Low Bone Mineral Density, Sedentary Lifestyle, and Depression as Risk Factors for Frailty Syndrome at a Home Care Facility in West Jakarta, Indonesia

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Abstract

Background: The life expectancy in Indonesia is increasing. The rising number of the elderly people plays a vital role for a country to achieve development success. However, it has many consequences in the health sector, including a frailty syndrome. This study aimed to explore the association between frailty and related factors.

Methods: : This cross-sectional study was conducted at a home care facility in West Jakarta between September and October 2019, using a simple random sampling method. Data were analyzed using the chi-square test and multivariate logistic regression. The inclusion criteria were members of the home care aged ≥60 years and had signed a written informed consent.

Results: In total, 97 respondents were included. Female gender and bone mineral density (BMD) were associated with frailty syndrome (p=0.018 and p=0.05, respectively). Multivariate logistic regression analysis showed the odds ratio of frailty for the female gender (OR= 3.319; 95% CI 1.045–10.543), low bone mineral density (OR= 4.939; 95% CI 1.516–16.090), depression (OR= 7.622; 95% CI 1.246 – 46.621), and low physical activity (OR = 3.639; 95% CI 1.096 – 12.079).

Conclusions: There is a relationship between female gender and bone mineral density with frailty syndrome with the risk factors for frailty syndrome in this study are female gender, low bone mineral density, depression, and low physical activity.

Keywords: Bone density, depression, elderly, frailty, physical activity

Introduction

Life expectancy is increasing globally. The rising life expectancy has led to the growth of the elderly population. In Indonesia, the Centre Bureau of Statistics of Indonesia in 2018 reported that the life expectancy for women was 73.19 years, and for men it was 69.3 years.[1] The percentage of Indonesian elderly is expected to reach 21.4% by 2050.[2,3] Indonesia has entered the aging population era because its elderly population has already surpassed 7% of the nation's total population.[2] The increase in the elderly population may reflect the success of the nation's social and economic development. On the other hand, it may also affect the nation's healthcare sector.

The elderly tend to have a decline in functional capability and adaptation as a result of the body system's function deterioration, which is often referred to as a frailty syndrome. Frailty is a condition related to aging. Frailty phenotypes include decreased strength of handgrips, exhaustion, body weight loss, low physical activity, and slow speed gait.[4] A systematic review reported the prevalence of frailty and pre-frail in the community of 10.7% and 41.6%, respectively 5 whereas a study in Indonesia reported the prevalence of frailty was 52.2%.[6]

Frailty increases the risk of premature death, falls, fractures, dementia which impair quality of life therefore, increasing health care cost.[7] A study in Germany has shown a relationship between an increase in the frailty index and an increase in health care costs.[8] The cost for frailty in-patient was €2,104, higher than that of a non-frailty patient (€268). For its

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risks and impacts, frailty can be a concerning issue for the elderly population. The elderly may develop various health problems such as nutrition, bone density, disability, physical activity, and depression as they get older. Research on the relationship between bone mineral density and frailty syndrome in Indonesia is still limited. The purpose of this study was to determine the association between frailty and its risk factors, especially bone mineral density, at a home care facility in West Jakarta.

Methods

The design of this study was analytic and cross-sectional, conducted between September and October 2019 at a home care facility in West Jakarta, Indonesia. The sampling method used in this study was simple random sampling. The minimum sample size was 96. The sample size was calculated using planned proportion at a 95% confidence level to achieve a 5% margin of error, with previous frailty prevalence in Indonesia of 52.2%.[6]

After obtaining permission from the head of home care and written informed consent signed by the respondents, the respondents were recruited. Respondents with physical and mental limitations were excluded. Characteristic of respondents included age, gender, and educational level. Furthermore, data on body mass index (BMI), bone mineral density (BMD), functional status, depression, and physical activity were collected.

Body mass index (BMI) was categorized by measuring the body weight and height using a stature meter and weight scale.

Bone mineral density was measured using bone sonometry and categorized into three groups namely normal, osteopenia, and osteoporosis. The assessment of activity of daily living (ADL) and instrumental activity of daily living (IADL) was done using the Barthel index and categorized into three groups namely independent, ADL or IADL disability, ADL and IADL disability. Physical activity was measured using a 24-hour physical activity recall report and converted to physical activity ratio (PAR) to calculate the physical activity level (PAL) formula with the final score category such as sedentary, active, and very active. Depression was assessed by the geriatric depression scale (GDS) with categories: not depressed, probably depressed, and depressed.

Frailty was assessed by the Survey of Health, Aging, and Retirement in Europe frailty instrument (SHARE-Fi), as depicted in Table 1. The SHARE-Fi contains the Fried phenotypes of frailty, including decreased strength of handgrips, exhaustion, body weight loss, low physical activity, and slow speed gait, with closed questions in every aspect except for the strength of handgrips. The result of SHARE was converted through SHARE-Fi calculator. Frailty was categorized into non-frail, pre-frail, and frailty. However, in multivariate analysis, the categorization was divided into non-frail and pre-frail to frailty.

The bivariate chi-square and multivariate logistic regression were used to analyze the relationship between frailty and determinant factors. A p-value lower or equal to 0.05 ($p \leq 0.05$) was considered as statistically

Table 1 Definition of Frailty

	Operational Definition	Measurement	Categorization
Frailty	A geriatric syndrome, where the elderly experience a state of increased vulnerability related to aging caused by decreased function and reserves in various physiological systems and affects resistance to deal with stressors also increased death vulnerability.[9]	Instruments: SHARE-Fi, dynamometer Measuring way: -Conducting interviews and checking grip strength with dynamometer -The results of interviews and hand grip strength checks were entered into the SHARE-Fi calculator according to gender to determine the frail status of respondents	Bivariate: [0] = Non-frail [1] = Pre-frail [2] = Frailty Multivariate: [0] = Non-frail [1] = Pre-frail and Frailty
Frail	The predicted D Factor Score of frailty calculator < 6 in female or < 7 in male[9]		
Pre-frail	The predicted DFactor Score of frailty calculator 0.32 – 2.13 in female or 1.21 – 3.01 in male[9]		

Table 2 Characteristics of the Elderly at the Home Care Facility

Variable		n	%
Age	60–64 years	**38**	**39.2**
	≥ 65 years	59	60.8
Gender	Male	27	27.8
	Female	70	72.2
Educational level	< 9 years	26	26.8
	≥ 9 years	71	73.2
BMI	Underweight	3	3.1
	Normal-overweight	47	48.5
	Obese	47	48.5
Bone mineral density	Normal	11	11.3
	Osteopenia	72	72.4
	Osteoporosis	14	14.4
Functional status	Independent	61	62.9
	ADL/IADL disable	36	37.1
Depression	Not depressed	86	88.7
	Depressed	11	11.3
Physical activity	Active	24	24.7
	Sedentary	73	75.3
Frailty status	Non-frail	57	58.8
	Pre-frail	34	35.1
	Frailty	6	6.2
Total		97	100

Note: BMI= Body mass index, ADL= Activity of daily living, IADL= Instrumental activity of daily living

significant. This study was approved by the Ethics Committee of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia with ethical clearance number 21/01/KEP-FKUAJ/2020.

Results

This study involved 97 home care members aged 60 years and over. Most of the respondents were aged ≥ 65 years, female, and had higher level of education. The respondents were predominantly obese, had osteopenia, were not depressed, and were independent based on functional status, however, had lower physical activity as shown in Table 2.

A relationship was found between gender and bone mineral density with frailty (p= 0.018 and p= 0.005, respectively). However, there was no significant association between age, educational level, BMI, disability, depression, and physical activity as shown in Table 3.

Further multivariate analysis showed that gender, bone mineral density, depression, and physical activity were related to pre-frailty and frailty and were considered risk factors for frailty, with the strongest association being depression followed by low bone mineral density, as depicted in Table 4.

Discussions

This study showed that gender and bone mineral density were statistically significant with frailty on bivariate analysis. Further multivariate analysis showed female gender (OR= 3.319; 95% CI 1.045–10.543), low bone mineral density (OR= 4.939; 95% CI 1.516–16.090), depression (OR= 7.622; 95% CI 1.246–46.621), and low physical activity (OR= 3.639; 95% CI 1.096–12.079) are risk factors for frailty syndrome.

Female gender has a significant relationship with frailty.[10,11] In addition to gender, low bone mineral density is also related to frailty.[12,13] Interestingly, a study in Brazil showed an increase in frailty cases in the low category of PAL.[14] In Indonesia, the relationship between depression and frailty has been proven, suggesting depression as a risk factor for frailty.[15] In a 2-year cohort study also showed that low physical activity and depression as

Table 3 Relationship between Gender and Bone Mineral Density with Frailty Syndrome

Characteristics		Non-frail		Pre-frail		Frailty		p
		n	%	n	%	n	%	
Age	60–64 years	22	57.9	14	36.8	2	5.3	0.927
	≥ 65 years	35	59.3	20	33.9	4	6.8	
Gender	Male	22	81.5	4	14.8	1	3.7	**0.018***
	Female	35	50	30	42.9	5	7.1	
Educational level	< 9 years	12	46.2	11	42.3	3	11.5	0.208
	≥ 9 years	45	41.7	23	24.9	3	4.4	
BMI	Underweight	2	66.7	0	0	1	33.3	0.144
	Normal-Overweight	27	57.4	19	40.4	1	2.1	
	Obese	28	59.6	15	31.9	4	8.5	
Bone mineral density	Normal	8	72.7	2	18.2	1	9.1	**0.005***
	Osteopenia	47	65.3	21	29.2	4	5.6	
	Osteoporosis	2	14.3	11	78.6	1	7.1	
Functional status	Independent	39	63.9	19	31.1	3	4.9	0.389
	ADL/IADL Disable	18	50	15	41.7	3	8.3	
Depression	Not depressed	54	62.8	27	31.4	5	5.8	0.076
	Depressed	3	27.3	7	63.6	1	9.1	
Physical activity	Active	18	75	5	20.8	1	4.2	0.176
	Sedentary	39	54.3	29	39.7	5	6.8	

Note: *p < 0.05 = statistically significant , BMI= Body mass index, ADL= Activity of daily living, IADL= Instrumental activity of daily living

risk factors for frailty.[16]

Other variables such as age, educational level, BMI, and disability do not show significant relationship with frailty. This study recruited a sample from an urban area with middle socioeconomic status, which differentiates this study from another study in Malaysia that recruited a sample in a rural area with a low socioeconomic status.[17] The socioeconomic background may cause the discrepancies in results.

Previous studies have found a relationship between educational level and frailty.[18,19] The difference in the statistical analysis may be caused by the length of the education category. In this study, we used a 9-year cut-off, while other studies used different categories.[17] The respondents of this study were able to adapt well to the routines and activities of life so that there was no difference between education less or more than 9 years.

A study conducted in China found a relationship between underweight and frailty, but not obesity.[20] The association between BMI categories and frailty remains unclear because several studies have obtained different results.

Table 4 Multivariate Logistic Regression Analysis of Frailty and Determinants

Factors	Frailty			
	p	OR	95% CI	
			Lower	Upper
Age	0.354	0.622	0.228	1.697
Gender	**0.042**	3.319	1.045	10.543
Educational level	0.542	0.703	0.227	2.179
Body mass index	0.416	0.693	0.286	1.677
Bone mineral density	**0.008**	4.939	1.516	16.090
Functional status	0.897	1.071	0.377	3.044
Depression	**0.028**	7.622	1.246	46.621
Physical activity	**0.035**	3.639	1.096	12.079

This may be due to the different methods used to measure body mass index. Central obesity is more related to the incidence of frailty than general obesity measurement.[21]

This study found no significant relationship between disability and frailty. However, a study in Korea[22] and another part of Indonesia[23] showed different results from this study. This might be due to differences in research background or setting, as well as the number of participants. Our study recruited respondents in a community-based place, while other studies recruited respondents in a hospital[23] or health centers.[22] These background dissimilarity might cause differences in the analysis results.

In addition, the results of the analysis of the frailty variables may differ because of different research instruments. There are several instruments besides SHARE to assess frail status in individuals, for example the Frailty Index (FI), Fried Criteria, and Frail Score (FS).

The limitation of this study is that it is a cross-sectional study that assesses conditions at a point in time. Another limitation is that the target population in this study is limited, so further research should be conducted on a wider population.

In conclusion, frailty syndrome tends to occur in individuals with low bone mineral density, female gender, depression, and sedentary. Further cohort studies on the relationship between frailty and risk factors are suggested.

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