ORIGINAL ARTICLE

Correlation Between Body Mass Index and Frailty on Activities of Daily Living among Elderly in The Nursing Home

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ABSTRACT

Introduction: High Body Mass Index (BMI) correlates with mortality and morbidity in the elderly. High BMI also correlates with limited physical function. Another issue faced by the elderly is frailty, which is associated with decreased exercise capacity, reduced muscle strength, and decreased bone mass leading to detrimental outcomes including falls, hospitalization, disability and death. Physical frailty is highly prominent for the elderly who is living in nursing homes. The aim of this study is to determine the correlation between BMI and frailty on Activities of Daily Living (ADL) among the elderly in the nursing home.

Methods: This study was conducted in 3 nursing homes in South Sulawesi. Frailty was assessed by Edmonton Frail Scale (EFS), while ADL was assessed by Barthel Index (BI). Data were managed using SPSS 25 program and Pearson test was used to analyze correlation between BMI and frailty to ADL.

Results: There were 30 participants, consisting of males 10 (33.3%), and females 20 (66.7%) with a median age of 72 years old, included in this study. The median BMI was 20.4 (13.3-29.2) kg/m^2. The median result of EFS was 5.5 (2-12). The median BI result was 92.5 (45-100). BMI have insignificant correlation with ADL ($r = 0.196$; $p = 0.298$), frailty have negative strong correlation with ADL ($r = -0.738$; $p = 0.000$).

Conclusion: There was no significant correlation between BMI and ADL. Otherwise, frailty and ADL have a strong correlation among the elderly in the nursing home.

Keywords: activities of daily living, body mass index, elderly, frailty, nursing home

ABSTRAK

Pendahuluan: Indeks Massa Tubuh (IMT) yang tinggi berhubungan dengan mortalitas dan morbiditas pada lansia. IMT yang tinggi dikaitkan dengan fungsi fisik yang terbatas. Masalah lain yang dihadapi oleh lansia adalah *frailty, frailty* berhubungan dengan penurunan kapasitas aktivitas, kekuatan otot, serta massa tulang, yang menyebabkan efek jangka panjang yang buruk seperti jatuh, frekuensi rawat inap yang meningkat, disabilitas dan kematian. *Frailty* sangat umum terjadi pada lansia yang tinggal di panti wreda. Tujuan dari penelitian ini adalah untuk mengetahui hubungan antara IMT dan *frailty* terhadap Activities of Daily Living (ADL) pada lansia di panti wreda.

Metode: Penelitian ini dilakukan di 3 panti wreda di Sulawesi Selatan. Frailty dinilai dengan *Edmonton Frail Scale* (EFS), sedangkan ADL diperiksa dengan Indeks Barthel. Data dikelola dengan menggunakan program SPSS 25 dan tes *Pearson* digunakan untuk menganalisa hubungan antara IMT dan *frailty* terhadap ADL.

Hasil: Subjek penelitian berjumlah 30 orang, terdiri dari 10 laki-laki (33,3%) dan 20 perempuan (66,7%) dengan usia rata-rata 72 tahun. Didapatkan nilai median IMT adalah 20,4 (13,3-29,2), nilai median EFS adalah 5,5 (2-12), dan nilai median Indeks Barthel adalah 92,5 (45-100). IMT tidak memiliki korelasi yang signifikan dengan ADL (r = 0,196; *p* = 0,298), frailty berkorelasi negatif kuat dengan ADL (r = -0,738; *p* = 0,000).

Kesimpulan: Tidak ada hubungan yang signifikan antara IMT dan ADL. Di sisi lain, *frailty* dan ADL memiliki korelasi yang kuat pada lansia di panti wreda.

Kata kunci: *activities of daily living, frailty,* indeks massa tubuh, lansia, panti wreda

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INTRODUCTION

Body mass index (BMI) is utilized as an applicable measure of overweight and obesity at the population level and being overweight or obese can cause many chronic diseases. In addition, several studies have proved that high BMI is correlated with mortality and morbidity in the elderly. People who are overweight and obese pose a serious public health concern due to increased risk of high blood pressure, stroke, coronary artery disease, dyslipidemia, musculoskeletal disease, type 2 diabetes and certain cancers. High BMI is also correlates with limited physical function.[1]

Another problem faced by the elderly is frailty. Frailty is associated with decreased exercise capacity, reduced bone mass, decreased muscle strength, and glucose intolerance. These physiological shifts cause a decline in physical functions and the initiation of dependence on activities of daily living. There are certain risk factors for frailty syndrome such as aging,

low physical activity, poor nutrition, weight loss unhealthy lifestyle behaviors, poor living environment, polypharmacy, comorbidities, heredity, and female gender. These factors are interconnected, form a cycle, and create conditions including inflammation, chronic malnutrition, and disturbance in hormone modulation and coagulation pathways.[2] Frailty is currently considered a geriatric syndrome due to the cumulative decline of multiple physiological systems leading to reduced physiological reserves and resistance to stressors, ultimately leading to detrimental outcomes such as falls, disability, hospitalization and death.[3]

Both abnormal BMI and frailty might lead to disability among the elderly, therefore it is important to identify the elderly with frailty and disability as a part of comprehensive geriatric assessment.3 The Barthel Index is a functional status measurement tool that is currently recognized as a standardized Activity Daily Living (ADL) assessment tool. The Barthel Index has been proven to be used for 50 years, where it was originally developed to measure the progress of individuals with disabilities participating in rehabilitation. Basic ADL assessed toileting, dressing, bathing, eating, transfer, continence and ambulation.[3]

Nursing homes in Indonesia are mostly subsidized by the government, private institutions, and charity organizations. The elderly in Indonesia frequently reside with their children and grandchildren; thus, few elderlies are sent by the family or are admitted to nursing homes. Usually, only the elderly with many comorbidities and lack of financial support move to nursing homes.[2] Physical frailty is highly prominent for the elderly who is living in nursing homes (range 19.0 to 75.6%) in western populations. Compared to community-dwelling elderly, individuals living in nursing homes may be more susceptible and often have various risk factors for frailty (i.e., activity of daily living disability, self-reported health status).[4]

Therefore, the avoidance and therapy of frailty in nursing homes can be more complicated. This study aimed to determine the correlation between body mass index and frailty to activities of daily living among the elderly in the nursing home.

METHODS

This study was a cross-sectional, conducted in 3 nursing homes which are *Balai Rehabilitasi Sosial Lanjut Usia* (BRSLU) *Gau Mabaji, Pusat Pelayanan Sosial Lanjut Usia Mappakasunggu,* and *Panti Werdha Theodora* Makassar, South Sulawesi in March 2022. BMI was measured by weight scale and height measuring device, then inserted into formula weight (kg)/(height (m))^2, while frailty and activities of daily living were evaluated using Edmonton Frail Scale (EFS) and Barthel Index (BI).

The EFS is a performance-based multifactorial frailty assessment instrument invented to help the screening and assessment of frail older patients in primary care and at the bedside. EFS comprises of 11 questions over nine different areas such as nutrition, cognition, health status, functional dependence, social support, medication use, mood, functional performance and continence. Interpretation of EFS scores

are: not frail if the points range from 0-5, apparently vulnerable if the points range from 6-11, and severe frailty if the points range from 12-17.[5,6] Otherwise, The BI comprises 10 items, such as the existence or absence of fecal and urinary incontinence and required assistance for grooming, feeding, toilet use, transfers (e.g., from the chair to bed), dressing, bathing, walking and climbing stairs. Two items about grooming and bathing are accounted on a 2-point scale (0 or 5 points); six items about dressing, feeding, bowel and urinary control, stair climbing and toilet use are accounted on a 3-point scale (0, 5, or 10 points). Two items about mobility and transferring are graded on a 4-point scale (0, 5, 10, or 15 points). The BI score is the collective score of all 10 items, with a maximum score of 100 means complete independence, and a minimum score of 0 means total dependence.[7]

The inclusion criteria for subjects were: sixty years old or older, able to communicate and understand instruction. The exclusion criteria were hearing and speech difficulty that cause communication problem. Data were managed using SPSS 25 program. Since data were normally distributed, Pearson test was used to analyze correlation between BMI and frailty to ADL.

Before conducting the research, this study has been approved by Ethical Commission of the Medical Faculty Muslim University of Indonesia and Ibnu Sina Hospital with register number UMI012201038.

RESULT

There were approximately 64 population subjects in three nursing homes, but only 30 participants that meet the inclusion criteria were included in this study. Their characteristics are listed in table 1. The median age was 72 years old, the youngest was 61 years old and the oldest was 98 years old. There were 20 female and 10 male participants. The median BMI result was 20.4 kg/m^2, the lowest BMI was 13.3 kg/m2 and the highest BMI was 29.2 kg/m^2. We found there were 8 (26.7%) subjects classified as underweight, 18 (60%) subjects have normal weight, and 4 (13.3%) subjects classified as overweight.

The median EFS result was 5.5, the lowest EFS score was 2 and the highest EFS score was 12. We found there were 15 (50%) subjects did not have frailty, 14 (46.7%) subjects classified as apparently vulnerable, and 1 (3.3%) subject classified as severe frailty.

The median BI result was 92.5. The lowest BI score was 45 and the highest BI score was 100. We found there were 22 (73.3%) subjects classified as independent, 5 (16.7%) subjects classified as minimally dependent, and 3 (10%) subjects classified as partially dependent.

As shown in table 2, BMI and ADL show very weak and insignificant correlation (r = 0.196 p = 0.298), while frailty and ADL have a strong negative correlation (r = -0.738 p = 0.00), which mean elderly with low frailty score have better independence in activities of daily living rather than elderly with high frailty score.

Table 1. Subject characteristics

Variables	N	%	Median	Min	Max
Age (years)			72.0	61.0	98.0
Sex					
Male	10	33.3			
Female	20	66.7			
Body Mass Index			20.4	13.3	29.2
Underweight	08	26.7			
Normal weight	18	60.0			
Overweight	04	13.3			
Edmonton Frail Scale			05.5	02.0	12.0
Not frail	15	50.0			
Apparently vulnerable	14	46.7			
Severe frailty	01	03.3			
Barthel Index			92.5	45.0	100.0
Independent	22	73.3			
Minimally dependent	05	16.7			
Partially dependent	03	10.0			

Table 2. Variable correlations

Variables	r	*p*
BMI – ADL	0.196	0.298
Frailty – ADL	-0.738	0.000

DISCUSSION

The number of elderly people with functional disorders are predicted to increase worldwide in the next decade. The prevalence rate is 30% for people aged > 75 years and 40% in elderly people aged 85 and older. On the one side, aging means increasing life expectancy, but there are problems including health costs and how to maintain the functional capacity of the elderly and live independently.[3]

The prevalence of overweight and obesity in the elderly population is escalating. Obesity is recognized to negatively impact morbidity and mortality. Many cohort studies have found that not only cognitive impairment, but also various frailty-related measures such as BMI and ADL performance can predict higher levels of frailty.[8] This study found that BMI and ADL have an insignificant correlation. This is because abnormal BMI, whether it is overweight or underweight, takes a certain period of time to cause health issues or impairment in specific organs (e.g.: cardiovascular, renal, etc.). Even if it already causes an impairment, it takes time to cause disability. The impact of obesity will lead to increased years lived with disability.[9]

ADL performances affected by many factors such as age, residence, financial support, comorbidities (stroke, sarcopenia, and dementia)[10], and eating habits. Eating habits of individuals with high BMI might reduce the malnutrition risk and possibly defend against ADL ability declining, considered that nutritional status is associated with ADL performance in elderly patients.[8] Sarcopenia is also related to ADL declining because it decreases muscle strength and mass and is a predictor of undesirable outcomes, such as disability, poor quality of life, and mortality.[1,8]

Many studies showed linear correlation between BMI and ADL, Radityo et al found that BMI and ADL have positive correlation, which mean high BMI have protective effect against the decline of ADL.1 Lu et al with a larger subjects reached 16.022, found that higher BMI was correlated with a lower chance of ADL disability among Chinese elderly aged 80 years or older. More awareness should be paid to the underweight, instead of the overweight or obesity, for the anticipation of disability in ADL after age 80 years.[11] On the other hand, Koyanagi et al. found a significant correlation between ADL disability and obesity were observed in Spain, Finland, South Africa, and Poland. The possibility for ADL disability among those with obesity are higher than the persons with normal weight in developed countries compared to developing and poor countries. This may be related to factors such as the decrease in cardiovascular disease mortality, longer exposure to obesity and the resulting longer life lived with disability observed in developed countries.[12]

Frailty is seen as a state of high vulnerability to health impairments including falls, disability, hospitalization, and death. The researchers showed that the existence of frailty remarkably predicted disability in the elderly.[13] Fried and colleagues found that frail elderly were at high chance for reduced mobility and decreased ADL.[14] This research found that strong negative and significant correlation between frailty and ADL, which means elderly with low frailty score have better independence in activities of daily living. This is supported by another study by Snih et al. It showed Pre-frail and frail status in older Mexican Americans were correlated with an elevated chance of activities of daily living disability over a 10-year period among non-disabled subjects.[13]

CONCLUSION

There was no significant association between BMI and ADL. Otherwise, frailty and ADL have strong association among elderly in nursing home.

REFERENCES

1. Radityo WE, Aryana IGPS, Kuswardhani RAT, Astika IN. The association between body mass index (BMI) and activity of daily living (ADL) in the population based elderly at buleleng and tabanan regencies, Bali, Indonesia. Bali Med J 2020; 9(1): 95–8.
2. Rizka A, Indrarespati A, Dwimartutie N, Muhadi M. Frailty among older adults living in nursing homes in Indonesia:

prevalence and associated factors. Ann Geriatr Med Res 2021; 25(2): 93–7.

3. Made Arie Mahayuni N, Tuty Kuswardani R. Frailty dan activity daily life pada lanjut usia laki-laki di kelurahan pemecutan, kecamatan denpasar barat, kota denpasar, bali. J Intern Med 2020; 4(2): 36–9.
4. Liu W, Puts M, Jiang F, Zhou C, Tang S, Chen S. Physical frailty and its associated factors among elderly nursing home residents in china. BMC Geriatr 2020; 20(1): 294.
5. He Y, Li LW, Hao Y, Sim EY, Ng KL, Lee R, et al. Assessment of predictive validity and feasibility of edmonton frail scale in identifying postoperative complications among elderly patients: a prospective observational study. Sci Rep 2020; 10(1): 14682.
6. Perna S, Francis MDA, Bologna C, Moncaglieri F, Riva A, Morazzoni P, et al. Performance of edmonton frail scale on frailty assessment: its association with multi-dimensional geriatric conditions assessed with specific screening tools. BMC Geriatr 2017; 17(1): 1–8.
7. Yi Y, Ding L, Wen H, Wu J, Makimoto K, Liao X. Is barthel index suitable for assessing activities of daily living in patients with dementia?. Front Psychiatry 2020; 11: 282.
8. Ozturk GZ, Egici MT, Bukhari MH, Toprak D. Association between body mass index and activities of daily living in homecare patients. Pak J Med Sci 2017; 33(6): 1479-84.
9. Wong E, Woodward M, Stevenson C, Backholer K, Sarink D, Peeters A. Prevalence of disability in australian elderly: impact of trends in obesity and diabetes. Prev Med 2016; 82: 105–10.
10. Wahyuni S, Effendy C, Kusumaningrum FM, Dewi FST. Factors associated with independence for elderly people in their activities of daily living. Periodic Epidemol J 2021; 9(1): 44.
11. Lv Y bin, Yuan JQ, Mao C, Gao X, Yin ZX, Kraus VB, et al. Association of body mass index with disability in activities of daily living among chinese adults 80 years of age or older. JAMA Netw Open 2018; 1(5): 181915.
12. Koyanagi A, Moneta M v., Garin N, Olaya B, Ayuso-Mateos JL, Chatterji S, et al. The association between obesity and severe disability among adults aged 50 or over in nine high-income, middle-income and low-income countries: a cross-sectional study. BMJ Open 2015; 5(4): 007313
13. Snih SA, Graham JE, Ray LA, Samper-Ternent R, Markides KS, Ottenbacher KJ. Frailty and incidence of activities of daily living disability among older mexican americans. J Rehabil Med 2009; 41(11): 892–7.
14. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001; 56(3): 146-56.