

## ANEMIA AS RISK FACTOR OF HANDGRIP STRENGTH DECREASED ON ELDERLY IN YOGYAKARTA PROVINCE'S PANTI WERDHA

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### ABSTRACT

**Background:** According to the WHO, by the end of 20<sup>th</sup> century, the more the world population grow, the more the elderly population will be. Yogyakarta province has a 13.72% of Indonesian elderly. The anemia prevalence increased as the age added. Aging process resulted in strength muscle reduced. Handgrip strength test is a valid and consistent as well as simple alternative to value the muscle strength decreased advanced age. Purpose of this study is to know whether anemia is a risk factor against muscle strength decreased measured by handgrip strength test on elderly population in nursing house.

**Method:** This study used cross sectional study design. The study time was in August 2010. The advance ages fullfilling the inclusion and exclusion criteria followed physical examination, routine blood test and handgrip strength measurement.

**Result:** This study involved 118 elderly participants. There was difference of mean handgrip strenght in: age (14.52 kg vs 19.64 kg;  $p=0.001$ ), gender (13.39 kg vs 22.47 kg;  $p=0.001$ ), activity level (7.94 kg vs 16.75 kg;  $p=0.001$ ) and anemia status (13.60 kg vs 17.84 kg;  $p=0.001$ ); for women even in mild anemia group, there was difference with non anemia group (12.36 kg vs 14.68 kg;  $p=0.027$ ).

**Conclusion:** According to multivariable analysis, there are 3 factors affecting handgrip strength in elderly, namely; Age, activity levels, and anemia which are statistically significant. In this study, it was concluded that anemia is a risk factor of handgrip strength decreased in elderly, for women even in mild anemia, there was statistically significant different with non anemia group.

**Keywords:** Elderly, anemia, handgrip strength

### INTRODUCTION

Based on the World Health Organization data on the late twentieth century, the more number people in the world, the more number of elderly will be, i.e. people with the age 65 years old or more. It's also happened in Indonesia, the elderly population in 2020 will be the fourth largest in the world after China, India, and USA. Jogjakarta province apparently demonstrated the highest elderly percentage in Indonesia by 13.72%<sup>1</sup>.

The study in America suggested that anemia was the condition frequently found in elderly population in society, with prevalence estimation in the range of 9 – 18% for male and 8 – 13% for female. Whilst in elderly population aged 85 years old or more as the most rapidly grow segment of elderly population in the whole world, anemia prevalence was even more than 20%<sup>2</sup>. The study in Indonesia mentioned that anemia prevalence rate for elderly was 33.3% for male and 10% for female<sup>3</sup>.

Anemia is associated with the decreased of balance ability measured objectively, the ability to rise up from chair, and the ability to walk fast in elderly population aged 71 years old or more. Strength muscle measured by handgrip dynamometer and muscle mass and density measured by quantitative computed tomography showed statistically significant lower result in elderly with anemia than that without anemia<sup>4</sup>.

In its following study observing the association between anemia and disability, physical ability, and muscle strength in elderly who lived in Chianti, Italy, total 894 people aged 65 years old or more participated in this study. After matching age, gender, body mass index, Mini-Mental State Examination Score, creatinine level, and various comorbid conditions, elderly with anemia experienced more disability and worse physical ability than elderly without anemia. Elderly with anemia also had statistically significant lower

extensor strength of lower leg and lower handgrip strength than elderly without anemia. Further matching for inflammation markers (interleukin-6, C-reactive protein, tumor necrosis factor- $\alpha$ ) remained unchanged this association<sup>5</sup>.

By considering that weakness and fatigue often become the main complaint on patients with anemia, possibly that elderly with anemia experienced physical activity decreased as well as muscle strength and muscle mass diminished resulted from the great reduction of muscle number and muscle usage quality. Hemoglobin concentration reduction could decrease muscle oxygenation, particularly in elderly with vascular disease that ameliorated tissue perfusion disorder<sup>6</sup>.

Elderly with cardiovascular disease and lower hemoglobin concentration, tended to be more related with weakness risk elevation or frailty i.e. geriatric syndrome characterized by loss body weight unintentionally, fatigue, weakness, slower movement, and inactive, compared to elderly without cardiovascular disease. Other possibility was that the association between anemia and much decreased physical function in elderly could be seen from the increase of inflammation condition or thr decrease of testosterone level, factor that could have adverse impact on erythropoiesis and muscle mass<sup>7</sup>.

It can be concluded that aging process will cause multiple body physiology decreased, in terms of muscle strength decreased in elderly reflected by the low handgrip strength and would further deteriorate the limitation already exist. Handgrip strength test is a valid, consistent, and simple alternative to asses muscle strength associated with motoric limitation, related to the attempt generally done by elderly during the daily activities. It can even predict the elderly health such as mortality and various limitations accompanying aging process itself.

### METHOD

The method used in this study was cross sectional by assessing muscle strength through measuring handgrip strength in elderly population at nursing house for elderly. The inclusion criteria: all elderly at Panti Werdha in Jogjakarta province's who were independent, age 60 years old either male or

female, and willing to participate in this study. Exclusion criteria: stroke history with motoric disorder on extremities, fracture history on upper extremities bone system, and rheumatoid disease.

### RESULT AND DISCUSSION

There were 118 elderly eligible as sample in this study. Elderly subjects were given explanation about blood sample collection procedure and hand grip strength measurement by handgrip dynamometer, then it was performed hand grip strength measurement assessment. During the assessment, there was no subject failed to accomplish the measurement or excluded from the study.

The distribution of 118 elderly studied is shown in table 1. Based on age category, it was found 82 (69.5%) subject proportions with age of 60 – 69 years old, 36 (30.5%) subject proportions with aged 70 years old. Female proportion in this study was more than male proportion respectively by 83 (70.3%) vs. 35 (29.7%). Nutrition status proportion with IMT 18.5 kg/m<sup>2</sup> was 108 (91.5%), while IMT 18.6 kg/m<sup>2</sup> was 10 (8.5%) subjects. Based on activity level category, moderate activity level proportion was bigger by 109 (92.4%) than low activity by 9 (7.6%). In this study, non anemia proportion was greater by 69 (58.5%) subjects than the subjects having anemia by 49 (41.5%).

Table 1. Basic Characteristic of Study Subjects

Subject Variable	Number (n=118)	Percentage (%)
Age		
60-69 years old	36	30,5
>70 years old	82	69,5
Gender		
Male	35	29,7
Female	83	70,3
Body Mass Index		
<18,5 kg/m <sup>2</sup>	108	91,5
>18,6 kg/m <sup>2</sup>	10	8,5
Activity Level		
Low ( $\leq 600$ )	9	7,6
Moderate ( $\geq 601$ )	109	92,4
Anemia Status		
Anemia (<12 gr/dl [female] & <13 gr/dl [male])	49	41,5
Non Anemia ( $\geq 12$ gr/dl [female] & $\geq 13$ gr/dl [male])	69	58,5

Table 2. The Difference of Mean Handgrip Strength Based on Subject Characteristic

Subject Variable	Handgrip Strength (Kg) Range	Handgrip Strength (Kg) Mean±SD	p
Age			
60-69 years old	8.0-37.0	19.64±6.74	0.001*
>70 years old	2.0-34.5	14.52±6.23	
Gender			
Male	5.0-37.0	22.47±7.63	0.001*
Female	2.0-23.0	13.39±4.11	
Body Mass Index			
<18,5 kg/m <sup>2</sup>	2.0-37.0	16.20±7.00	0.721
>18,6 kg/m <sup>2</sup>	9.0-21.0	14.85±3.88	
Activity Level			
Low (≤600)	2.0-15.0	7.94±4.68	0.001*
Moderate (≥601)	4.5-37.0	16.75±6.50	
Anemia Status			
Anemia (<12 gr/dl [female] & <13 gr/dl [male])	2.0-37.0	13.60±6.21	0.001*
Non Anemia (≥12 gr/dl [female] & ≥13 gr/dl [male])	5.0-34.5	17.84±6.67	

\* Showed statistically significant difference  $p < 0.05$

\* Mann Whitney test

Table 2 demonstrated that of 118 subjects studied, there was statistically significant difference in mean handgrip on category of age, gender, activity level, and anemia status ( $p < 0.05$ ). Based on age category, mean handgrip strength at the age of 60–69 years old or more was greater than the age of 70 years old ( $19.64 \pm 6.74$ ;  $14.52 \pm 6.23$ ,  $p = 0.001$ ).

In this study, male group had greater mean handgrip strength than female group ( $22.47 \pm 7.63$ ;  $13.39 \pm 4.11$ ,  $p = 0.001$ ). Based on activity level category, the group with moderate activity level had greater mean handgrip strength compared to the group with low activity ( $17.84 \pm 6.21$ ;  $13.60 \pm 6.21$ ;  $p = 0.001$ ). Mean handgrip strength on anemia group was lower than that of non anemia group ( $13.60 \pm 6.21$ ;  $17.84 \pm 6.67$ ;  $p = 0.001$ ). This result was similar with the study performed on 894 subjects and found that mean handgrip strength on anemia was lower than that of non anemia ( $27.5 \pm 11.6$ ;  $21.8 \pm 10.4$ ;  $p = 0.001$ ). In this study, there was no statistically significant difference mean handgrip strength ( $p = 0.721$ ) on nutrition status<sup>5</sup>.

The study of 231 elderly in population identified age as independent determinant on handgrip strength. The age getting older was recognized negatively close associated with

handgrip strength, the older people, the lower handgrip strength would be. Muscle strength and muscle mass were also reduced as the age adds particularly because of muscle fiber decreased<sup>11</sup>. The decrease in muscle usage became one of the strength diminish causes as the time running, which was a secondary effect from worse health on elderly<sup>10</sup>.

Male had greater handgrip strength than female. Gender difference could not completely be explained by muscle mass because woman had statistically significant lower strength per cm<sup>2</sup>. Better physical ability on male was found in all age, however in elderly population, lower physical ability on female might be explained by morbidity resulted from the reduction of physical activity level on female<sup>10</sup>.

Higher hemoglobin level was found to be related with better appearance and muscle strength. Considering fatigue frequently became the main complaint of anemia patient, possibly that elderly with anemia had a decrease in physical activity and diminish of muscle strength and muscle mass due to disuse. Hypothesis suggested that a decrease in hemoglobin concentration would reduce muscle oxygenation<sup>5</sup>.

An analysis is performed for mean difference in handgrip strength on male subject with mild anemia and non anemia. The result showed that male subject with mild anemia had no statistically significant mean handgrip strength compared to male subject without anemia ( $19.66 \pm 6.04$ ;  $23.45 \pm 7.47$ ;  $p = 0.245$ ), while the analysis of mean difference in handgrip strength on female subject with mild anemia and non anemia female demonstrated that female with mild anemia had lower mean handgrip strength than female subject without anemia ( $12.36 \pm 3.46$ ;  $14.68 \pm 3.50$ ,  $p = 0.027$ ), as seen in Table 3 and 4.

Table 3. The difference of mean handgrip strength on male group with mild anemia vs. male group without anemia

Male	Handgrip Strength (Kg) Range	Handgrip Strength (Kg) Mean±SD	p
Mild Anemia (n=3)	15-26.5	19.66±6.04	0.245
Non-Anemia (n=23)	5.0-34.5	23.45±7.47	

\*Mild Anemia 10-13 gr%

Table 4. The difference of handgrip strength on female group with mild anemia vs. female group without anemia

Female	Handgrip Strength (Kg) Range	Handgrip Strength (Kg) Mean±SD	p
Mild Anemia (n=16)	5.0-17.0	12.36±3.46	0.027*
Non-Anemia (n=23)	7.0-21	14.68±3.50	

\*Mild Anemia 10-13 gr%

Further analysis was conducted toward anemia based on low, moderate, and high anemia level, between male and female group. The study result demonstrated that there was not found the statistically significant difference between male and female group based on anemia level ( $p = 0.927$  and  $p = 0.549$ ). This result could be found at Table 5. This result was different with the study performed in USA, which found statistically significant difference between low, moderate, and high level anemia ( $p = 0.01$ )<sup>5</sup>.

Table 5. The difference of mean handgrip strength based on anemia level

		Mean ±SD	p
Male Group			
Low Level	3	19.66±6.04	0.927
Moderate Level	5	19.70±4.72	
High Level	3	22.00±15	
Female Group			
Low Level	16		0.549
Moderate Level	8	12.70±3.46	
High Level	14	10.43±4.11	
Total	49	11.57±4.59	

Table 6. Multivariate analysis on factors influencing handgrip strength

Variable	Coefficient of Regression	S.E	Beta	p
Age	-0.164	0.064	-0.214	0.012*
Activity Level	7.100	2.140	0.279	0.001*
Hemoglobin	3.172	1.179	0.230	0.008*

\* showed the statistically significant difference  $p < 0.05$   
S.E: Standard Error

From multivariate analysis, it was found that higher activity level would contribute on greater handgrip strength by 7.1 kg compared to lower activity level ( $p = 0.001$ ), for every 1 gr/dl hemoglobin elevation would contribute on greater handgrip strength by 3.1 kg ( $p = 0.008$ ). At the age category, for every 1 year addition would reduce handgrip strength by 164 gram ( $p = 0.012$ ). The result demonstrated that activity level would have greatest effect on handgrip strength (Beta= 0.279).

This suggested that activity level must also become concern on elderly. It was reported that exercise habit on elderly could prevent or slower the functional capacity decreased or diminished. Prospective study also proved that functional dependent on inactive elderly would increase 40–60% compared to physically fit and active elderly<sup>1</sup>.

Considering that factor influencing handgrip strength which could be change in this study was anemia factor, thus it became very important to monitor that condition in elderly. Functional ability measured by muscle strength measurement using handgrip strength test might be parameter describing physical appearance on elderly.

## CONCLUSION AND SUGGESTION

Anemia is a risk factor of handgrip strength decreased in elderly, particularly in female elderly with anemia even categorized as mild anemia, and there was statistically significant difference from female group without anemia. Age and activity levels are also risk factors of handgrip strength decreased according to multivariable analysis.

We suggest that :

1. Long term study about the association between handgrip strength and survival or mortality on elderly at *Panti Werdha* DIY province is warranted.
2. A long term study about correction effect toward anemia on elderly on handgrip strength of post correction anemia is needed.
3. Further studies including other factors influencing handgrip strength are needed. Such factors including muscle mass measurement using DEXA (Dual-Energy X-ray Absorptiometry) to asses muscle mass reduction generally occurred in elderly, or depression which is also recognized influencing handgrip strength.

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