Medica Hospitalia
Journal of Clinical Medicine
Med Hosp 2023; vol 10 (2) : 235–238

OPEN ACCESS

Original Article

Relationship of Serum Hemoglobin and Vitamin D Levels with Postural Balance

Dwi Ngestiningsih[1], Maulana Akbar Wicaksono[2], Muhammad Agung Wibowo Wicaksono[2], Probosuseno[3], Yuswo Supatmo[4], Banundari Rachmawati[5]

[1]Geriatric Division of Internal Medicine, Biochemistry, Medical Faculty of Diponegoro University, Semarang, Indonesia
[2]Medical Faculty of Diponegoro University, Semarang, Indonesia
[3]Geriatric Division of Internal Medicine, Sardjito Hospital, Yogyakarta, Indonesia
[4]Physiology Department, Medical Faculty of Diponegoro University, Semarang, Indonesia
[5]Clinical Pathology, Medical Faculty of Diponegoro University, Semarang, Indonesia

p-ISSN: 2301-4369 e-ISSN: 2685-7898
https://doi.org/10.36408/mhjcm.v10i2.948

Accepted: April 14th, 2023
Approved: July 12th, 2023

Author Affiliation:
Geriatric Division of Internal Medicine, Biochemistry,
Medical Faculty of Diponegoro University, Semarang, Indonesia

Author Correspondence:
Dwi Ngestiningsih
Dr. Sutomo Street 16, Semarang,
Central Java 50244, Indonesia

E-mail:
ngestiningsih@fk.undip.ac.id

Abstract

Background : The population of the elderly in Indonesia has increased significantly in recent years. The incidence of falls is influenced by postural balance. Vitamin D and hemoglobin deficiency are associated with decreased muscle function and postural balance. This study is to investigate the relationship between vitamin D and hemoglobin levels with postural balance in the elderly.
Methods : The study used a cross-sectional design with the participation of 33 patients (aged 64.94±5.42 years). The study sample was elderly individuals who fulfilled the inclusion criteria at Semarang Elderly Posyandu. Patients performed postural balance test, with Sharpened romberg and tandem gait test. The examination of vitamin D and hemoglobin was taken from the patient's venous blood. Vitamin D was measured using ELISA.
Results : The results of the independent sample t-test analytic test revealed a P value of vitamin D (0.007) and a P value of hemoglobin of (0.021) ($p<0.05$). There is a meaningful relationship between vitamin D and hemoglobin levels with postural balance in the elderly.
Conclusion : Decreasing Haemoglobine and Vitamin D impair the postural balance.

Keywords : Haemoglobine, Postural balance, vitamin D

INTRODUCTION

In recent years, the number of elderly people in Indonesia has increased significantly. According to the Indonesian Central Bureau of Statistics in 2020, the elderly in Indonesia have touched 9.92% of the entire Indonesian population or around 26.82 million people, an increase of 0.32% (1 million people) from the previous year.[1]

The incidence of falls in the elderly is caused by two things, which are intrinsic factors and extrinsic factors. Intrinsic factors such as vision, hearing, neuromuscular and extrinsic factors such as tripping, slipping, and falling due to loss of balance as well as elements that are not directly related include the help of environmental factors in seeing the surroundings (example: indoor light intensity), and safety equipment.[2]

The incidence of falls in the elderly is due to intrinsic factors, one of which is a disorder of the limb system. Limb system disorders such as muscle wasting and osteoporosis provide complications in the form of postural balance disorders. Physical activity plays a role in maintaining postural balance. In the literature proposed by Habut, M. Y. *et al* that a person who has strenuous physical activity has good postural balance.[3]

Included in any of the geriatric syndromes, postural balance disorder is defined as the inability to integrate sensory input and determine body oscillations in an upright position while simultaneously maintaining balance.[5,6]

Low hemoglobin levels contribute to a variety of adverse health outcomes, including not only decreased muscle strength, but also impaired walking; increased fatigue, anxiety, and depression; and decreased quality of life in the elderly.[7–11] Iron deficiency has a substantial effect on muscle function, oxidative energy metabolism, immunity, and the nervous system.[12,13]

Vitamin D (calcitriol) or 1,25-dihydroxyvitamin D3 (1,25 (OH) 2D3) is a major hormone that regulates the homeostasis of calcium phosphate and bone mineral metabolism. Some literature mentions that vitamin D is implicated in the regulation of the immune system, cardiovascular system, oncogenesis, and cognitive function. Low serum levels of vitamin D are associated with decreased muscle strength and physical function. Previous studies have shown that increased muscle strength and decreased body sway in response to vitamin D can reduce the incidence of falls. Vitamin D levels in the body are measured by knowing the concentration of serum 25(OH) vit D levels. Vitamin D that enters the body and is produced cutaneously is converted to 25 (OH) vit D, but in serum only a fraction of 25 (OH) vitamin D is converted to 1,25 (OH) 2 vitamin D. Thus measuring serum 25 (OH) vitamin D levels is the best test to assess vitamin D stores. The researcher's aim is to determine whether there is an association between vitamin D levels, hemoglobin, and balance disorders in the elderly to establish a basis for future clinical intervention trials.

METHODS

Descriptive analytical studies with case control. A total of 33 respondents aged 60 years or older were at the Posyandu of Kalipancur Village in Semarang City for the period September November 2021. This research has received approval from KEPK No.282/EC/KEPK/FKUNDIP/XII/2020. History of diseases issued by respondents that affect postural balance such as Parkinson's disease, stroke, seizures, epilepsy; the presence of motor neurological deficits such as paresis or orthopedic problems such as amputations and critical osteoarthritis; intake of sedatives; taking vitamin D supplements.

As a postural balance test, a modified Romberg test (SR = Sharpened Romberg) and a tandem gait test were performed. SR requires that the subject stand in a tandem position (heel to toe), first with eyes open and then with eyes closed while the examiner observes body shake or the subject's inability to maintain position. A Tandem gait test was conducted with respondents asked to fold their arms on their chests and walk as fast as possible along 5 m then turn back to their original place. Respondents walked in a pattern of heel-to-toe steps on ribbons or ropes. Results were unbalanced for the tandem gait test when the subject went off the track. For the Romberg test when the subject moves from a standing place. It is said to be unbalanced if the results of both tests of the subject cannot maintain postural balance or one of the two tests cannot maintain postural balance.

Blood samples were taken from the respondents' venous blood. Blood was taken for measurement of hemoglobin and vitamin D. The serum 25 (OH) D level was measured using the ELISA method. Statistical analysis was done by computer using a data analysis program. The normality of the data was verified using Shapiro-wilk, then tested for the descriptive statistics and then analysed using the Independent-t test and the non-significant data was continued with the Mann-Whitney test. The outcome is meaningful if the value of $p<0.05$ is obtained.

RESULTS

Based on Table 1, out of 33 respondents, all respondents were elderly at the Kalipancur Elderly Posyandu, Semarang City, where 8 (24.2%) respondents were male and 25 (75.8%) other respondents were female. Respondents aged 60–74 years were 29 (87.9%) and respondents aged 75–90 years were 4 respondents (12.1%). Respondents who have the results of balanced 27 (81%) and unbalanced 6 (19%) on the balance test results.

TABLE 1
Characteristics of the subject (Age, Hemoglobin, Vitamin D, Balance test results)

Variable	Average (SD)
Age (year)	64.94±5.42
Hemoglobin (gr/dl)	12.71±1.50
25 (OH) D (ng/ml)	21.73±4.89
Sex type	
Man	8
Woman	25
Balance posture	
Balanced	27
Not balanced	6

TABLE 2
Result vitamin D level and hemoglobin

Variable	Balance posture	Non balance posture	P-value
Vitamin D level	16.03±4.89	10.63±0.29	0.007
Hemoglobin	12.71±1.50	11.90±0.58	0.021

From the results obtained from the independent sample t-test analytical test, the P value designated by Sig (2-tailed) is 0.007 ($p < 0.05$) from this it can be said that there is a meaningful relationship between vitamin D levels and postural balance in elderly. From the results of the independent sample t-test analytical test, the P value designated by Sig (2-tailed) is 0.021 ($p < 0.05$), it can be said that there is a significant relationship between hemoglobin levels and postural balance in the elderly.

DISCUSSION

The study was screened first. Among 60 respondents who have been tested with a health questionnaire, there were 33 respondents who met the inclusion criteria from the Kalipancur Elderly Posyandu, Semarang City. Statistical test of relationship between vitamin D levels with postural balance obtained p value = 0.007 ($p < 0.05$) it shows there is a significant relationship between vitamin D levels with postural balance in the elderly. This is in accordance with the research hypothesis that there is a relationship between vitamin D levels and postural balance in the elderly. These results show the suitability of research that has been conducted by Akdeniz *et al* where in the study it was found that respondents with serum 25 (OH) D levels higher than 50.0 nmol / l in women aged 60 years and over experienced significantly better improvements in patients in postural balance, gait, chair stand performance and Short Physical Performance Battery (SPPB).[21–23]

The correlation statistical test between hemoglobin and postural balance obtained a value of $p = 0.021$ ($p < 0.05$), it shows that there is a significant relationship between hemoglobin and postural balance of the elderly. Research published by Zakai, *et al* mentioned that a decrease in blood hemoglobin levels up to 0.4 g/dl can increase the risk of morbidity and mortality of the elderly. A decrease in hemoglobin can represent the development of new diseases, such as cardiovascular disease, kidney disease, or inflammation in the elderly. Inflammation that occurs in the elderly has adverse effects on physical function. According to research conducted by Cesari, one of the symptoms of anemia is fatigue. This causes the most problems and limitations in physical function in the elderly. Another research mentioned that the decreased hemoglobin affects its deliveries to the skeletal muscles, thus disrupting the performance of the muscles. [24,25]

Research published by Nakamura, *et al* mentioned that Vitamin D levels are not longitudinally associated with impaired postural sway in older women. Mean subject age and serum 25(OH)D levels were 73.3 years (SD 3.7) and 61.0 nmol/L (SD 16.9), respectively. No significant association was found between 25 (OH) D

levels and changes in postural sway velocity (adjusted P for trend=0.72). Women with 25 (OH) D <30 nmol/L tended to have lower Δpostural sway velocity than those with 25(OH)D ≥30 nmol/L (mean, -0.59 vs 0.37 cm/s, respectively; adjusted P=0.13).[26]

The limitation of this research is that vitamin D supplementation has not been given so it is not known whether vitamin D supplementation will affect postural balance.

CONCLUSION

In conclusion, the researchers found a significant relationship between the postural balance with the levels of vitamin D and hemoglobin in the elderly. Explanatory mechanisms regarding the relationship between vitamin D and hemoglobin levels of patients with postural balance can be used as future research.

REFERENCES

1. Badan Pusat Statistik. Statistik Penduduk Lanjut Usia 2020. Statistik Penduduk Lanjut Usia di Indonesia 2020. 2020;
2. Sumarsih G, Maisa EA. Faktor-Faktor yang Berhubungan dengan Kejadian Jatuh pada Lansia di Wilayah Kerja Puskesmas Andalas Tahun 2016 [Internet]. 2017.
3. Habut MY, Putu I, Nurmawan S, Ayu I, Wiryanthini D. Hubungan Indeks Massa Tubuh dan Aktivitas Fisik terhadap Keseimbangan Dinamis pada Mahasiswa Fakultas Kedokteran Universitas Udayana. Majalah Ilmiah Fisioterapi Indonesia [Internet]. 2016.
4. Moraes DC, Lenardt MH, Seima MD, Mello BH de, Setoguchi LS, Setlik CM. Postural instability and the condition of physical frailty in the elderly TT – Instabilidade postural e a condição de fragilidade física em idosos. Rev Lat Am Enfermagem [Internet]. 2019 Apr 29;27:e3146–e3146. Available from: https://pubmed.ncbi.nlm.nih.gov/31038639
5. Merchant RA, Banerji S, Singh G, Chew E, Poh CL, Tapawan SC, *et al*. Is Trunk Posture in Walking a Better Marker than Gait Speed in Predicting Decline in Function and Subsequent Frailty? J Am Med Dir Assoc. 2016 Jan;17(1):65–70.
6. Pollock AS, Durward BR, Rowe PJ, Paul JP. What is balance? Clin Rehabil. 2000 Aug;14(4):402–6.
7. Penninx BWJH, Pahor M, Cesari M, Corsi AM, Woodman RC, Bandinelli S, *et al*. Anemia is associated with disability and decreased physical performance and muscle strength in the elderly. J Am Geriatr Soc. 2004 May;52(5):719–24.
8. Aung KCY, Feng L, Yap KB, Sitoh YY, Leong IYO, Ng TP. Serum albumin and hemoglobin are associated with physical function in community-living older persons in Singapore. J Nutr Health Aging. 2011 Dec;15(10):877–82.
9. Thein M, Ershler WB, Artz AS, Tecson J, Robinson BE, Rothstein G, *et al*. Diminished quality of life and physical function in community–dwelling elderly with anemia. Medicine (Baltimore). 2009 Mar;88(2):107–14.
10. Stewart R, Hirani V. Relationship between depressive symptoms, anemia, and iron status in older residents from a national survey population. Psychosom Med. 2012;74(2):208–13.
11. Wu T-Y, Chie W-C, Liu J-P, Liaw C-K, Netuveli G, Blane D. Association of quality of life with laboratory measurements and lifestyle factors in community dwelling older people in Taiwan. Aging Ment Health. 2015;19(6):548–59.
12. Stugiewicz M, Tkaczyszyn M, Kasztura M, Banasiak W, Ponikowski P, Jankowska EA. The influence of iron deficiency on the functioning of skeletal muscles: experimental evidence and clinical implications. Eur J Heart Fail. 2016 Jul;18(7):762–73.
13. Beard JL. Iron biology in immune function, muscle metabolism and neuronal functioning. J Nutr. 2001 Feb;131(2S-2): 568S–579S; discussion 580S.
14. Halfon M, Phan O, Teta D. Vitamin D: a review on its effects on muscle strength, the risk of fall, and frailty. Biomed Res Int. 2015;2015:953241.
15. Ticinesi A, Meschi T, Lauretani F, Felis G, Franchi F, Pedrolli C, *et al*. Nutrition and Inflammation in Older Individuals: Focus on Vitamin D, n-3 Polyunsaturated Fatty Acids and Whey Proteins. Nutrients. 2016 Mar;8(4):186.
16. Nair R, Maseeh A. Vitamin D: The sunshine vitamin. J Pharmacol Pharmacother. 2012;3(2):118–26.
17. Girgis CM, Clifton-Bligh RJ, Hamrick MW, Holick MF, Gunton JE. The Roles of Vitamin D in Skeletal Muscle: Form, Function, and Metabolism. Endocr Rev [Internet]. 2013 Feb 1;34(1):33–83. Available from: https://doi.org/10.1210/er.2012–1012
18. de Souza WN, Norde MM, Oki É, Rogero MM, Marchioni DML, Fisberg RM, *et al*. Association between 25-hydroxyvitamin D and inflammatory biomarker levels in a cross-sectional population-based study, São Paulo, Brazil. Nutr Res. 2016 Jan;36(1):1–8.
19. Wacker M, Holick MF. Vitamin D - effects on skeletal and extraskeletal health and the need for supplementation. Nutrients. 2013 Jan;5(1):111–48.
20. Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. Mayo Clin Proc. 2010 Aug;85(8):752–8.
21. Akdeniz S, Hepguler S, Öztürk C, Atamaz FC. The relation between vitamin D and postural balance according to clinical tests and tetrax posturography. J Phys Ther Sci [Internet]. 2016/04/28. 2016 Apr;28(4):1272–7. Available from: https://pubmed.ncbi.nlm.nih.gov/27190466
22. Veronese N, Bolzetta F, Toffanello ED, Zambon S, De Rui M, Perissinotto E, *et al*. Association Between Short Physical Performance Battery and Falls in Older People: The Progetto Veneto Anziani Study. Rejuvenation Res [Internet]. 2014 Jan 6;17(3):276–84. Available from: https://doi.org/10.1089/rej.2013.1491
23. Trombetti A, Reid KF, Hars M, Herrmann FR, Pasha E, Phillips EM, *et al*. Age-associated declines in muscle mass, strength, power, and physical performance: impact on fear of falling and quality of life. Osteoporos Int [Internet]. 2016;27(2):463–71. Available from: https://doi.org/10.1007/s00198-015-3236-5
24. Zakai NA, French B, Arnold AM, Newman AB, Fried LF, Robbins J, *et al*. Hemoglobin decline, function, and mortality in the elderly: the cardiovascular health study. Am J Hematol. 2013 Jan;88(1):5–9.
25. Cesari M, Penninx BWJH, Lauretani F, Russo CR, Carter C, Bandinelli S, *et al*. Hemoglobin levels and skeletal muscle: results from the InCHIANTI study. J Gerontol A Biol Sci Med Sci. 2004 Mar;59(3):249–54.
26. Nakamura K, Saito T, Takahashi A, Kobayashi R, Oshiki R, Kitamura K, *et al*. Serum 25-hydroxyvitamin D levels are not associated with impaired postural sway in community-dwelling older women: a 6-year follow-up study. J Musculoskelet Neuronal Interact. 2021 Dec;21(4):501–8.