RESEARCH ARTICLE

THE RELATIONSHIP OF VITAMIN D 25(OH)D LEVELS WITH THE INCIDENCE OF HYPERTENSION ON THE ELDERLY AT PUBLIC HEALTH CLINIC

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ABSTRACT

Introduction: Hypertension is a chronic disease which its presence is often not known until occurrence of other diseases. Several studies had previously investigated the relationship between vitamin D concentration and hypertension. However, no concluding result is obtained. This paper aimed to determine the relationship between vitamin D 25(OH)D concentration and hypertension on elderly at a public health clinic located at Reni Jaya, South Tangerang.

Methods: This was cross-sectional study conducted in a public health clinic between January 2017 to January 2018. One hundred and fifty subjects were recruited by consecutive sampling after informed consent were obtained. Anamnesis, physical examination, and anthropometric measurement were performed by general practitioners. The following day serum vitamin D 25(OH)D examination were collected and examined at certified laboratory. The data were then analyzed using Chi-Square test.

Results : As many as 80 (53.4%) subjects had insufficient vitamin D 25(OH)D concentration (25-50 nmol/L). Stage I and II hypertension were found in 51 (34.0%) and 34 (22.7%) subjects, respectively. Age was significantly associated with hypertension (p=0.048). No significant association was observed between vitamin D 25 (OH)D and hypertension p=0.347.

Conclusions: There was no significant association between serum vitamin D 25(OH)D and hypertension.

Keywords : Vitamin D concentration, serum level, hypertension, elderly, public health clinic.

INTRODUCTION

Cardiovascular-related diseases have been one of the most common causes of death in the world. One risk factors contributing to cardiovascular-related death is hypertension. It is a chronic disease which rarely causes symptoms therefore its presence is often not known until occurrence of other diseases. In 2004, hypertension is responsible for 7.5 million death around the world.[1] In Indonesia, 34.1% of the population has hypertension. In the elderly, the prevalence is even higher at 45.9%.[2]

Vitamin D has an important role in calcium absorption and bone strength maintenance. Several studies had previously investigated the relationship between vitamin D concentration and various cardiovascular diseases, such as heart failure, insulin resistance, coronary calcification, and hypertension.[3-5] Observational studies conducted by Bhandari et al showed that low levels (<16 nmol/L) of vitamin D 25(OH)D are associated with an increased incidence of hypertension.[6] Its result supported previous study by Scragg et al on United States population through The Third US National Health and Nutrition Examination Survey (NHANES III).[7] The association was explained by an increase in angiotensin II levels in patients with low vitamin D level. It was accompanied by blunting renal blood flow response to the infusion of angiotensin II, which indicated the activation of the renin-angiotensin-aldosterone system.[8] Study by Li et al research in mice showed that unoccupied vitamin D receptors increase plasma angiotensin II and renin gene expression.[9] In addition, vitamin D has anti-inflammatory property by modulating toll-like receptor (TLR) signalling. As a result, gene expression and production of inflammatory mediators such as TNF-a, IL-6, and monocyte chemoattractant protein-1 (MCP-1) increase which are apparently associated with hypertension.[10]

However, the results were contradicted by other studies. Research by Veloudi et al showed that supplementation of vitamin D alphacalcidol in the elderly showed no significant effect.[11] Similar results were also observed by the Bressendorf et al in which supplementation of vitamin D cholecalciferol 3000 IU / day did not affect blood pressure.[12] Therefore, this study aims to investigate the relationship between vitamin D and hypertension, especially in Indonesian elderly people.

METHODS

Study design

This was a cross-sectional study conducted since January 2017 to January 2018 at the Reni Jaya Public Health Clinic, Syarif Hidayatullah Jakarya State Islamic University.

Participants

Estimated sample requirement calculation was done using the Lameshow two population hypothesis formula. A minimum of 131 subjects were required for this study. One hundred and fifty subjects who came to the outpatient clinic were included through consecutive sampling. Anamnesis, physical examination, and anthropometric measurements were performed by registered general practitioners. Blood pressure was measured using aneroid manometer once after subjects arrived at the location and took a rest for half hour. Blood test procedures were performed on the next day by certified personnel and laboratory. Subjects were advised to fast for 12 hours before blood examination, and wake up no later than 4 hours before examination. Blood was drawn as many as 10 mL and placed in a blood tube. The blood sample was then sent to laboratory for blood vitamin D 25(OH)D levels examination.

Variables

Age, gender, hypertension, serum vitamin D 25(OH)D levels, body mass index (BMI), and hypertension statuslk, were gathered. Hypertension status was determined using the Joint National Committee (JNC) VII criteria; normal (SBP <120 and DBP <80), pre-hypertension (SBP 120-139 and DBP 80-89), Stage 1 hypertension (SBP 140-159 and DBP 90-99), Stage 2 hypertension (SBP 160 or DBP 100). Vitamin D 25(OH)D level was examined using chemiluminescent assay. Subjects were grouped into deficiency, insufficiency, and sufficiency if their serum vitamin D 25(OH)D levels were <25 nmol/L, 25-50 nmol/L, and >50-125 nmol/L, respectively.

Inclusion and exclusion criteria

To be eligible for becoming participant, subjects should age 60-79 years with a body mass index 30 kg/m^2. Subjects with vitamin D 25(OH)D level of <12.5 or >125 nmol/L or had consumed vitamin D supplement in the last 30 days were excluded from this study.

Statistical analysis

Collected data were analysed using 22nd edition of Statistical Package for the Social Science (SPSS) for Windows. The characteristics of the research subjects were shown in table 1 below. The relationship between blood levels of vitamin D and hypertension were analysed using Chi-Square test.

RESULT

A total of 150 subjects were involved in this study. Characteristics of research subjects can be seen in table 1 below,

Table 1. Demographic Characteristics of the Subject

Variable	Total Respondent n = 150 (%)
Age	
Young elderly (60-69)	111 (74.0)
Late Elderly (70-79)	39 (26.0)
Gender	
Man	40 (26.67)
Woman	110 (73.33)
Body Mass Index (kg/m^2)	
Underweight (<18.50)	6 (4.0)
Normal (18.50 – 25.00)	73 (48.7)
Overweight (>25.00)	71 (47.3)
25(OH)D Serum level	
Sufficient (>50 – 125 nmol/l)	51 (34.0)
Insufficient (25 – 50 nmol/l)	80 (53.4)
Deficient (<25 nmol/l)	19 (12.7)
Hypertension Status	
Stage II hypertension	34 (22.7)
Stage I hypertension	51 (34.0)
Prehypertension	18 (12.0)
Normal	47 (31.3)

Analysis of factors associated with hypertension can be seen in table 2 below. BMI with three categories cannot be analyzed using Chi-square so it was transformed into two categories, a combination of underweight to normal and excess BMI.

Table 2. Relationship of Various Independent Variables to Hypertension Status

Independent Variables	*p* value
Age	0.048
Gender	0.848
Body Mass Index*	0.064
25(OH)D Serum level	0.347

*grouped into two categories: underweight+normal; overweight

Table 3. Odd Ratio of Vitamin D 25(OH)D Concentration and Hypertension Status

Vit D Concentration	Hypertension Status							
	Hypertension Stage II		Hypertension Stage I		Pre-hypertension		Normotension	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Deficient	5 (26.3)	0.6 (0.15 – 2.31)	3 (15.8)	0.2 (0.05 – 0.38)	2 (10.5)	0.3 (0.05 – 1.13)	9 (42.4)	
Insufficient	17 (21.3)	0.7 (0.27 – 1.99)	31 (38.8)	0.9 (0.38 – 2.31)	7 (8.8)	0.4 (0.12 – 1.33)	25 (31.3)	Reference
Sufficient	12 (23.5)	Reference	17 (33.3)	Reference	9 (17.6)	Reference	13 (25.5)	
Total	34		51		18		47	

DISCUSSION

Subjects gender majority in this study was women. This is consistent with data from the Ministry of Health of the Republic of Indonesia which states that the number of elderly women in Indonesia is higher than men, with a slightly different proportion, namely 52.42% compared to 47.57%, respectively. In addition, the greater number of elderly women is also due to the higher life expectancy of women than men.[13]

In term of age, there were more young elderly than late elderly. This is consistent with the data from Statistics Indonesia which states that the number of young elderly is more than late elderly with percentage 63.39% to 27.92% in 2018.[13] Moreover, the high number of young elderly is also in accordance with Indonesian life expectancy which is around 73.33 years and 69.44 years for women and men, respectively.[14]

Hypertension had significant relationship with age. This has been proven long ago in various studies, including Framingham Heart study.[17,18] As people age, changes in arterial and arteriolar stiffness result from structural and calcified changes. In addition, decreased baroreceptor sensitivity, increased responsiveness to sympathetic nervous system stimuli, and altered renal and sodium contribute to increased blood pressure in the elderly.[19]

This study supported previous study which found no significant relationship between vitamin D 25(OH)D level with hypertension. It is in line with Jeong et al study who found no significant difference between subjects taking vitamin D supplementation for three months and hypertension.[8] Research conducted by Wood AD also concluded that cholecalficerol (vitamin D3) supplementation had no effect on patient's blood pressure lipid profiles, insulin resistance, nor inflammatory biomarkers.[15] It was later explained that its insignificance result probably caused by unremoved potential confounding factors such as sunlight exposure or seasonal changes occurred in that study. Ultimately, meta-analysis by Shu et al showed small significant decrease of diastolic blood pressure 1.65 mmHg but no significant effect of vitamin D supplementation was found on other parameter.[16]

There were several limitations in this research. This study design was analytic cross-sectional which could not observe the temporal and longitudinal effect on relationship between vitamin D and hypertension. In addition, several unmeasured factors such as lifestyle, physical activity, salt intake, or smoking can potentially affect the results. Consecutive sampling methods also have the potential to cause uneven distribution of data. Despite all of the limitations, we hope this public health clinic-setting study could serve as a reference for the next public health research investigating the effect of vitamin D on hypertension in Indonesia with pre and post test or randomized clinical trial design in the future time.

CONCLUSIONS

There was no significant relationship between serum concentrations of vitamin D 25(OH)D with hypertension in the elderly at our public health clinic.

Acknowledgements

The authors would like to appreciate Irfan Kurnia Pratama for his technical support.

Funding

The authors received no financial support for this research, authorship, and publication of this article.

Availability of data and materials

Data and materials can be accessed by contacting the corresponding author.

Conflict of interest

The authors declare no potential conflicts of interests with respect to the research, authorship, and publication of this article.

Ethical Approval

This study was approved by the Institutional Review Board Faculty of Public Health Universitas Indonesia.

Print ISSN: 2716-3628, Online ISSN: 2720-9563

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