

# Effect of chair-based exercise and vitamin d levels with hand grip strength in elderly woman



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Received: 2022-09-12

Accepted: 2022-11-10

Published: 2022-12-19

## ABSTRACT

**Introduction:** The decrease in muscle mass in the elderly is due to a decrease in nerve function and muscle weakness due to the aging process, lack of physical activity, and malnutrition. This study aimed to determine the effect of chair-based exercise and vitamin D levels on the strength of the hand grip on elderly women.

**Patients and methods:** Cross-sectional study involving 50 female respondents (aged 64.94±5.42 years) The study sample was elderly individuals who met the inclusion criteria at the Semarang Elderly Posyandu. Respondents were divided into 2 groups, namely the chair-based sports group and the chair-based no-sport group for 8 weeks. Checking the strength of the hand grip using a grip dynamometer.

**Results:** No significant differences was found in hand grip score between chair-based and non chair-based exercise ( $p>0.05$ ). Meanwhile significant difference was found in hand grip score between person with.

**Conclusion:** There is an influence of vitamin D levels on the strength of the hand grip in elderly women.

**Keywords:** Chair-based exercise, Postural balance, Vitamin D level, Hand grip strength.

**Cite This Article:** Ngestiningsih, D., Wibowo, M.A., Probosuseno., Supatmo, Y., Rachmawati, B. 2022. Effect of chair-based exercise and vitamin d levels with hand grip strength in elderly woman. *Bali Medical Journal* 11(3): 1953-1955. DOI: 10.15562/bmj.v11i3.3786

## INTRODUCTION

Aging is associated with a decrease in the functioning of the body's main organs. The decreased muscle mass in old age is known to pose serious health problems.<sup>1</sup> Muscle, bones, and extracellular matrices are important for maintaining tissue structure, muscle contraction, and the spread of strength.<sup>2</sup> The decrease in muscle mass in the elderly is due to a decrease in nerve function and muscle weakness due to the aging process, lack of physical activity, and malnutrition. However, muscle weakness can be prevented through exercise and rehabilitation Increased physical activity and resistance training has been shown to improve muscle strength and function in the elderly.<sup>2,3</sup>

The grip strength test is an easy test for muscle strength measurements. The low hand grip strength test results indicated a decrease in upper extremity strength<sup>4</sup> and lower extremity function.<sup>5</sup> In some studies, hand-held strength tests were used to detect decreased muscle

strength associated with aging, associated sarcopenia, and frailty.<sup>6,7</sup> Low hand grip strength is associated with dependence in daily life activities, poor mobility, and predicts decreased body function and death.<sup>8-10</sup>

The elderly are an important stage of life to encourage physical activity to improve life function and prevent the development of diseases and disabilities. In addition, the spread of COVID-19 has the consequence that the elderly further reduce physical activity and increase time with a sedentary lifestyle (sitting, watching television, reading, using mobile devices).<sup>11</sup>

Vitamin D, calcitriol, or 1,25-dihydroxy vitamin D<sub>3</sub> (1.25(OH)<sub>2</sub>D<sub>3</sub>) are the main hormones that regulate homeostasis from calcium phosphate and bone mineral metabolism. Some studies suggest that vitamin D has implications for the regulation of the immune system, cardiovascular system, oncogenesis, and cognitive function. Low levels of Vitamin D in serum, are associated with decreased muscle strength and physical function.

Previous studies have shown that an increase in muscle strength and a decrease in body swing in response to vitamin D can decrease the incidence of falling.<sup>12,13</sup> Vitamin D levels in the body were measured by knowing the concentration of serum 25(OH) Vit D levels. Vitamin D that enters the body and is produced in a quantified manner is converted into 25 (OH) Vit D, but in serum, only a fraction of 25 (OH) Vit D is converted into 1.25 (OH) 2 Vit D. So the measurement of serum 25 (OH) Vit D levels is the best test to assess vitamin D stores.

A partial or complete decrease in physical activity can lead to a decrease in metabolism and body functions. This has the potential to worsen the health condition of the elderly. Chair-based exercise is a seat-sitting exercise program that uses chairs to provide stability and can be used by older adults and those who are fragile.<sup>14</sup> Elder can exercise safely, simply, and easily and can be used for fragile elderly.<sup>15</sup> The researchers' goal is to determine the effect between chair-based

exercise and vitamin D levels with hand grip strength in elderly women to establish a basis for clinical intervention trials in the future.

## MATERIAL AND METHODS

### Design and Sample Study

Cross-sectional study with 50 female respondents aged 60 years and over at the Kalipancur Elderly Posyandu, Semarang City in the period September-November 2021. Respondents who met the inclusion criteria for this study requirement: Women 60 years of age and older, able and willing to sign consent. Respondents will be excluded from the study by the criteria: pain in the extremities almost every day, injuries or surgery in the last 6 months, and inability to follow the research procedures.

Furthermore, respondents were divided into 2 groups: the chair-based sports group and the chair-based no-sports group. The exercise program is carried out for 8 weeks. Health professionals designed and developed exercise programs based on American college of sports medicine guidelines.<sup>16</sup> Sessions of this sport are carried out 3 times a week, for 8 weeks.

The exercise program is structured with 5 minutes of warm-up, with six general mobility exercises and dynamic stretching, and 35 minutes with 7 to 10 exercises with seat support, using calisthenic repetition and body weight training. Furthermore, it was used randomly on five participants during the training session to aid the adjustment and control of the training load. For safety reasons, the intensity of exercise is predicted indirectly using the Carvenot formula but with a maximum heart rate (HRmax) calculated using franklin's formula ( $HR_{max} = 207 \text{ beats per minute} - 0.7 \times \text{chronological age}$ ).

The strength of the hand grip is measured three times for the non-dominant hand with the dynamometer grip. The best of the three maximum attempts, with proper interval rest, is noted.

A blood sample was taken from the respondent's venous blood. Serum level 25 (OH) D was measured using the ELISA method. Serum 25(OH)D level < 20 ng/ml is considered vitamin D deficiency.<sup>17</sup>

Statistical analysis is already carried out with a computer using a data analysis

program. The normality of the data was tested using Shapiro-Wilk, then for descriptive statistics and analytics using an independent t-test and insignificant data followed by the Mann-Whitney analysis test. The result is considered significant if the value of  $p < 0.05$ .

## RESULTS

Based on table 1 of the 50 research respondents, it was found that all respondents were elderly at the Kalipancur Elderly Posyandu, Semarang City. Respondents were 60-74 years as many as 29 (87.9%) respondents and those aged 75-90 years as many as 4 (12.1%) respondents. Respondents who had a normal Body Mass Index were 17 (51.5%) respondents and mild obesity among as many as 16 (48.5%) respondents based on table 1 of the 50 respondents of the study, it was found that all respondents were elderly at the Kalipancur Elderly Posyandu, Semarang City. Respondents aged 60-74 years were as many as 29 (87.9%), and respondents aged 75-90 years were as many as 4 (12.1%). Respondents with a normal Body Mass Index were 17 (51.5%), and mild obesity was 16 (48.5%). There were no significant differences in hand grip score between the two groups (chair-based and non-chair based exercise) (Table 2). There were significant differences in hand grip score between person with normal and

deficiency of vitamin D (Table 3).

From the results of Mann-Whitney analytical tests, a P-value addressed by Sig (2-tailed) was 0.003 ( $p < 0.05$ ) which means that there is a significant relationship between vitamin D levels and the strength of the hand grip.

## DISCUSSION

Research has been conducted first. Of the 60 respondents who had been tested with the questionnaire, 50 respondents were obtained who met the inclusion criteria from the *Kalipancur Elderly Posyandu*, Semarang City. The statistical test of the correlation between seat-based sports and the strength of the hand grip obtained a value of  $p = 0.176$  ( $p > 0.05$ ) this showed that there was no significant relationship between chair-based sports and the strength of the hand grip. These results are inconsistent with Furtado et al. research, which showed that the exercise program was seat-based with a 14-week program and there was an addition of a program using an elastic band.<sup>18</sup> In the study, significant results were obtained between chair-based exercise and hand grip strength.

Research by Rieping et al., also showed that the exercise program is chair-based with a 14-week program and the addition of a program using an elastic band. The study obtained significant results between

**Table 1. Characteristics of study participant.**

Variable	Average (SD)
Age ( year )	64.94±5.42
25 (OH) D (ng/ml)	21.46±4.91
Body mass Index (Kg/m <sup>2</sup> )	24.60±2.56
Food Recall	1500.46±272.00
Hand grip score	15.36±5.04

**Table 2. Chair-based exercise with hand grip.**

Study group	Hand grip score (median-IQR)	Mean rank	p
Chair based exercise	15.45 (7.28)	28.06	0.176
Without chair-based exercise	14.35 (7.33)	22.73	

Mann Whitney U test

**Table 3. Vitamin D level with hand grip.**

Study group	Hand grip score (median-IQR)	Mean rank	p
Normal vitamin D	13.10 (7.40)	30.43	0.003
Deficiency of vitamin D	11.20 (5.00)	19.72	

Mann Whitney U test

chair-based exercise and hand-holding strength.<sup>19</sup>

Kocak et al. research, Vitamin D levels of vitamin D deficiency and normal groups were 7.5 (3-19) g/L, and 11.6 (11.6-34.9) g/L, which means a significant decrease in vitamin D levels in the weak group ( $p=0.01$ ). Vitamin D levels correlated significantly with hand-held strength scores ( $r:0.362$ ,  $p=0.001$ ). Vitamin D levels were found to be independent predictors of weakness according to HGST in logistic regression analysis (OR: 0.453.95% CI: 0.138-0.769,  $p=0.05$ ).<sup>20</sup>

Women with vitamin D deficiency ( $<40$  nmol/L [16 ng/mL]) were more likely to have low grip strength (OR = 2.64,  $p = 0.025$ ) compared to women with higher values of 25(OH)D.<sup>21</sup> A consistent association between vitamin D status and muscle function, especially in weakened elderly patients. There is evidence that hypovitaminosis D is associated with a decrease in muscle function. Vitamin D has beneficial effects on muscle strength, balance, and gait in a variety of settings including adolescents, the elderly, and CKD patients. However, the effect of vitamin D on fall prevention is still the subject of debate due to conflicting interpretations of the data.<sup>12</sup>

## CONCLUSION

In conclusion, researchers found vitamin D levels were meaningfully related to hand grip strength. The mechanism of explaining the relationship between patients' vitamin D levels and hand-holding in elderly women can be used for research in the future.

## ACKNOWLEDGMENTS

We would like to express my deepest appreciation to our professor and lecturer who guided this article's work. I am also thankful to member *Kalipancur Elderly Posyandu*, Semarang City who has allowed to be used as research.

## DISCLOSURE

The author reports no conflicts of interest in this work.

## ETHICAL CONSIDERATION

This study has been approved by Ethical Committee Faculty of Medicine Universitas Diponegoro, with ethical clearance reference number 282/EC/KEPK/FK-UNDIP/XII/2020.

## AUTHOR CONTRIBUTION

All author had contributed to manuscript writing and agreed for the final version of manuscript for publication.

## FUNDING

None.

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