical activity questionnaire that will be used in this study is the International Physical Activity Questionnaire (IPAQ)¹⁴ and vitamin D status.¹⁵⁻¹⁷ The questionnaire has been tested for validity and reliability test on 30 homogeneous respondents with research respondents. Validity test is done based on the calculated r value (Corrected Item–Total Correlation) > r table. The r table is obtained from the product moment table with a significant level of 5%, if the r value > 0.361 so the question is declared valid. While the reliability test uses the Cronbach alpha correlation. Cronbach alpha value is said to be reliable if the questionnaire reliability test value is equal to or more than 0.6.

Physical activity categories divided into 3 groups, namely light physical activities (cleaning the house, shopping, doing yoga), moderate physical activities or physical activities which can only increase heart work (dancing, gardening, doing light exercise), and heavy physical activities or physical activities that can make breathing faster and increase the work of the heart (running, fast cycling, climbing, doing competitive sport).¹²

Data on physical activity and vitamin D status analyzed by using the chi-square test to see differences in physical activity and vitamin D status in the obese and non-obese geriatric groups.

Results

Characteristics of respondents in both groups were present in Table 1. It was seeing more women respondents than men in groups. 112 respondents were found 19 men (17%) and 93 women (83%), while 47 people aged 45–59 years (42%), 50 people aged 60–66 years (45%), and 15 people aged >70 years (13%).

The results of the value distribution of questionnaires about physical activity in both groups are present in Table 2. Level low of physical activity in the obesity group was 47

respondents (90%) and the non-obese group also shows a low level of physical activity that was equal to 54 respondents (92%).

The distribution results of the vitamin D status category are present in Table 3. Vitamin D status in the obese and non-obese groups was mostly in the deficiency category. The obesity group was 42 respondents (81%), while in the non-obese group there were 38 respondents (63%).

The results of data analysis by chi-square test in both groups on the level of physical activity are in Table 4 and vitamin D status in Table 5. Based on the results of data analysis with chi-square test showed the p value at the level of physical activity (Table 4) was 0.883 (p>0.05), while the value of vitamin D status (Table 5) showed p value=0.042 (p<0.05).

Discussion

Geriatrics is a natural aging process that is sure to happen to everyone. The aging process is accompanied by a decrease in physical activity, organ function and immune system and changes in diet. This results in geriatric susceptibility to disease.

Vitamin D is often called prohormones, which have 2 active forms of vitamin D2 (ergocalciferol)

Table 1 Distribution of Respondents Based on Gender and Age

Characteristics		Groups			
		Obesity (n=52)		Non-obesity (n=60)	
		Frequency	Percentage	Frequency	Percentage
Gender	Man	8	15	11	18
	Woman	44	85	49	82
Age (year)	45–59	21	40	26	43
	60–69	25	48	25	42
	>70	6	12	9	15

Table 2 Distribution of Levels of Physical Activity in Both Groups

Physical Activity	Groups			
	Obesity (n=52)		Non-obesity (n=60)	
	Frequency	Percentage	Frequency	Percentage
Low	47	90	54	92
Medium	4	8	4	5
High	1	2	2	3
Total	52	100	60	100

Table 3 Distribution of Vitamin D Status

Vitamin D Status	Groups			
	Obesity (n=52)		Non-obesity (n=60)	
	Frequency	Percentage	Frequency	Percentage
Deficiency	42	81	38	63
Non-deficiency	10	19	22	37
Total	52	100	60	100

Table 4 Chi-square Test Results of Physical Activity Level

Groups	Physical Activity			Total	Chi-square Test
	Low	Medium	High		
Obesity	47 (90%)	4 (8%)	1 (2%)	52 (100%)	p value=0.883 (p>0.05)
Non-obesity	54 (92%)	4 (5%)	2 (3%)	60 (100%)	
Total	101	8	3	112	

p<0.05=significant

Table 5 Chi-square Test Results of of Vitamin D Status

Groups	Vitamin D Status		Total	Chi-square Test
	Deficiency	Non-deficiency		
Obesity	42 (81%)	10 (19%)	52 (100%)	p value=0.042 (p<0.05)
Non-obesity	38 (63%)	22 (37%)	60 (100%)	
Total	80	32	112	

p<0.05=significant

and vitamin D₃ (cholecalciferol). Ergocalciferol comes from vegetable sources, while cholecalciferol is derived from animal sources, which is formed by ultraviolet B radiation at 7-dehydrocholesterol. Furthermore, vitamin D is converted into an active hormone so it can be used in mineral metabolism and physiological functions of the body. Vitamin D₂ and vitamin D₃ have the same potential.⁷

Vitamin D in humans serves to maintain serum calcium concentration and increase phosphorus absorption, but does not regulate phosphorus concentration in the blood but depends on renal excretion. Vitamin D in the form of 1,25(OH)₂D also works with parathyroid and calcitonin hormones to maintain calcium concentration in plasma within the normal range. This is done by adjusting the efficiency of the small intestine to absorb calcium from the diet, mobilizing calcium from the bones and tubular reabsorption of

calcium in the kidneys. Parathyroid hormones and 1,25(OH)₂D together stimulate osteoblasts to induce pre-osteoclast maturation into osteoclasts, thereby increasing bone resorption.^{7,18}

The physical activity is a body movement that results in greater energy expenditure than at rest. The physical activity carried out in the outside environment, with sun exposure, will provide an increase in vitamin D in the body.¹⁹

Vitamin D is one of the important vitamins in geriatrics because it has the ability to increase endurance. The main source of vitamin D is easy to obtain, which is through exposure to sunlight. However, several factors can inhibit the formation of vitamin D such as less physical activity and obesity.^{20,21}

The results show no difference between the level of physical activity in geriatric obesity and non-obesity. However, there were similarities between the two groups, most of which have a

low level of activity. Whereas in vitamin D status, there was a significant difference between the geriatric obesity group and the non-obesity, although most of the vitamin D status in both groups is in deficiency status.

Conclusion

Geriatrics with obesity and non-obesity had similar levels of physical activity, but vitamin D status in obesity tended to be lower than non-obese.

Conflict of Interest

The authors declare no conflict of interest.

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