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COMPARING SARC-F WITH SARC-CALF TO SCREEN SARCOPENIA IN COMMUNITY LIVING OLDER ADULTS

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Abstract: *Objective:* To compare the diagnostic value of the SARC-F combined with calf circumference (SARC-CalF) with the standard SARC-F to screen sarcopenia in community-dwelling older adults. *Design:* Cross-sectional, diagnostic accuracy study. *Setting:* Geriatric outpatient clinic of a university hospital. *Participants:* Older adults >= 65 years. *Measurements:* Muscle mass (bioimpedance analysis device), muscle strength (hand grip strength-Jamar hydraulic hand dynamometer), and physical performance (usual gait speed). Four currently used diagnostic criteria [European Working Group on Sarcopenia in Older People (EWGSOP), Foundation for the National Institutes of Health (FNIH), International Working Group on Sarcopenia (IWGS), and Society on Sarcopenia Cachexia and Wasting Disorders (SCWD) criteria] were applied. SARC-CalF was performed by using two different calf circumference threshold: standard cut-off 31 cm (SARC-CalF-31) and national cut-off 33 cm (SARC-CalF-33). The sensitivity/specificity analyses of the SARC-CalF and SARC-F tools were run. We used the receiver operating characteristics curves and the area under the receiver operating characteristics curves (AUC) to compare the diagnostic accuracy to identify sarcopenia. *Results:* We included 207 subjects; 67 male and 140 female with a mean age of 74.6±6.7 years. The prevalence of sarcopenia ranged from 1.9% to 9.2%. The sensitivity of SARC-F was between 25% (EWGSOP) and 50% (IWGS); specificity was about 82%. For SARC-CalF-31 and SARC-CalF-33 sensitivity was in general similar -between 25-50%- which pointed out that SARC-CalF was not superior to SARC-F for sensitivity in this sample. Corresponding specificities for SARC-CalF-31 and SARC-CalF-33 were higher than SARC-F and were between 90-98%. Additionally, the AUC values, which indicates the diagnostic accuracy of a screening test, were in general higher for SARC-CalF-33 than the SARC-F and SARC-CalF-31. *Conclusions:* We reported that addition of calf circumference item to SARC-F tool improved the specificity and diagnostic accuracy of SARC-F but it did not improve the sensitivity in a community-dwelling Turkish older adult population sample that had low prevalence of sarcopenia. The performance of SARC-CalF tool to screen sarcopenia is to be studied in different populations and living settings.

Key words: Sarcopenia, SARC-F, SARC-CalF, screening, sensitivity, specificity, diagnostic accuracy.

Introduction

Sarcopenia is loss of skeletal muscle mass and function accompanied with ageing. It possesses well-identified adverse outcomes including functional dependency, falls, fractures, institutionalization and mortality. It affects the older adults in all settings i.e. community, nursing home, long-term care facilities and hospitals albeit the prevalence is lower in the community-dwelling older adults. Most of the older adults live in the community. The prevalence of sarcopenia depends on the definitions used to define sarcopenia. Regarding the European Working Group on Sarcopenia in Older People (EWGSOP) criteria, it has been reported between 1%-29% (1) among community-dwelling older adults. In view of the adverse outcomes and prevalence of sarcopenia among older adults, it is prudent to screen for sarcopenia in primary care practice. This would enable the referral of the screening positive older adults for detailed examination for diagnosis of sarcopenia.

SARC-F represents the first tool to screen sarcopenia. It represents a very simple, practical and easily applied screening tool for older adults and for the applicant. In former studies, SARC-F exhibited very good specificity to diagnose sarcopenia but low sensitivity which may be regarded as a flaw for a questionnaire aimed at screening (2-5) Intending to improve this weakness, it is suggested that SARC-CalF (-a modified version of SARC-F) that is produced by adding calf circumference (CC) to the SARC-F could significantly increase the sensitivity (-increasing from 33.3 to 66.7%) and diagnostic accuracy of SARC-F (6). It is recommended that this finding should be validated in different study populations (5, 6). Recently, we performed cross-cultural adaptation and clinical validation of Turkish version of SARC-F (7). This study is a continuum study of that cohort and we aimed to compare the diagnostic value of the SARC-F with SARC-CalF in regard to sarcopenia screening in a community-dwelling older adult population.

Material and Methods

Study Design and Population

This study is conducted as a diagnostic accuracy study. The study is performed in geriatric outpatient clinic of our University Medical School. The study participants aged >= 65 years were included between August 2016 and August 2017 in

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a consecutive manner. The exclusion criteria were as follows: dementia, unable to walk, and techniqual aspects that would preclude assessment with bioimpedance analysis (BIA), i.e edema, implantable pacemaker. Consent form was received from the all participants. The questionnaires were filled by a single qualified physiotherapist who also performed all the measurements.

The measurements included anthropometric measures (i.e. calf circumference, mid-arm circumference), handgrip strength (HGS), usual 4 m gait speed (UGS) test, and BIA. The study protocol was approved by the local Ethical Committee of our University.

Measurement of skeletal muscle mass, hand grip strength, usual gait speed and anthropometric measures

Muscle mass was assessed by BIA device (TANITA BC532) that estimated the total skeletal muscle mass (SMM) and SMM was adjusted by height (m)2. Hand grip strength was assessed by a Jamar hydraulic hand dynamometer with a validated protocol (8, 9) It was measured in sitting position, with the elbow in 90° flexion, wrist in the neutral position. Participants applied the maximum grip strength with both left and right hands. Three trials were performed for both hands. HGS was regarded as the maximum produced grip strength. Population specific cut-offs (32 and 22 kg in males and females) were used to designate low muscle mass and low muscle strength for the European Working Group on Sarcopenia in Older People (EWGSOP), International Working Group on Sarcopenia (IWGS) and Society on Sarcopenia Cachexia and Wasting Disorders (SCWD) criteria (10). Foundation for the National Institutes of Health (FNIH) defined grip strength cut-offs (26 and 16 in males and females) were used for FNIH definition of sarcopenia (11). Usual gait speed was performed by the subjects walking 4 m with usual speed. Calf circumference (CC) was measured as the widest circumference of calf when subjects stand. Mid-arm circumference was measured at the middle of humerus when the arm was elevated mildly and internally rotated without contraction of the biceps. Both the standard CC cut-off (31cm) and population specific cut-off (33cm) (10) were used and compared in SARC-CalF analyses. Height was measured using a stadiometer and body mass index (BMI) was calculated as weight (kg)/ height (m2).

Screening sarcopenia with SARC-F and SARC-CalF

The standard SARC-F is composed of 5 items questioning the strength, assistance in walking, rise from a chair, climb stairs, and falls scored between 0 to 2, the higher scores being suggestive for sarcopenia. SARC-CalF is composed of 6 items, the first 5 items being and scored the same as the standard SARC-F and the sixth additional item being the CC item. CC item is scored as 0 point if the CC is above the CC cut-off and as 10 points if it is below the CC cut-off. For SARC-F and SAC-CalF, a total score of >= 4 (11) and >=11 indicates positive screening for sarcopenia, respectively (6).

We used 4 different definitions of sarcopenia as the reference standard of sarcopenia diagnosis, i.e. EWGSOP (13); IWGS (14); SCWD (15); FNIH (11) definitions.

Covariates

The demographic and clinical characteristics were obtained by face-to-face interviews, i.e. age, sex, number of chronic diseases, number of regular drugs, Katz-ADL and Lawton-IADL measurements, quality of life (EQ-5D) nutritional status (Mini Nutritional Assessment) and specific chronic diseases: hypertension, , diabetes, coronary heart disease, stroke, chronic obstructive pulmonary disease (16-19).

Statistical Analyses

Descriptive statistics were reported as numbers (percentage) for categorical variables. After assessing the normality, continuous variables are given as mean ± standard deviation for all variables and median for skew-distributed variables. Using different criteria as the reference standard, we calculated the diagnostic value [sensitivity, specificity, positive likelihood ratio (+LR), and negative likelihood ratio (-LR)] of the SARC-F and SARC-CalF for identifying sarcopenia. We used a receiver operating characteristics (ROC) curve to compare the overall accuracy of the SARC-F and SARC-CalF. The area under the ROC curve (AUC) and 95% confidence interval (CI) were calculated. The larger the AUC is, the better the overall diagnostic accuracy is. The comparisons between ROC curves were performed using the DeLong method. For statistical significance, p value <0.05 was considered to be significant in the 95% confidence interval. Statistical analyses were performed by using SPSS v 21.0 (SPSS Statistics; IBM, Armonk, NY) and MedCalc Statistical Software v 15.2 (MedCalc Software bvba, Ostend, Belgium).

Results

We included a total of 207 subjects (67 male and 140 female) with mean ages of 75.4±5.9 years vs 74.2±7.1 years. The demographic, clinical characteristics of the population are given in Table 1.

10.4% of the male participants and 22.9% of female participants were identified as sarcopenia screening positive by the standard SARC-F. Corresponding figures were lower as 3% and 2.1% by the SARC-CalF-31; 4.5% and 12.9% by the SARC-CalF-33, in males and females, respectively. Sarcopenia was detected in 3.9% by EWGSOP criteria, 9.2% by FNIH criteria, 1.9% by IWGS criteria, and 2.4% by SCWD criteria. The prevalence of sarcopenia ranged between 4.5% and 10.4% in males and 0.7% and 9.3% in females with the different sarcopenia definitions.

The performance -including the sensitivity, specificity, positive and negative likelihood ratios and area under the curve (AUC) values- of the Turkish version of the SARC-F, SARC-CalF-31 and SARC-CalF-33 questionnaire in regard to sarcopenia definitions is given in Table 2 for comparison. The sensitivity of SARC-F was between 25% (EWGSOP) and

50% (IWGS); specificity was about 82% (Table 2). For SARC-CalF-31 and SARC-CalF-33 sensitivity was in general similar -between 25-50%- which pointed out that SARC-CalF was not superior to SARC-F for sensitivity in this sample. On the other hand, corresponding specificities for SARC-CalF-31 and SARC-CalF-33 were higher than SARC-F and were between 90-98%. Additionally, the AUC values, which indicates the diagnostic accuracy of the screening test, were in general higher for SARC-CalF-33 than the SARC-F and SARC-CalF-31 (Table 2). The ROC curves of SARC-F, SARC-CalF-31 and SARC-CalF-33 against different reference standards of sarcopenia are given in Figure 1a, 1b, 1c and 1d.

Table 1
Characteristics of the study population

	Male (n=67)	Female (n=140)
Age (years)	75.4±5.9	74.2±7.1
BMI (kg/m2)	28.7±4.7	31.5±6.0
Calf circumference (cm)	37.2±3.6	37.2±4.3
Waist circumference (cm)	102.3±12.4	100.7±13.4
Mid-arm circumference (cm)	28.1±3.1	29.5±3.8
Number of illnesses	4.4±1.8 (4)	4.3±2.2 (4)
Number of regular drugs	7.5±3.7 (7)	6.5±3.5 (6)
Specific chronic diseases		
Diabetes	29.9%	37.9%
Hypertension	76.1%	75%
Coronary heart disease	35.8%	20.7%
COPD	14.9%	7.1%
Hyperlipidemia	47.8%	38.6%
Falls in past year	37.3%	46.4%
SMM/height2	11.0±1.3	10.1±1.1
SMM/bmi	1.066±0.139	0.753±0.101
Hand grip strength (kg)	32.7±7.6	21.1±5.4
Gait speed (m/s)	0.98±0.25 (1.05)	
SARC-F total score	1.31±2.2 (1)	2.1±2.4 (1)
SARC-F Question 1/Strength		
None	82.1%	53.6%
Some	10.4%	20.7%
A lot	7.5%	25.7%
SARC-F Question 2/Assistance in walking		
None	87.9%	85.7%
Some	9.1%	13.6%
A lot	3%	0.7%
SARC-F Question 3/Rise from a chair		
None	84.8%	80.7%
Some	10.6%	17.1%
A lot	4.5%	2.1%
SARC-F Question 4/Climb stairs		
None	83.6%	65%
Some	7.5%	19.3%
A lot	9%	15.7%
SARC-F Question 5/Falls		
None	61.2%	55.7%
Some	31.3%	38.6%
A lot	7.5%	5.7%
SARC-F screening positive (>=4 points)	10.4%	22.9%
SARC-CalF total score		
SARC-Calf Item 6/ Calf circumference		
CC< 31 cm	1.76± 3.5 (1)	2.36± 2.95 (1)
CC<=33 cm	2.21 ±3.96 (1)	3.51 ±4.62 (1)
SARC-CalF screening positive (>=11 points)		
SARC-CALF (CC< 31 cm)	3.0%	2.1%
SARC-CalF (CC< 33 cm)	4.5%	12.9%
Prevalence of sarcopenia		
EWGSOP	10.4%	0.7%
FNIH	9%	9.3%
IWGS	4.5%	0.7%
SCWD	6%	0.7%

Data are given as mean±standard deviation (median) as appropriate; BMI, body mass index; SMM, skeletal muscle mass; SMMI, skeletal muscle mass index; CC, calf circumference; EWGSOP, European Working Group on Sarcopenia in Older People; FNIH, Foundation for the National Institutes of Health; IWGS, International Working Group on Sarcopenia; SCWD, Society on Sarcopenia Cachexia and Wasting Disorders.

Discussion

The findings of our study indicated that SARC-CalF, either with introduction of calf circumference threshold of 31 or 33cm (SARC-CalF-31 and SARC-CalF-33) revealed similar sensitivity but higher specificity when compared with the standard SAR-F tool. On the other hand, SARC-CalF-33 revealed the highest diagnostic accuracy among all.

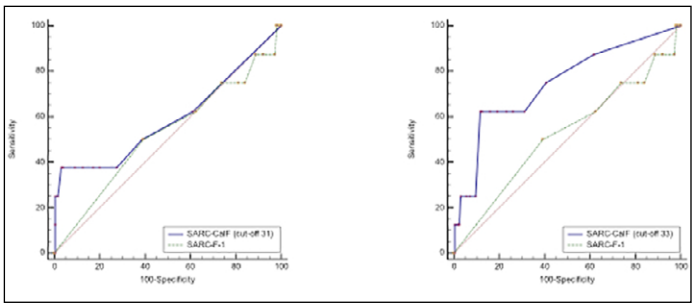
SARC-F tool is the pioneer screening tool to screen sarcopenia and demonstrated its efficacy in regards to predicting consequent functional impairment, hospitalization, emergency care use, quality of life and mortality in different cohorts (20, 21) Hence, it stands as a major tool to predict sarcopenia related adverse outcomes thereby aiding the therapeutic interventions focusing on sarcopenia. It emerges with its excellent specificity and diagnostic accuracy characteristics. However, the sensitivity analyses are not so satisfying and the low sensitivity restricts its use as there would be high risk of a missed diagnosis of individuals with sarcopenia. That's why SARC-CalF was suggested as a modification that aim to increase sensitivity of original SARC-F tool. The researches reported from China, Brazil and Slovenia suggested that SARC-CalF had better sensitivity than SARC-F as 48.9-60.7%, 66.7% and 77.4% (5, 6, 22) but they also noted that this finding needs to be validated in different study populations. However, in this Turkish study sample of older adults, SARC-CalF depicted non-superiority over SARC-F for the sensitivity analyses but for specificity and diagnostic accuracy.

Table 2
Sensitivity/Specificity Analyses and Receiver Operating Curve Models for SARC-F, SARC-CalF Validation Against Different Sarcopenia Definitions in the study population

	Sensitivity (%)	Specificity (%)	+LR	-LR	AUC
EWGSOP					
SARC-F	25.0% (0.0-55%)	81.4% (76-86.8%)	1.3	0.9	0.522
SARC-CalF (CC<31cm)	25.0% (0.0-55%)	98% (96-99.9%)	16.5	0.8	0.59
SARC-CalF (CC< 33 cm)	25.0% (0.0-55%)	90% (86-94.5%)	2.6	0.8	0.746
FNIH					
SARC-F	31.6% (10.6-52.5%)	82.4% (77-87.9%)	1.8	0.8	0.701
SARC-CalF (CC< 31cm)	10.5% (0.0-24%)	98.4% (96-99.9%)	6.7	0.9	0.712
SARC-CalF (CC< 33 cm)	15.7% (0.0-32%)	90.4% (86-94.6%)	1.6	0.9	0.682
IWGS					
SARC-F	50.0% (1-99%)	81.8% (76.5-87.1%)	2.7	0.6	0.64
SARC-CalF (CC< 31cm)	50.0% (1-99%)	98.5% (96.8-99.9%)	33.8	0.5	0.671
SARC-CalF (CC< 33 cm)	50.0% (1-99%)	90.6% (86.6-94.6%)	5.3	0.6	0.836
SCWD					
SARC-F	40.0% (0.0-82.9%)	81.7% (76.3-87.0%)	2.1	0.7	0.551
SARC-CalF (CC< 31cm)	40.0% (0.0-82%)	98.5% (96.8-99.9%)	26.9	0.6	0.575
SARC-CalF (CC< 33 cm)	40.0% (0.0-82%)	90.5% (86.5-94.6%)	4.2	0.7	0.705

+LR: positive likelihood ratio; -LR: negative likelihood ratio; Data are presented with the 95% CI in parenthesis; CC, calf circumference; EWGSOP, European Working Group on Sarcopenia in Older People's; FNIH, Foundation for the National Institutes of Health; IWGS, International Working Group on Sarcopenia; SCWD, Society on Sarcopenia Cachexia and Wasting Disorders.

Figure 1a
The ROC curves of SARC-F and SARC-CalF against EWGSOP definition



The reason why SARC-CalF showed better sensitivity in other three populations but not in our study may be the lower prevalence of sarcopenia in this cohort (6). In our study, the prevalence of sarcopenia was between 0.7-10.4% while the corresponding figure was 11.7-25% in the Chinese study (5). The Brazil study only noted EWGSOP definition of sarcopenia with an overall prevalence of 8.4 % (6) while it was 0.4% in our study population. The last former study was from Slovenia in 2017 (22) which studied the role of SARC-CalF among nursing home residents by using EWGSOP criteria and reported 38.7% prevalence of sarcopenia by EWGSOP diagnostic criteria. The sensitivity of SARC-CalF was most in the Slovenian nursing home population where also the sarcopenia was most prevalent. Accordingly, in a Turkish population with higher prevalence of sarcopenia e.g. maybe the nursing home population, SARC-CalF may also prove better sensitivity than SARC-F but this hypothesis should be analysed. On the other hand, in all these three former studies, as a screening tool, the sensitivity of SARC-CalF was not still perfect. Nevertheless, the specificity and diagnostic accuracy of SARC-F tool increased by introduction of calf circumference item both in our study and in the former studies. So, SARC-CalF improved the performance of SARC-F. SARC-CalF is expected to have efficacy in regard to predicting incidence for sarcopenia related outcomes and mortality but to date it remains as another research topic.

This study has some strengths and limitations. First we were able to use the population specific cut-offs for sarcopenia components thanks to the former cut-off studies in our population. We also had population specific cut-off value for calf circumference and so that we were able to compare SARC-CalF using the standard CC threshold (31 cm) and population specific threshold (33 cm). We included four currently agreed and commonly used definitions of sarcopenia while the former two studies included only the EWGSOP definition (6, 22). On the other hand, we used BIA for muscle mass estimation instead of more precise techniques i.e. DXA or MRI-CT imaging. The former two studies included BIA (5, 22) while one included DXA for muscle mass assessment (6). However, BIA is suggested as comparable to DXA analyses and has been suggested as a good muscle mass assessment tool both in researches and clinical practice (13).

Figure 1b
The ROC curves of SARC-F and SARC-CalF against FNIH definition

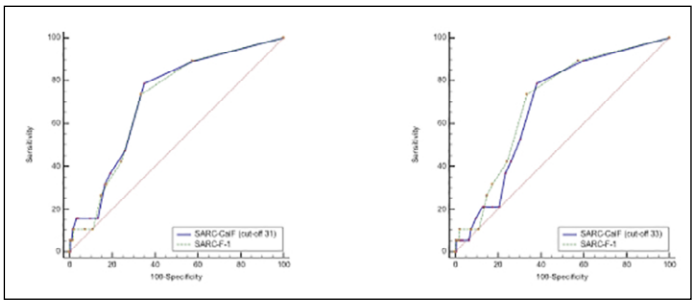


Figure 1c
The ROC curves of SARC-F and SARC-CalF against IWGS definition

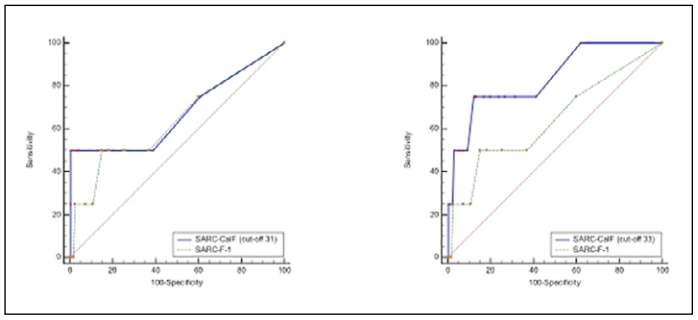
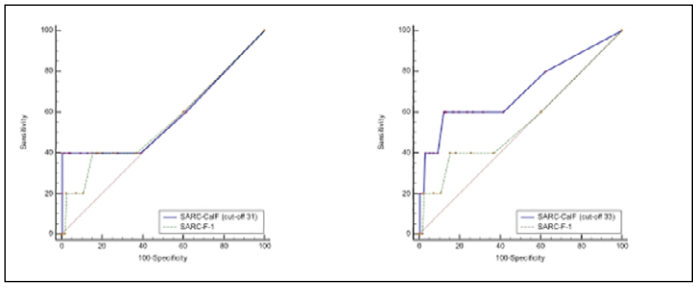


Figure 1d
The ROC curves of SARC-F and SARC-CalF against SCWD definition



In conclusion, our findings suggest that addition of calf circumference item to SARC-F tool (i.e. SARC-CalF) improved the specificity and diagnostic accuracy of SARC-F but it did not improve the sensitivity in a community-dwelling Turkish older adults population with a low prevalence of sarcopenia. The performance of SARC-CalF tool to screen sarcopenia is to be studied in different populations and living settings.

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Conflicts of interest: The authors declare no conflict of interest.

Ethical standard: The authors declare that the study procedures comply with current ethical standards for research involving human participants in Turkey. The study protocol had been approved by Istanbul University, Istanbul Medical School Ethics Committee.

References

1. Cruz-Jentoft AJ, Landi F, Schneider SM, et al. Prevalence of and interventions for sarcopenia in ageing adults: A systematic review. Report of the international sarcopenia initiative (EWGSOP and IWGS). Age Ageing 2014; 43: 748-59.
2. Woo J, Leung J, Morley JE. Validating the SARC-F: a suitable community screening tool for sarcopenia? J Am Med Dir Assoc 2014; 15: 630–34.
3. Parra-Rodrı´guez L, Szlejf C, Garcı´a-Gonza´lez AI et al. Cross-cultural adaptation and validation of the Spanish-language version of the SARC-F to assess sarcopenia in Mexican community-dwelling older adults. J Am Med Dir Assoc 2016; 17: 1142–1146.
4. Beaudart C, Locquet M, Bornheim S et al. French translation and validation of the sarcopenia screening tool SARC-F. Eur Geriatr Med 2018;9.1:29-37.
5. Yang M, Hu X, Xie L et al. Screening Sarcopenia in Community-Dwelling Older Adults: SARC-F vs SARC-F Combined With Calf Circumference (SARC-CalF). J Am Med Dir Assoc 2018;19:277.
6. Barbosa-Silva TG, Menezes AM, Bielemann RM et al. Enhancing SARC-F: Improving sarcopenia screening in the clinical practice. J Am Med Dir Assoc 2016;17:1136-141.
7. Bahat G., Yilmaz O., Kılıç C., Oren M.M. et al. Performance of SARC-F in regard to sarcopenia definitions, muscle mass and functional measures. J Nutr Health Aging in press
8. Fess EE(1992). Grip strength. In: Casanova JS(ed) Clinical assessment recommendations, American Society of Hand Therapists; 2nd edn. Chicago. pp 41-45.
9. Massy-Westropp NM, Gill TK, Taylor AW et al. Hand grip strength: age and gender stratified normative data in a population-based study. BMC Res Notes 2011; 14:127.
10. Bahat G, Tufan A, Tufan F et al. Cut-off points to identify sarcopenia according to European Working Group on Sarcopenia in Older People (EWGSOP) definition. Clin Nutr 2016; 35:1557-563.
11. Studenski SA, Peters KW, Alley DE et al. The FNIH sarcopenia project: Rationale, study description, conference recommendations, and final estimates. J Gerontol Ser A Biol Sci Med Sci 2014; 69: 547-58.
12. Malmstrom TK, Morley JE. SARC-F: A simple questionnaire to rapidly diagnose sarcopenia. J Am Med Dir Assoc 2013; 14: 531-532.
13. Cruz-Jentoft AJ, Baeyens JP, Bauer JM et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010; 39: 412-23.
14. Fielding RA, Vellas B, Evans WJ et al. Sarcopenia: An undiagnosed condition in older adults. Current consensus definition: Prevalence, etiology, and consequences. International working group on sarcopenia. J Am Med Dir Assoc 2011; 12: 249-256.
15. Morley JE, Abbatecola AM, Argiles JM et al. Sarcopenia with limited mobility: an international consensus. J Am Med Dir Assoc 2011; 12:403–09.
16. Katz S, Ford AB, Moskowitz RW, Jackson BA et al. Studies of illness in the aged. The Index of Adl: a standardized measure of biological and psychosocial function. JAMA 1963; 185:914-9.
17. MP, Brody EM. Assessment of older people: self-management. Gerontologist 1969; 9:179-86.
18. Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. Ann Med 2001; 33:337–43.
19. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. Nutr Rev 1996; 54:59–65.
20. Wu TY, Liaw CK, Chen FC et al. Sarcopenia screened with SARC-F questionnaire is associated with quality of life and 4-year mortality. J Am Med Dir Assoc 2016;17: 1129- 135.
21. Malmstrom TK, Miller DK, Simonsick EM et al. SARC-F: A symptom score to predict persons with sarcopenia at risk for poor functional outcomes. J Cachexia Sarcopenia Muscle 2016;7: 28-36.
22. Urzi F, Šimunič B, Buzan E. Basis for Sarcopenia Screening With the SARC-CalF in Nursing Homes. J Am Med Dir Assoc 2017; 18:991.e5-991-10.