

Artikel Asli/Original Articles

Identification of Older Adults with Sarcopenia: Comparison of Two Methods (Penentuan Warga Emas yang Mengalami Sarkopenia: Perbandingan antara Dua Kaedah)

HANISAH ROSLI, SUZANA SHAHAR, MANAL BADRASAWI, DEVINDER KAUR AJIT SINGH & NOOR IBRAHIM MOHAMED SAKIAN

ABSTRACT

To compare the ability of methods based on skeletal muscle index (SMI) and another one by the European Working Group on Sarcopenia in Older People (EWGSOP) based on both muscle mass and physical function in identifying older adults with sarcopenia. Anthropometric measurements and physical performance (hand grip strength and gait speed) were performed. In order to determine the value of SMI, body impedance analysis was also carried out. A total of 426 older adults, mostly women (60.8%) with mean age of 68.4 ± 6.2 years participated in this study. Methods based on SMI and EWGSOP identified 50.5% and 32.2% older adults as sarcopenic respectively. Method based on SMI showed a significantly higher percentage of men (70.7%) were sarcopenic as compared to women (37.5%) ($p < 0.05$). No such difference was noted for EWGSOP method, with 28.7% of men were sarcopenic as compared to women (34.4%). Binary logistic regression indicated that aged 75 years and above (adjusted odds ratio: 3.3, 95% confidence interval: 1.9 – 5.6) and having arthritis (adjusted odds ratio: 2.5, confidence interval: 1.3 – 4.7) to be associated with sarcopenia as assessed using method recommended by EWGSOP. The lower prevalence of sarcopenia by EWGSOP as compared to SMI may be due to the more comprehensive method by EWGSOP. Further research regarding validation of these two screening methods against a gold standard of screening for sarcopenia is needed in order to identify the best method..

Keywords: Sarcopenia; older adults; screening method; skeletal muscle index; physical function

ABSTRAK

Untuk membandingkan keupayaan kaedah berdasarkan indeks otot rangka (SMI) dan 'European Working Group on Sarcopenia in Older Adults' (EWGSOP) bagi menentukan warga emas yang mengalami sarkopenia. Pengukuran antropometri and kekuatan fizikal (kekuatan genggam tangan dan gait speed) telah dilakukan. Bagi menentukan SMI, analisis impedans tubuh turut dijalankan. Seramai 426 warga emas, kebanyakannya golongan wanita (60.8%) dengan purata umur 68.4 ± 6.2 tahun terlibat di dalam kajian ini. Kaedah berdasarkan SMI dan EWGSOP mengenal pasti seramai 50.5% dan 32.2% subjek mengalami sarkopenia. Kaedah SMI mendapati lebih ramai lelaki (70.7%) mengalami sarkopenia secara signifikan berbanding wanita (37.5%) ($p < 0.05$). Perbezaan sedemikian tidak dicerap bagi kaedah EWGSOP, dengan 28.7% lelaki sarkopenia berbanding wanita (34.4%). Analisa regresi logistik binari menunjukkan usia 75 tahun dan ke atas (adjusted odds ratio: 3.3, 95% confidence interval: 1.9 – 5.6) dan mengalami artritis (adjusted odds ratio: 2.5, confidence interval: 1.3 – 4.7) adalah berkaitan dengan sarkopenia sebagaimana ditentukan menggunakan EWGSOP. Prevalens sarkopenia yang lebih rendah berdasarkan EWGSOP berbanding SMI disebabkan oleh kaedah penentuan yang lebih menyeluruh oleh EWGSOP. Kajian selanjutnya berkaitan pengesahan dua kaedah ini berbanding kaedah penyaringan sarkopenia piawai adalah diperlukan bagi menentukan kaedah yang paling baik..

Kata kunci: Sarkopenia; warga emas; kaedah penyaringan; indeks otot rangka; fungsi fizikal

INTRODUCTION

As Malaysia progresses from a developing towards a developed country, the number of older adults aged 60 years and above is expected to increase due to the improvements in healthcare service and better control of communicable diseases as compared to pre-independence era (Pala 1998). It was estimated that Malaysia will have four millions older adults by the year 2025 (Arokiasamy 1997). Due to this, more attention in terms of disease prevention and treatment should be given to this group. One

of the most common health issues among the older adults is sarcopenia, which can be defined as degradation of skeletal muscle and muscle strength related to the aging process (Morley et al. 2001). Among the factors contributing to the occurrence of sarcopenia include aging process, dietary intake, sedentary lifestyle, chronic diseases and intake of certain drugs (Thomson 2007). The prevalence of sarcopenia ranges from 5 to 13% for older adults aged 60 to 70 years and 11 to 50% for their counterparts aged 80 years and above, according to the sarcopenia screening tools used (Stephan et al. 2010).

The definition of sarcopenia is still widely debated especially in research and clinical settings (Cruz-Jentoft et al. 2010). In addition, there are several tools that are used to identify sarcopenia among older adults. Thus, providing different results according to the tools utilized. One of the tools that have been commonly used to classify sarcopenia is recommended by Janssen et al. (2002) using skeletal muscle index (SMI). Skeletal muscle mass was estimated from bioimpedance analysis measurements and expressed as SMI ($\text{SMI} = \text{skeletal muscle mass}/\text{body mass} \times 100$). Skeletal muscle index (SMI) below -two standard deviations of normal older adults values cut-off has been used to identify sarcopenia (Janssen et al. 2002).

On the other hand, the European Working Group on Sarcopenia in Older People (EWGSOP) (2010) developed a practical clinical definition and consensus of diagnostic criteria for age-related sarcopenia. For the diagnosis of sarcopenia, EWGSOP recommends using the presence of

both low muscle mass and low muscle function (strength or performance). This tool also uses physical performance (gait speed and hand grip strength) as the parameters to identify a person with sarcopenia. Following EWGSOP (2010), cut-off points of $< 8.87 \text{ kg/m}^2$ and $< 6.42 \text{ kg/m}^2$ for men and women respectively were used to identify subjects who had poor skeletal muscle index. The algorithm for the screening of sarcopenia based on EWGSOP is as shown in Figure 1.

Due to the high prevalence of sarcopenia especially among older adults aged 80 years and above and the vital need to identify a robust and reliable screening tool which can identify sarcopenia, this paper aims to compare the results of Janssen et al. (2002) and EWGSOP (2010) in identifying older adults with sarcopenia. In addition, the risk factors of sarcopenia among older adults were also evaluated.

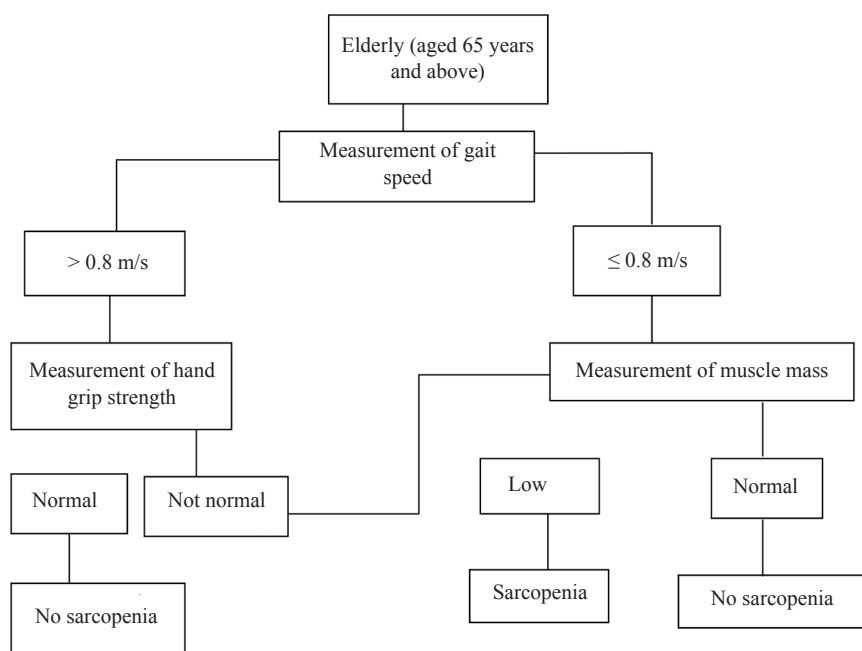


FIGURE 1. The algorithm for the screening of sarcopenia based on EWGSOP

METHOD

This cross-sectional study was designed to compare the ability of screening methods by Janssen et al. (2002) and EWGSOP (2010) in identifying older adults aged 60 years and above with sarcopenia in a community setting in Cheras, Kuala Lumpur, Malaysia. Ethical approval was obtained from the Secretariat for Research and Ethics of Universiti Kebangsaan Malaysia (KLAS-NN-135-2011). Consent was obtained from all participants. Participants were recruited by convenience sampling by researchers who contacted them personally. Participants' inclusion criteria included those who were able to communicate and

ambulate without assistance. Participants were excluded if they had mental or chronic diseases.

Participants were identified as having sarcopenia using methods based on SMI by Janssen et al. (2002) and EWGSOP (2010). Anthropometric measurements such as height and weight were carried out.

Physical performance tests that include gait speed, hand grip strength and calculation of skeletal muscle index ($\text{SMI} = \text{skeletal muscle mass}/\text{body mass} \times 100$) were performed. Gait speed test required the participants to walk normally for a distance of 4 metres. The walking time was then recorded for scoring. In order to measure body composition, bioimpedance measurement using the

Maltron 916 method was also carried out. Participants were in supine position throughout the measurement of body composition. Measurement of hand grip was conducted using a Hydraulic hand Dynamometer (JAMAR, USA). Participants were required to sit up straight with their hand holding the hydraulic hand dynamometer. The hand holding dynamometer was held at 90° flexion at the elbow. Participants were asked to grip the hand dynamometer as strong as possible for three times for both left and right hands, alternately. Readings were taken in kilogram (kg) unit. Mean of all three readings were calculated.

Data analysis was carried out using Statistical Product and Service Solution 21.0 (SPSS version 17.0). Pearson's chi square test was used to test differences in the level of sarcopenia for categorical data. Binary logistic regression analysis (enter method) was used to determine the factors associated with sarcopenia. Descriptive statistics included mean and standard deviation (SD).

RESULTS

STUDY POPULATION

A total of 426 older adults, with mostly women (60.8%) participated in this study. The mean age for men was 69.2 ± 6.3 years whilst the mean age for women was 67.9 ± 6.1 years. Most participants in this study aged 60 to 74 years with mean age for all participants was 68.4 ± 6.2 years. The majority of participants were Chinese (58.9%), followed by Malays (26.1%) and Indians (15.0%). Among the most common health conditions experienced by the participants

were hypertension (55.1%) and dyslipidemia (41.4%). In addition, more females (14.3%) experienced arthritis as compared to their male counterparts (5.5%) ($p < 0.01$).

ANTHROPOMETRY AND NUTRITIONAL STATUS

The mean of body mass index (BMI) for all participants was 25.5 ± 4.3 kgm⁻² which falls in the overweight category, according to WHO classification. Interestingly, more women participants were categorized as underweight and obese as compared to men (Table 1).

GAIT SPEED

Gait speed has been used as one of the parameters in identifying sarcopenia by the EWGSOP. EWGSOP recommended the cut-off point value of ≤ 0.8 m/s. The mean gait speed for both were the same ie. 1.0 ± 0.2 m/s. Based on this, a total of 13.8% and 21.2% of men and women respectively were identified as having poor gait speed, whilst 18.3% of all participants were below the recommended cut-off points.

HAND GRIP STRENGTH

Hand grip strength was used in the EWGSOP method and the cut-off point was set at < 30 kg for males and < 20 kg for females. A total of 67.0% participants were identified as having poor hand grip strength. More women (70.3%) seem to have were having this problem as compared to 59.3% men ($p < 0.05$).

TABLE 1. BMI classifications of subjects

	Male (n = 167)	Female (n = 259)
Underweight (BMI < 20.0 kgm ⁻²)	13 (7.8%)	26 (10.0%)
Normal weight (BMI 20.0 – 24.9 kgm ⁻²)	70 (41.9%)	98 (37.9%)
Overweight (BMI 25.0 – 29.9 kgm ⁻²)	64 (38.3%)	93 (35.9%)
Obese (BMI ≥ 30 kgm ⁻²)	20 (12.0%)	42 (16.2%)

SKELETAL MUSCLE INDEX

Skeletal muscle index (SMI) was used as a parameter for identifying sarcopenia by both methods (SMI = skeletal muscle mass/body mass × 100). Based on Janssen et al. (2002), SMI below two standard deviations of normal older adult values cut-off was used to identify sarcopenic whilst cut-off points of < 8.87 kg/m² and < 6.42 kg/m² for males and females respectively were used by EWGSOP (2010) to identify participants who had poor skeletal muscle index.

Based on the method recommended by EWGSOP (2010), a total of 26.0% of participants were identified as having poor SMI. When compared between genders, more females were found to have this problem as 27.8% had been identified as compared to 26.3% of males.

IDENTIFICATION OF OLDER ADULTS WITH SARCOPENIA

Janssen et al. (2002) used SMI per se as the parameter to screen for sarcopenia whereas the EWGSOP (2010) used gait speed, hand grip strength and SMI in its formula. Participants who did not meet the minimum cut-off points of two or more parameters would be identified as sarcopenic (EWGSOP 2010). Using both methods by Janssen et al. (2002) and EWGSOP (2010), we identified 50.5% and 32.2 of participants respectively as sarcopenic (Table 2). Surprisingly, Janssen et al. (2002) (70.7%) showed large difference of male participants identified with sarcopenia as compared with EWGSOP (2010) (28.7%). In addition, method recommended by Janssen et al. (2002) showed significant difference ($p < 0.01$) on the number of men

TABLE 2. Subjects identified with sarcopenia by Jansen et al. (2002) and EWGSOP (2010)

	Men (<i>n</i> = 167)	Women (<i>n</i> = 259)	All subjects (<i>n</i> = 426)
Janssen et al. (2002)	118 (70.7%) ^a	97 (37.5%)	215 (50.5%)
EWGSOP (2010)	48 (28.7%)	89 (34.4%)	137 (32.2%)

^a*p* < 0.01; significant difference between sex (Pearson's chi square test)

TABLE 3. Risk factors of sarcopenia according to EWGSOP (2012)

Risk factors	Adjusted odd ratios	95% confidence interval (lower-upper bound)
Aged 75 years and above ^a	3.3	1.9 – 5.6
Arthritis ^a	2.5	1.3 – 4.7

^a*p* < 0.01

participants with sarcopenia as compared to women participants. This is in contrast with the results from the method recommended by EWGSOP (2010) as the number of female participants with sarcopenia was more as compared to male participants but with no significant difference.

FACTORS ASSOCIATED WITH SARCOPENIA AMONG OLDER ADULTS

As shown in Table 3, binary logistic regression indicated that aged 75 years and above and having arthritis were found to be associated with sarcopenia as assessed using method recommended by EWGSOP. Older adults aged 75 years and above were 3.3 times more likely to develop sarcopenia than those aged 60 to 74 years (*p* < 0.01) whilst those having arthritis had 2.5 times higher risk to develop sarcopenia than those not having arthritis (*p* < 0.01).

DISCUSSION

To the best of our knowledge, this is the first study which compares the results from two different sarcopenia screening methods [i.e. Janssen et al. (2002) and EWGSOP (2010)]. Both methods have been used in research involving clinical and community settings in Malaysia. In identifying individuals with sarcopenia, method by Janssen et al. (2002) used skeletal muscle index (SMI) parameter per se whilst method by EWGSOP (2010) used a more comprehensive method by combining SMI, gait speed and hand grip parameters. In this study, we were able to compare the ability of both methods using different parameters in identifying individuals with sarcopenia and thus, providing appropriate care plan strategies involving medical, nutritional and physical activities to those who in need.

Poor gait speed indicates depletion of functional reserve and thus a critical aspect of functioning in old age (Ferrucci et al. 2000). Poor lower extremity performance is a strong and robust risk factor for incident disability, hospitalization, institutionalization, and mortality

independent of potential confounders (Newman et al. 2006). This study showed that more women had poor gait speed as compared to men. Most studies of walking speed conducted in older adults have described a linear pattern of slower walking speed with increasing age. Studies by Tolea et al. (2010) showed that generally, women walked slower than men at every age, with more marked differences after age 55. Shorter stature, smaller waist circumference and less physical activities among women may have contributed to this condition.

Handgrip strength is a general indicator of muscle strength, and low handgrip strength has been linked with premature mortality in middle-aged and older adults (Metter et al. 2002; Takata et al. 2007). In the present study, a total of 70.3% women had hand grip strength that was below the recommended values as compared to 59.3% men (*p* < 0.05). A randomized controlled trial reported that sex steroid plus growth hormone intervention significantly increases muscle strength in men, but not in women (Cheung et al. 2013). This suggests that hormonal factor may play a role in determining muscle strength in advanced age.

Skeletal muscle index (SMI) (SMI = skeletal muscle mass/body mass x 100) was used as a parameter for identifying sarcopenia in both methods. After adjustments made according to the cut-off points, more women were identified to have poor SMI values as compared to the men. Studies by Janssen et al. (2004) showed that poor SMI was associated with physical disability. Compared with women with low-risk skeletal muscle values, women with moderate- and high-risk skeletal muscle values had odds for physical disability of 1.41 (95% confidence interval (CI): 0.97, 2.04) and 3.31 (95% CI: 1.91, 5.73), respectively. The corresponding odds in men were 3.65 (95% CI: 1.92, 6.94) and 4.71 (95% CI: 2.28, 9.74).

Results using the method by Janssen et al. (2002) (70.1%) showed that larger difference in men was identified with sarcopenia as compared with the method by EWGSOP (2010) (28.7%). In addition, using the method by Janssen et al. (2002) demonstrated significantly higher percentage

of men were identified as sarcopenic (70.7%) as compared to women (37.5%) ($p < 0.05$). This is in contrast with the results from EWGSOP (2010) that a higher number of women with sarcopenia as compared to men but with no significant difference. This result could be due to the fact that the method by Janssen et al. (2002) uses SMI per se as a parameter in identifying participants with sarcopenia. One of the factors that may associate with higher prevalence of sarcopenia among older men is poorer bioavailability of testosterone. Testosterone has been known to have anabolic properties in muscles. Bioavailable testosterone is related to lower extremity strength and function. Moreover, testosterone treatment in older men with hypogonadal increased hand-grip strength and lowered extremity muscle strength (Szulc et al. 2004). Thus, hormonal changes may be one of the factors in the multifactorial system affecting skeletal muscle mass and, consequently, influencing strength and function in older men.

As shown in Table 2, the prevalence of sarcopenia by the method by Janssen et al. (2002) was higher than the method by EWGSOP (2010). This may be due to the limited parameters used in the method by Janssen et al. (2002) as compared to the method by EWGSOP (2010) which uses a more comprehensive method in identifying participants with sarcopenia. Due to this, there may be a possibility of overestimating participants with sarcopenia as the method by Janssen et al. (2002) only includes muscle mass, without assessment of muscle function (gait speed and hand grip strength) as compared to the method used by EWGSOP (2012). Further research regarding validation of these two screening methods against a gold standard of sarcopenia is needed in order to identify the better method.

CONCLUSION

From the results, it shows that method by EWGSOP (2012) is more suitable to be used in identifying older adults with sarcopenia. This study showed that the prevalence of sarcopenia among older adults in a community setting in Malaysia is still relatively high using both screening methods. Remedial actions involving medical, nutritional and physical approaches are needed in order to promote healthy aging among older adults.

ACKNOWLEDGEMENT

This study acknowledged the cooperations from all subjects and fieldworkers involved in this study. This study was funded by a Research University Grant (NN135 2011), as part of a larger project on Kuala Lumpur Aging Study (KLAS).

REFERENCES

- Arokiasamy, J.T. 1997. Malaysia's ageing issues. *Medical Journal of Malaysia* 52(3): 197-201.
- Cheung, C.L., Nguyen, U.S., Au, E., Tan, K.C., Kung, A.W. 2013. Association of handgrip strength with chronic diseases and multimorbidity: A cross-sectional study. *Age (Dordr)* 35(3): 929-941.
- European Working Group on Sarcopenia in Older People (EWGSOP). 2010. Sarcopenia: European consensus on definition and diagnosis. *Age and Ageing* 39: 412-423.
- Ferrucci, L., Bandinelli, S., Benvenuti, E., Di Iorio, A., Macchi, C., Harris, T.B., Guralnik, J.M. 2000. Subsystems contributing to the decline in ability to walk: bridging the gap between epidemiology and geriatric practice in the InCHIANTI study. *Journal of American Geriatric Society* 48(12): 1618-1625.
- Janssen, I., Baumgartner, R.N., Ross, R., Rosenberg, I.H., Roubenoff, R. 2004. Skeletal muscle cutpoints associated with elevated physical disability risk in older men and women. *American Journal of Epidemiology* 159: 413-421.
- Janssen, I., Heymsfield, S.B., Ross, R. 2002. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. *Journal of American Geriatric Society* 50(5): 889-96.
- Metter, E.J., Talbot, L.A., Schrager, M., Conwit, R. 2002. Skeletal muscle strength as a predictor of all-cause mortality in healthy men. *The Journals of Gerontology: Series A* 57(10): B359-65.
- Morley, J.E., Baumgartner, R.N., Roubenoff, R., Mayer, J., Nair, K.S. 2001. Sarcopenia. *Journal of Laboratory and Clinical Medicine* 137(4): 231-243.
- Newman, A.B., Simonsick, E.M., Naydeck, B.L., Boudreau, R.M., Kritchevsky, S.B., Nevitt, M.C., Pahor, M., Satterfield, S., Brach, J.S., Studenski, S.A., Harris, T.B. 2006. Association of long-distance corridor walk performance with mortality, cardiovascular disease, mobility limitation, and disability. *Journal of American Medical Association* 295(17): 2018-2026.
- Pala, J. 1998. *Senior Citizens and Population Ageing in Malaysia. Population Census Monograph Series. No.4*. Kuala Lumpur: Department of Statistics Malaysia.
- Szulc, P., Duboeuf, F., Marchand, F., Delmas, P.D. 2004. Hormonal and lifestyle determinants of appendicular skeletal muscle mass in men: the MINOS study. *American Journal of Clinical Nutrition* 80(2): 496-503.
- Takata, Y., Ansai, T., Akifusa, S., Soh, I., Yoshitake, Y., Kimura, Y., Sonoki, K., Fujisawa, K., Awano, S., Kagiya, S., Hamasaki, T., Nakamichi, I., Yoshida, A., Takehara, T. 2007. Physical fitness and 4-year mortality in an 80-year-old population. *The Journals of Gerontology: Series A* 62 (8):851-858.
- Thompson, D. 2007. Aging and sarcopenia. *Journal of Musculoskeletal and Neuronal Interactions* 7(4): 344-345.
- Tolea, M.I., Costa, P.T., Terracciano, A., Griswold, M., Simonsick, E.M., Najjar, S.S., Scuteri, A., Deiana, B., Orrù, M., Masala, M., Uda, M., Schlessinger, D., Ferrucci, L. 2010. Sex-Specific Correlates of Walking Speed in a Wide Age-Range Population. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 65B(2): 174-184.

von Haehling, S., Morley, J.E., Anker, S.D. 2010. An overview of sarcopenia: facts and numbers on prevalence and clinical impact. *Journal of Cachexia, Sarcopenia and Muscle* 1(2): 129–133.

Hanisah Rosli
Suzana Shahar
Manal Badrasawi
Dietetics Program
School of Healthcare Science
Faculty of Health Science
Universiti Kebangsaan Malaysia
Jalan Raja Muda Abdul Aziz
50300 Kuala Lumpur, Malaysia

Devinder Kaur Ajit Singh
Physiotherapy Program
School of Rehabilitation Science
Faculty of Health Science
Universiti Kebangsaan Malaysia
Jalan Raja Muda A. Aziz
50300 Kuala Lumpur, Malaysia

Noor Ibrahim Mohamed Sakian
Occupational Therapy Program
School of Rehabilitation Science
Faculty of Health Science
Universiti Kebangsaan Malaysia
Jalan Raja Muda A. Aziz
50300 Kuala Lumpur, Malaysia

Corresponding author: Suzana Shahar
Email: suzana.shahar@ukm.edu.my

Tel: +603-9289 7511
Fax: +603-2694 7621

Received: December 2015
Accepted for publication: April 2017