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INCIDENCE OF SARCOPENIA AND PHYSICAL DISABILITY IN ELDERLY PATIENTS IN NURSING PRACTICE

Jitka Doležalová *, Jan Neugebauer, Valérie Tóthová

University of South Bohemia in České Budějovice, Faculty of Health and Social Sciences, Institute of Nursing, Midwifery and Emergency Care, České Budějovice, Czech Republic

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Abstract

Background: An overview of sarcopenia status assessment using assessment tools and other measurement techniques over the last 3 years.
Purpose: The main goal of the study is to survey the practical information on the incidence of sarcopenia and physical disability in the elderly population, and to analyze the available sarcopenia measurements in nursing practice.
Methods: Based on the determined conditions, 9 studies were selected that focus on the evaluation of sarcopenia.
Results: The results show that the evaluation criteria according to EWGSOP are the most frequently used for the diagnosis of sarcopenia. Based on the analysis of these studies, SARC.F became the most widely used assessment tool.
Conclusions: Sarcopenia is a serious disease that comes with age. It has been shown to cause disability in the elderly population. It is necessary to regularly treat sarcopenia and implement it more in nursing care.

Keywords: *Disability; Geriatric (elderly) patient; Nursing and assessment; Sarcopenia*

REVIEW ARTICLE

INTRODUCTION

Sarcopenia is one of the most severe examples of functional decline and causes loss of independence in the elderly (Walston, 2012). The term was first used by Rosenberg in 1989, who described it as an age-related loss of muscle mass.

Sakuma and Yamaguchi (2012) add that it is not only an age-related loss of muscle, but that sarcopenia is accompanied by the reduction of myofibriles quality and quantity, as well as the reduction of muscle strength and an increase of falling risks. Nascimento et al. (2019) define sarcopenia as one part of frailty syndrome, and as a predictor of morbidity, disability, and death. Flemr et al. (2014) add that the trigger mechanisms are only partly known. The origin may be caused by an insufficient intake of proteins and decreased exercise (Welch et al., 2018), a shortage of vitamin D (Fragala et al., 2015), an accumulation of inflammatory processes (Toth et al., 2005), oxidation stress (Howard et al., 2007), resistance to anabolic stimuli (Breen et al., 2013), mitochondrial dysfunction (Johnson et al., 2013), or muscle de-innervation (Rygiel et al., 2016). In addition, sarcopenia has an important influence on the quality of life for its entire duration (Park et al., 2019). As in other diseases, prevention must be taken into consideration, and in this case the condition of physical disability can be prevented (Muscaritoli et al., 2010; Vellas, 2018).

It is obvious that the terms sarcopenia and physical disability are closely associated, because the variability of muscle loss results in functional or structural changes to the body, a decrease in mobility and flexibility, an increase of risks, and finally in limited self-sufficiency or some everyday activities (Siegert et al., 2018). Cruz-Jentoft et al. (2019) state that with sarcopenia or physical disability, cardiac and respiratory diseases, cognitive disorders, and long-term hospitalization to which the elderly are inclined need to be focused on. This process also works the other way around since patients have an inborn or acquired functional or structural disorder. This can lead to the immobilization of lower extremities, which finally results in muscle atrophy of less-used parts.

Cardiac and respiratory diseases, cognitive disorders and long-term hospitalization are based on the same principle (Suhonen and Charalambous, 2019). Another correlation between sarcopenia and physical disability can be found in a more advanced age, where sarcopenia has a good predictive power for disability (Park et al., 2019). This combination can significantly influence the fall risk and occurrence of fractures in the elderly population (da Silva Alexandre et al., 2014).

Professional and holistic nursing care must accept patients, and ensure their needs, values, information, comfort, and emotional support (Jasemi et al., 2017). The accuracy of these theoretical solutions is confirmed by the statistic values of inpatients whose numbers are more and more reduced. In 2017, the Czech Institute of Health Information and Statistics mentioned that 13.3% of the total number of patients were hospitalized because of physiotherapeutic interventions. The specific numbers focused on hospitalizations due to fractures (896,000 cases), sprained joints or stretched ligaments (162,000 cases), or diseases of the skeletal system (164,000 cases), show a high accumulation of these cases. The sarcopenia death rate is typically: long-term care departments (38.4%), geriatric departments (11.6%) and departments of internal medicine (41.2%) (Czech Health Statistics Yearbook 2017, 2018).

Although the incidence of sarcopenia has been described in professional literature across the globe, sarcopenia is not registered in the international classification of diseases – 10th edition (MKN-10, 2009), which is used in the Czech Republic (MKN-10, 2009). In the world classification, ICD-10, this disease existed under the code M62.84 as early as 2016 (Anker et al., 2016; Shen et al., 2019).

Since sarcopenia is a highly serious issue, several working groups have been established to ensure topical information and to clarify the diagnostics (Table 1). One of the best- known is EWGSOP (European Working Group on Sarcopenia in Older People). This is particularly focused on the area of a unified definition of sarcopenia, which operates in accordance with modern scientific evidence-based approaches (Cruz-Jentoft et al., 2010). EWGSOP developed an algorithm to identify sarcopenia by evaluating walking speed, handgrip strength, and muscle mass. Another group is called ESPEN-SIG (European Society for Clinical Nutrition and Metabolism Special Interest Group). This deals not only with sarcopenia but also with precachexia and cachexia. It tries to draw attention to these topics, and, at the same time to distinguish between these two issues (Yu et al., 2016). IWGS (International Working Group on Sarcopenia) is another working group focused on the successful clinical assessment of sarcopenia. It consists of geriatricians and academic professionals (Cesari et al., 2012). The SDOC (The Sarcopenia Definitions and Outcomes Consortium) was established to determine the limit values of muscular strength and muscle mass using evidence-based approaches. It ought to be mentioned that this consortium is focused on patients with an increased risk of physical disability (Cawthon et al., 2020).

The main goal of the study is to survey the practical information on the incidence of sarcopenia and physical disability in the elderly population, and to analyze the available sarcopenia measurements in nursing practice.

MATERIALS AND METHODS

The literature survey was processed according to the information by Gülpinar and Güçal Güçlü (2014), who describe a four-step approach: (1) determination and definition of the most suitable clinical question; (2) identification of relevant studies looked up in professional databases using keywords determined by the authors of this article; (3) evaluation of

Table 1 – Definition of sarcopenia according to selected groups

Working group	Definition of sarcopenia
EWGSOP	low muscle mass, low muscle strength, low physical performance
EWGSOP2	low muscle strength, low muscle quality or quantity, low physical performance
AWGS	low muscle mass, low physical performance, low muscle strength
IWGS	loss of skeletal muscle mass and function
FNIH	weakness, slowness, low lean mass
SCWD	reduced muscle mass, limited mobility

Note: Chen et al., 2014; Cruz-Jentoft et al., 2010, 2019; Fielding et al., 2011, Morley et al., 2011; Studenski et al., 2014.

the quality of the papers and the selection of the papers; (4) synthesis and interpretation of the results obtained.

Determination and definition of the clinical question and keywords

To determine the clinical question, the recommendations of Aslam and Emmanuel (2010) were used, i.e. to use the acronym PECO(T) – patient/population, environment, comparison and outcomes – for the nursing sphere. This acronym was mainly used in order to maintain a unified methodology when developing literary surveys, and to ensure an effective setting for the search in electronic databases that was determined to get articles relevant to the clinical question (Jarošová and Zeleníková, 2014; Melnyk et al., 2010). The actual definition of the clinical question is as follows: *Is sarcopenia in elderly patients with a physical disability (P) in a nursing environment (E) recognized as well (O) as in other elderly patients (C)?* All the signs are illustrated graphically in Table 2 to make them clearer.

Phase 1 and the so-called preparatory process were concluded by defining the keywords. They were chosen in accordance with Pearce et al. (2018) and Nagai and Noguchi (2002) who recommended using a standard approach to avoid errors. In phase one, the researchers defined their own words using their own methods "a priori", while 12 different keywords were defined directly relating to the clinical question and goals of the study. After finishing the primary defining, the words were classified and reconstructed into their final form. In the end, all of the researchers agreed upon the following keywords: geriatric patient, sarcopenia, physical disability, nursing and assessment.

Table 2 – Graphical illustration of the PECO acronym

P (patient/population/ environment)	Elderly patient
E (environment)	Nursing practice
C (comparison)	Geriatric syndromes
O (outcomes)	Identification of sarcopenia

Identification of relevant studies

The defining of the necessary components was followed by the next phase – identification of relevant studies. This phase was inspired by Newbert, who mentioned 4 criteria for the identification of studies: (1) the articles must be published either in Czech or in English; (2) the articles must be sufficiently valid, (3) the articles must have been published between 2017 and 2019; (4) (Newbert, 2007) at least one defined keyword must be found in the title, abstract or keywords. The actual search was performed in the following databases: PubMed, Scopus, Web of Science, Science Direct, Ebsco and Willey Online Library. The identification, classification, and trying to find the final number of studies were divided into 5 phases. The process was completed according to the recommendations by Kimber et al. (2017), graphically presented in the Prisma Flow Diagram (Fig. 1). The characteristics of the resulting publications were processed in Table 3. The graphic representation of the course of the study was inspired by the official version accessible at the pages called Preferred Reporting Items for Systematic Reviews and Meta-Analyses, used since 2009 (Moher et al., 2009).

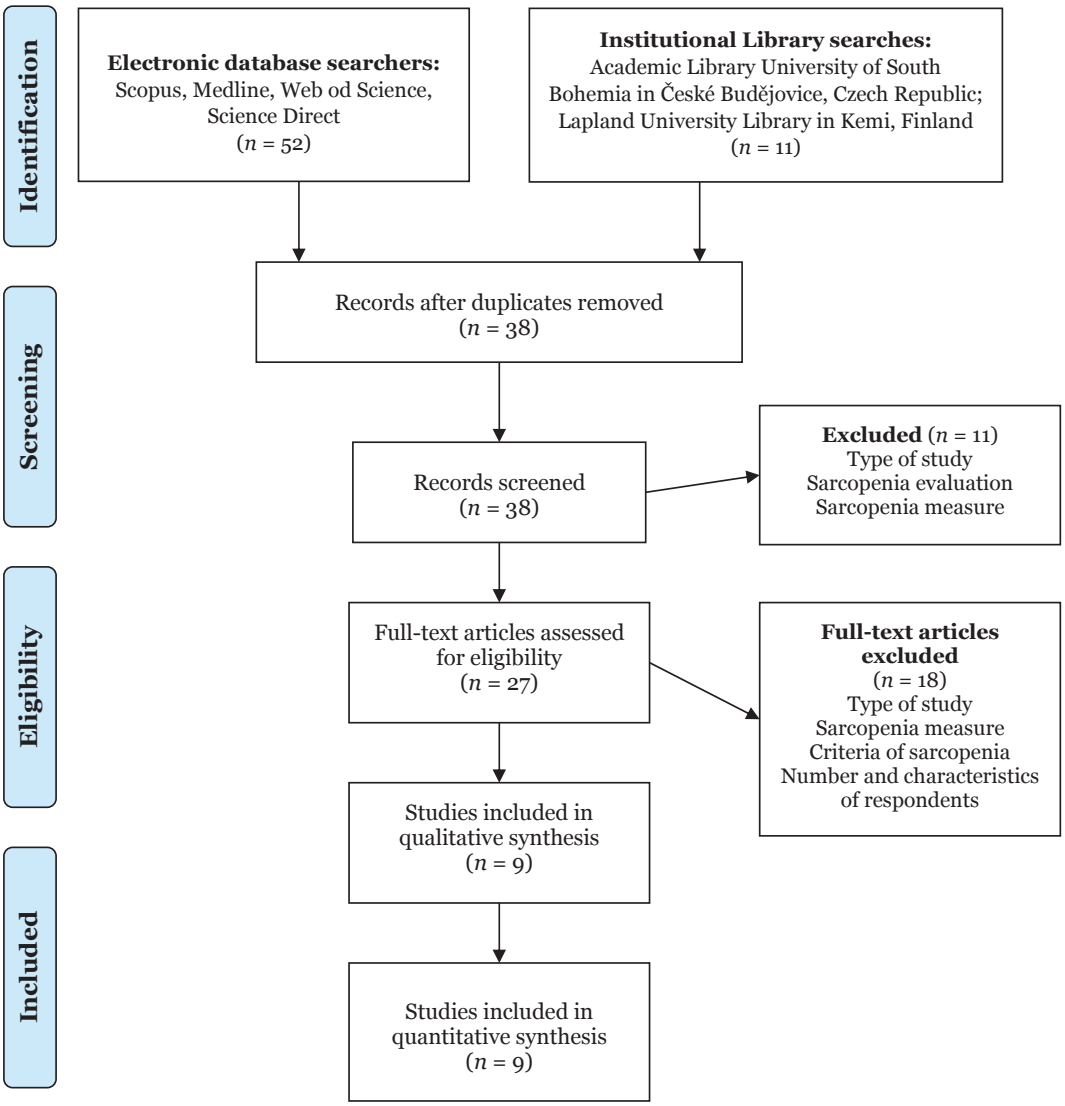

Fig. 1 – PRISMA flow diagram

Quality assessment and selection of the articles

Phase 1 included a simple search of articles in the databases mentioned. Overall, 52 articles were found in the following databases: Scopus = 14; Medline = 15; Web of Science = 14; Science Direct = 9. The goal of this phase was to identify all accessible sources that meet the above-mentioned criteria of the time range and publication language.

In phase 2, the first selection focused on the exclusion of duplicate studies ($n = 14$). The total number of studies was reduced to 38.

In phase 3, the abstracts of individual articles were analyzed. To be included in our study, articles needed to contain the data on sarcopenia assessment, and only quantitative studies were chosen to get more trustworthy data. In this phase, 11 studies were excluded and the total number was reduced to 27 studies.

Table 3 – Characteristics of resulting articles

	Type of study	Sample	Assessment used	Criterion limitation of sarcopenia	Age range	Sample size
Kera et al., 2019	quantitative	elderly adults – Japan	SARC-F Handgrip strength, walking speed, 5-time repeated chair stand test TUG test SPPB RTG absorption spectrometry	EWGSOP AWGS	f = 73.7 m = 73	f = 431 m = 279
Kim and Won, 2019	quantitative	outpatient elderly adults – Korea	SARC-F	EWGSOP2	f = 75.4 m = 76.4	f = 1046 m = 1053
Yang et al., 2019	quantitative	elderly adults living in nursing homes – China	MSRA-7 MSRA-5 SARC-F SARC-CalF	EWGSOP IWGS AWGS FNIH	f = 82.0 m = 80.7	f = 194 m = 83
Yang et al., 2018	quantitative	elderly adults – China	SARC-F SARC-F3	AWGS	f = 70.9 m = 72.3	f = 224 m = 160
Rodriguez-Rejon et al., 2018	quantitative	elderly adults – Spain	Pfeiffer test Barthel index score Functional ambulation classification Anthropometric measurements	EWGSOP algorithm, A, B	f = 85.4 m = 83.3	f = 187 m = 62
Su et al., 2019	quantitative	elderly adults – Japan	MNA-SF GDS 15 Handgrip strength BMI TBW BIA SMI	EWGSOP2	f = 75.4 m = 77.4	f = 221 m = 89
Confortin et al., 2017	quantitative	elderly adults – Brazil	ASMI BMI Waist circumference Waist to height ratio Handgrip strength	not mentioned	f = 60+ m = 60+	f = 390 m = 207
Bahat et al., 2018	quantitative	elderly adults – Turkey	SARC-F SARC-CalF	EWGSOP IWGS SCWD FNIH	f = 74.2 m = 75.4	f = 140 m = 67
Reiss et al., 2019	quantitative	hospitalized geriatric patients – Austria	Walking speed Handgrip strength RTG absorption spectrometry	EWGSOP	f/m = 80.6	f = 84 m = 57

Phase 4 included the full-text reading. The criteria for being included in our study were as follows: (1) Type of the study – quantitative; (2) Data on the assessment of sarcopenia; (3) Data on the criterium limitation of sarcopenia; (4) Size of the sample ($n > 100$); (5) Heterogeneous sample; (6) Data on the age range of the sample. In total, 18 studies were excluded, and the final qualitative information synthesis contained 9 foreign studies.

RESULTS AND DISCUSSION

The study by Kera et al. (2019) was focused on the validation of the SARC-F (strength, assistance walking, rising from a chair, climbing stairs, falls) tool for the Japanese population. To clarify the term sarcopenia, the EWGSOP (European Working Group on Sarcopenia in Older People) definition was used. The AWGS (Asia Working Group for Sarcopenia) was also used. The IADL and TMIG-IC (Tokyo Metropolitan Institute of Gerontology Index of Competence) tools were used for the validation and identification of all the necessary information. Frailty was also assessed using KCL (Kihon Checklist). MSRA (Mini Sarcopenia Risk Assessment) was included for the validity assessment. In the participants, physical functions such as body constitution composition were assessed using bioelectric impedance analysis (BIA), percentage of fat mass, skeleton muscle mass, appendicular skeleton muscle mass, handgrip strength, and walking speed. Participants were divided into groups that were classified as the SARC-F sarcopenia group (9 males and 15 females) and the control group. The results of their testing show that the Sarcopenia group had lower physical functions, MSRA assessment, and higher levels of frailty than the control group. In this study, Cronbach's alpha for SARC-F has the value of 0.610, which may show insufficient inner consistency of the tool. The SARC-F revealed a low sensitivity but a high specificity of the tool. The results of SARC-F assessment in combination with the EWGSOP criteria show that sarcopenia was proven in 6 participants. According to the AWGS criteria it was proven in 4 participants, and according to J sarcopenia in 10 participants. Chen et al. (2014) monitored the incidence of sarcopenia in Asia, using a combination of handgrip strength and walking speed test. The results showed that in the case of lower handgrip strength and walking speed, a higher level of disability occurred, which was independent of increasing age, chronic co-morbidities, lower achieved education, and economic level of the patient (Kera et al., 2019).

A study by Kim and Won (2019) focused on the demonstrability of sarcopenia using the updated version of EWGSOP2 criteria from 2018. The analysis excluded 272 participants because of joint prostheses, neurological diseases, and dementia. The final number was 2,099 participants. According to the EWGSOP2 criteria, the low muscle strength was proven by the handgrip strength (in men <27 kg, in women <16 kg), and by the 5-time repeated chair stand test (>15s in both men and women). The low amount of muscle mass was demonstrated by measuring the appendicular skeletal muscle mass using X-ray absorption spectrometry. Low physical performance was measured by the walking speed test (≤0.8m/s in both men and women), by SPPB (Short Physical Performance Battery) (≤8 points both in men and women), and by the TUG (Timed Up and Go) test (≥20s both in men and women). When assessing the low muscle strength, significant differences were found between men and women for the handgrip and chair stand tests. The chair stand test classified more women as sarcopenic, and the handgrip test classified more men as sarcopenic. Only 73 participants demonstrated low muscle strength in the chair stand and handgrip tests. Sarcopenia was, according to EWGSOP2 criteria, evaluated in 4.6–14.5% men and in 6.7–14.4% women. Indicators of severe sarcopenia were based on low muscle strength, low muscle mass and low physical activity, observed in 0.3–2.2% men and 0.2–6.2 women. The SARC-F tool showed 2.2% of participants to be at risk of sarcopenia, confirmed sarcopenia in 1.4% of participants, and indicated 0.8% participants were at risk of severe sarcopenia.

Yang et al. (2019) included SARC-F in their study. However, they also used the SARC-CalF version, which is complemented by measuring calf circumference. MSRA-7 and its shortened version of MSRA-5 were also used. For the specific identification of sarcopenia, so-called golden standards for sarcopenia were used. In particular, this means diagnostic criteria established by EWGSOP, AWGS, IWGS (International Working Group on Sarcopenia) and FNIH (Foundation for National Institutes for Health). The combination of these diagnostic criteria defines sarcopenia as low muscle mass with low muscle strength and/or decreased physical functionality. Low amounts of muscle mass were defined according to the skeletal muscle mass index (SMI) and the appendicular skeletal muscle mass index (ASM). Low muscle strength was indicated using the handgrip strength, and reduced physical

functionality was proven by the usual walking speed test. ROC (Receiver Operating Characteristic), curve 4 of the tools used in comparison with golden standards shows that the SARC-CalF had the largest AUC (Area Under the Curve), i.e., from 0.816 to 0.867, which means that this tool achieved the highest total diagnostic precision. The SARC-CalF proved sarcopenia in 131 participants, which was the highest number of sarcopenia cases. The results of Yang et al. (2019) show that SARC–CalF is the best tool for sarcopenia assessment by nurses. As suitable alternatives, SARC-F and MSRA-5 are offered since SARC-F has a better specificity (according to golden standards from 96.8 to 98.4%), and MSRA-5 has a better sensitivity (according to golden standards from 49.1 to 56.3%).

In another study, Yang et al. (2018) dealt with SARC-F and SARC-F3, in a shorter version, which only contains strength assessment, walking upstairs and assistance with walking. As a diagnostic criterion, the recommendations of AWGS were used. SARC-F and SARC-F3 assessments were performed by trained nurses who asked participants about their age, sex, and chronic diseases; in particular, hypertension, diabetes, brain stroke, ischemic heart disease, and chronic obstruction pulmonary disease. The height, weight and BMI were also identified. Using the AWGS criteria and ROC curves, the SARF-C specificity was assessed as 98.1% and the SARC-F3 specificity was 97.8%. The sensitivity of SARC-F and SARC-F3 were 29.5% and 13.1% respectively. The results show that SARC-F3 is not suitable for monitoring sarcopenia in the elderly population, particularly due to the generally low diagnostic accuracy and lower sensitivity. As early as 2002, Janssen et al. (2004) drew attention to the fact that a reduced amount of skeletal muscle mass in elderly individuals, particularly women, is associated with a functionality disorder and disability, and the resulting sarcopenia is a potential cause of morbidity and mortality.

The study of Rodriguez-Rejon et al. (2018) was a part of the Granada Sarcopenia Study, which was performed at the departments for long-term patients. Criteria were established for the sample choice, such as hospitalization lasting more than 3 months, age higher than 70 years, and steady health status. The study did not include patients at the terminal stage, they were provided with palliative care. The prevalence of sarcopenia was confirmed using EWGSOP, algorithm A and algorithm B. Algorithm A first includes muscle strength, and, if it is low, the muscle mass is assessed. Algorithm B first assesses muscle mass, and, if it is low, muscle strength is assessed. According to Barthel index score, it was found that 67% participants were partly or heavily dependent. According to Pfeiffer test, 64% participants had moderately or heavily damaged cognition, and according to the FAC (Functional Ambulation Classification) score, 49% of participants were not ambulant and only 21% were ambulant with the assistance of another person. The prevalence of sarcopenia was assessed to be as much as 63%; such a high prevalence is probably caused by a rather high age (84.9 ± 6.7 age) and by an increased degree of cognitive and functional abilities. No significant difference was found between algorithms A (63.2%) and B (63%) (McNemar test, $P = 1.000$). Therefore, both algorithms can be regarded as valid for sarcopenia assessment of this type of population.

The article by Su et al. (2019) is based on a large survey of The Nutritional Status of Japanese Community Dwelling Older People. The study included participants older than 65 years who were ambulant without help. According to a low handgrip strength, sarcopenia was identified in 14.5% of participants. Furthermore, it was found that there was no significant difference between men and women (10.1% vs. 7.2%). After assessing the age, nutritional status, smoking, alcohol consumption, obesity, diabetes, and whether the individual took more than four prescribed medicaments, it was found that these factors were independently associated with sarcopenia. BMI and TBW (total body water) were assessed as negatively correlated with sarcopenia, as mentioned in EWGSOP2. In addition, Su et al. (2019) found that only one half of participants had a normal nutritional status (according to the MNA-SF). However, this fact did not play an important role in the occurrence of sarcopenia.

Confortin et al. (2017) describe a cohort study called EpiFloripa, which focused on the health assessment of Brazilians living in a city. The age of 60 years and more was determined for the sample. The prevalence of sarcopenia was assessed to be 16.03% in women

and 28.85% in men. According to the index of appendicular skeletal muscle mass, sarcopenia had a prevalence of 16.03% in women and 28.85% in men. The three anthropometric variables (BMI, waist circumference, and waist-to-height ratio) indicated a prevalence of sarcopenia of 18.49% in women and 36.33% in men. BMI and waist circumference were established as the best indicators for determining the state of sarcopenia in men and women.

In the study by Bahat et al. (2018), university hospital outpatients older than 65 years were included. According to SARC-F, sarcopenia was proven in 10.4% men and 22.9% women. SARC-CalF-31 was identified in 3% men and 2.1% women. SARC-CalF-33 discovered sarcopenia in 4.5% men and 12.9% women. SARC-CalF, also including the measurement of calf circumference (31 and 33 cm), revealed a similar sensitivity but a higher specificity (SARC-CalF-31 98.5%, SARC-CalF-33 90.5%) than SARC-F (81.7%). The best ever diagnostic accuracy was proven to be SARC-CalF-33. It should be pointed out that the value of calf circumference increases the specificity of SARC-F, but it does not have any influence on the increase of the tool sensitivity.

The study by Reiss et al. (2019) is based on the SAGE study focused on the assessment of the muscle mass in the geriatric population. The study included inpatients with a minimum age limit of 70 years. It was found that osteoporosis was only proven in 15.6% of participants, sarcopenia in 13.5%, and osteosarcopenia in 14.2%. The prevalence of osteoporosis was increased in patients who simultaneously suffer from sarcopenia. Furthermore, it was found that participants suffering from osteoporosis, sarcopenia or osteosarcopenia had lower BMI and MNA-SF values. They also had a lower handgrip strength and walking speed than the reference group. A higher osteoporosis prevalence was identified in women (40.5% vs. 14%), while no significant gender difference was observed in the prevalence of sarcopenia and osteosarcopenia.

CONCLUSIONS

Sarcopenia is a highly topical problem affecting current medical and nursing care provided to the elderly population. Several diagnostic criteria were created to define sarcopenia and make it more precise. According to the articles studied, the criterion based on EWGSOP represents the most frequently used criterion. In the practice, several assessment tools are used. SARC-F is the basic tool used in several modified versions at clinical practice.

The results show that sarcopenia represents a large problem for the ageing population, as it can result in the development of disability. Using simple assessment tools or other measurements, it can be seen that sarcopenia is easily detectable even in disabled patients. It can be supposed that in practice, sarcopenia can be assessed as well as other geriatric syndromes. Czech nursing needs to find a solution to reduce the problems associated with sarcopenia and disability. As the first step, sarcopenia needs to be recognized as an independent disease. Furthermore, the incidence of sarcopenia needs to be assessed and monitored in practice. This relates to the adjustment of care, which should be sufficiently individualized and mainly focused on patients' exercise and nutritional status. Due to insufficient knowledge about the state of the Czech population and sarcopenia, studies should be developed to provide important information.

Ethical aspects and conflict of interests
The authors have no conflict of interests to declare.

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Contact:

Jitka Doležalová, University of South Bohemia in České Budějovice, Faculty of Health and Social Studies, Institute of Nursing, Midwifery and Emergency Care, J. Boreckého 1167/27, 370 11 České Budějovice, Czech Republic
Email: dolezj08@zsf.jcu.cz