The Comparison of Sarcopenia Prevalence between Elderly in Community Dwelling and Nursing Home Based on Indonesian Young Adult Cut-Off Point

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Abstract: Sarcopenia is a progressive loss of skeletal muscle mass and strength that can decrease quality of life. This study aimed to find a cut-off point of appendicular skeletas muscle mass (ASM), hand grip strength (HGS), and gait speed (GS) from young adult, as a based value to defined the Sarcopenia in elderly; and to find the differences values of sarcopenia between elderly in community dwelling and nursing home. Subjects recruited by simple random sampling and convenience sampling. There were 369 young adults (44% male, 56% female), 183 elderly (47% male, 53% female) on community dwelling, and 62 elderly (40% male, 60% female) on nursing home. Cut-off point from young adult for ASM, HGS, and GS for male and female were 8,1 and 5,6 Kg/m^2, 32 and 20 Kg, and 1,2 and 1,17 m/sec. The value of ASM, HGS, and GS in male from community dwelling were higher (8,8 vs 7,5 Kg/m^2 ($p<0,001$), 25,9 vs 17,7 Kg ($p<0,001$), and 1,5 vs 0,8 ($p<0,001$), while the value of GS in female from community dwelling were higher 1,3 vs 0,73 m/sec ($p=0,008$), and similar on ASM and HGS. The percentage of lower ASM, HGS, and GS in male were all higher on elderly from nursing home; 28% vs 60% ($p<0,026$), 82% vs 99% ($p<0,001$), and 28% vs 88% ($p<0,001$), as well as in female 5% vs 5,4% ($p<0,001$), 70% vs 86,2% ($p<0,001$), and 34% vs 100% ($p<0,001$). There were cut-off point based on Indonesian young adult to determination the sarcopenia in elderly, and the elderly from nursing home have a lower muscle mass and performance, especially in male.

1 INTRODUCTION

Sarcopenia is a major clinical problem and a quite commonly treatable geriatric condition (Moreira, Perez and Lourenço, 2019; Shafiee et al., 2017). It defined as an age related loss muscle accompanied by a reduction in muscle strength and function (Rodríguez-Rejón et al., 2019; Abe et al., 2011; Milanović et al., 2013). Progressive loss of skeletal muscle mass and strength as the individual gets older often contribute to numerous negative health outcomes, such as disability, functional impairment, increased risk of falls, hospitalisation, decreased quality of life and increased risk of mortality (Santilli et al., 2014, Lees et al., 2019).

In addition, sarcopenia is a potentially modifiable risk factor for health status, risk of falls, and fractures in elderly. So, an early detection of sarcopenia is important to prevent progressive reduction in skeletal muscle mass and function (Yeung et al., 2019; Lees et al., 2019).

Based on International Working Group on Sarcopenia (IWGS) and Asian Working Group for Sarcopenia (AWGS), sarcopenia is defined as low muscle mass and low muscle strength, and/or low physical performance, that can be measured by appendicular muscle mass divided by the height squared, the handgrip strength, and/or gait speed.(Chumlea et al., 2011, Chen et al., 2014)

The definitions of sarcopenia provided by EWGSOP, IWGS, and AWGS were based on different methods and different cut-off points to define loss of muscle mass, reduction in muscle strength, and low gait speed (Chumlea et al., 2011; Chen et al., 2014; Carvalho do Nascimento, Poitras and Bilodeau, 2018). The measurement of muscle

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mass along with muscle performance were assessed using hand grip strength and gait speed.Muscle mass were measured using Body Impedance Analysis calculated in (Kg)/body height (m^2), hand grip strength were evaluated using Jamar Hand Grip (kg), and gait speed were calculated by measuring gait speed (second) on four meter track of gait (m/sec) (Cruz-Jentoft et al., 2010; Bahat et al., 2016; Yeung et al., 2019)

The elderly population in the world, as well as in Indonesia, continues to grow throughout the following years and decades. Based on the statistic data, elderly population in Indonesia on 2010 took up as much as 7.6% of the total population, increasing up to 8.5% in 2015, and the population were estimated to have expected increase up to a total of 10% in 2020 (Depkes RI, 2016). However, research on the prevalence of sarcopenia in Indonesia is still limited, as well as the lack of further research to determine the cut-off point for skeletal muscle mass, muscle strength, and/or gait speed in Indonesia. Since the cut-off point of muscle mass, handgrip strength and gait speed varies among countries and populations, the measurement on young adult is necessary to be done as a standard in every country. (Chen et al., 2014; Bahat et al., 2016; Yeung et al., 2019)

Determination of sarcopenia in elderly were based on – 2 standard deviation or lowest quartile of normal value of muscle mass, hand grip strength, and gait speed in young adult. Young subjects as the standard value are required to be in perfect health, without history or current chronic disease or chronic drug usage as a reference population for assessing muscle mass (Bahat et al., 2016).

Based on previous study on Asian working group for sarcopenia in elderly population above 65 years, diagnosis of sarcopenia in Taiwan were established based on skeletal muscle index (SMI) 2 SD below normal young adult were <8,87Kg/m^2 (23,6% male); <6,42 Kg/m^2 (18,6% female), while in Japan it was established based on Appendicular skeletal muscle (ASM) 2 SD below young adult values were < 7,0 Kg/m^2 (11,3% male); <5,8 Kg/m^2 (10,7% female); ≤ 6,42 Kg/m^2 (22,1% female), and in Korea based on ASM were 6,75 Kg/m^2 (21,8% male); <5,07 Kg/m^2 (22,1% female) (Chen et al., 2014).

The value of hand grip strength (HGS) based on lowest quartile in young adult in Japan were 30,3 Kg (male), and 19,3 kg (female), while HGS value based on Asian Working Group of Sarcopenia in <18 kg for females and <26 kg for males were considered as cut-off points for the definition of sarcopenia. In Taiwan, HGS value based on European Working Group of Sarcopenia (EWGSOP) recommendation and adjusted according to Asia data were <22,4 Kg (male), and <14,3 Kg (female). (6,9)

The physical performance quality assessed by measurement of gait speed (GS) in Japan, based on the lowest quartile of study group were measured within the standard of <1,27m/s (11,3% male); <1,19 m/s (10,7% female); ≤ 1,22 m/s (22,1% female). In Taiwan, the standard used are ≤ 1 m/s, be it for male or female (Chen et al., 2014).

This study aimed to find the cut-off point of skeletal muscle mass, handgrip strength, and gait speed in Indonesian young adult, as a reference for determining the prevalence of sarcopenia, and also the differences between elderly who lived in community dwelling and nursing home.

2 METHODS

The method design of this study was cross-sectional. The community dwelling elderly were recruited from an outpatient setting in one of the private hospital on South Tangerang, and elderly subjects who lived in nursing home were recruited from a social nursing home located in Cengkareng, West Jakarta. All subjects were male and female above 60 years old who were able to walk without walking aid, able to grip, and in good health. Subjects with cardiac failure, chronic obstructive pulmonary disease, acute asthma were excluded.

The young adult group were recruited from one of the private university in West Jakarta. Inclusion criteria for the subjects of the young adult group includes: age range between 17-25 years old, with good health condition, are able to walk without walking aids, able to grip, no history of chronic disease, and did not consume any drugs.

Ethical clearance were previously approved by the ethics committee with 128/KER/FK/III/2018 ethical clearance number. Data collection was conducted between June 2018 and December 2018.

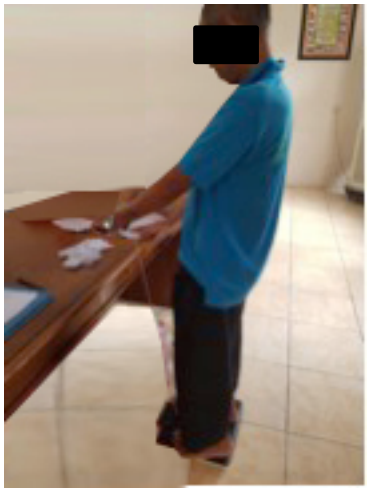

Figure 1: Body Impedance Analysis data sampling.

Figure 2: HGS data sampling.

Figure 3: Gait speed data sampling.

All included subjects agreed to perform several tests; the measurement of appendicular skeletal muscle mass (ASM) in Kg/m^2 using "TANITA" body impedance analysis, hand grip strength (HGS) in Kg using Jamar Hand Grip, and gait speed (GS) in m/sec evaluated by measuring the time on four meter gait test using stopwatch.

3 RESULTS

There were 369 young adult subjects included in the study. The subjects consisted of 163 male (44%) and 206 female (56%), and for the elderly subjects group, there were 183 elderly subjects from community dwellings with 86 male (47%) and 97 female (53%); and 62 elderly subjects from nursing home consisted of 25 male (40%) and 37 female (60%). The characteristic of the young adult and elderly subjects are listed on the table 1.

The cut-off value of ASM, HGS, and GS based on young male listed in table 2 were 8,1 Kg/m^2; 32 Kg; and 1,2 m/sec, while cut-off value of ASM, HGS, and GS based on young female were 5,6 Kg/m^2; 20 Kg; and 1,17 m/sec.

Table 3 showed that the value of ASM, HGS, and GS of elderly male subjects from nursing home were significantly lower ($p = <0,001$, $p<0,001$, $p<0,001$). The value of ASM and HGS were quite similar between the elderly female subjects groups ($p=0,1$ and $p=0,9$), while the GS value of the nursing home elderly female subjects group were significantly lower compared to the community dwelling elderly subjects group ($p=0,008$).

The data listed in Table 4 have shown percentage of lower values of ASM, HGS, and GS male and female from nursing home were higher ($p=0,026$, $p<0,001$, $p<0,001$), examined by Mc Nemar test.

Table 1: Characteristics of the young adult and elderly subjects.

	Young adult N=369		Elderly			
			Community dwellings N=183		Nursing home N= 62	
	Male	Female	Male	Female	Male	Female
Total	163 (44%)	206 (56%)	86 (47%)	97 (53%)	25 (40%)	37 (60%)
Age (years)	20 (17-24)	19 (17-25)	68,5 (60-87)	67 (60-87)	62,6± 9,5	65±10
Body weight (Kg)	69,6 ± 12,6	55,6 ± 10,9	67± 12,2	60,6± 9,8	55±12	50±9
Body height (cm)	169,3±6	156±5,7	165 (142-183)	152 (141-165)	153,6±9,2	141± 7,2
BMI (Kg/m^2)	24,3±4	22 (15,5-37,6)	24,9 (16,7-40,9)	26,9 (17,6-45,9)	22,2± 4,5	25±4.1

Table 2: The Cut-off Values of Appendicular Muscle Mass, Hand Grip Strength, and Gait Speed in young adult subjects.

	Male	Female
ASM (Kg/m^2)	2SD: 8,1	25% percentile: 5,6
HGS (Kg)	25% percentile: 32	25% percentile: 20
GS (m/sec)	25% percentile: 1,2	25% percentile: 1,17

Table 3: Value difference of the Appendicular Skeletal Muscle Mass, Hand Grip Strength, and Gait Speed on elderly subjects between community dwelling and nursing home settings.

	Male			Female		
	Community Dwelling N=86	Nursing home N=25	p	Community Dwelling N=97	Nursing home N=37	p
ASM (Kg/m^2)	8,8 (5.6-14.9)	7,5 ± 1,4	<0,001*	6,8 (4,9-11)	6,6 (4,9-10)	0,1
HGS (Kg)	25,9 ± 6,8	17,7± 5,6	<0,001**	18 (8-31)	11,8 ± 5,8	0,9
GS (m/sec)	1,5 ± 0,4	0,84± 0,24	<0,001**	1,3 ± 0,3	0,73 ± 0,2	0,008**

* Mann-Whitney Test

** T-test

Table 4: The percentage differences of lower ASM, HGS and GS between elderly in community dwelling and nursing home.

	Male				Female			
	Cut-off Value	Community Dwelling	Nursing home	P	Cut-off Value	Community Dwelling	Nursing home	P
ASM (Kg/m^2)	2SD: 8,1	28%	60%	<0,026	25% percentile: 5,6	5%	5,4%	<0,001
HGS (Kg)	25% percentile : 32	82%	99%	<0,001	25% percentile: 20	70%	86,2%	<0,001
GS (m/ sec)	25% percentile: 1,2	28%	88%	<0,001	25% percentile: 1,17	34%	100%	<0,001

4 DISCUSSION

This study found that the value of – 2 SD of the ASM from the young male were 8,1 Kg/m^2 , which is a bit lower than the ASM of the young male in Taiwan (8,82 Kg/m^2), and higher than Japan (7,0 Kg/m^2) and Korea (6,75 Kg/m^2). While the lowest quartile of the ASM from the young female were 5,6 Kg/m^2, that was lower than Taiwan (<6,42 Kg/m^2) and Japan (< 5,8 Kg/m^2), and higher than Korea (< 5,07 Kg/m^2). The lowest quartile of HGS in young male was 32 Kg, higher than Japan (30,3 Kg) and EWGSOP to Asia data (22,4 Kg). Furthermore, the lowest quartile of HGS in young female from this study was 20 Kg, higher than Japan (19,3 Kg) and EWGSOP recommendation (14,3 Kg). The study result of the lowest quartile of the GS in young male was 1,2 m/sec, is a bit lower than in Japan (1,27 m/sec), yet still higher than the Taiwan study (< 1 m/sec). The lowest quartile of the GS in young female from this study was 1,17 m/sec, slightly lower than Japan (1,19 m/sec) and a bit higher than Taiwan (1 m/sec) (Chen et al., 2014).

The value of ASM, HGS, and GS of elderly male subjects from community dwelling home were significantly higher; 8,8 (5,6-14,9) vs 7,5 ± 1,4 Kg/M^2 (p<0,001); 25,9 ± 6,8 vs 17,7± 5,6 Kg (p< 0,001, and 1,5 ± 0,4 vs 0,84± 0,24 m/sec (p<0,001). However, the ASM and the HGS in elderly female subjects were shown slightly higher in female from community dwelling home, but statistically no difference between community dwelling and nursing home subjects; 6,8 (4,9-11) vs 6,6 (4,9-10) Kg/m^2 (p=0,1); 18 (8-31) vs 11,8 ± 5,8 kg (p=0,9) , while the GS of elderly female subjects in community dwelling settings was higher; 1,3 ± 0,3 vs 0,73 ± 0,2 m/sec (p=0,008).

The percentage of the lower ASM, HGS, and GS in elderly male from community dwellings were lower; 28% and 60% (p<0,026); 82% and 99% (p<0,001); 28% and 88% (<0,001). As well as in elderly female subjects, the percentage of the lower ASM, HGS, and GS from community dwellings were lower than in nursing home; 5% and 5,4% (<0,001); 70% and 86,2% (p<0,002); 34% and 100% (p<0,002).

The prevalence of sarcopenia increases in a nursing home setting. The results of this study are consistent with previous studies, showing that there is a close association between the degree of sarcopenia and the degree of dependence among residents (Buckinx et al, 2017). This results also consistent with one of the multi-center study from Spanish, stating that sarcopenia is a frequent condition in elderly population who lived in a nursing home, especially among female. (Salvà et al., 2016). Although, in this study, elderly male in nursing home have lower value of ASM, HGS and GS, while elderly female in nursing home only have lower value in GS.

Elderly skeletal muscle performance is regulated by some factors, such as nervous, muscular, and skeletal systems. These factors are influenced by lifestyle, biological, and psychosocial factors. Lifestyle factors including physical activity and nutritional intake; biological factors including genetics, hormones, and low-grade inflammation; psychosocial factors including fear of falling, psychological resiliency, self-efficacy, and loneliness (Tieland, Trouwborst and Clark, 2017). Based on systemic review and meta-analysis study conducted by Shen Y, et al, the review also said that malnutrition was quite common in nursing home setting, and it appeared to be an independently associated factor of sarcopenia (Shen et al., 2019). This study found that the prevalence of sarcopenia was higher in nursing home than in the community dwelling. It can be caused by low physical activity in nursing home, low nutrition intake, and some other psychological problem, because nursing home usually don't have any family that can support them, so they usually lacking motivation to be active.

The percentage of the lower ASM in elderly male subjects from community dwellings (28%) and nursing home (60%) were significantly higher than previous study in Taiwan (23,6%), Japan (11,3%), and Korea (21,8%). While the lower ASM in elderly female subjects from community dwellings (5%) and nursing home (5,4%) were lower than earlier study in Taiwan (18,6%), Japan (10,7% and 22,1%), and Korea (22,1%) (Chen et al., 2014).

The prevalence of the lower physical performance by measuremalet of gait speed in this study of elderly male subjects from community dwellings (28%) and in nursing home setting (88%) were higher than the Japanesestudy (11,3%). As well as the lower gait speed in elderly female subjects from community dwellings (34%) and nursing home (100%) were higher than elderly female subjects in the Japanese study (22,1%) (Chen et al., 2014).

The limitations of this study were each group of the adult and elderly subjects were recruited only from one location.

5 CONCLUSIONS

Based on this study, Sarcopenia in Indonesia can be determined by cut-off point from young adult values for the ASM; <8,1 Kg/M^2 (male) and <5,6 Kg/M^2 (female), the HGS; < 32 Kg (male) and <20 Kg (female), and the GS; < 1,2 M/sec (male) and < 1,17 (female)**.**

The values of the ASM, HGS, and GS in elderly male subjects from community dwelling were higher than values obtained from subjects in nursing home setting. While the ASM and HGS results in elderly female subjects were quite similar between both location, however, elderly female subjects from community dwelling group have higher GS compared to the elderly female subjects in the nursing home. The percentage of the lower ASM in elderly male and female subjects were significantly higher in nursing home setting than community dwelling home.

The physical performance in this study presented by gait speed was better in elderly who lived in community dwelling home in both gender.

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