

## Original Article

## Prevalence of sarcopenia in patients with Alzheimer's disease

*Prevalência de sarcopenia em pacientes com doença de Alzheimer*Paola Christina Antoniassi<sup>1</sup>, Nicole Sophia Froehner<sup>2</sup>, Milena Laís Maçan<sup>3</sup>, Lindsey Mitie Nakakogue<sup>4</sup>Antoniassi PC, Froehner NS, Maçan ML, Nakakogue LM. Prevalence of sarcopenia in patients with Alzheimer's disease / *Prevalência de sarcopenia em pacientes com doença de Alzheimer*. Rev Med (São Paulo). 2022 Jul-Aug;101(4):e-176416.

**ABSTRACT:** *Objective:* To demonstrate the association between Alzheimer's disease (AD) and the development of sarcopenia in patients who were diagnosed with AD in 2018 at the Polyclinic of Londrina. *Method:* Retrospective cohort study with n of 36 patients, who were interviewed in person in 2019, where they had performed the Mini-Mental State Examination (MMSE), Basic Activities of Daily Living (ABVD), SARC-F, BMI, calf circumference measure (CC) and, for those suspected of sarcopenia, the hand grip strength measurement test and the Sit and Stand Test were applied. The obtained results were compared to the outcome of the 2018 tests (year of AD diagnosis). *Results:* Patients diagnosed with Alzheimer's Disease in 2018 showed an increase in dependence for performing BADL ( $p = 0.049$ ) and a decrease in MMSE ( $p = 0.011$ ), BMI ( $p = 0.027$ ) and CC, in 2019 assessments. *Conclusion:* The prevalence of sarcopenia in patients with AD was 34% after one year of disease progression, causing a reduction in quality of life and an increase in the need for a caregiver for simple daily tasks.

**Keywords:** Sarcopenia; Alzheimer's disease; Prevalence; Epidemiology.

**RESUMO:** *Objetivo:* Demonstrar a associação entre doença de Alzheimer (DA) e o desenvolvimento de sarcopenia nos pacientes que foram diagnosticados com DA no ano de 2018 na Policlínica de Londrina. *Método:* Estudo de coorte retrospectivo com um número de 36 pacientes, os quais foram entrevistados presencialmente em 2019, quando realizaram o Mini-Exame do Estado Mental (MEEM); Atividades Básicas de Vida Diária (ABVD); SARC-F; IMC; medida da circunferência da panturrilha (CP); e, para aqueles suspeitos de sarcopenia, foram avaliados a medida de força de preensão palmar e o Timed Get Up and Go (Teste do sentar e levantar). Os resultados obtidos foram comparados aos de 2018 (ano do diagnóstico de DA). *Resultados:* Os pacientes diagnosticados com Doença de Alzheimer no ano de 2018 apresentaram um aumento na dependência para realização das ABVD ( $p = 0,049$ ), uma diminuição do MEEM ( $p = 0,011$ ), do IMC ( $p = 0,027$ ) e do CP na avaliação de 2019, em relação ao ano anterior. *Conclusão:* A prevalência de sarcopenia em pacientes com DA foi de 34% após um ano de evolução da doença, ocasionando uma redução da qualidade de vida e aumento da necessidade de um cuidador para tarefas diárias simples.

**Palavras-chave:** Sarcopenia; Doença de Alzheimer; Prevalência; Epidemiologia.

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## INTRODUCTION

The Alzheimer's disease is an important clinical diagnosis and it is prevailing in nowadays society, it believes that are over 24 million of people with the diagnosis of such disease and the number continuous to rise at an enormous rate, reduplicating its number at every 20 years<sup>1</sup>. Patients with AD tends to be underfed for numerous reasons, such as lack off appetite due to anticholinesterase medicines administrated during the course of treatment, as well as by the usual memory loss caused throughout the course of the disease<sup>2,3</sup>. Studies indicating the emergence of sarcopenia during the course of AD, specially after the first year of diagnosis, had already been published, illustrated by a decrease in the elderly quality of life, because the person becomes much more vulnerable and susceptible to falls, fractures and hospitalization<sup>4</sup>.

The main goal of this paper is to demonstrate the association between Alzheimer's disease and the emergence of sarcopenia at patients diagnosed with AD in the year of 2018 at Policlínica de Londrina.

## MATERIALS AND METHODS

### Ethical Aspects

This study was conducted after the approval of the Research Ethics Committee CAAE number 19083819.9.0000.0020 through signed consent from the participants, after a thoroughly explanation of its development, in agreement with resolution nº 466/2012 of the National Health Council and the Declaration of Hensinki.

### Sample Population

This research paper is distinguished as a retrospective cohort and was conducted at Londrina's Policlínica in the year of 2019. Patients were initially recruited from an analysis of over 200 medical charts, in which patients with Alzheimer's disease CDR 1 and 2, diagnosed at the year 2018, were selected. Of these, a group of 71 patients were eligible to the research, for this reason, they were contacted through telephone and invited to participate. As a result, 36 patients accepted the invite for the research, and from that point on, an interview was arranged with these patients for data collection at Londrina's Alzheimer's Outpatient Clinic and so, they all consent to participate at the research. During the interview, some questionnaires were applied, such as Mini-Mental State Examination (MMSE), Basics Activities of Dayli Living (ABVD), and finally, SARC-F. Moreover, the patients were measured and weighed, in purpose of calculating their BMI. Then, the measurement of the patient's calf circumference was taken with a flexible measuring tape graduated up to 150cm

from Coats Corrente Ltda. For those patients whose, according to the SARC-F questionnaire, adduced signs of having sarcopenia, possessing a score greater than or equal to 11, it was applied a grip strength measurement using a hand-held dynamometer of up to 90kg from Instrumtherm Instrumentos de Medição Ltda. The Timed Up and Go Test was also applied, which consists in getting yourself up, backwards from a chair, in order to sit and stand up for five times without losing balance, and also, using the smallest possible number of support whilst the evaluator is on the premiss offering security in case the patients lose his balance. For this reason, the results were quantified by number of times each individual was able to perform the movements correctly. Finally, the patient was inquired about comorbidities, for example, Systemic Arterial Hypertension, diabetes mellitus, chronic renal failure, personal history of neoplasia, congestive heart failure, history of previous stroke, previous acute myocardial infarction. To conclude, they were also questioned about schooling, family income and sedentary lifestyle.

Patients with less than 50 years, that have not been diagnosed with AD at the year of 2018, were excluded from the case study, as well as those with a CDR scale of 3, to sum up, the N of this paper was 36.

The collected data were analysed and compared to the patients first medical charts. Graphics and charts made from those collected data were helpful to better compare the results of the paper. The interviewees were sorted between two distinguished groups, sarcopenics and non-sarcopenics. Consequently, the results were achieved through the comparison of these groups medical charts, with the addition of the data analysis. Lastly, during the interview, the patient's data were reviewed and compared with the ones presented in the diagnostic consultation, so as it was the data presented at the diagnostic consultation were reviewed and compared with the ones presented by the patients.

### Statistical Analysis

The continuous variables (BMI, MMSE, ABVD) were described as average (M) and as standard error (EP), whereas, categorical variables (gender) were shown as absolute numbers (n) and percentage (%). Bivariate correlations procedures (Tau-b de Kendall) were used to determine the existence between independent variables and SARC-F.

The statistical analysis was made by SPSS for Windows, version 22.0 (SPSS Statistics, Chicago-IL, E.U.A) and the significance level set as  $p < 0,05$ .

## RESULTS

The average age of patients was 79,36 years (varying between 64 to 92 years) and the average income at

the patient's house, was 2,4 minimum wages per month. A total of 88% of the patient presents a CDR 1 classification (mild dementia) whilst the Other 11,11% are classified as CDR scale 2 (moderate dementia). Most part of the interviewees (41,66%) attended school for up to 4 years, 38,88% were illiterate, 16,6% were able to attend school between 4 to 8 years, finally, a small percentage of only 2,7% had studied for a period of time between 8 to 11 years, as a consequence, none of the patients had been able to study for period of time of over 11 years.

**Table 1.** Characteristics of the survey respondents

Characteristics	N	%
<i>total=36</i>		
<i>Gender</i>		
Feminine	27	75
Masculine	9	25
STR	4	11,1
DM2	11	30,5
SAH	23	63,8
Smoker	8	22,2
Alcoholism	2	5,5
CI	1	2,7
CRF	1	2,7
Neoplasia	3	8,3

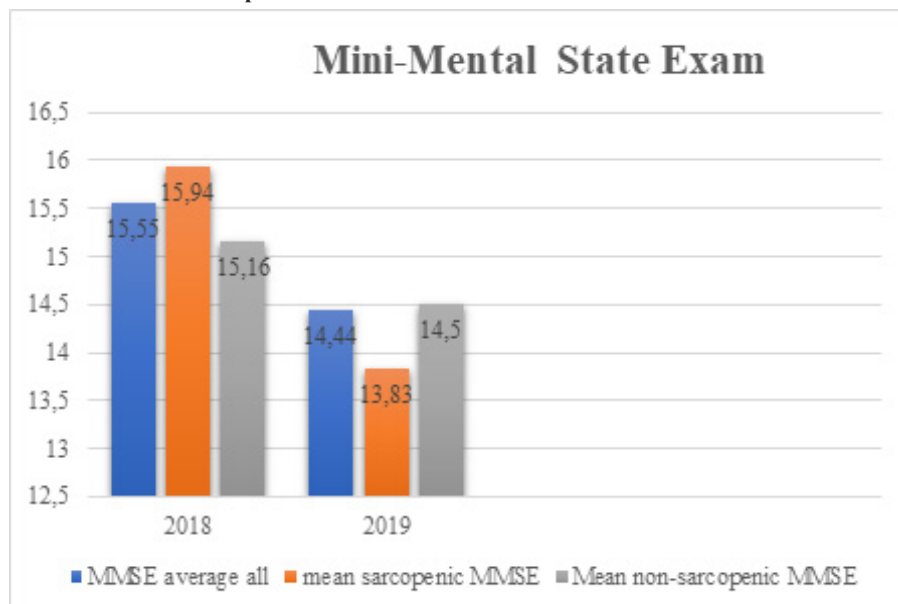
STR = Stroke; DM2 = Diabetes mellitus type 2; SAH = Systemic Arterial Hypertension; CI = Cardiac Insufficiency; CRF = Chronic Renal Failure

The results of the Basics Activities of Dayli Living were significantly bigger at the first medical consultation compared to 2019, showing an increasing dependency for basics living activities during the first year after the diagnosis of AD. On the one hand, in 2018, 75% of the patients were independent for all of the ABVD, on the other hand, in 2019, only 44,44% continued to have this independency in those activities.

Moreover, when analysing calf circumference (CC), measured in all members of the study population, it was observed that male patients had loss much more muscular mass in comparison to female patients in the first year of AD. For this reason, it was seen that 77,77% of men presented CC bellow the reference value ( $\leq 34$ cm), whilst, only 48,15% of women had their CC altered ( $\leq 33$ cm). According to an evaluation made through SARC-F, Grip Strength and Timed Up and Go, 34% of the patient's presented sarcopenia in the 2019 medical exams.

Analysing the data, it was able to calculate MMSE arithmetic mean of the study population. Seeing that, the average was calculated with the first and last medical exam, reaching the result of 15,55 in the year of 2018, whereas in the following year, the results decreased to 14,44. Besides, a comparison between the average of patients with and without suggestive symptoms of sarcopenia, in 2018 was 15,94 whilst in 2019 was 13,83. In like matter, at non-sarcopenics the average in the year of 2018 was 15,16 and in the following year, 14,5. From that point, it is possible to notice a slight reduction in the arithmetic mean on those patients considered non-sarcopenics throughout the exams.

**Graphie 1.** Mini-Mental State Exam 2018 and 2019



In order to evaluate if there was any difference between the first exams of BMI, MMSE, plus ABVD and the last exam in the year of 2019, a paired t-test was

performed [t(degrees of freedom)]. The results were presented as average (M) and standard error (EP).

On average, the BMI calculated on the first medical

exam (M=24,69; EP= 1,00) was significantly higher than the result achieved in 2019 (M= 22,55; EP= 0,90),  $t(17) = 2,418$ ,  $p=0,027$ .

The average MMSE at the first exam (M= 16,00; EP= 1,08) was significantly higher than the result achieved at the evaluation made in 2019 (M= 13,78; EP= 1,06),  $t(17) = 2,842$ ,  $p=0,011$ .

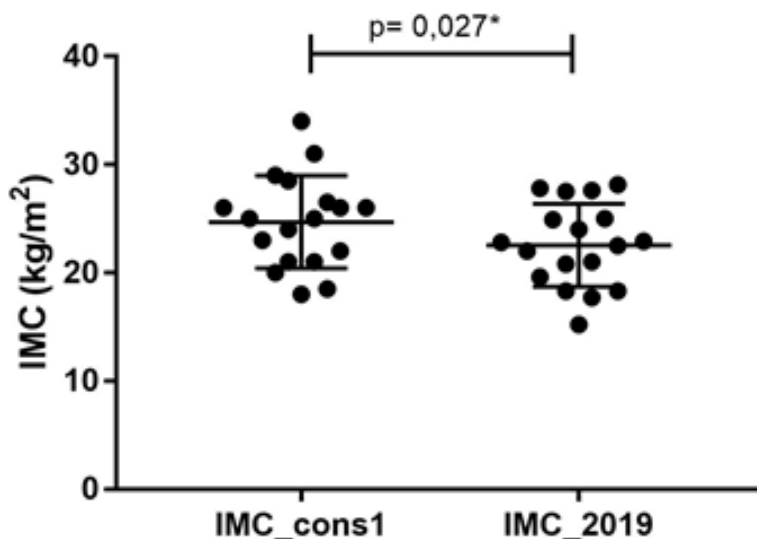


Figure 1. BMI variation between first exam (cons1) and the 2019 evaluation

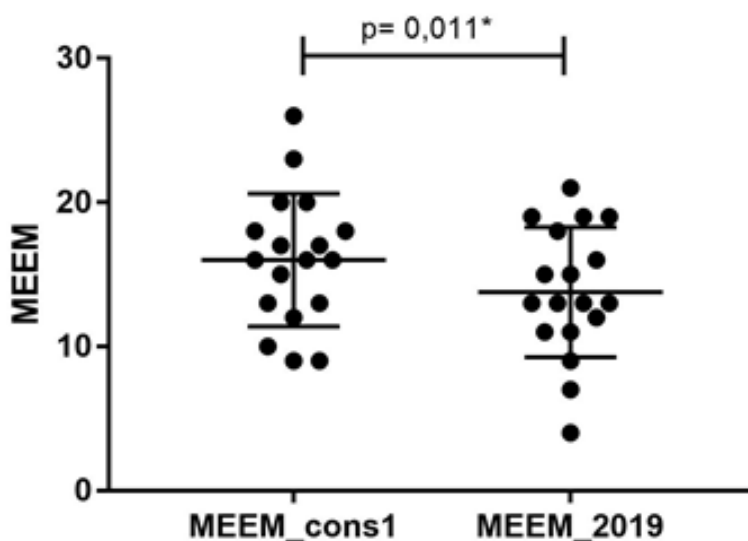


Figure 2. MMSE variation between first exam (cons1) and the 2019 evaluation

In comparison, the ABVD was considerably higher at the first exam (M= 5,56; EP= 0,23), when compared to the results from 2019 (M= 5,17; EP= 0,31),  $t(17)= 2,122$ ,  $p= 0,049$ .

Nevertheless, to identify the effect of BMI, MMSE and AVD variables at the SARC-F index of the study population, the data were submitted to a correlation analysis. As since, ABVD had shown a moderate negative correlation with SARC-F (Tau-b=-0,554;  $p= 0,008$ ).

However, the BMI (Tau-b= -0,118;  $p= 0,526$ ) and MMSE (Tau-b= -0,038;  $p= 0,842$ ) variables did not show any correlation with SARC-F.

Other variables presented at this paper were also submitted to a correlation analysis with SARC-F, as grip strength, (FAP), as well as Timed Up an Go Test (TSL). Even so the correlation was made, there was no significantly association (FAP Tau-b= 0,028;  $p= 0,887$ ; TSL Tau-b= 0,055;  $p= 0,792$ ).

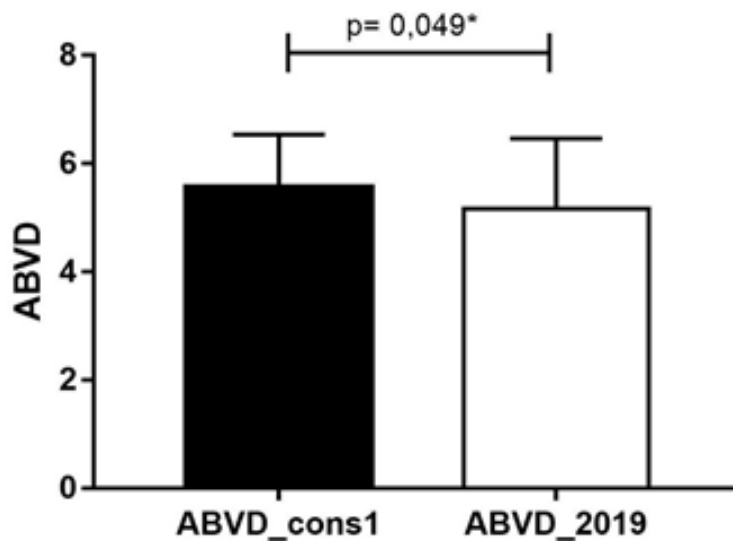


Figure 3. ABVD variation between the first exam (cons1) and the 2019 evaluation

## DISCUSSION

The Alzheimer's disease stricken a not only significant, but an increasing part of the worldwide population. In its pathophysiological path, the evident loss of functionality can achieve considerably higher levels when associated with mass loss. In this paper, it is possible to associate the loss of basics functionality with sarcopenia. Among the interviewees, independency to accomplish a range of simple tasks as to dress yourself, having meals without any help, being able to have bladder and bowel control, not receiving any support during a bath or personal hygiene, in addition to being able to put yourself to bed and getting up or sitting down without any help were impaired during the course of one year, concomitant with a decrease at BMI. At Burns et al.<sup>6</sup> the loss lean body mass was verified at patients suffering early-onset Alzheimer's disease (N=70) in comparison with the group without dementia (N=70), besides the correlation mentioned previously, at this paper we were able to find an impairment at basics activities at the first year of disease evolution, concomitant with a decrease at BMI.

Patients diagnosed with Alzheimer's disease at the year of 2018, have shown an eventual downfall at his MMSE results, when compared with the results of the following year examination. Besides, the score mentioned at the ABVD test were also inferior, and negatively correlating to the SARC-F, as a result, providing evidence to the positive correlation between smaller values of body mass and the diminishing capacity at basics living activities.

There are few studies in which presents a relation between sarcopenia and AD, in spite of that, a paper published by Ogawa et al.<sup>5</sup> in Tokio with 285 elderlies with AD, had shown that the prevalence of sarcopenia in healthy

adults of 60 years or older is of 10% and, an individual diagnosed with AD, even at its early stages, revealed a sarcopenia prevalence rate of 45% in women with mild AD, as well as 60% of the study population with moderate AD. On the Other hand, when analysing the male gender, the prevalence was of 47% in both cases. In this research a significant difference was found at the prevalence of sarcopenia at the study population in the city of Londrina-PR. The percentage of sarcopenia during the first year of AD evolution in the women's group was 30,4% with mild AD, in contrast with 75% at moderate disease. As there was any male member with CDR 2 (moderate AD) in the study population, from the one's diagnosed with CDR 1 (mild AD) 22,2% presented sarcopenia symptoms. According to Ogawa et al.<sup>5</sup>, sarcopenia could be involved, or even be a consequence of AD. At the analysed sample group, it was possible to correlate the evolution of the Alzheimer's disease and the development of sarcopenia.

Aligning with Machado et al.<sup>8</sup> and Lechetta et al.<sup>4</sup> studies, patients diagnosed with AD had shown independence for ABVD in 70% of the cases. Even though this paper had presented a different methodology then the studies mentioned earlier, as a result of analysing the evolution of ABVD during the course of a year, and reaching the result that in the year of 2018, 86% of patients were independents for basic activities, there has been a downsize to 80% after a year of the initial evaluation, indicating the necessity of a caretaker for basic activities. Senior population with dementia, at the sample group, had presented a weight loss, and according to Machado et al.<sup>8</sup>, there is, yet, no explanation. One might be explained through atrophy of the medial temporal cortex and energy expenditure, leading to a muscular decrease, loss of autonomy, and functional dependence, as well as, the risk



of falling, decubitus ulcer and infections.

Still analysing Lechetta et al.<sup>4</sup> research, with a sample group of 91 elderly patients with probable AD at Curitiba-PR, there was a non-intentional weight loss at 64,6% of the patients, in addition to 77% presenting a poor grip strength, demonstrating a muscular decrease and strength loss. At the evaluation made for the sample group in this research, it was able to observe a reduction in grip strength in 77% of women, and 40% of the interviewed men, besides a significantly decrease in BMI after the first year of AD diagnoses. There is as well, as mentioned earlier, the necessity to pay attention at the patient complaints of anorexia described after the beginning of the treatment with anticholinesterase for the disease's control, because they can imply in a severe Independence loss in daily basics activities.

This paper presents some restrictions, as the patients socioeconomics conditions, in order of their similar average incomes, for one thing, this research might have had a distinctive result once the patients had a better socioeconomic condition. Besides, the sample group had a sedentary lifestyle, for that reason, interviewing and evaluating a more mobile sample group, results could have shown a smaller number of sarcopenics. We would also like to stress that the use of medicines could reduce the patient's

appetite, leading to a minor calorie ingestion. Finally, the validated methods of SARC-F was used, as well as, grip strength and Timed Up and Go Test to evaluate the presence of sarcopenia, since there were no specific tests for body fat measurement and body mass, such as bone densitometry by dual energy X-ray (DEXA).

## CONCLUSION

To conclude, a positive association was found between the presence of sarcopenia during the first year of AD Evolution in a south Brazilian sample population, in which was observed a prevalence rate of sarcopenia at 34% of patients with AD at the diseases first year. There was also a reduction of BMI values and ABVD scores along the dementia progress, leading to an increase at basics living activities dependency. For all of those reasons it is why health professionals involved during the course of treatment of Alzheimer's disease, should be alert of the risk of overlapping sarcopenia at this population. For that matter, it is extremely important for innovative papers to be published, in order to better describe the correlation between AD and sarcopenia, summing up to confirm this paper results in others study population.

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**Author's contributions:** The 5<sup>o</sup> year medicine students of Pontifícia Universidade Católica Do Paraná (*Paola C. Antoniassi, Nicole S. Froehner* and *Milena L. Maçan*), divide themselves and called all the patients' participants at the research and scheduled a medical exam at the Policlínica de Londrina. Once a week the students took turns and performed the consultation (anamnesis and physical exam) at the scheduled patients. Lastly, after intense research in medical literature and data analysis obtained from the patients interviews, the students were able to write the presented paper. The advisor *Lindsey M. Nakakogue* mediated the use of Policlínica de Londrina, and shared her knowledge over the subject, as well as, corrected the papers sent to her.

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