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Prevalência da disfagia sarcopénica na população geriátrica

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Terapia da Fala - Ramo das Perturbações da Comunicação e da Deglutição em Adultos e Idosos, realizada sob a orientação científica da Doutora Maria da Assunção Coelho de Matos, Professora Adjunta da Escola Superior de Saúde da Universidade de Aveiro e coorientação científica do Doutor Pedro Miguel Ferreira de Sá Couto, Professor Auxiliar no Departamento de Matemática da Universidade de Aveiro.

Dedico este trabalho à minha filha Margarida e aos meus avós. Em especial, à memória da minha avó Vina, vítima indireta da pandemia Covid-19.

O júri

Presidente	Professora Doutora Marisa Lobo Lousada Professora Adjunta da Escola Superior de Saúde da Universidade de Aveiro
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"(…) às vezes não precisamos de palavras, só do som que vem do coração!"
(Antoine de Saint-Exupéry)

Palavras-chave Envelhecimento, malnutrição, disfagia orofaríngea, disfagia sarcopénica, sarcopenia.

Resumo

Enquadramento: A disfagia orofaríngea (DO) e a sarcopenia têm sido reconhecidas como síndromes geriátricas e têm apresentado maior prevalência em idosos institucionalizados, estando associadas a elevados encargos socioeconómicos. A prevalência da Disfagia Sarcopénica (DOS) parece aumentar com a idade média da população. **Objetivos:** Investigar a presença de sarcopenia e risco de ter DO, numa população geriátrica e analisar a relação existente entre os fatores associados à DOS. **Métodos:** Estudo transversal realizado em duas Estruturas Residenciais para idosos (ERPI), em Tomar. A DO foi rastreada usando o Gugging Swallowing Test (GUSS). A sarcopenia foi diagnosticada com base nas orientações do Grupo de Trabalho Europeu sobre Sarcopenia em Idosos. O estado nutricional foi examinado usando o Mini Nutritional Assessment-Short Form (MNA-SF), e a independência nas atividades de vida diária (AVDs) foi avaliada usando o Indice de Barthel (IB). Dividiu-se a amostra em 4 grupos, com base no diagnóstico: G1: sem patologia; G2: apenas com risco de DO; G3: apenas com sarcopenia; G4: com provável DOS. Realizaram-se comparações entre os diferentes grupos, análises univaridas para encontrar os preditores para cada um dos grupos, e por fim, um estudo correlacional entre as diferentes escalas utilizadas. **Resultados:** Estudaram-se 36 idosos (23 mulheres; 13 homens; média de idade 88.0±5.6), 55.6% apresentaram risco de ter DO, 52.8% apresentaram sarcopenia e 36.1% apresentaram provável DOS. O nível de alfabetização foi menor ($p<.05$) nas mulheres. A prevalência de malnutrição com base no MNA-SF foi de 19.4%. A maioria dos idosos era independente nas AVDs (91.7%). Os resultados da análise univariada dos indivíduos nos diferentes grupos mostraram que o questionário SARC-F foi um preditor significativo (OR=9.0; IC95%=1.285-63.025) para o risco de ter DOS. **Conclusão:** A prevalência de DO e sarcopenia aumentou com a idade e com o risco de malnutrição ou desnutrição. Observámos que o género feminino, o baixo nível educacional e a pontuação ≥4 no teste de rastreio SARC-F, estão associados a maiores probabilidades de sarcopenia, bem como de maior risco de DO e DOS. Vimos ainda que a utilização de próteses dentárias mal ajustadas, aumenta em 50% a probabilidade de ocorrência de sarcopenia, e que esta condição foi um preditor significativo ($p<.05$) de risco de DO. Com base nos resultados, sugere-se a inclusão do Terapeuta da Fala nas equipas multidisciplinares das ERPI, a fim de melhorar a prevenção de DO, sarcopenia e DOS, evitando as consequências das mesmas.

Keywords Aging, malnutrition, oropharyngeal dysphagia, sarcopenia, sarcopenic dysphagia

Abstract **Introduction:** Oropharyngeal Dysphagia (OD) and sarcopenia have been recognized as geriatric syndromes and have shown a higher prevalence in institutionalized elderly, being associated with increased socioeconomic burdens. Prevalence of Sarcopenic Dysphagia (SOD) seems to increase with the average age of population. **Objectives:** To investigate the presence of sarcopenia and risk of OD in a geriatric population and to analyse the relationship between the factors associated with SOD. **Methodology:** Cross-sectional study conducted in two nursing homes in Tomar. The OD was screened using The Gugging Swallowing Screen (GUSS). Sarcopenia was assessed according to the criteria defined by the European Working Group on Sarcopenia in Older People. The nutritional status was screened using the Mini Nutritional Assessment - Short Form (MNA-SF), and independence in daily living activities (ADL) was assessed using the Barthel Index (BI). The sample was divided into 4 groups, based on the diagnosis: G1 - Without pathology; G2 - Only being at risk of having OD; G3 - Only with sarcopenia; G4 - With probable SOD. Comparisons were made between the different groups, univariate analyses were performed to find the predictors for each group, and finally, a correlational study between the different scales used. **Results:** We studied 36 elderly people (23 women; 13 men; age 88.0 ± 5.6), 55.6% were at risk for DO, 52.8% had sarcopenia and 36.1% were probable SOD. Literacy was lower ($p<.05$) in women. The prevalence of malnutrition based on MNA-SF was 19.4%. The most elderly were independent in ADL (91.7%). The results of the univariate analysis of individuals in different groups showed that the SARC-F questionnaire was a significant predictor (OR=9.0; CI95%=1,285-63,025) for the risk of having SOD. **Conclusions:** The prevalence of OD risk and sarcopenia has increased with age and with the risk of malnutrition or malnourishment. We have observed that female gender, low educational level and score ≥4 on the SARC-F screening test are associated with higher odds of being at risk for OD, sarcopenia, and even probable SOD. We found that the use of badly adjusted artificial teeth increases odds for sarcopenia by 50%, and that this condition was a significant predictor ($p<.05$) of risk for OD. Based on the results, we suggested including a Speech and Language Therapist in the multidisciplinary geriatric teams in order to improve the prevention of OD, sarcopenia and SOD, avoiding its consequences.

Abreviations

ADL – Daily life activities
ASM – Appendicular Skeletal Muscle Mass
BIA – Bioimpedance analysis
BI – Barthel Index
BMI – Body Mass Index
CI – Confidence interval
ESEnfC – Nursing School of Coimbra
EWGSOP – European Working Group on Sarcopenia in Older People
G1 – group without pathology
G2 – group only with OD
G3 – group only with sarcopenia
G4 – group with ODS
GUSS – The Gugging Swallowing Screen
ICD – International Statistical Classification of Diseases and Related Health Problems
IOPI – Iowa Oral Performance Instrument
kPa – kilopascals
Kg – kilograms
M – mean
MNA®- SF – Mini Nutritional Assessment-Short Form
m/s – meters per second
n.a. – Not applicable
n.s. – Not significant
OD – Oropharyngeal Dysphagia
OR - odds ratio
SD – standard deviation
SLP – Speech Language Therapist
SOD – Sarcopenic dysphagia (SOD)
SPSS – IBM SPSS Statistics
UICISA: E – Ethics Committees of the Health Sciences Research Unit: Nursing

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1. INTRODUCTION

In the last years, as in many countries all over the world, the Portuguese population has been showing increasing aging indicators, with an aging rate of 159.4% in 2018[1,2]. Presbyphagia is a common problem that refers to the characteristic changes in the swallowing mechanism of healthy older adults that result from the normal aging process[3]. This age related swallowing disorder includes changes in the cervical spine, reduced olfactory and taste function, reduction of saliva production, impaired dental status, weak tongue height, reduced oral and pharyngeal sensitivity, as well as weakness of the suprahyoid muscles, mainly resulting in a delay in the closing of the laryngeal vestibule and opening of the upper esophageal sphincter [4-8]. Therefore, it is associated with biological and physiological changes that are not necessarily due to illness or disease, but that have an impact on the anatomy of the head and neck and on the physiological and neuronal mechanisms underlying the swallowing function[3]

Differing to presbyphagia, oropharyngeal dysphagia (OD) is characterized by a set of symptoms related to changes in the swallowing function, that occur within the multiple phases of the swallow, whereby the impairments may occur in planning the motor sequence of swallowing, coordination and timing, or anatomical structural displacement during swallowing[4]. Thus, it constitutes an impaired or uncomfortable difficulty in forming or moving food or liquids safely from the oral cavity to the esophagus[9]. According to the World Health Organization in the International Statistical Classification of Diseases and Related Health Problems (ICD), OD is classified as a digestive condition in ICD-9 (787.2) and ICD-10 (R13.10)[10].

The age-related changes in swallowing physiology as well as age-related diseases are predisposing factors for dysphagia in the elderly[11]. In this sense, OD has been recognized as a geriatric syndrome due to its high prevalence and its relation with many comorbidities and their poor outcomes in elderly population[5,9]. Although, it is still underdiagnosed by health professionals and frequently not spontaneously reported by the patients[12]. This condition contributes to a decreased quality of life and has a negative social impact, as it is strongly associated with malnutrition, dehydration, respiratory infections and aspiration pneumonia, as well as functional disability and frailty, institutionalization and increased hospital readmissions, anxiety, depression and even mortality[4,5,9,11,13]. This geriatric syndrome has shown an increased prevalence rate associated with impaired functionality, higher comorbidity and fragility, with the prevalence of OD in elderly living in the community being 27%, increasing to 51% in institutionalized elderly and rising to 91% in hospitalized elderly with community-acquired pneumonia [5]. It is also identified as an independent risk factor for mortality in nursing home residents[14].

Therefore, OD is highly prevalent in the elderly in different settings. It was strongly associated with admissions from nursing homes, medical history of dementia and stroke, malnutrition (MNA<17), as well as poor functional capacity, with an average Barthel Index (BI) score of 24-48/100[15,16]. Several studies have shown that a reduced mass and function of the muscles involved in the swallowing process contribute to OD due to aging[6,17-19]. It occurs because swallowing muscles are formed primarily from type II muscle fibers which are more affected by malnutrition and sarcopenia than type I fibers[20]. In addition, it has been observed that the etiology of OD in the elderly population includes muscular weakness, and sarcopenia, as well as the increased incidence rate of most of the diseases leading to this condition, like stroke and neurodegenerative diseases[5,21].

Sarcopenia is also defined as a geriatric syndrome characterized by the progressive and generalized skeletal muscle disorder that involves the accelerated loss of muscle mass (myopenia), and a decline in muscle strength (dinapenia)[22-25]. This accelerated loss of muscle mass and function can lead not only to physical deficiencies, but also to low quality of life (due to the consequent impact on disability and loss of independence) and even death[25,26]. It has been internationally recognized as a disease since 2016, when it was classified in the ICD-10 (M62.84)[26,27].

An algorithm was suggested by the European Working Group on Sarcopenia in Older People (EWGSOP) for sarcopenia case-finding, diagnosis and severity determination in the elderly, using necessarily two criteria, the reduction of muscle mass and the decrease of muscle function (both in strength and performance)[22]. For these authors a probable sarcopenia diagnosis is considered when low muscle strength is detected; it is confirmed by the presence of low muscle quantity or quality; and it is considered severe when low muscle strength, low muscle quantity/quality and low physical performance are all detected.

The influence of several internal and external factors leads to muscle atrophy related to sarcopenia[25]. The pathophysiology of this disease is multifactorial; in addition to genetic factors it is associated with reduced physical activity, decreased caloric intake (reduced protein intake and vitamin D levels declining), muscle fiber denervation and type II fast-twitch muscle fiber atrophy, intracellular oxidative stress, enhanced myostatin, and age associated hormonal declines[25,29].

Sarcopenia affects more often people with an average age of 70.5 years for men and 71.6 years for women[30]. Depending on the methodology adopted, the prevalence of sarcopenia observed in the elderly population had very different values, ranging from 0.9% to 85.4%[22,25]. Cruz-Jentoft and colleagues found a prevalence rate of 1 to 29% in elderly living in the community and 14 to 33% in institutionalized elderly[31].

Risk factors consistently correlated with sarcopenia include aging[32,33], increasing in people with over 80 years old[34], people in nursing homes[33], with hip fractures[34], low BMI[32] as well as low physical activity[35]. This progressive and generalized muscle disorder is associated with an increased likelihood of adverse outcomes, including falls, fractures, physical disabilities and mortality[22,25,36]. It is also associated with an increased risk of OD, having been considered an independent risk factor for its diagnosis[7,13,37]. This relation is justified by the decrease in the elasticity of muscle mass and connective tissue inherent to sarcopenia, with a consequent loss of strength and range of motion of the tongue and other muscles related to the swallowing process[7,22,25,38]. Therefore, the oropharyngeal functional decline is part of the sarcopenia syndrome. In addition, the decreased tongue strength has been associated with sarcopenia[23], and isometric tongue strength and grip strength was positively associated[39]. Tongue pressure was also related to general nutritional status, skeletal muscle mass, and developed daily life activities (ADL)[7].

Sarcopenic dysphagia (SOD) is characterized by a difficulty in swallowing linked to a loss of whole-body skeletal and swallowing muscle mass and function, including the intrinsic muscles of the tongue and mimetic, masticatory, suprahyoid, infrahyoid, palatine, pharyngeal and esophageal muscles[37,40,41]. Its diagnostic criteria includes the presence of OD and sarcopenia, and the causes of OD will have to be attributed to sarcopenia, so other possible causes such as stroke, neuromuscular diseases or head and neck tumors have to be excluded[25].

Although both sarcopenia and OD have a high prevalence in the elderly population, elderly people diagnosed with sarcopenia may or may not suffer from OD, however, the prevalence of SOD increases with the average age of population[41]. In a study conducted with elderly people, undergoing rehabilitation for the diagnosis of OD, there was an increase in the prevalence of SOD in elderly people, malnourished or with disuse of oral muscles, with a prevalence of 32% and it was independently associated with poor swallowing function at discharge[42]. Sakai and colleagues also observed a strong correlation between the diagnosis of SOD and measuring the strength of the tongue and lips and concluded that these measures were useful factors in its diagnosis [23]. They also noted that the strength of the lips can be a useful predictor of this geriatric syndrome. SOD is also related to complications such as poor nutritional state[43], aspiration pneumonia, accumulation of waste in the oropharyngeal cavity, hydroelectrolytic disorders, poorer quality of life and longer hospitalization stays[37,40,42].

The aging of the world population is a reality increasingly observed, so the close association between aging and difficulty in swallowing is a growing concern with the health of elderly people. The incidence of OD and SOD in the geriatric population in Portugal is unknown, as well as its inherent characteristics. Likewise, OD in the elderly is often underdiagnosed. In this sense, the present study is innovative, of special importance, and aims relating the risk of having OD and sarcopenia, describe the prevalence of SOD in the elderly, and analyze the existing relationship between its associated factors.

2. METHODOLOGY

In order to meet the defined goals, a cross sectional study was conducted in two nursing homes in Tomar (Portugal) between October 2019 and March 2020.

2.1 Participants

All participants included in the study were aged ≥65 years, living in nursing homes or in a day center in the municipality of Tomar. Excluding criteria included a history of cerebrovascular disease, head and neck cancer, and/or underlying neuromuscular diseases such as Parkinson's disease that might have directly impaired the nerves or muscles involved in oral strength, as well as prior orthopedic surgery involving metal implantation, total dependence, and having a pacemaker.

2.2 Procedure and Measurements

Approval for the study was provided by the Ethics Committee of the Health Sciences Research Unit: Nursing (UICISA: E) of the Nursing School of Coimbra (ESEnfC) (Annex I) and the institutions involved (Annex II). All the participants were aware of the purpose of the study and have signed a written informed consent (Annex III).

Participants' data was all collected by a principal investigator through a standardized questionnaire including sociodemographic characteristics and a self-report functional status. These questionnaires were filled using data provided by nurses and interviews with the participants. Furthermore, swallowing, sarcopenia, and objective measurements of lips and tongue strength, nutritional status and physical function were also assessed (see sample data collection in Annex III). Figure 2.1 provides a descriptive flow diagram of the study process.

After swallowing screening and sarcopenia assessment, the participants were grouped in four different groups, depending on those diagnoses: G1: Without pathology; G2: Only with OD risk; G3: Only with sarcopenia; G4: With probable SOD.

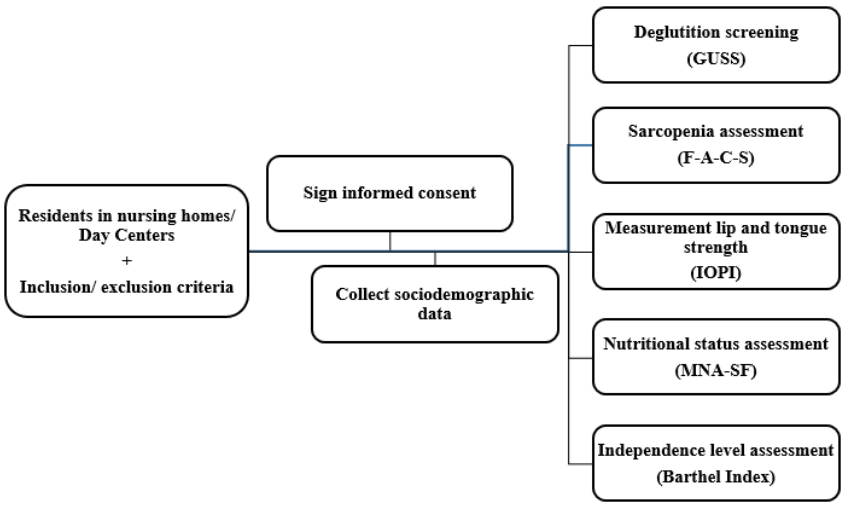

Figure 2.1. Flow diagram describing the study process.

2.2.1. Screening of OD

The screening of OD was conducted using the European Portuguese version of The Gugging Swallowing Screen (GUSS)[44] (Annex IV). The aim of this test is to determine the possible presence of OD, its severity, and the risk of the presence of aspiration. It uses the validated risk characteristics and scientifically investigated criteria for aspiration (swallowing not possible/delayed, drooling, coughing and voice change). If a participant presented an impairment in the efficiency and/or in the safety of swallowing, he/she were considered to be at risk of having OD.

Nutilis® Clear (Nutricia) was the thickener used for the application of GUSS during all the period of the study.

No clinical or instrumental assessment was performed to confirm GUSS results.

2.2.2. Diagnosis of sarcopenia

Sarcopenia was assessed according to the criteria defined by the EWGSOP2[22]: Find cases-Assess-Confirm-Severity (F-A-C-S).To identify individuals at risk for sarcopenia (F) the SARC-F questionnaire[45] was used (Annex IV). To assess for evidence of sarcopenia (A) handgrip strength was tested. To confirm sarcopenia (C) by detection of low muscle mass, quantity, and quality, bioimpedance analysis (BIA) was used. In addition, to evaluate the sarcopenia severity (S), the gait speed to calculate the performance was used (figure 2.2). The cut-off points indicated in the EWGSOP2 consensus were also used (table 2.1).

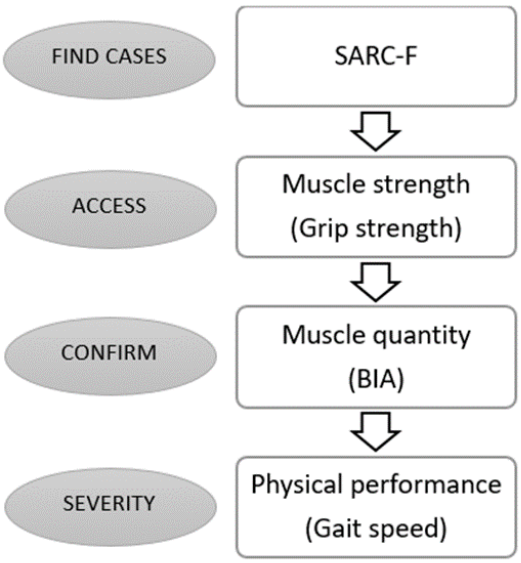

Figure 2.2. Sarcopenia assessment: It was used the EWGSOP2 algorithm, F-A-C-S (Find-Access-Confirm-Severity), for case-finding, making a diagnosis and quantifying severity of sarcopenia[22].

The SARC-F questionnaire[45] has been shown to be a rapid screening test for sarcopenia[46]. This tool has five components: Strength, Assistance with walking, Rise from a chair, Climb stairs and Falls (Figure 2.3). The scores range from 0 to 10, with 0 to 2 points for each component. A score equal to or greater than 4 is predictive of sarcopenia and poor outcomes. For this study, a Portuguese translation of SARC-F was carried out (Figure 2.3; Annex IV).

(a)

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0 Some = 1 A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1–3 falls = 1 4 or more falls = 2

(b)

Componente	Questão	Pontuação (0-2)
Força	1- Qual é a dificuldade que sente ao levantar ou transportar um peso de 4,5Kg? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Ajuda na marcha	2- Qual é a dificuldade que sente ao andar numa divisão? Usa ajudas para o fazer? Precisa de apoio para o fazer? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Levantar da uma cadeira	3- Qual é a dificuldade que sente ao fazer transferência de uma cadeira ou cama? Precisa de usar ajudas? Precisa de apoio para o fazer? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Subir escadas	4- Qual é a dificuldade que sente ao subir uma escada de 10 degraus? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade ou incapaz de o fazer)	
Quedas	5- No último ano teve algum episódio de queda? Quantas quedas? (0=sem quedas; 1= 1-3 quedas; 2= 4 ou mais quedas)	
	Pontuação total:	

Figure 2.3. SARC-F: A Simple Questionnaire to Rapidly Diagnose Sarcopenia[45]: (a) original version; (b) Portuguese translation version.

Muscle strength was assessed by maximum grip strength (kilograms - Kg). It was measured using a handheld Jamar dynamometer (Model Sammons Preston). Participants were in a sitting position, were shown how to use the dynamometer and then were encouraged to exhibit the greatest possible strength; the best value of three assessments of the dominant hand was used for the analysis. Low strength was considered when it was less than 27 Kg in men and 16 kg in women[22] (see table 2.1).

Muscle quantity was calculated using Bioelectrical Impedance Analysis (BIA), with a Tanita body composition monitor (Model Inner Scan V BC-545N; Tanita, Japan). The subjects had to remove their shoes and stand on a monitor that sends a very small current through the body, having to hold two handgrips whilst standing on the monitor. This allowed the segmental analysis of the composition of arms and legs (Kg), and thus was calculated the Appendicular Skeletal Muscle Mass (ASM). This measure refers to the major muscles of the arms and legs and provides a proxy for all skeletal muscle mass[47]. The muscle quantity was classified as low when ASM was less than 20 kg and 15 kg in men and women, respectively (table 2.1).

Usual walking speed (meters per second - m/s) on a 4-m course was used as an objective measure of physical performance. Gait speed, measured at the individual's usual pace has been reported to be a relevant clinical marker of health, well-being, and functional status of older population[48]. The speed was measured manually with a stopwatch. Instructions to walk at usual pace from a still standing position behind the starting line were provided to the participants. A

straight clearly marked course was used. The manual measurement was made using a stopwatch. Timing started at the first foot movement and ended when a foot completely crossed the finish line. Canes and walkers were allowed if the subject normally used this equipment in his/her daily life. Participants were identified with low physical performance if their speed was lower than 0.8 m/s (table 2.1).

Table 2.1 - EWGSOP2 sarcopenia cut-off points for low strength, low muscle quantity and low performance[22]

Test	Cut-off points for men	Cut-off points for women
Low strength (Grip strength)	<27kg	<16kg
Low muscle quantity (ASM)	<20kg	<15kg
Low performance (Gait speed)	≤0.8 m/s	

2.2.3. Measurement of lip and tongue strength

Participants underwent assessments of maximum tongue and lip pressure. Maximum tongue and lip pressure were measured using the Iowa Oral Performance Instrument (IOPI), model 3.1(IOPI® Medical LLC). The instrument presented maximum tongue and lip pressure from a numerical display (kilopascals - kPa).

Measurements were taken with participants sitting in a relaxed position. To measure tongue strength, the participants held an air-filled bulb (tongue bulb) attached to the tip of the probe between the tongue and the front of the hard palate using maximum voluntary effort, with the instruction “Press your tongue against the air-bulb as hard as possible”. To measure lip strength the participants held the tongue bulb under the orbicularis oris (just inside the corner of the patient´s lips), lateral to the central incisor, and were instructed to "Press the air-filled bulb against your teeth by squeezing your lips as hard as you can for about two seconds".

Measurements were performed after the calibration of the inner balloon pressure. It was automatically displayed by the instrument, with the display screen showing 0.0 kPa when the instrument was calibrated successfully.

Tongue and lip pressures were measured three times with a 30 second break between each measurement, and the maximum value recorded.

2.2.4. Nutritional status

Since SOD was associated with malnutrition[26], the nutritional status was screened using the Mini Nutritional Assessment – Short Form (MNA®- SF)[49,50], following the guidelines from the MNA® User Guide[51]. The MNA®-SF is a valid and sensitive rapid nutrition screening tool, validated specifically for the elderly[52]. It is a questionnaire survey recommended for use in the screening diagnosis of malnutrition among older patients, with a total score ranging from 0 to 14 points. The MNA®- SF comprises six questions addressing the decline in food intake and weight loss over the past three months, mobility, psychological stress or acute disease in the past 3 months, neuropsychological problems, and body mass index (BMI). Malnutrition is indicated by a

score of ≤7, risk of malnutrition by a score of 8–11, and favorable nutritional status by a score of 12–14.

2.2.5 Physical function

The independence level or physical function was assessed using the Barthel Index (BI)[53,54]. This instrument is used to measure the patient's ability to successfully carry out ADL and it consists of an ordinal assessment (0–100 points), where higher scores represent greater independence. The BI consists of 10 items: feeding; moving from wheelchair to bed and returning; personal toileting; getting on and off a toilet; bathing; walking on levelled surface (or propelling a wheelchair if unable to walk); ascending and descending stairs; dressing and undressing; controlling bladder; and, controlling bowel.

2.2.6 Other parameters

Other possible factors related to SOD such as age, gender, literacy, and dentition status were assessed.

The dentition status was included as a variable because of the effect on mastication. It was performed considering the absence or presence of the participant's teeth, if they had natural or artificial teeth and, in this case, what their adaptation state was.

2.3 Statistical analysis

Descriptive statistics are presented in n(%) for qualitative variables and in mean (M)±standard deviation (SD) for quantitative variables. For testing the existent association between qualitative variables, the Chi-Square test was used when the requirement of less than 20% of the cells could not have an expected value of less than five verified. Otherwise, the Fisher exact test was used. For Gender group analysis, the independent t-test was used (when normality was present) or the Mann-Whitney test (if otherwise).

For the different group comparison diagnosis (G1: Without pathology; G2: Only with OD risk; G3: Only with sarcopenia; G4: With probable SOD), an independent one-way analysis of variance (ANOVA) was used (when the requirements of normality and homogeneity of variance were verified) or the Kruskal-Wallis test (otherwise). The post-hoc analysis (multiple comparisons) were conducted by the Tukey test.

For establishing the univariate predictors for groups G2, G3, and G4, respectively, a binary logistic regression analysis was used. The results are presented in odds ratio (OR) format and the correspondent 95% confidence intervals (95%CI).

Finally, a correlation between the quantitative variables of study was analyzed using the Spearman Rank test. For the strong correlations (values above 0.6 or higher in module), scatterplot is displayed for a better illustration of the correlation results.

All the results were produced using IBM SPSS Statistics V25.0 (Armonk, NY), and considered significant if p-value<0.05.

3. RESULTS

A total of 36 participants (23 females and 13 males) were included in the present study. Their mean age was 88 years (SD=5.6), with no difference between men and women. The literacy level was lower in women (p<.05); 83.3% of women and 16.7% of men had low education. Half of the sample (5 male; 13 female) showed teeth problems. Of these, 25% (2 male; 7 female) had badly adjusted artificial teeth, and the remaining 25% had total absence of teeth. No significant relationship was found between gender and teeth problems (p=0.587). All participants had an oral diet intake. The prevalence of malnutrition based on the MNA-SF was 19.4% (25% male; 75% female). Most of the elderly were independent in the ADLs (91.7%), with only three dependent females. Overall, 55.6% of this study's population were at risk of having OD (as defined by GUSS). According to the EWGSOP2 criteria, the prevalence of sarcopenia diagnosed by hand grip strength and BIA was 52.8% (36.8% male; 63.2% female). Moreover, 36.1% (38.5% male; 61.5% female) of all participants were diagnosed with possible SOD. In these parameters, there were no significant differences between men and women (p>0.05).

Isometric measures of lips and tongue strength had an average score of 19.5±5.3, and 33.8±14.0 respectively, but they did not differ significantly between males and females (p>0.05). There were significant differences between genders regarding the sarcopenia risk screening (SARC-F scores), ASM, maximum grip strength and gait speed scores (all p<0.01). All scores had worse results in women. For further details, see Tables 3.1 and 3.2.

Table 3.1 - Sample characterization (quantitative variables).

Characteristic	Total, n=36	Male, n=13 (36.1%)	Female, n=23 (63.9%)	Statistical results[a]
Age, (years), M±SD	88.0±5.6	88.0±5.6	88.0±5.8	t(34)=0.0 p=0.983
MNA-SF, (no units), M±SD	12.0±1.5	12.4±1.0	11.8±1.7	t(34)=1.2 p=0.245
BI, (no units), M±SD	84.5±14.8	90.0±9.8	81.8±16.5	t(34)=1.6 p=0.112
SARC-F, (no units), M±SD	3.4±2.9	1.9±2.5	4.2±2.7	U=74 p=0.012*
Lips strength, (kPa), M±SD	19.5±5.3	18.9±6.3	19.9±4.7	t(34)=-0.6 p=0.567
Tongue strength, (kPa), M±SD	33.8±14.0	35.8±16.1	32.7±13.0	t(34)=0.6 p=0.530
ASM, (Kg), M±SD	15.4±3.7	18.8±4.0	13.4±1.5	U=28.5 p<0.001**
Maximum grip strength, (Kg), M±SD	18.5±5.9	22.7±6.6	16.1±3.9	U=53.5 p=0.002**
Gait speed, (m/s) M±SD	0.55±0.25	0.68±0.22	0.48±0.24	t(34)=2.6 p=0.01**

M=mean; SD=standard deviation; ASM= Appendicular Skeletal Muscle Mass; MNA-SF= Mini Nutritional Assessment–Short Form; BI= Barthel Index; SARC-F= Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; ASM= Appendicular Skeletal Muscle Mass; Kg= kilograms.
[a]- P-Value (p) from T-test (t) or Mann-Whitney test (U). *p≤0.05; **p≤0.01.

Table 3.2 – Sample characterization (qualitative variables).

Characteristic	Total, n=36	Male, n=13 (36.1%)	Female, n=23 (63.9%)	Statistical results[a]
Literacy, n (%)				
<4th grade	18 (50.0)	3 (16.7)	15 (83.3)	χ2(1)=5.9
≥4th grade	18 (50.0)	10 (55.6)	8 (44.4)	p=0.015*
Dentition status, n (%)				
Natural teeth/Artificial teeth Well Adjusted	18 (50.0)	8 (44.4)	10 (55.6)	
Artificial teeth bad adjusted	9 (25.0)	2 (22.2)	7 (77.8)	Fisher=1.4
Absence of teeth	9 (25.0)	3 (33.3)	6 (66.7)	p=0.587
Nutritional status (MNA-SF), n (%)				
Normal	28 (77.8)	11 (39.3)	17 (60.7)	χ2(1)=0.550
Risk malnutrition/ Malnourished	8 (19.4)	2 (25.0)	6 (75.0)	p=0.682
Physical function, n (%)				
Dependent	3 (8.3)	0 (0.0)	3 (100)	χ2(1)=0.550
Independent	33 (91.7)	13 (36.1)	20 (60.6)	p=0.682
Sarcopenia risk screening (SARC-F), n (%)				
Yes (cut-off)	16 (44.4)	3 (18.8)	13 (81.3)	χ2(1)=3.8
No	20 (55.6)	10 (50.0)	10 (50.0)	p=0.052*
Low muscle quantity, n (%)				
Yes (cut-off)	26 (72.2)	7(26.9)	19 (73.1)	χ2(1)=3.4
No	10 (27.8)	6 (60.0)	4 (40.0)	p=0.119
Low muscle strength, n (%)				
Yes (cut-off)	22 (61.1)	10 (45.5)	12 (54.5)	χ2(1)=2.1
No	14 (38.4)	3 (21.4)	11 (78.6)	p=0.143
Low performance, n (%)				
Yes (cut-off)	31 (86.1)	9 (29.0)	22 (71.0)	n.a.
No	5 (13.9)	4 (80.0)	1 (20.0)	
Sarcopenia, n (%)				
Yes	19 (52.8)	7 (36.8)	12 (63.2)	χ2(1)=0.009
No	17 (47.2)	6 (35.3)	11 (64.7)	p=1.00
Risk of OD, n (%)				
Yes (cut-off)	20 (55.6)	6 (30.0)	14 (70.0)	χ2(1)=0.73
No	16 (44.4)	7 (43.8)	9 (56.3)	p=0.493
Probable SOD, n (%)				
Yes	13 (36.1)	5 (38.5)	8 (61.5)	χ2(1)=0.049
No	23 (63.9)	8 (34.8)	15 (65.2)	p=1.00

n=sample size; MNA-SF= Mini Nutritional Assessment–Short Form; SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; n.a.=not available/ not applicable; OD=Oropharyngeal dysphagia; SOD= Sarcopenic dysphagia.
[a]-P-Value (p) from Fisher exact test (Fisher) or Chi-square test(χ2)
*p≤0.05

The studied population was divided in four groups according to their diagnosis. They were included in G1 if they did not present any pathology (n=10, 27.8%), in G2 if they only presented being at risk of OD (n=7, 19.4%), in G3 if they only had diagnosis of sarcopenia (n=6, 16.7%), and in G4 (n=13, 36.1%) if they had a probable diagnosis of SOD (risk of OD and sarcopenia).

The relationship between the different diagnosis (G1: Without pathology; G2: Only with OD risk; G3: Only with sarcopenia; G4: With probable SOD) is shown in Table 3.3. No significant relationships were observed between differential diagnosis and gender, literacy, dentition status, age, nutritional status, physical function, as well as with lips and tongue strength. A significant relationship between SARC-F results and the different group comparison diagnosis was found.

Table 3.3 – Results for the different group comparison diagnosis

	Groups					
Characteristic	**G1**	**G2**	**G3**	**G4**	**Statistical**	**Post hoc**
	n= 10 (27.8%)	**n= 7**	**n=6**	**n=13**	**results**	**analysis by**
		(19.4%)	**(16.7%)**	**(36.1%)**		**Tukey test**
Gender, n(%)						
Male	5(38.5)	1(7.7)	2(15.4)	5(38.5)	Fisher=2.299	n.a.
Female	5(21.7)	6(26.1)	4(17.4)	8(34.8)	p=0.541	
Literacy, n(%)						
<4th grade	3(16.7)	4(22,2)	3(16.7)	8(44.4)	Fisher=2.484	n.a.
≥4th grade	7(38.9)	3(16.7)	3(16,7)	5(27.8)	p=0.515	
Dentition status, n(%)						
N. teeth/ A. teeth						
Well Adjusted	6(33.3)	1(5.6)	4(22.2)	7(38.9)	Fisher=8.712	
A. teeth bad adjusted	1(11.1)	5(55.6)	1(11,1)	2(22.2)	p=0.165	n.a.
Absence of teeth	3(33.3)	1(11.1)	1(11.1)	4(44.4)		
Age, (years), M±SD	86.2±5.7	85.6±6.6	91.5±4.8	89.0±4.9	F(3;32)=1.8	n.s.
					p=0.168	
MNA-SF, (no units), M±SD	12.7±1.0	11.3±2.3	11.7±2.0	12.0±1.5	F(3;32)=1.5	n.s.
					p=0.245	
BI, (no units), M±SD	89.0±13.3	89.3±15.4	86.7±11.7	78.2±16.1	F(3;32)=1.4	n.s.
					p=0.252	
SARC-F, (no units), M±SD	1.6±1.8	3.4±2.9	2.3±2.6	5.2±2.8	F(3;32)=4.1	G1=G2=G3
					p=0.014**	G2=G3=G4
Lips strength, (kPa), M±SD	19.4±6.5	20.4±1.8	21.1±6.2	18.4±5.3	F(3;32)=0.5;	n.s.
					p=0.722	
Tongue strength, (kPa), M±SD	32,4±15.9	34.1±13.7	36.3±13.5	33.0±14.4	F(3;32)=0.1	n.s.
					p=0.944	

n=sample size; n.a.=not available/ not applicable; N. teeth= Natural teeth; A. teeth= Artificial teeth; M=mean; SD=standard deviation; n.s.= not significant;; MNA-SF= Mini Nutritional Assessment–Short Form; BI= Barthel Index; SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals.[a] - P-Value (p) from Fisher Exact Test (Fisher) or One-way ANOVA (F).
**p≤0.01

The average score in the identification of the different groups was M=1.6 (SD=1.8) for G1, for G2 it was M=3.4 (SD=2.9), for G3 it was M=2.3 (SD=2.6) and M=5.2 (SD=2.8) for G4. One-way ANOVA showed that groups differ from each other (F=4.1; p=0.01). From multiple comparisons using the Tukey method, two groups of different effects were obtained: G1=G2=G3 and G2=G3=G4. This indicates that it is possible to distinguish the groups that are at the extremities, thus the group without pathology (G1) differs from the group with probable SOD (G4).

Table 3.4.A - Univariate predictors for probable SOD (reference group: Without any pathology)

	Univariate analysis	
Variables	**Odds ratio**	**95% CI**
Gender		
Male (Reference group)	--	
Female	1.600	[0.302;8.490]
Literacy		
<4th grade	3.733	[0.646;21.577]
≥4th grade (Reference group)	--	
Dentition status		
Natural teeth/ Artificial teeth well adjusted (Reference group)	--	
Artificial teeth bad adjusted	1.714	[0.123;23.939]
Absence of teeth	1.143	[0.179;7.283]
Nutritional Status (MNA-SF)		
Normal (Reference group)	--	
Risk Malnutrition/ Malnourished	1.636	[0.127;21.104]
Sarcopenia risk screening (SARC-F)		
Yes (≥4)	**9.000***	[1.285;63.025]
No (Reference group)	--	
Variables		
Age (years)	1.115	[0.939;1.325]
Lips strength (kPa)	0.968	[0.836;1.122]
Tongue strength (kPa)	1.003	[0.947;1.062]
MNA-SF (no units)	0.353	[0.106;1.177]
BI (no units)	0.94	[0.883;1.013]

MNA-SF= Mini Nutritional Assessment–Short Form; SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; BI= Barthel Index.
*p<0.05

Univariate analysis was used to individually screen the measured variables for an association with a pathology (G2, G3, G4), and calculate odds ratio (OR) in order to quantify the strength of that association and, consequently, the odds of the occurrence of pathology given the exposure to a particular condition (variable). Thus, the results of the univariate analysis of individuals in the different groups showed that there were some significant predictors among the factors examined. Table 3.4.A presents the results of the odds risk analysis for probable SOD. Only the results obtained in the SARC-F questionnaire were a significant predictor (OR=9.0, 95% CI=1.285-63.025, p<0.05). The likelihood of having probable SOD is 9 times higher if the elderly with a score of four or higher in the SARC-F questionnaire as opposed to a score below four. However, the upper and lower limits of the confidence interval showed a large amplitude.

Although there is no dependency relationship between the remaining parameters, the odds ratio for gender indicates that when holding all other variables constant, a woman is 1.6 times more likely to suffer probable SOD than a man. Also notes that low educational level is associated with 3.7 times more likely to have probable SOD. The odds of having probable SOD are 1.7%

higher if the person has badly adjusted artificial teeth, which was worse than total absence of teeth. Risk of malnutrition or malnourishment is associated with 1.6 times more likely to have probable SOD, and it was observed that the likelihood of presenting probable SOD decreases by 64.7% for each point added in the MNA test. The physical function is also associated with probable SOD, for each point added in the BI the odds of probable SOD decreases by 5.4%. As age increases, the odds of probable SOD also increase 11.5%. Regarding the strength of lips and tongue, it was observed that as a kPa is added to the strength of the lips, the likelihood of probable SOD decreases 3.2%, while with strength of the tongue the effect was not very noticeable.

Table 3.4.B - Univariate predictors for sarcopenia (reference group: Without any pathology)

	Univariate analysis	
Variables	**Odds ratio**	**95% CI**
Gender		
Male (Reference group)	--	
Female	2.000	[0.244;16.352]
Literacy		
<4th grade	2.333	[0.287;18.965]
≥4th grade (Reference group)	--	
Dentition status		
Natural teeth/ Artificial teeth well adjusted (Reference group)	--	
Artificial teeth bad adjusted	1.500	[0.71;31.575]
Absence of teeth	0.500	[0.037;6.683]
Nutritional Status (MNA-SF)		
Normal (Reference group)	--	
Risk Malnutrition/ Malnourished	4.500	[0.310;65.229]
Sarcopenia risk screening (SARC-F)		
Yes (≥4)	2.00	[0.201;19.914]
No (Reference group)	--	
Variables		
Age (years)	1.257	[0.954;1.656]
Lips strength (kPa)	1.050	[0.886;1.245]
Tongue strength (kPa)	1.020	[0.948;1.097]
MNA-SF (no units)	0.549	[0.214;1.412]
BI (no units)	0.984	[0.905;1.070]

MNA-SF= Mini Nutritional Assessment–Short Form; SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; BI= Barthel Index.

The results of the univariate analysis of individuals with sarcopenia versus individuals without any pathology did not show significant predictors among the variables examined (see Table 3.4.B). However, these results suggested that a woman is 2.0 times more likely to suffer sarcopenia than a man and that the literacy parameter has also been related to the risk of elderly people having sarcopenia, since the participants who had low education are 2.3 times more likely to suffer from this disorder. The odds for sarcopenia are 50% higher if the elderly had badly

adjusted artificial teeth as opposed to having natural teeth or well-adjusted artificial teeth. Surprisingly, the likelihood for sarcopenia is 50% lower if the elderly has the total absence of teeth as opposed to having natural teeth or well-adjusted artificial teeth. Risk of malnutrition or malnourishment is associated with a 4.5 times higher probability of having sarcopenia, and it was observed that the risk of this disorder decreases 45.1% for each point added in the MNA test. Elderly people with a score equal to or greater than four on the SARC-F screening test are 2.0 times more likely to have sarcopenia. As age increases, the likelihood of sarcopenia increases by 25.7%. The effect of physical function, the lips and tongue strength were not very noticeable.

Table 3.4.C - Univariate predictors for the OD risk (reference group: Without any pathology)

	Univariate analysis	
Variables	**Odds ratio**	**95CI**
Gender		
Male (Reference group)	--	
Female	6.000	[0.516;69.754]
Literacy		
<4th grade	3.111	[0.414;23.393]
≥4th grade (Reference group)	--	
Dentition status		
Natural teeth/ Artificial teeth well adjusted (Reference group)	--	
Artificial teeth bad adjusted	**30.000***	[1.471;611.797]
Absence of teeth	2.000	[0.090;44.350]
Nutritional Status (MNA-SF)		
Normal (Reference group)	--	
Risk Malnutrition/ Malnourished	6.750	[0.526;86.561]
Sarcopenia risk screening (SARC-F)		
Yes (≥4)	3.000	[0.348;25.870]
No (Reference group)	--	
Variables		
Age (years)	0.981	[0.829;1.161]
Lips strength (kPa)	1.045	[0.854;1.278]
Tongue strength (kPa)	1.014	[0.947;1.086]
MNA-SF (no units)	0.518	[0.213;1.257]
BI (no units)	1.002	[0.931;1.077]

MNA-SF= Mini Nutritional Assessment–Short Form; SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; BI= Barthel Index.
*p<0.05

Table 3.4.C shows the results of the odds risk analysis for OD. The use of badly adjusted artificial teeth was a significant predictor (OR=30.0; 95% CI=1.471-611.797, p<0.05) of being at risk of having OD. With due reservations for the small sample size in the interpretation of odds ratios, the likelihood of being at risk for OD is 30 times higher if the elderly have badly adjusted artificial teeth as opposed to a natural teeth or well-adjusted artificial teeth. There was no significant relationship between the remaining parameters. However, those results indicate that

when holding all the other variables constant, a female elderly is 6.0 times more likely to be at risk of suffering OD than a male. The low level of education is also associated with being 3.1 times more likely to be at risk of having OD. Participants with a score equal to or greater than four on the SARC-F screening test are 3.0 times more likely to be at risk of having OD. The likelihood of being at risk of having OD is 6.75 times higher if the elderly has risk of malnutrition or malnourishment as opposed to the reference group (G1), and it was observed that the likelihood of this condition decreases 48.2% for each point added in the MNA test. As age increases, the likelihood of being at risk of having OD increases only by 1.9%. The strength of the lips and tongue, as well as the physical function was not very noticeable of the odds risk analysis for being at risk for OD.

Finally, in order to examine the relationship between being at risk for OD and sarcopenia, the sample data was analyzed and the participants who were diagnosed with sarcopenia were crossed with the elderly who were at risk of having OD (see table 3.5). 52.8% of participants had sarcopenia and 68.4% of these had associated risk of OD. The odds of being at risk of having OD was 3 times higher (OR=3.095; CI 95%=0.789-12.144, p>0.05) where, though the odds ratio shows an association, the 95% CI spans across 1 on either side and hence the p value is greater than 0.05.

Table 3.5 - The association between Sarcopenia and being at risk for OD

	Risk for OD		
Sarcopenia	**Yes (with OD risk)**	**No (without OD risk)**	**Total**
Yes (Risk group)	13	6	52.8%
No (Reference group)	7	10	47.2%
Total	20	16	100%

OR=3.095; CI95%=[0.789;12.144]
Note: Data are expressed as n, %

The tables 3.6.A-D present the Spearman's rank of correlation coefficients between the quantitative variables of the study. For the G1, the control group (for more details, see Table 3.6.A), strong and very significant negative correlation between muscle quantity (ASM) and SARC-F scores (-0.841, p<0.01), as well as a strong and significant positive correlation among BI scores and muscle quantity (ASM) (0.646, p<0.05) were found. Therefore, the increase of ASM is associated with the decrease in SARC-F scores and increase of BI scores is associated with the increase of ASM. Although the correlations were not significant (p>0.05), there were moderate to strong and negative correlations between BI scores and SARC-F scores (-0.607), as well as among BI scores and age (-0.568), and between age and lip strength (-0.5). Thus, the increase in one variable is associated with the decrease in the other. In addition, there was a positive correlation among gait speed (m/s) and MNA scores (0.564). Figure 3.1 displays the scatterplots of the negative correlation between SARC-F scores and muscle quantity (to the left), and the correlation with functional capacity (on the right): the higher the SARC-F scores, the lower the muscle quantity (ASM) and the functional capacity (BI).

Table 3.6.A - Correlation analysis between age, SARC-F scores, lips strength, tongue strength, muscle quantity (ASM), maximum grip strength, physical performance (gait speed), MNA-SF scores, BI scores and GUSS scores for the control group (only significant values p<0.05). Bold values identify moderate to strong correlations.

	Age	SARC-F	Lips strength	Tongue strength	ASM	Max. grip strength	Gait speed	MNA	BI
Age (years)	1	0.360	**-0.500**	0.232	-0.274	-0.246	0.086	0.349	**-0.568**
SARC-F		1	0.028	0.159	**-0.841****	-0.469	-0.481	-0.092	**-0.607**
Lips strength (kPa)			1	0.344	-0.152	0.351	-0.468	-0.451	-0.079
Tongue strength (kPa)				1	0.172	0.227	-0.352	-0.168	-0.153
ASM (Kg)					1	0.465	0.474	0.229	**0.646***
Maximum grip strength (Kg)						1	0.475	0.285	0.434
Gait speed (m/s)							1	**0.564**	0.453
MNA-SF (no units)								1	-0.197
BI (no units)									1

SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; ASM=Appendicular Skeletal Muscle Mass; Kg=kilograms; m/s= meters per second; MNA-SF= Mini Nutritional Assessment–Short Form; BI= Barthel Index. **p<0.01; *p<0.05.

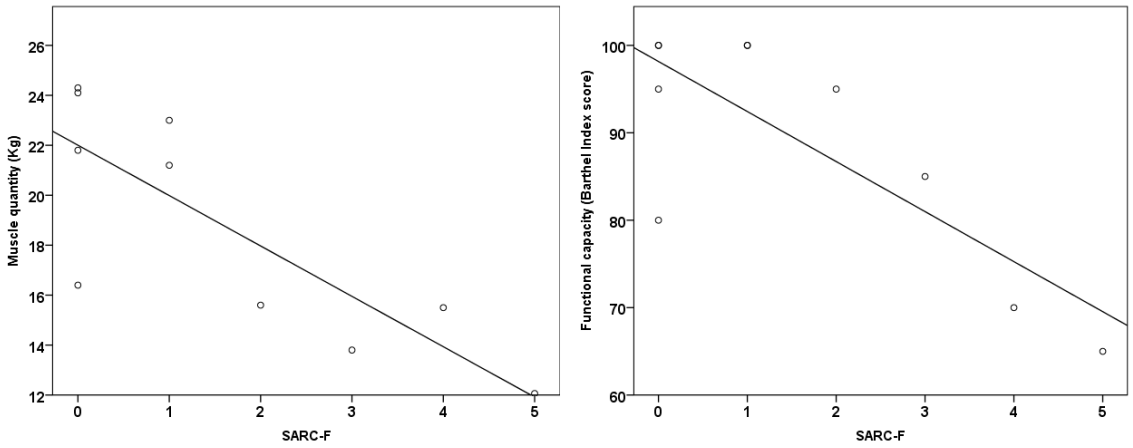

Figure 3.1. Relationship between: SARC-F and muscle quantity - ASM (to the left); functional capacity – BI (on the right), for control group.

Table 3.6.B presents the Spearman's rank of correlation coefficients among the factors for the group at risk of having OD (G2). It shows strong and significant negative correlations between age and tongue strength (-0.847, p<0.05), age and muscle quantity (ASM) (-0.775, p<0.05), as well as age and maximum grip strength (-0.784, p<0.05). Thus, an increase of age is associated with a decrease in tongue strength, ASM, and grip strength. In addition, ASM had a strong and significant positive correlation with maximum grip strength (0.767, p<0.05), and also there was a strong and significant positive correlation between gait speed (m/s) and BI scores (0.815, p<0.05).

Therefore, an increase of ASM is associated with an increase in grip strength, and an increase in BI scores is associated with an increase of gait speed.

Table 3.6.B - Correlation analysis between age, SARC-F scores, lips strength, tongue strength, muscle quantity (ASM), maximum grip strength, physical performance (gait speed), MNA-SF scores, BI scores and GUSS scores for the OD risk group (only significant values p<0.05). Bold values identify moderate to strong correlations.

	Age	SARC-F	Lips strength	Tongue strength	ASM	Max. grip strength	Gait speed	MNA-SF	BI	GUSS
Age (years)	1	0.183	-0.318	**-0.847***	**-0.775***	**-0.784***	-0.288	0.345	-0.318	-0.183
SARC-F(no units)		1	-0.100	-0.455	-0.473	-0.191	-0.400	-0.495	**-0.698**	0.278
Lips strength (kPa)			1	**0.512**	-0.118	0.031	-0.256	0.169	0.225	-0.311
Tongue strength (kPa)				1	**0.643**	**0.636**	0.179	-0.054	0.371	-0.036
ASM (Kg)					1	**0.767***	**0.750**	0.054	**0.630**	0.473
Maximum grip strength (Kg)						1	**0.617**	-0.113	0.466	0.200
Gait speed (m/s)							1	**0.523**	**0.815***	**0.564**
MNA-SF(no units)								1	**0.692**	0.165
BI (no units)									1	0.189
GUSS (no units)										1

SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; ASM=Appendicular Skeletal Muscle Mass; Kg=kilograms; m/s= meters per second; MNA-SF= Mini Nutritional Assessment–Short Form; BI= Barthel Index; GUSS= The Gugging Swallowing Screen.

*p<0.05.

Although it was not significant, there were also moderate to strong negative correlations between scores of SARC-F and BI (-0.607), muscle quantity (ASM) and, maximum grip strength and MNA scores (-0.523). Thus, the increase in one variable is associated with the decrease in the other. In addition, there were moderate to strong positive correlations between scores of ASM and gait speed (0.750), gait speed and GUSS scores (-0.564), among lips strength and tongue strength (0.512), between tongue strength and ASM (0.643), as well as with maximum grip strength (0.636), between ASM and BI (0.630), and between MNA scores and BI (0.692). Therefore, the increase in one variable is associated with an increase in the other.

For the group with sarcopenia (G3), correlation analyses (see Table 3.6.C) exhibit a significant negative correlation among tongue strength and MNA scores (-0.941, p<0.01), and between age and BI scores (-0.833, p<0.05). Therefore, the increase of tongue strength was associated with the decrease of the MNA scores, and the increase of age is associated with the decrease in BI scores. There were also strong and significant positive correlations between ASM and BI scores (0.833, p<0.05), thus, as the muscle quantity (ASM) scores increase there is also an increase in the BI scores. Although not significant, there were still other moderate to strong negative correlations between age and ASM (-0.714), SARC-F scores and grip strength (-0.765),

lips strength and BI scores (-0.626), as well as SARC-F and gait speed (-0.609). Therefore, the variations between the variables were in the opposite direction, so the increase in one variable is associated with the decrease in the other. In addition, SARC-F was positively associated with tongue strength (0.580). Therefore, the greater the scores of SARC-F questionnaire the greater the tongue strength. A positive correlation between age and lips strength (0.667) and a negative correlation between ASM and MNA (-0.667) were also observed.

Table 3.6.C - Correlation analysis between age, SARC-F scores, lips strength, tongue strength, muscle quantity (ASM), maximum grip strength, physical performance (gait speed), MNA-SF scores, BI scores and GUSS scores for the sarcopenia group (only significant values p<0.05). Bold values identify moderate to strong correlations.

	Age	SARC-F	Lips strength	Tongue strength	ASM	Maximum grip strength	Gait speed	MNA	BI
Age (years)	1	-0.087	**0.667**	-0.257	**-0.714**	-0.058	0.429	0.395	**-0.833***
SARC-F(no units)		1	0.088	**0.580**	-0.116	**-0.765**	**-0.609**	-0.462	-0.391
Lips strength (kPa)			1	-0.116	-0.493	0.015	0.116	0.370	**-0.626**
Tongue strength (kPa)				1	0.429	-0.464	0.029	**-0.941****	0.185
ASM (Kg)					1	0.464	-0.143	**-0.638**	**0.833***
Maximum grip strength (Kg)						1	0.145	0.277	0.423
Gait speed (m/s)							1	0.030	0.062
MNA-SF(no units)								1	-0.361
BI (no units)									1

SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; ASM=Appendicular Skeletal Muscle Mass; Kg=kilograms; m/s= meters per second; MNA-SF= Mini Nutritional Assessment–Short Form; BI= Barthel Index. **p<0.01; *p<0.05.

Finally, table 3.6.D presents the Spearman's rank of correlation coefficients among the quantitative variables of the study for the group with probable SOD (G4). It shows a significant and strong negative correlation (-0.808) between SARC-F scores and BI scores (-0.808, p<0.01), and among SARC-F and gait speed (-0.677, p<0.05). Therefore, the greater SARC-F scores the lower functional capacity (BI), and the lower physical performance. There was also a significant and strong positive correlation between muscle quantity (ASM) and physical performance (gait speed) (0.572, p<0.05). Thus, an increase of ASM was related to an increase of gait speed. Although it was not significant, there was also a moderate positive correlation between maximum grip strength and physical performance (gait speed) (0.540), so an increase in grip strength is associated with an increase in the physical performance. To exemplify these correlations, figure 3.2 displays the scatterplots of negative correlations among SARC-F scores and physical

performance (on the left), and between SARC-F scores and BI scores (on the right): the greater SARC-F scores the lower gait speed, as well as lower functional capacity (BI).

Table 3.6.D - Correlation analysis between age, SARC-F scores, lips strength, tongue strength, muscle quantity (ASM), maximum grip strength, physical performance (gait speed), MNA-SF scores, BI scores and GUSS scores for the probable SOD group (only significant values p<.05). Bold values identify moderate to strong correlations.

	Age	SARC-F	Lips strength	Tongue strength	ASM	Max. grip strength	Gait speed	MNA	BI	GUSS
Age (years)	1	-0.069	0.092	0.162	-0.138	0.054	-0.041	0.484	0.106	-0.160
SARC-F (no units)		1	-0.465	-0.084	-0.182	-0.484	**-0.677***	0.227	**-0.808****	-0.111
Lips strength (kPa)			1	0.436	0.345	0.363	0.145	0.144	0.273	-0.192
Tongue strength (kPa)				1	0.364	0.155	0.055	0.003	0.141	-0.276
ASM (Kg)					1	0.437	**0.572***	-0.114	-0.094	-0.321
Maximum grip strength (Kg)						1	**0.540**	0.107	0.244	0.124
Gait speed (m/s)							1	-0.183	0.452	0.230
MNA-SF (no units)								1	-0.137	-0.196
BI (no units)									1	-0.013
GUSS (no units)										1

SARC-F=Simple Questionnaire to Rapidly Diagnose Sarcopenia; kPa= kilopascals; ASM=Appendicular Skeletal Muscle Mass; Kg=kilograms; m/s= meters per second; MNA-SF= Mini Nutritional Assessment–Short Form; BI=Barthel Index; GUSS= The Gugging Swallowing Screen.

**p<0.01; *p<0.05.

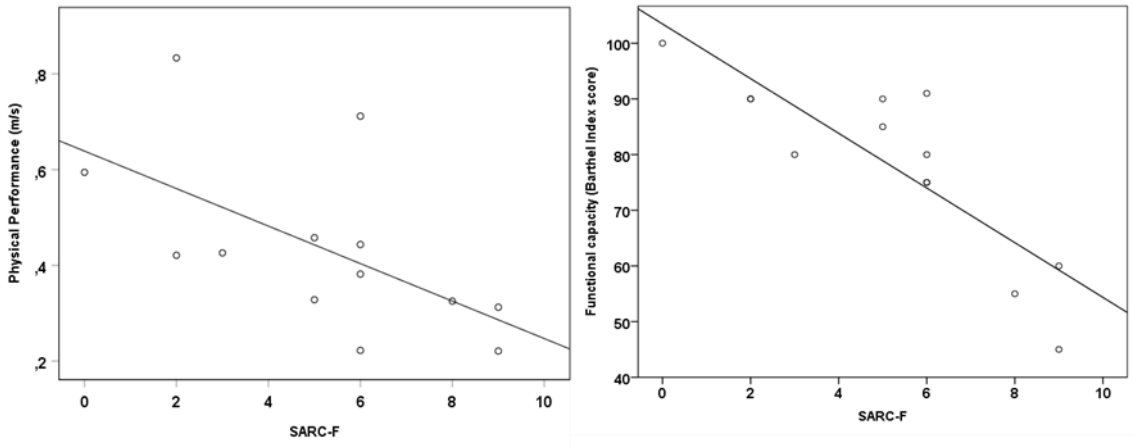

Figure 3.2 - Relationship between SARC-F and physical performance – gait speed (to the left); SARC-F and functional capacity - BI (on the right), for group with probable SOD.

4. DISCUSSION

This study involved 36 elderly living in nursing homes and found that the prevalence of being at risk of having OD and presenting sarcopenia were 55.6% and 52.8%, respectively, and that the prevalence of having probable SOD was 36.1%. Regarding both OD and SOD results, the obtained prevalence, although slightly higher, are in line with the existing literature, which indicates a prevalence, in institutionalized elderly of 51%[5] and 32%[42], respectively. However, the prevalence rate of sarcopenia in institutionalized elderly reported in the previous studies was 14 to 33%[31], indicating that the prevalence founded in our studied population is higher.

The population involved in our study has an average age of 88 years (SD=5.6), being a too aged sample, which is in line with the increasingly aging trend of the Portuguese and world population[1,2]. On the other hand, the literature reported an average age to people who suffers from sarcopenia of 70.5 years for men and 71.6 years for women[30], with increased values for people aged over 80 years old[34]. As the sample mean of this study was significantly higher than that average, as well as higher than 80 years old, this may explain the prevalence of sarcopenia values we have found.

Analyzing our sample, we observed significantly worse results ($p=0.012$) in women, for the results of SARC-F. Comparing these values with the cut-off point, we saw that women have a higher risk of suffering from sarcopenia than men ($p=0.052$). These results suggest a trend towards a higher prevalence of sarcopenia in females than in males, in our sample. Similarly, females showed significantly worse results ($p<0.05$) in the measures that allow the evaluation of sarcopenia: grip strength, ASM and gait speed. However, these values are expected due to natural differences between genders, in relation to muscle composition and consequent strength and walking speed.

The educational qualifications of our sample showed a low educational level, with significant gender differences, with 83.3% women and 16.7% men with low educational levels ($p<0.05$). On the other hand, half of our sample had poor oral health. These values were expected, as Portugal is one of the countries with the lowest rates of dental treatment, and with oral health indicators below the European average[55]. It is known that average levels of health literacy are highly related to educational qualifications. Indeed, several studies have shown that the higher the level of education, the higher the levels of health literacy, and that individuals with only the 1st cycle of basic education, are those with lower results compared to groups with other levels of education[56-59]. Health literacy is defined as the individual's ability to access, communicate, understand, manage, reflect, and make health-related decisions[56]. Similarly, in Portugal, the elderly population has a high prevalence of poor oral health, with a high rate of elderly people with less than 20 natural teeth and a high number of lost teeth, apparently associated with the lack of interventions to combat periodontal disease[60,61]. And, we know that oral hygiene in institutionalized elderly people is generally deficient, because in addition to the decrease in interest in their oral health, they also present a decrease in visual acuity and manual dexterity, cognitive decline, incapacitating diseases, which together make oral hygiene very difficult[62,63]. Therefore, our results

show that low schooling, low health knowledge and skills seem to have significant implications for oral health.

Our sample is made up of elderly living in nursing homes and that have shown a prevalence of malnutrition risk of 19.4% (25% male; 75% female), and it was mostly independent in the ADLs (91.7%), with an average BI score of 84.5/ 100 (SD=14.8). The whole sample had an oral diet, however most reported difficulty in preparing the bolus, having to cut the meat and other harder foods into small sizes, or eating only the accompaniment and excluding the meat. OD was recognized as a geriatric syndrome[5,10] because it is highly prevalent in the elderly and is related to many comorbidities and poor results in this population. It is strongly associated with malnutrition (MNA<17) and dehydration[4,5,9,13], as well as functional disability and fragility, with an average BI score of 24-48/100[15,16]. For these reasons, it contributes to a decrease in quality of life and has a negative social impact[4,5,9,13]. This condition has been strongly associated with the admission of nursing homes[15,16], and is also identified as an independent risk factor for mortality in this population[14].

Considering these data and these specificities of aging, it was decided to transmit information to formal caregivers, about the changes in alimentation, directly related to aging, as well as the importance of ensuring adequate nutrition to the elderly. In particular, it was alerted to the difficulty of adequate food intake due to sensory changes (vision, taste and smell), reduction of appetite, early satiety and difficulty in preparing the bolus, resulting from structural changes, such as the absence of teeth, or artificial teeth badly adapted or deteriorated, or even xerostomia, caused by frequent polimedication in elderly people. The importance of protein intake in the muscle health of the elderly was also emphasized, as well as the need for rheological adaptations of food, so that this intake is facilitated or even possible, due to the structural difficulties already mentioned. We also sought to raise awareness of the need for calorie-protein adjustments in the diet of the elderly to ensure the nutritional needs of this population. Since aging is associated with a reduced capacity to stimulate protein synthesis of skeletal muscle in response to nutrition, insulin and resistance exercise, determining an increase in protein intake needs, as well as the regular distribution of protein in the three main meals[64,65]. These aspects determine a need in increase of protein intake needs, as well as the regular distribution of protein in the three main meals, so there should be an intake of approximately 25-30g of protein per meal to preserve skeletal muscle mass during aging[64]. ESPEN guidelines recommend protein intake of more than 1g/Kg of weight/day[66]. Attention was also drawn to the risk of dehydration in the elderly, and therefore the need to redouble the supply of liquids, as well as any necessary volume and viscosity adjustments.

In our opinion, the crucial need for adequate hydric and protein supply in order to preserve the health of the elderly justifies the need for the presence of a Speech and Language Therapist (SLP) in the residences of the elderly. However, and unfortunately, this is not yet a reality in Portugal, so a change in geriatric health practices, which focus on health promotion and disease prevention, is imperative.

The studied population was divided in four groups depending on the initial obtained diagnosis: G1 - without pathology (27.8%; n=10); G2 – only with OD risk (19.4%; n=7); G3 - only with sarcopenia (16.7%, n=6); and, G4 – with probable SOD (36.1%, n=13). Interestingly, a significant relationship was found between the SARC-F questionnaire and the different diagnosis in the groups comparison. Thus, the results obtained with SARC-F allow us to distinguish the group without pathology (G1) from the group with probable SOD (G4) ($p=0.014$).

SOD is characterized by a difficulty in swallowing linked to a loss of whole-body skeletal and swallowing muscle mass and function[37,40,41]. In this sense, the strength of the tongue and lips have been shown to be a useful predictor of SOD[23], with a strong correlation between the diagnosis of SOD and the measures of strength of the tongue and lips. However, the results we obtained do not meet the described. Yet, despite the fact that the measures founded for the strength of lips and tongue did not prove to be useful factors in the diagnosis of SOD, we think that this result is due to the small sample size. Even though the isometric measures of the tongue found were not very noticeable, it was observed an increase in the strength of the lips associated with the decreased risk of probable SOD in 3.2%. Founded average of lips and tongue strength was19.5±5.3, and 33.8±14.0, respectively. It should also be noted that in assessing the sample' tongue and lip strength, the instruction for measuring lip force, “close your lips as hard as you can”, seemed to be easier to understand and execute than the instructions provided for measuring tongue strength.

Prevalence of SOD increases as the average age of population[41], and it is related to complications such as poor nutritional state[43], accumulation of residues in the oropharyngeal cavity[37,40,42], hip fractures[34], low BMI[32] as well as low physical activity[35]. Our study results are in agreement with those reported in previous studies, once we have verified that an increase of age, having badly adjusted artificial teeth, an higher level of dependence in the ADLs, and risk of malnutrition or malnourishment rise the potential to have probable SOD. No data from previous studies were found, but our results also showed that parameters such as gender (female) and low educational level are associated with higher odds of having this geriatric syndrome. The SARC-F questionnaire was the only founded significant predictor to probable SOD found ($p<0.05$), indicating that the likelihood of presenting this condition increases relevantly if the elderly has a final score in this tool equal to or greater than four.

We have used the algorithm suggested by the European consensus[22] for the diagnosis and severity determination of sarcopenia in the elderly. Thus, the reduction of muscle mass and the decrease of muscle function criteria were used. Sarcopenia is a progressive and generalized muscle disorder and it has been associated with an increased likelihood of adverse outcomes, including falls, fractures, physical disabilities and mortality[22,25,36]. Our results showed significant differences between gender in regards to the measures we have used for sarcopenia case-finding, diagnosis and severity determination in the elderly: sarcopenia risk screening (SARC-F scores); ASM; maximum grip strength; and, gait speed scores (all $p<0.01$). In addition, it should be noted that all obtained measures were worse in women. As we have already mentioned, the sarcopenia incidence proportion in this study is slightly higher compared with the incidence

proportion found in others recent studies. Although we did not find significant predictors for sarcopenia, our results show that the risk of malnutrition or malnourishment is associated with a higher odds of having sarcopenia, which has also been shown in previous studies[25,29]. We also found that the literacy parameter (low education), gender (woman), and score equal to or greater than four on the SARC-F screening increases the likelihood of elderly people having sarcopenia; and also, that the condition of badly adjusted artificial teeth increases odds for sarcopenia in 50%. Surprisingly, the likelihood for sarcopenia is 50% lower if the elderly has the total absence of teeth as opposed to having natural teeth or well-adjusted artificial teeth. In agreement with previous studies[32,33] the odds of sarcopenia also increased with the age rise. Contrary to what has been documented in the literature[7,23,25,29,35,39], there has been no increase in the probability of sarcopenia in relation to the physical condition, not even in relation to the strength of the lips and tongue. However, once again attention is drawn to the small size of the sample and therefore to the limitations in the interpretation of probability ratios.

It is known that the etiology of OD in the elderly population includes muscle weakness and sarcopenia[5,21], and that a reduction in the mass and muscle function of the muscles involved in the swallowing process, associated with sarcopenia, contributes to OD due to aging[6,17-19]. Furthermore, recent studies showed that OD prevalence rates are markedly increased with age[12]. Similarly, the results of this investigation point out that as age increases, the likelihood of being at risk of having OD is also higher. We also found that the use of badly adjusted artificial teeth was a significant predictor ($p<0.05$) of risk for OD. Although it was not possible to find any information related to these results in previous studies, these are easy perceived due to the importance of the integrity and good functioning of intraoral structures for a correct and safe swallowing. In agreement with literature[16,67], we found that with an increase of age, the level of dependence of the elderly in the ADLs is higher, and the risk of malnutrition or malnourishment increases the odds of risk for OD. Similar to the results found for probable SOD and sarcopenia groups, even if we had not found data from previous studies, we also observed that the gender (female), low educational level and score equal to or greater than four on the SARC-F screening test are associated with higher odds to OD risk. Finally, the strength of the lips and tongue, as well as the physical function was not very noticeable of the odds risk analysis for being at risk for OD.

Tongue pressure has been positively correlated with grip strength[39], thus suggesting that tongue strength is associated with skeletal muscle power. On the other hand, gait speed has been reported to be a relevant clinical marker of health, well-being, and functional status of older population[48]. Being at risk for OD has been strongly associated with malnutrition, functional disability and frailty[4,5,9,13]. The previous studies observed that the etiology of OD in the elderly population includes sarcopenia[5,21]. Thus, generalized sarcopenia has been considered an independent risk factor for OD[13,37], because of an oropharyngeal functional decline[7,22,25,38], and has been associated with the swallowing mechanism aging[40]. In agreement with this, we found that sarcopenia increased the odds of being at risk for OD, although this result was not significant, as expected, we believe it is most likely due to the small size of our sample.

In addition, sarcopenia has been associated with aging[32,33], decreased tongue strength[23], and isometric tongue strength have been positively associated with grip strength[39]. Moreover, SOD was also associated with aging[41], strength of the tongue and lips[23], and malnourishment[42, 43]. These reports have not been shown in our study, we believe that the main reason for not having achieved greater correlations between these factors was, once more, the small sample size. However, in our study, a simple correlation analyses for the quantitative variables studied in the different groups, showed that in the healthy older group it was reported a strong negative correlation between ASM and SARC-F and among ASM and BI. We inferred that this correlation exists due to an association among muscle quantity and physical function. In elderly at risk for OD group, age was negatively correlated with tongue strength; gait speed was positively correlated with BI as well as ASM was associated with grip strength; and, although not significatively, gait speed was correlated with risk for OD. In the group with sarcopenia we found a positive association between age and lip strength, while age showed a negative correlation with both ASM and BI. These last two correlations are in line with existing studies, however the positive correlation between age and lip strength was not expected, as in the elderly with sarcopenia, aging has been associated with reduced lip strength, reduced ASM, and increased difficulty in mobility and physical dependence[17,18,23,24,34-36]. Similarly, we observed a positive correlation between SARC-F values and tongue strength. However, as the values of SARC-F higher than 4 indicate risk of suffering sarcopenia, and this disease being associated with a decrease in tongue strength, we were not expecting this result either. However, we consider that these incongruous outcomes result from the small size of our sample. Still in the group with sarcopenia we found a negative association between the values of SARC-F and the grip strength and gait speed, this correlation is supported by the ability of the SARC-F test to track sarcopenia. We also observed a negative correlation of MNA-SF test results with both tongue strength and ASM. These results are supported by previous studies, as desnutrition and malnutrition are strongly associated with loss of muscle mass and low tongue strength[7,66,68]. Finally, among probable SOD group, gait speed was associated with SARC-F and ASM, and SARC-F was also associated with BI.

4.1 Study Limitations

Although the present study has revealed interesting findings, several important limitations should be noted.

Firstly, unfortunately due to the Covid-19 pandemic, data collection had to be stopped in March, which led to a small sample size. Moreover, this study was conducted in just two nursing homes, resulting in an unrepresentative sample. Therefore these results are limited and must be interpreted carefully. Secondly, the presence or absence of OD was obtained using a screening tool (GUSS), not being confirmed with a clinical assessment performed by SLP or by an instrumental examination (e.g., videofluoroscopy and/ or fiberoptic endoscopic examination of swallowing - FEES). This may have affected the accuracy of the OD diagnosis as well as of SOD. Furthermore, medications that can affect swallowing function have not been investigated and considered. This might have resulted in bias for OD and SOD results in the study. Thirdly, the use

of BIA for the muscle mass assessment presents some disadvantages, mainly due to the hydration problems usually observed in older people, possibly resulting in an underestimation of body fat and an overestimation of fat-free mass. Finally, the cross-sectional design of the study did not allow us to clarify any temporal or causal relationships between sarcopenia and its associated factors. We are aware that acutely ill older participants may experience a transient impairment of walking speed and muscle strength, not related to sarcopenia, but due to the systemic effect of the acute disease.

4.2 Future work

OD is identified as an independent risk factor for mortality in nursing home residents[39]. This reason and the results obtained support the importance of paying close attention to the screening/evaluation of both OD and sarcopenia in the geriatric population. In future works, an interventional study will be needed to prevent OD and its consequences in such SOD population. Additionally, an institutional extended research study will be needed to verify and support the results of the present investigation. Furthermore, due to the cross-sectional nature and small sample size of this research, the causal relationship between sarcopenia and OD could not be evaluated, therefore a prospective cohort study with a larger sample size will be required to reveal their causal relationship.

5. CONCLUSIONS

This article reports a survey of the prevalence of probable SOD in a Portuguese elderly sample living in two nursing homes, in order to understand the relationship between OD and sarcopenia and the frequency of this pathology in the studied population.

This study involved 36 elderly, with a mean age of 88 year, which is in line with the increasingly aging trend of the Portuguese and world population. We have found a prevalence of OD risk, sarcopenia and probable SOD slightly higher than in previous studies. Likewise, we also have found that as the age increases, the higher level of dependence of the elderly in the ADLs, and the risk of malnutrition or malnourishment is associated with higher odds of being at risk of having OD and present sarcopenia. Despite not finding similar results in literature, our data shows that the gender (female), low educational level and score equal to or greater than four on the SARC-F screening test are associated with higher odds of being at risk for OD, sarcopenia, and even probable SOD. Also, we found that the use of badly adjusted artificial teeth increases odds for sarcopenia by 50%, and that this condition was a significant predictor ($p<0.05$) of being at risk for OD. That is easily related to the importance of the integrity and good functioning of intraoral structures for a correct and safe swallowing. Our results showed yet that sarcopenia increased the chances of having OD risk. In addition, it was observed an increase in the strength of the lips associated with the decreased risk of SOD by 3.2%.

Therefore, this study allowed an estimate of the prevalence of probable SOD in the studied elderly population and was able to an estimate of the odds ratios to study the association between different subgroups diagnosis and the sample outcomes.

As has been observed, the aging of the world population is an increasingly observed reality, so the close association between aging and swallowing impairment is a growing health concern in elderly. Whereby with an increasing aging population, SOD has become an important public health issue. OD and sarcopenia prevalence raise with the increase of age and with the risk of malnutrition or malnourishment.

In conclusion, sarcopenia and OD are very frequent conditions in the elderly related to disability and other adverse clinical events. However, the implementation of effective interventions, both in prevention and treatment, requires proper diagnosis, and both sarcopenia and OD are still often underdiagnosed conditions in the geriatric population. SOD has a major impact on the mobility and independence of elderly people, leading to an increase in adverse effects such as physical fragility, disability, falls and fractures and even death. Thus, the screening for OD is fundamental, especially in institutionalized elderly, since this population has specific characteristics, such as a higher risk of malnutrition and sarcopenia. Thus, the need to integrate SLP in these institutions observed, as a health professional specialized in prevention, diagnosis, and treatment of swallowing problems. It is important to promote a multidisciplinary work between SLP, nutritionist, physiotherapist, and nurse, in order to improve the prevention of OD, malnutrition and sarcopenia. This multidisciplinary work should be carried out systematically in all institutions that provide care to elderly and should be a guideline of the institutions.

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ANNEX I – Authorization from the Ethics Committee of the Health Sciences Research Unit: Nursing (UICISA: E) of the Nursing School of Coimbra (ESEnfC)

COMISSÃO DE ÉTICA

da **Unidade Investigação em Ciências da Saúde: Enfermagem** (UICISA: E)

da **Escola Superior de Enfermagem de Coimbra** (ESEnfC)

Parecer Nº 602/ 06-2019

Título do Projecto: Prevalência da disfagia sarcopénica na população geriátrica

Identificação das Proponentes

Nome(s): Susana Maria Aparício Gaspar Portinha

Filiação Institucional: Escola Superior de Saúde da Universidade de Aveiro

Investigador Responsável/Orientador: Susana Maria Gaspar Portinha, Maria da Assunção Coelho de Matos e Pedro Miguel Sá Couto

Relator: Ana Margarida Abrantes

Parecer

A sarcopenia, uma síndrome geriátrica pode estar associada à presença de disfagia justificada pela perda de força e amplitude do movimento da língua e restantes músculos relacionados com a deglutição. Assim, os autores definem como objetivos para este projeto relacionar a disfagia e a sarcopenia descrevendo a prevalência da disfagia sarcopénica na população geriátrica e quantificando a força de lábios e de língua associada à disfagia sarcopénica.

Este estudo, que decorrerá entre setembro de 2019 e maio de 2020, está definido como estudo descritivo-correlacional.

A amostra será constituída por indivíduos com idade igual ou superior a 65 anos residentes ou em regime de Centro de Dia em Lares de idosos do concelho de Tomar, definidos no projeto.

Os instrumentos de recolha de dados são apresentados assim como o consentimento informado sendo garantida a confidencialidade, a voluntariedade e a autonomia das participantes. Os benefícios para os sujeitos da investigação são identificados pelos proponentes.

Sendo assim, somos do parecer que o projeto poder ser aprovado sem restrições de natureza ética. O presente parecer não dispensa a autorização das instituições onde o estudo será desenvolvido.

O relator: Ana Abrantes

Data: 15/07/2019 O Presidente da Comissão de Ética: Maria Filomena Botelho

Escola Superior de Enfermagem de Coimbra

FCT

ANNEX II – Requests for authorisation to institutions to collect data samples.

Exmo. Senhor

Presidente do Lar de S. José do Centro de Assistência Social de Tomar,

Chamo-me Susana Maria Aparício Gaspar Portinha, sou terapeuta da fala no Hospital de Tomar e aluna do Mestrado em Terapia da Fala da Escola Superior de Saúde da Universidade de Aveiro, encontrando-me a realizar a minha dissertação de Mestrado com o tema "Prevalência da Disfagia Sarcopénica na população geriátrica", sob a orientação da Professora Doutora Maria da Assunção Coelho de Matos e co-orientação do Professor Doutor Pedro Sá Couto.

A área desta investigação é a disfagia na população geriátrica, e tem o objetivo de relacionar a disfagia e a sarcopenia, descrevendo a prevalência da disfagia sarcopénica na população geriátrica e quantificando a força de lábios e de língua associadas à disfagia sarcopénica. A disfagia define-se como sendo um conjunto de sintomas relacionados com alteração na função da deglutição, ao passo que a sarcopenia, considerada uma síndrome geriátrica, é definida por uma diminuição da força muscular resultante da diminuição da função e da massa muscular esquelética generalizada. A sarcopenia está associada ao aumento da probabilidade de resultados adversos, incluindo quedas, fraturas, incapacidade física e mortalidade, bem como ao risco de disfagia em idosos saudáveis, pela diminuição da massa muscular e elasticidade do tecido conjuntivo, associada à idade, com consequente perda de força e amplitude do movimento da língua e restantes músculos relacionados com o processo de deglutição. A disfagia sarcopénica carateriza-se pela dificuldade de deglutição ligada à sarcopenia.

Este estudo é inovador em Portugal e pretende contribuir para melhorar o diagnóstico precoce, possibilitando prevenir complicações, prolongar a alimentação por via oral e preservar a segurança e a eficácia da função da deglutição no idoso(ver anexo, por favor).

No âmbito da realização desta investigação, venho solicitar a colaboração de Vossa Exa. com a autorização para efetuar a recolha de dados de amostragem junto dos Vossos utentes. A recolha visará uma avaliação da pessoa idosa, através de um breve questionário acerca de dificuldades sentidas na alimentação/ deglutição, bem como recolha de medidas de Índice de Massa Corporal, força muscular, força de lábios e de língua e avaliação da capacidade de deglutição. Prevê-se que a recolha decorra entre os

meses de setembro de 2019 e janeiro de 2020, nas Vossas instalações em datas a combinar.

Saliento que este estudo foi submetido à Comissão de Ética da Escola Superior de Enfermagem de Coimbra, e que a recolha dos dados só terá início após o parecer positivo daquela Comissão. Comprometo-me ainda, a oferecer o meu apoio junto dos idosos que sejam diagnosticados com disfagia no decorrer da recolha dos dados, no sentido de reabilitar a capacidade de deglutição.

A Vossa colaboração é essencial para a realização desta investigação pelo que desde já, agradeço a atenção dispensada e apresento a minha disponibilidade para fornecer informações adicionais, que considerem necessárias, sobre o projeto de investigação que pretendo desenvolver.

Com os melhores cumprimentos,

_____

(Susana Portinha)

Tomar, 10 de setembro de 2019

Exmo. Senhor

Presidente do Lar Raízes do Nabão,

Chamo-me Susana Maria Aparício Gaspar Portinha, sou terapeuta da fala no Hospital de Tomar e aluna do Mestrado em Terapia da Fala da Escola Superior de Saúde da Universidade de Aveiro, encontrando-me a realizar a minha dissertação de Mestrado com o tema "Prevalência da Disfagia Sarcopénica na população geriátrica", sob a orientação da Professora Doutora Maria da Assunção Coelho de Matos e co-orientação do Professor Doutor Pedro Sá Couto.

A área desta investigação é a disfagia na população geriátrica, e tem o objetivo de relacionar a disfagia e a sarcopenia, descrevendo a prevalência da disfagia sarcopénica na população geriátrica e quantificando a força de lábios e de língua associadas à disfagia sarcopénica. A disfagia define-se como sendo um conjunto de sintomas relacionados com alteração na função da deglutição, ao passo que a sarcopenia, considerada uma síndrome geriátrica, é definida por uma diminuição da força muscular resultante da diminuição da função e da massa muscular esquelética generalizada. A sarcopenia está associada ao aumento da probabilidade de resultados adversos, incluindo quedas, fraturas, incapacidade física e mortalidade, bem como ao risco de disfagia em idosos saudáveis, pela diminuição da massa muscular e elasticidade do tecido conjuntivo, associada à idade, com consequente perda de força e amplitude do movimento da língua e restantes músculos relacionados com o processo de deglutição. A disfagia sarcopénica carateriza-se pela dificuldade de deglutição ligada à sarcopenia.

Este estudo é inovador em Portugal e pretende contribuir para melhorar o diagnóstico precoce, possibilitando prevenir complicações, prolongar a alimentação por via oral e preservar a segurança e a eficácia da função da deglutição no idoso(ver anexo, por favor).

No âmbito da realização desta investigação, venho solicitar a colaboração de Vossa Exa. com a autorização para efetuar a recolha de dados de amostragem junto dos Vossos utentes. A recolha visará uma avaliação da pessoa idosa, através de um breve questionário acerca de dificuldades sentidas na alimentação/ deglutição, bem como recolha de medidas de Índice de Massa Corporal, força muscular, força de lábios e de língua e avaliação da capacidade de deglutição. Prevê-se que a recolha decorra entre os

meses de setembro de 2019 e janeiro de 2020, nas Vossas instalações em datas a combinar.

Saliento que este estudo foi submetido à Comissão de Ética da Escola Superior de Enfermagem de Coimbra, e que a recolha dos dados só terá início após o parecer positivo daquela Comissão. Comprometo-me ainda, a oferecer o meu apoio junto dos idosos que sejam diagnosticados com disfagia no decorrer da recolha dos dados, no sentido de reabilitar a capacidade de deglutição.

A Vossa colaboração é essencial para a realização desta investigação pelo que desde já, agradeço a atenção dispensada e apresento a minha disponibilidade para fornecer informações adicionais, que considerem necessárias, sobre o projeto de investigação que pretendo desenvolver.

Com os melhores cumprimentos,

_____

(Susana Portinha)

Tomar, 10 de setembro de 2019

ANNEX III – Written informed consent

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Apresentação do Estudo

Título do estudo: Prevalência da disfagia sarcopénica na população geriátrica

Equipa de Investigação: Maria da Assunção Coelho de Matos, Pedro Miguel Sá Couto e Susana Maria Aparício Gaspar Portinha.

Introdução:

O meu nome é Susana Maria Aparício Gaspar Portinha, sou aluna do Mestrado em Terapia da Fala da Escola Superior de Saúde da Universidade de Aveiro e gostaria de o/a convidar para participar no estudo que vou realizar. Antes de decidir fazer parte deste estudo precisa de compreender os seus objetivos bem como os benefícios e riscos envolvidos. Peço-lhe que leia atentamente as informações que se seguem sobre o projeto de investigação e esclareça todas as questões que possam surgir (o contacto encontra-se no final desta folha). Se concordar em fazer parte deste estudo de investigação, ser-lhe-á solicitado que assine este formulário de consentimento. Este processo é conhecido por consentimento informado.

Informações sobre o estudo:

O objetivo deste estudo é relacionar a presença de disfagia com a sarcopenia. A disfagia é um conjunto de sintomas de perturbação do processo de deglutição, enquanto a sarcopenia é definida pela diminuição da força, função e massa muscular generalizada e está associada ao aumento de risco de disfagia em pessoas idosas saudáveis. Assim, com este estudo pretende-se perceber se apresenta sintomas de dificuldade de deglutição e se revela alteração de força, massa muscular e dificuldade na realização das atividades do dia a dia.

Procedimento:

O investigador irá recolher alguns dados pessoais e irá administrar instrumentos para avaliar a capacidade de deglutição, a força, a massa muscular e a capacidade de realizar as atividades do dia a dia. Será analisada a sua capacidade de deglutição através da administração de uma prova de

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avaliação da deglutição, de seguida serão recolhidas as medidas de força e massa muscular através de instrumentos, e por fim será analisada a sua capacidade de realização das atividades do dia a dia pela administração de uma prova simples de marcha.

Possíveis Riscos e Desconfortos:

A tarefa não apresenta qualquer risco para o participante.

Custos:

Não lhe serão imputadas quaisquer despesas por participar no estudo.

Direito a desistir do estudo:

A sua participação neste estudo de investigação é voluntária. Poderá decidir não começar ou terminar a sua participação em qualquer altura. Ser-lhe-ão comunicadas quaisquer novas informações sobre o estudo que possam modificar a sua vontade de participar. Deverá notificar a investigadora do estudo, caso decida terminar a sua participação antes do tempo previsto.

Confidencialidade:

Os dados que vamos recolher serão tratados com total confidencialidade. O protocolo de recolha de dados terá toda a informação que poderá identificar o paciente, numa folha à parte, destacável, que é removida assim que sejam inseridos os dados numa base de dados no computador, devidamente codificados.

Assim que o estudo terminar, toda a documentação será destruída. Os dados só serão analisados pelos investigadores responsáveis.

Contacto para informações adicionais:

Em caso de dúvidas entre em contacto com Susana Portinha (susana.portinha@ua.pt/963471735).

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Consentimento Informado

Participação no projeto de investigação "Prevalência da disfagia sarcopénica na população geriátrica".

Eu, abaixo-assinado, (nome completo do participante ou responsável legal) _____ _____,

compreendi a explicação que me foi fornecida acerca do estudo que se tenciona realizar. Foi-me dada oportunidade de fazer as perguntas que julguei necessárias e as minhas dúvidas foram esclarecidas.

Tomei conhecimento dos objetivos, métodos, benefícios previstos e riscos.

Foi-me garantido que toda a informação recolhida no decurso do estudo será mantida estritamente confidencial. Os dados relativos à identificação dos participantes serão mantidos no anonimato. Apenas os investigadores do projeto terão acesso aos mesmos, sendo que, toda a documentação será eliminada aquando o término do estudo.

Não obterei qualquer remuneração financeira ao participar neste estudo e tenho conhecimento que não existe para o investigador e colaboradores qualquer benefício financeiro na realização do mesmo.

Sei que posso recusar-me a autorizar a participação ou interromper a qualquer momento a participação no projeto, sem algum tipo de penalização.

Autorizo de livre vontade a minha participação no projeto acima mencionado.

Concordo que seja efetuada a recolha de dados (escritos) necessária no presente projeto. Também autorizo a divulgação dos resultados obtidos no meio científico.

Data: ____ / _____ / ____

Assinatura do participante ou responsável legal/cuidador:

_____

A Investigadora responsável:

Nome: *Susana Maria Aparício Gaspar Portinha*

Assinatura: _____

ANNEX IV – Sample data collection

Protocolo de recolha de dados

Prevalência da disfagia sarcopénica na população geriátrica

- Código: _____
- Dados clínicos (critérios exclusão):
  - AVC: S☐ N☐
  - Doença neurológica: S☐ N ☐
  - TCP: S☐ N ☐
  - Possui prótese metálica ou pacemaker: S ☐ N☐
- Dados investigação:
  - Disfagia (GUSS): S ☐ N ☐
  - Sarcopenia (SARC-F): S☐ N☐
  - Força lábios (IOPI): _____
  - Força língua (IOPI): _____
  - Massa Muscular (BIA):_____
  - Força preensão palmar:_____
  - Função muscular (Prova marcha):_____
  - Nível nutrição (MNA):_____
  - Barthel Index (BI):_____

- Observações:

  _____

  _____

  _____

Protocolo de recolha de dados

(destacável)

Prevalência da disfagia sarcopénica na população geriátrica

- Código:_____
- Instituição:_____
- Regime: residente Lar☐ Centro de Dia☐
- Dados pessoais:

  Idade: _____ Estado Civil:_____

  Género: Feminino ☐ Masculino ☐

  Habilitações literárias:_____ Profissão que exerceu:_____

  Atividade física:_____

  Passatempos/ Ocupações:_____

  Medicação:_____

  _____

  Higiene oral (Dentição/ Cáries/ Prótese):_____

  Observações: _____

  _____

  _____

Nome:
PU:
Data:
Hora:

GUSS *Gugging Swallowing Test*

(Teste de Avaliação da Deglutição)

Secção 1. Avaliação preliminar / teste de deglutição indirecto

	SIM	NÃO
Vígil (o doente deve estar alerta durante pelo menos 15 minutos)	☐ 1	☐ 0
Tosse e/ou pigarreio (tosse voluntária) (o doente deve conseguir tossir ou pigarrear 2 vezes)	☐ 1	☐ 0
Deglutição de saliva • Deglutição sem alteração	☐ 1	☐ 0
• Escape de saliva	☐ 0	☐ 1
• Modificação da voz (rouca, gorgolejante, molhada ou fraca)	☐ 0	☐ 1
TOTAL:	(5)	
	1 – 4 = Investigação posterior[1] 5 = Continuar para a secção 2	

Secção 2. Teste de deglutição directo (Material: água bidestilada, colher de chá rasa, espessante, pão)

Seguir a ordem:	1 →	2 →	3 →
	SEMISSÓLIDO*	LÍQUIDO**	SÓLIDO***
DEGLUTIÇÃO			
• Impossível	☐ 0	☐ 0	☐ 0
• Demorada (> 2 seg.) (sólidos > 10 seg.)	☐ 1	☐ 1	☐ 1
• Sem alteração	☐ 2	☐ 2	☐ 2
TOSSE (involuntária) (antes, durante ou após a deglutição – até 3 minutos após)			
• Sim	☐ 0	☐ 0	☐ 0
• Não	☐ 1	☐ 1	☐ 1
ESCAPE DE SALIVA			
• Sim	☐ 0	☐ 0	☐ 0
• Não	☐ 1	☐ 1	☐ 1
MODIFICAÇÃO DA VOZ (escutar a voz antes e após a deglutição – o doente deve dizer "i")			
• Sim	☐ 0	☐ 0	☐ 0
• Não	☐ 1	☐ 1	☐ 1
TOTAL:	(5)	(5)	(5)
	1 – 4= Investigação posterior[1] 5 = Continuar para líquido	1 – 4 =Investigação posterior[1] 5 = Continuar para sólido	1 – 4 =Investigação posterior[1] 5 = Normal
TOTAL: (Secção 1 + Secção 2) (20)			_____

*	Primeiro administre entre 1/3 a metade de uma colher de chá com água bidestilada e espessante (consistência de pudim). Se ausência de sintomas, administrar 3 a 5 colheres. Avaliar no final da última colher.
**	Administre, com uma colher, as quantidades 3, 5, 10, 20 ml de água bidestilada – se ausência de sintomas continuar com um copo com 50 ml de água bidestilada (Daniels et al.2000; Gottlieb et al.1996). Avaliar e interromper a investigação quando um ou mais critérios sejam observados.
***	Administre uma pequena porção de pão seco
[1]	Encaminhar para médico fisiatra/terapeuta da fala

RESULTADOS		GRAVIDADE	RECOMENDAÇÕES
20	Semissólido, líquido e sólido com sucesso	Disfagia ligeira / sem disfagia Risco mínimo de aspiração	• Dieta normal • Líquidos normais (primeira refeição sob supervisão de Terapeuta da Fala ou Enfermeiro com experiência em AVC)
15–19	Semissólido e líquido com sucesso Sólido sem sucesso	Disfagia ligeira Baixo risco de aspiração	• Dieta para disfagia (purés e comida mole) • Líquidos muito devagar (um gole de cada vez) • Avaliação especializada[1]
10–14	Semissólido com sucesso Líquido sem sucesso	Disfagia moderada Risco de aspiração	Dieta para disfagia começando com: • Textura semissólida como comida de bebé e alimentação parentérica adicional • Líquidos espessados • Comprimidos esmagados e misturados em líquido espessado • Não administrar medicação líquida • Avaliação especializada[1] *Suplementação por via nasogástrica ou parentérica*
0-9	Investigação preliminar sem sucesso ou semissólido sem sucesso	Disfagia grave Alto risco de aspiração	• NPO (*non per os* – proibida alimentação por via oral) • Avaliação especializada[1] *Suplementação por via nasogástrica ou parentérica*

Autores da versão portuguesa: Almeida J.; Amaral C.; Lucas I.; Laíns J.; Matos M. disponível em: https://gussgroupinternational.wordpress.com/guss-sheets/;

Questionário SARC-F*

Identificação/ Código: _____

O SARC-F avalia cinco itens por forma a analisar as alterações no estado de saúde associadas às consequências da Sarcopenia: 1) força; 2) ajuda na marcha; 3) levantar de uma cadeira; 4) subir escadas; e, 5) quedas.

A cotação do SARC-F varia de 0 a 10 pontos (0-2 pontos para capa item; 0=melhor para 10=pior) e é dicotomizada para representar: Sintomático (4+) vs. Saudável (0-3).

Preencher cada item com a pontuação 0, 1 ou 2 de acordo com a resposta obtida:

Componente	Questão	Pontuação (0-2)
Força	1- Qual é a dificuldade que sente ao levantar ou transportar um peso de 4,5Kg? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Ajuda na marcha	2- Qual é a dificuldade que sente ao andar numa divisão? Usa ajudas para o fazer? Precisa de apoio para o fazer? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Levantar da uma cadeira	3- Qual é a dificuldade que sente ao fazer transferência de uma cadeira ou cama? Precisa de usar ajudas? Precisa de apoio para o fazer? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade, uso de ajudas, ou incapaz de o fazer sem ajuda)	
Subir escadas	4- Qual é a dificuldade que sente ao subir uma escada de 10 degraus? (0 = sem dificuldade; 1 = alguma dificuldade; 2 = muita dificuldade ou incapaz de o fazer)	
Quedas	5- No último ano teve algum episódio de queda? Quantas quedas? (0=sem quedas; 1= 1-3 quedas; 2= 4 ou mais quedas)	
	Pontuação total:	

(* Traduzido de Malmstrom T. & Morley J. SARC-F: A Simple Questionnaire to Rapidly Diagnose Sarcopenia. J Am Med Dir Assoc. 2013 Aug; 14(8):531-2. DOI: 10.1016/j.jamda.2013.05.018, por Susana Portinha a 30/06/2019).

BARTHEL INDEX (BI) – VERSÃO PORTUGUESA

	Com ajuda	*Independente*
1. Alimentação (se precisar de cortar os alimentos = ajuda)	5	10
2. Move-se da cadeira de rodas para a cama e o inverso (inclui sentar-se na cama)	5-10	15
3. Cuidados pessoais (lavar o rosto, pentear-se, barbear-se, escovar os dentes)	0	5
4. Senta-se e levanta-se da sanita (manuseia as roupas, limpa-se, lava-se, puxa o autoclismo)	5	10
5. Toma banho sozinho	0	5
6. Caminha em terreno plano (ou se não for capaz de caminhar, é capaz de impulsionar a cadeira de rodas) *pontuar apenas se não for capaz de caminhar	10 0*	15 5*
7. Sobe e desce escadas	5	10
8. Veste-se e despe-se (inclui atar atacadores e usar botões/fechos)	5	10
9. Continência intestinal	5	10
10. Continência urinária	5	10

Um paciente que pontue 100 é continente, alimenta-se sozinho, veste-se sozinho, levanta-se da cama e das cadeiras, toma banho sozinho, caminha pelo menos 200 metros e consegue subir e descer escadas. Isto não significa que seja capaz de viver sozinho: pode não ser capaz de cozinhar, manter a casa e atender à porta, mas é capaz de ficar sozinho sem necessidade de prestação de cuidados.

Mini Nutritional Assessment

MNA®

Nestlé Nutrition Institute

Apelido: Nome:

Sexo: Idade: Peso, kg: Altura, cm: Data:

Responda à seção "triagem", preenchendo as caixas com os números adequados.
Some os números para obter a pontuação final da triagem.

Triagem

A Nos últimos três meses houve diminuição da ingesta alimentar devido a perda de apetite, problemas digestivos ou dificuldade para mastigar ou deglutir?
0 = diminuição grave da ingesta
1 = diminuição moderada da ingesta
2 = sem diminuição da ingesta

B Perda de peso nos últimos 3 meses
0 = superior a três quilos
1 = não sabe informar
2 = entre um e três quilos
3 = sem perda de peso

C Mobilidade
0 = restrito ao leito ou à cadeira de rodas
1 = deambula mas não é capaz de sair de casa
2 = normal

D Passou por algum *stress* psicológico ou doença aguda nos últimos três meses?
0 = sim 2 = não

E Problemas neuropsicológicos
0 = demência ou depressão graves
1 = demência ligeira
2 = sem problemas psicológicos

F1 Índice de Massa Corporal (IMC) = peso em kg / (estatura em m)^2
0 = IMC < 19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23

SE IMC NÃO DISPONÍVEL, SUBSTITUIR A QUESTÃO F1 PELA QUESTÃO F2.
NÃO RESPONDER À QUESTÃO F2 SE A QUESTÃO F1 JÁ ESTIVER COMPLETA

F2 Circunferência da Perna (CP) em cm
0 = CP menor que 31
3 = CP maior ou igual a 31

Pontuação da Triagem (subtotal, máximo de 14 pontos)

12-14 pontos: estado nutricional normal
8-11 pontos: sob risco de desnutrição
0-7 pontos: desnutrido

Salvar
Imprimir
Recomeçar

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4. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment Short-Form (MNA®-SF): A practical tool for identification of nutritional status. *J Nutr Health Aging.* 2009; 13:782-788.

Para maiores informações: www.mna-elderly.com