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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

Wayan Eko Radityo,[1*] I Gusti Putu Suka Aryana,[2] Raden Ayu Tuty Kuswardhani,[2] I Nyoman Astika[2]

ABSTRACT

Background: High Body Mass Index (BMI) is known associated with mortality and morbidity among the elderly. However, other studies also show the opposite result in high BMI as protective against Activity Daily Living (ADL). Accurate quantification of the role of BMI in the incidence of disability in ADL is desirable in the face of the increasing prevalence of individuals with overweight and obesity and prolonged life span in the population. This study aims to investigate the association between Body Mass Index and Activity of Daily Living in population-based elderly.

Method: A cross-sectional analytic study was conducted in the urban and rural area of Bali Province, particularly in Buleleng and Tabanan regencies. BMI and Barthel Index score were recorded among respondents. Data were analyzed using SPSS version 17 for Windows and aP-value less than 0.05 was considered statistically significant.

Results: A total of 167 respondents, 100 and 67 from the urban and rural area of Bali Province respectively, was predominant by 93 (55.7%) females and followed by 74 (44.3%) males. Spearman test found a significant weak positive correlation between weight and Activity of Daily Living ($r= 0.168$; $p<0.05$). In addition, a significant weak positive correlation was also found between BMI and ADL ($r= 0.158$; $p<0.05$).

Conclusion: Our study showed increased values of BMI is a protective effect on ADL.

Keywords: Body Mass Index, Activity Daily Living, elderly

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[1]Residency of Internal Medicine, Faculty of Medicine, Universitas Udayana, Sanglah Hospital, Bali, Indonesia
[2]Geriatric Department of Internal Medicine, Faculty of Medicine, Universitas Udayana University, Sanglah Hospital, Bali, Indonesia

[*]Correspondence to:
Wayan Eko Radityo; Residency of Internal Medicine, Faculty of Medicine, Universitas Udayana, Sanglah Hospital, Bali, Indonesia;
ekoradityo_rock@yahoo.com

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INTRODUCTION

Body Mass Index (BMI) is used as a useful population-level measure of overweight and obesity.[1] Overweight or obesity may cause many chronic illnesses. Furthermore, several studies have shown that high BMI is associated with mortality and morbidity among the elderly.[2,3] Individuals with overweight and obesity constitute a significant public health problem owing to the increased risk of hypertension, dyslipidemia, coronary heart disease, stroke, type 2 diabetes, musculoskeletal disorders, and some kinds of cancer.[4] High BMI also shows associations with impaired physical functioning.[5] Mobility is another important topic concerning the elderly. Accurate quantification of the role of BMI in the incidence of disability in Activity of Daily Living (ADL) is desirable in the face of the increasing prevalence of individuals with overweight and obesity and prolonged life span in the population.[3]

Difficulties in mobility are often the first sign of functional decline and may indicate the need for preventive measures.[6] Mobility problems have been reported as a predictor of all-cause mortality, and patients with BMI >30 kg/m^2 have low scores in the "Time Up to Go" test, which assesses mobility.[7] Mobility problems, as well as illnesses leading to cognitive impairment, are a cause of dependence. Weight loss through the diet may be associated with cognitive impairment. Therefore, obesity or being overweight could adversely affect the performance of activities of daily living (ADL) in older adults.[2] It still has many controversies since some studies report that obesity is protective against ADL, but the opposite is reported in some others. Many explanations still can be debated about those issues.[2,3]

Barthel index is a simple index of independence, which is used to score the patients' ability to perform ADLs.[8] The Barthel index comprises 10 items, including the presence or absence of faecal and urinary incontinence and the need for assistance with grooming, toilet use, feeding, transfers (e.g., from the chair to bed), walking, dressing, climbing stairs, and bathing.[2] Based on those mentioned above, this study aims to investigate the association between BMI and ADL in the

population-based elderly at Buleleng and Tabanan regencies, Bali, Indonesia

METHOD

A cross-sectional observational study was conducted among 167 respondents from the rural and urban area at Buleleng and Tabanan regencies, Bali, Indonesia using consecutive sampling approach. Body Mass Index (BMI) measurement in the physical examination, body weight and height were measured by trained medical staff using a standardized protocol. Bodyweight was measured to the nearest 1 kg for individuals wearing light clothing. Height measured by observation from patient height from the base of the foot until the highest point of the head when they stand up in a straight position against a wall. BMI was measuring using formula person's weight in kilograms divided by height in meters squared. BMI was divided into 4 categories according to the guideline for WHO: underweight (BMI <18.5), normal weight (BMI 18.5 to <24.9), overweight (BMI 25.0 to <29.9), and obese (BMI>30.0).[3]

The Activity of Daily Living (ADL) measure using the interview method with the Barthel score. The score was introduced in 1965 by Mahoney, F.I and Barhtel, D.W. The score consists of 10 variables about performance in daily living such as presence or absence of faecal incontinence, urinary continence, help needed with grooming, toilet use, feeding, transfer (example from the chair to bed), mobility, dressing, climbing stairs, and bathing. Each variable has 0-2 score, except for bathing and grooming variable has 0-1 score, mobility and transfer has 0-3 score. Higher scores represent a higher degree of independence. The Barthel index scores are classified as follows: a) 0-4 points: total dependency; b) 5-8 points: severe dependency; c) 9-11 points: moderate dependency; d) 12-19 points: mild dependency; and e) 20 points: total independence

Data were analyzed using SPSS version 17 for Windows and depicted in number, percentage, correlation coefficient, and P-value, whereas less than 0.05 was considered statistically significant.

Table 1 Baseline characteristic of respondents

Variables	Total (%)
Gender (%)	
Male	74 (44.3)
Female	93 (55.7)
BMI (kg/m2)	
Underweight	65 (38.9)
Normal Weight	76 (45.5)
Overweight	22 (13.2)
Obese	4 (2.4)
ADL Barthel (score)	
Moderate dependence (9-11)	1 (0.6)
Mild dependence (12-19)	35 (21.1)
Total independence (20)	130 (78.3)

BMI: body mass index; ADL: activity daily living

Table 2 Normality and Spearman correlation test between weight and BMI to ADL Barthel score

Parameters	Shapiro-Wilk	r	P
ADL Barthel			
Weight (kg)	0.019	0.168	0.030*
BMI (kg/m^2)	0.000	0.158	0.042*

BMI: body mass index; ADL: activity daily living; *P-value: statistically significant if less than 0.05

RESULT

A total of 167 elderly from Barthelurban and rural area of Buleleng and Tabanan regencies was enrolled in this study. About 74 (44.3%) respondents were males and 93 (55.7%) of them were females (Table 1). Most of the respondents were normal (45.5%), followed by underweight (38.9%), overweight (13.2%), and obese (2.4%) in BMI. Based on ADL Barthel Index assessment, most of them were total independence (78.3%), followed by mild dependence (21.1%), and moderate dependence (0.6%) (Table 1).

Data were not normally distributed by Shapiro-Wilk test in gender, weight, BMI dan ADL Barthel (p<0,05). Based on that results, a Spearman correlation test was used to analyze the correlation among variables. A Spearman correlation test found a significant weak positive correlation between weight and ADL (r= 0.168; p=0.030) and between BMI and ADL (r= 0.158; p=0.042) (Table 2).

DISCUSSION

Elderly populations in Indonesia was projected at about 26.66 million (9.03%) in 2017. Predicted 27.08 million in 2020, 33.69 million in 2025, 40.95 million in 2030 and 48.19 million in 2035.[9] According to the World Health Organization (WHO), 71.4 years (males: 69.1 years; females: 73.7 years) is the average life expectancy at birth, and the life expectancy over the age of 60 years was 20.4 years (males: 18.9 years; females: 21.7 years) among the global population

in 2015.[10] Similarly, 55.7% of our study group was female, which is probably the result of the longer life expectancy of women.

In our study, we found a positive correlation between BMI and ADL Barthel. This support by another study before from Ozturk GZ et al. it shows obesity is protective against ADL. Similarly, we obtained controversial results for whether overweight increases the ADL disability or has protective effects.[2] This is because ADL-performing ability changes with not only weight but also eating habits, and the eating habits of overweight or obese individuals may decrease the malnutrition risk and may protect against the decline of ADL ability, given that nutritional status is related to ADL performing ability in geriatric patients.[2] High waist circumference (WC) not associated with poor physical performance and ADL disability in Lisko et al.[11] The combination of a higher level of BMI and lower level of WC has been found to protect from mortality in older adults, they also had a decreased likelihood of having ADL disability.[11]

But another study found an opposite correlation, e.g Lv YB et al. concluded that higher BMI was associated with a lower risk of disability in ADL among Chinese adults age 80 years or older, which suggest that current recommendations for the BMI may need to be revisited.[3] More attention should be paid on underweight, rather than overweight for obesity for the prevention of disability in ADL after age 80 years. Being overweight or obese was linked to a higher risk of mortality and disabling pathologic problems before the age of 80 years.[3] Koyanagi et al. found that the higher odds for disability among obese individuals in high-income countries may imply longer life lived with disability.[12] It also observed in Poland, Finland, Spain, and South Africa which is a country with higher income. Obesity is an independent indicator while excluding the chronic conditions.[12] Taken together, causation of the inverse association between BMI and disability in ADL is probably multifactorial. Malnutrition, frailty, survival bias or selection bias, and reverse causation were considered to be the potential explanations.[3]

Many studies have shown that sarcopenia which is one of the main problems in the elderly, is associated with the decline in muscle mass and strength and is a predictor of poor outcomes, including mortality, disability, and poor quality of life. Malnutrition and weight loss are the causes of sarcopenia which is associated with functional dependence in the elderly. Accordingly, in our study, when the BMI decreased, the ADL-performing ability decreased, possibly because of the slowing down of activity due to malnutrition or sarcopenia.[2]

CONCLUSION

The association between BMI and ADL in the literature is still in controversies. Some studies report that obesity is protective against ADL, but the opposite is reported in some others. This is because underweight and obesity have similar risks. In our study showed increased values of BMI as the protective effects of ADL Barthel. Accordingly, we conclude that higher weight and BMI are associated with an increase in ADL Barthel score. In general, physicians can advise all patients to receive adequate nutrition and perform exercises to get ideal BMI, which will protect them from most chronic diseases and help them with healthy ageing.

CONFLICT OF INTEREST

There is no competing interest regarding the manuscript

ETHICS CONSIDERATION

Ethics approval has been obtained by the Ethics Committee, Faculty of Medicine, Universitas Udayana, Sanglah General Hospital, Bali, Indonesia prior to the study being conducted.

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AUTHOR CONTRIBUTION

Wayan Eko Radityo is responsible for the conceptual framework, data gathering, data analysis, and interpreting the results of the study. I Gusti Putu Suka Aryana, Raden Ayu Tuty Kuswardhani, and I Nyoman Astika are responsible as supervisors and revised the early draft of the manuscript.

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