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Title: The Association Between Sarcopenia and Cognitive Impairment in Hospitalized Older Adults: A Systematic Review

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Table of Contents

1.1 Abstract

This systematic review investigates the association between sarcopenia and cognitive impairment among hospitalized older populations across five studies with diverse geographic settings. The review reveals a significant association between these conditions, emphasizing the impact of sarcopenia on cognitive function. Variability in diagnostic criteria and sample demographics across studies underscores the need for standardized methods to enhance comparability. The findings suggest that sarcopenia and cognitive impairment are interlinked through potentially shared pathological processes, highlighting the importance of early detection and integrated management in geriatric care. Future research should focus on elucidating the underlying mechanisms and developing targeted interventions to mitigate these conditions.

Keywords: Sarcopenia, Cognitive Impairment, Older Adult Care, Diagnostic Criteria, Geriatric Health

1.2 Background

Sarcopenia is defined as a significant condition affecting the quality of life of older adults, characterized by the progressive loss of muscle mass and function with aging. [1] Research has demonstrated that muscle strength declines with age, even among the healthy older population.[2] The hallmark symptoms of sarcopenia—diminished muscle strength and decreased physical performance—complicate daily activities and reduce physical activity, thereby contributing to further health deterioration. Although sarcopenia primarily affects physical health by impairing muscle strength and mobility, its influence extends beyond physical limitations. Notably, the decline in muscle function often parallels the decline in

cognitive function, underscoring the interconnection between physical and mental health in aging populations.[3] According to a statement by Maeda and Akagi[4], the onset and progression of sarcopenia may also be affected by comorbidities such as cognitive impairments, heart failure, cerebrovascular disease, and chronic respiratory diseases, and other comorbidities. Therefore, the impact of sarcopenia goes far beyond muscle degeneration itself, and its link to cognitive impairment is an area of interest.

Cognitive impairment itself affects multiple domains, including memory, reasoning, and social cognition, and may aggravate the adverse effects of muscle weakness, creating a vicious cycle.[5] Individuals with sarcopenia are more likely to experience cognitive decline, which in turn leads to further loss of functional ability and worsening overall health.[4] This bi-directional relationship emphasizes the importance of integrating the assessment and management of sarcopenia and cognitive decline to improve quality of life in older adults.[5] Cognitive impairment also compromises communication, socialization, and independence, with severity ranging from mild dysfunction to complete dependence.[6]

The dual presence of sarcopenia and cognitive impairment significantly threatens independence among older adults, posing serious challenges for healthcare and socioeconomic systems.[7] Understanding the interplay between these two conditions is crucial to developing effective interventions. A study by Rosso et al.[8] identified sarcopenia and cognitive impairment as two of the most common contributors to independence loss in older populations, reinforcing the urgent need to explore their association. However, the diagnosis of sarcopenia remains inconsistent.[9] The lack of standardized diagnostic criteria has led to multiple approaches worldwide, resulting in variations in prevalence rates across different populations.[10] For example, an Italian study found that the prevalence of sarcopenia among hospitalized older women reached 36.3% using the European Working

Group on Sarcopenia in Older People (EWGSOP) criteria.[11] Globally, the prevalence among those aged 60 years and older ranges between 10% and 27% depending on the applied definition.[9]

Given these inconsistencies, assessing sarcopenia—especially in hospitalized older adults—remains a challenge. Hospitalized individuals often experience accelerated muscle loss and cognitive decline due to acute illness, immobility, and poor nutrition, making this population particularly vulnerable. Despite the growing evidence linking sarcopenia and cognitive impairment, existing research has not comprehensively evaluated their association in hospitalized older adults. Therefore, this systematic review aims to examine the strength of the association between sarcopenia and cognitive impairment in hospitalized older adults and to summarize the diagnostic approaches and assessment tools used in existing studies. However, the biological mechanisms linking sarcopenia and cognitive impairment remain poorly understood. Furthermore, the lack of standardized diagnostic criteria for sarcopenia limits inter-study comparability and global prevalence estimates.

1.3 Methods

1.3.1 Design

This review used a quantitative design to focus on assessing the relationship between sarcopenia and cognitive impairment in an older hospitalized population. The selection and analysis of quantitative studies (both cross-sectional and cohort studies) allowed for a comprehensive synthesis of the available data.[12] The methodology of this review is based on the PRISMA guidelines (Appendix 1), which provide a robust framework for reporting a systematic review.[13] This systematic review was not registered in PROSPERO.

1.3.2 Eligibility Criteria

The inclusion and exclusion criteria for this review were meticulously defined prior to the literature search to ensure a focused and relevant collection of data. Using the PEO (Population, Exposure, Outcome) framework[14], these criteria guided the selection of studies for the review. In this systematic review, Population (P) is hospitalized geriatric adults, Exposure (E) is sarcopenia, and Outcome (O) is cognitive impairment.

The review included hospitalized older adults aged 65 years or older with sarcopenia and impaired cognition from published articles between 2013 and 2024. Recognized diagnostic criteria for sarcopenia, such as the European Working Group on Sarcopenia in Older People (EWGSOP), the Asian Working Group on Sarcopenia (AWGS) were selected as described by Chen et al[15], and Pagotto and Silveira.[10] Cognitive impairment was chosen to be assessed by standardized cognitive assessment tools such as Mini-Mental State Examination or Montreal Cognitive Assessment (MoCA)[8].

The review excluded people over the age of 65 with specific diseases. These diseases may affect muscle mass or cognitive function in isolation. Articles that were not conducted to assess the relationship between sarcopenia and cognitive impairment were also excluded.

1.3.3 Information sources and search strategy

To ensure the comprehensiveness and quality of the literature, four databases were selected for searching: PubMed, CINAHL, Cochrane, and Web of Science (Appendix 2). The final search terms are as follows: "cognitive impairment*" OR "cognitive dysfunction" OR "cognitively impaired" OR dementia AND “sarcopenia*” OR "muscle weakness" OR "muscular atrophy"

OR "muscle loss" AND “hospitalized*” OR "inpatient" OR "hospitalized" AND “elderly*” OR

“aged” OR “older” OR “elder” OR “geriatric” OR "elderly people" OR "old people" OR “senior”. These search terms are combined from independent searches. Restrictions include articles published between 1 January 2013 and 1 January 2024 and published in the language of English.

1.3.4 Study Selection

All selected studies are first imported into Zotero for reading and saving. Next, studies are transferred to the Covidence Systematic Review Manager to remove duplicates, after which the screening process is initiated. The screening process is performed by two independent reviewers and ranges from an initial screening of titles and abstracts to a detailed review of the full text. At each stage of the screening process, any discrepancies in the reviewer's opinion were discussed and resolved by the two reviewers.

1.3.5 Data Extraction Process

The elements of data extraction required for the review were completed by the reviewers. Data extraction included: (a) Study characteristics (authors, country of study, year of publication, study aim, and design). (b) Sample characteristics (sample size, area, sex). (c) Diseases characteristics (diagnosis of sarcopenia, diagnosis of cognitive impairment). (d) Main results (prevalence of sarcopenia, prevalence of cognitive impairment, association measures, correlation, risk ratios, P values). In addition, the data extraction process will pay additional attention to any interventions or methodological details that affect the results.

1.3.6 Critical Appraisal

The quality assessment tools used in this study were chosen based on the specific research designs involved. The reviewers used the Joanna Briggs Institute (JBI)[14] assessment tool, which provides specific assessment forms for different types of study designs. For quality assessment, each study used the appropriate JBI assessment form based on its design type.

For cross-sectional studies, the assessment form contains 8 questions; for cohort studies, the assessment form contains 11 questions. These questions were to be answered by answering "Yes", "No", "Unclear", or "Not applicable". These questions were used to evaluate the quality of the study by answering and accordingly a statistical score was calculated.[14] This process ensures a systematic and standardized assessment of studies and helps to objectively judge the quality and credibility of the included studies.

1.3.7 Synthesis of Results

Data synthesis was conducted by the reviewers, employing narrative synthesis due to the variability in study designs, populations, and measurement tools across the included studies. This method facilitates an efficient and coherent summary and analysis of the data.[16] The narrative synthesis was structured around key themes that emerged from the data. For the articles included in the review, essential elements relevant to the systematic review were meticulously extracted. Each element was then rigorously analyzed and compared, emphasizing the similarities and differences among the studies.[17] These elements included diagnostic criteria for sarcopenia and cognitive impairments, prevalence rates, and the impact of sarcopenia on cognitive functions. Although there is some variation in the definition of the relationship between sarcopenia and cognitive impairment across studies, some studies have reported a significant association between sarcopenia and an increased risk of cognitive impairment.[4] However, the magnitude of this effect varied across the studies, which could be largely attributed to differences in the diagnostic criteria for sarcopenia and the methods used to assess cognitive impairment.[10] Additionally, the characteristics of the populations[18], geographical locations, and cultural backgrounds in the studies may have influenced the degree of significance and the manifestation of this

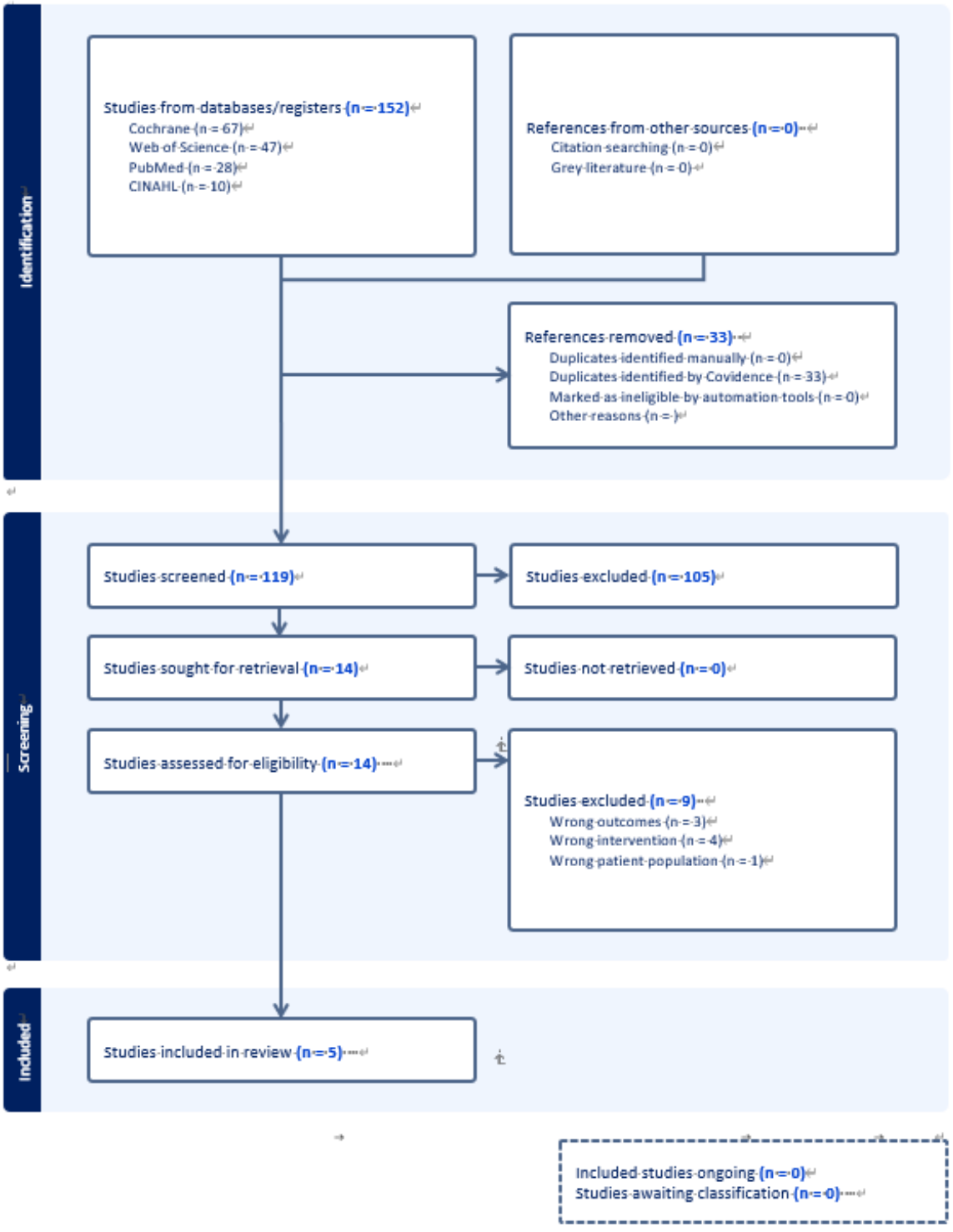
association.[19] Furthermore, the included studies were observational in nature, which would limit the results on a possible association between sarcopenia and cognitive impairment.

1.4 Results

1.4.1 Study Selection

The literature search initially retrieved 152 studies. After removing 33 duplicates, 119 studies underwent title and abstract screening, resulting in 14 articles selected for full-text review. Finally, five studies met the inclusion criteria, consisting of four cross-sectional studies and one prospective cohort study (Figure 1: PRISMA flow diagram).

Figure 1


Identification
Studies from databases/registers (n = 152)
Cochrane (n = 67)
Web of Science (n = 47)
PubMed (n = 28)
CINAHL (n = 10)
References from other sources (n = 0)
Citation searching (n = 0)
Grey literature (n = 0)
References removed (n = 33)
Duplicates identified manually (n = 0)
Duplicates identified by Covidence (n = 33)
Marked as ineligible by automation tools (n = 0)
Other reasons (n =)
Screening
Studies screened (n = 119)
Studies excluded (n = 105)
Studies sought for retrieval (n = 14)
Studies not retrieved (n = 0)
Studies assessed for eligibility (n = 14)
Studies excluded (n = 9)
Wrong outcomes (n = 3)
Wrong intervention (n = 4)
Wrong patient population (n = 1)
Included
Studies included in review (n = 5)
Included studies ongoing (n = 0)
Studies awaiting classification (n = 0)

1.4.2 Characteristics of Included Studies

The five included studies were conducted in China[20,21], Switzerland[22], Spain[23], and one without a specified location[4]. Four studies had a cross-sectional design, while one was a prospective cohort. The total number of hospitalized older adults analyzed ranged from 95 to 619 per study.

In the included studies, sarcopenia and cognitive impairment were diagnosed using different standardized criteria and measurement methods. Sarcopenia was assessed according to one of three diagnostic frameworks: the Asian Working Group for Sarcopenia (AWGS), the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), and the SARC-F questionnaire.

For studies adopting the AWGS and EWGSOP2 criteria, muscle mass was commonly measured by bioelectrical impedance analysis or dual-energy X-ray absorptiometry, muscle strength was assessed using handgrip strength, and physical performance was evaluated through gait speed, the chair stand test, or the Short Physical Performance Battery[15,22]. The SARC-F questionnaire, is a self-reported screening tool evaluating five domains—strength, assistance in walking, rising from a chair, climbing stairs, and falls—where a total score of ≥4 indicates a high risk of sarcopenia[24].

Cognitive impairment was evaluated using three different criteria. The Mini-Mental State Examination (MMSE)[5] is a 30-point scales assessing global cognitive impairment, with a cut-off <27, and the Montreal Cognitive Assessment (MoCA)[6] is also a 30-point test, cut-off <26. The Short Portable Mental State Questionnaire (SPMSQ)[4] is a 10-item questionnaire that classifies cognitive impairment based on the number of errors, with ≥3 errors suggesting impairment.

Table 1 summarizes the characteristics of included studies.

Table 1 Characteristics of the included studies

Study	Country	Design	Sample Size	Mean Age (years)	% Female	Sarcopenia Criteria	Cognitive Assessment	Sarcopenia Prevalence	Cognitive Impairment Prevalence	Notes
Li et al. (2022)	China	Cross-sectional	250	79.6±8.59 years	0%	AWGS	MMSE	20.8%	19.6%	
Zhang et al. (2023)	China	Cross-sectional	95	71.6±6.4 years	49.47%	AWGS	MoCA	Not Reported	28.4%	Mean age data is calculated from subgroup data.
Bertschi et al. (2020)	Switzerland	Cross-sectional	305	84 years (Median)	65.6%	EWGSOP2	MMSE	22.6%	Not reported	
Calleja et al. (2019)	Spain	Prospective cohort	596	84.9±5.2 years	52.9%	SARC-F	SPMSQ	49.5%	42.1%	Follow-up duration: 1 year
Maeda & Akagi (2016)	Not Reported	Cross-sectional	619	83±8.2 years	59.29%	AWGS	MMSE	67.4% (definitive), 14.1% (possible)	Definitive Sarcopenia Group: 54.4% Possible Sarcopenia Group: 70.1%	

Notes: In the study by Maeda & Akagi, the Definitive sarcopenia, defined as a decrease in skeletal muscle index (SMI) below the cut-off value accompanied by reduced handgrip strength. Possible sarcopenia, defined as a decreased SMI together with an inability to walk independently.

1.4.3 Synthesis of Main Findings

All included studies identified a significant association between sarcopenia and cognitive impairment among hospitalized older populations, although the magnitude varied due to differences in diagnostic criteria and assessment tools. In most studies, sarcopenia status served as the independent variable, while cognitive performance or impairment was analyzed as the dependent variable. Regression analyses were commonly applied, and most studies adjusted for key confounding factors, including age, sex, body mass index (BMI), education level, and comorbidities such as hypertension, diabetes, and cardiovascular disease.

Across the included studies, the mean participant age ranged from approximately 65 to 91 years, and females accounted for 45–46% of the samples. The primary indications for hospitalization were medical conditions such as acute infections, frailty, or functional decline related to aging. Among the prospective study, the follow-up duration was 1 year, during which both muscle strength and cognitive performance were reassessed to evaluate longitudinal changes.

Li et al.[20] reported that, in a sample of hospitalized older Chinese men (n=250), sarcopenia (prevalence 20.8%) was significantly associated with cognitive impairment (prevalence 19.6%), with an adjusted Odds Ratio (OR)=4.06, 95%, Confidence Interval (CI): 1.42–11.6, Probability value (P)=0.009. This association remained significant after adjustment for age, education, smoking status, and BMI, and although further adjustment for biochemical markers—including creatinine, uric acid, glucose, Low-Density Lipoprotein, total cholesterol, C-Reactive Protein, Glycated Hemoglobin—in a third model attenuated the effect size, the association persisted.

Zhang et al.[21] found a strong association between sarcopenia and cognitive impairment (adjusted OR=31.59, 95% CI: 5.87–170.11, p<0.001) after adjusting for age, body mass index, systolic blood pressure, heart rate, triglyceride levels, High-density lipoprotein (HDL) cholesterol, blood glucose, antihypertensive medication use and physical activity. This association remained significant after additional adjustment for white matter hyperintensity grade.

Bertschi et al.[22] reported that cognitive impairment was independently associated with confirmed sarcopenia (adjusted OR = 2.20, 95% CI, 1.01–4.81) in a multivariable logistic regression model adjusted for age, sex, calf circumference, BMI, risk of malnutrition and functional disability.

Calleja et al.[23] reported that 31.4% (187/596) of hospitalized older adults had co-occurrence of sarcopenia and cognitive impairment, based on their Venn diagram illustrating overlapping conditions. In univariate analyses, sarcopenia, frailty, and cognitive impairment were each associated with increased 1-year mortality. However, in the multivariate model adjusted for confounders, only sarcopenia remained independently associated with 1-year mortality (HR = 1.775, 95% CI: 1.270–2.481; p = .001). Frailty and cognitive impairment were associated with mortality in univariate analyses, but their independent effects were not evaluated in the multivariate model, as the authors did not report adjusted estimates for these variables.

Maeda & Akagi[4] reported that in a sample of 619 hospitalized older adults (mean age 83.0 ± 8.2 years), cognitive impairment was independently associated with sarcopenia (adjusted OR = 1.98, 95% CI: 1.06–3.71; p = 0.032) after adjustment for age, sex, Mini-Nutritional Assessment-Short Form score, Barthel Index and primary disease.

Overall, despite methodological heterogeneity across studies, geographic and cultural differences within studies may have influenced the reported associations, and limited demographic data in some studies restricted further analysis of age- and sex-specific effects,

the evidence consistently supports a robust and independent association between sarcopenia and cognitive impairment in hospitalized older adults, underscoring the importance of early assessment and integrated management strategies targeting both physical and cognitive health.

1.4.4 Methodological Quality

Quality assessment using Joanna Briggs Institute tools indicated overall good methodological quality across studies, with minor variability due to differences in study designs and reporting practices. All studies clearly defined inclusion criteria, utilized validated diagnostic tools, and conducted appropriate statistical analyses.

Detailed quality appraisal tables are provided in Appendix 3.

1.5 Discussion

This systematic review synthesized evidence from five studies investigating the association between sarcopenia and cognitive impairment in hospitalized older adults. Overall, a significant positive association between the two conditions was observed across studies, although the strength of this relationship varied depending on diagnostic tools, study design, and population characteristics[4,20–23]. These findings reinforce the growing

recognition that sarcopenia and cognitive impairment are interrelated geriatric syndromes that mutually exacerbate functional decline and dependence in older populations[20].

Differences in the magnitude of associations appear to stem largely from the use of distinct diagnostic criteria and cognitive assessment tools. Studies employing the AWGS definition generally reported higher prevalence rates than those using the updated EWGSOP2 criteria[20,22,25]. Similarly, variations in cognitive assessment methods—such as the MMSE, MoCA, or SPMSQ—may contribute to discrepancies in identifying mild versus moderate cognitive deficits[21,23]. These methodological inconsistencies complicate the comparison of prevalence data and may partially explain why the odds ratios reported ranged widely from approximately 2.0 to over 30.0[20–23].

In addition, differences in study populations could have influenced the results. For example, Bertschi et al.[22] included a relatively older sample (median age 84 years, 65.6% female) with diverse acute illnesses, while Zhang et al.[21] studied a younger hospitalized cohort with nearly equal sex distribution. Maeda and Akagi[4] also highlighted that comorbidities such as cerebrovascular and cardiovascular diseases significantly modify the relationship between sarcopenia and cognitive impairment. These differences in participant characteristics, hospitalization causes, and follow-up duration (12 months in prospective studies) may have contributed to the observed variation in effect sizes.

Despite the consistent evidence for an association, the underlying mechanisms remain incompletely understood. Previous research suggests that sarcopenia may indirectly impair cognitive function through metabolic and inflammatory pathways, including chronic inflammation, oxidative stress, and hormonal dysregulation[26,27.] Reduced muscle strength and physical inactivity may also lead to decreased cerebral perfusion and neuroplasticity,

further accelerating cognitive decline[26]. Conversely, cognitive impairment can limit physical activity and nutritional intake, promoting muscle wasting—a bi-directional relationship that compounds vulnerability in older adults[4,20]. However, shared pathological mechanisms such as inflammation, oxidative stress, and hormonal dysregulation have not yet been comprehensively investigated, and further mechanistic studies are warranted to elucidate these biological links.

When interpreting these findings, several methodological strengths and limitations should be considered. Strengths include the use of validated diagnostic criteria and standardized cognitive assessments in most studies[20–23]. However, most of the included studies were cross-sectional, limiting the ability to infer causality. Sample sizes were modest, and confounding factors such as nutritional status, depression, and medication use were not consistently controlled for. Moreover, heterogeneity in diagnostic definitions and cut-off thresholds may have led to under- or overestimation of prevalence[22,25]. Only two studies used a longitudinal design, which restricts understanding of temporal changes and the potential reversibility of these conditions[23].

From a clinical perspective, these findings underscore the importance of routine screening for both sarcopenia and cognitive impairment in hospitalized older adults. Early detection and integrated management could prevent further decline, improve independence, and enhance quality of life[27]. Future studies should aim to standardize diagnostic criteria, employ larger and more diverse cohorts, and incorporate prospective analyses to clarify causal mechanisms. Exploring potential mediating factors—such as inflammation, physical activity, and nutritional status—may also provide insight into effective multidisciplinary interventions.

In summary, this review highlights a robust association between sarcopenia and cognitive impairment in hospitalized older populations, despite methodological heterogeneity across studies. The evidence suggests that these conditions are interconnected through shared biological and behavioral pathways. Addressing them concurrently within geriatric care models is essential to optimize functional outcomes and reduce healthcare burden.

1.6 Limitations

This systematic review, while comprehensive, presents several limitations that must be acknowledged. The variability in diagnostic criteria across included studies may have introduced heterogeneity, impacting the comparability of results. Additionally, the inclusion of studies all from hospital settings may limit the generalizability of findings to community-dwelling older populations. At the same time, the majority of studies relied on observational data, which, despite rigorous statistical adjustments, cannot entirely eliminate potential confounding factors. Furthermore, not all studies reported detailed demographic data, which might obscure potential age, sex, or ethnicity-related differences in the relationship between sarcopenia and cognitive impairment.

1.7 Implication for Future Research

Given the findings and limitations of this review, several recommendations can be made for future research. There is an urgent need to standardize diagnostic criteria for sarcopenia and cognitive impairment to improve comparability across studies and clinical settings. Indeed, the Global Leadership Initiative on Sarcopenia (GLIS) is working to unify definitions[28]. This initiative aims to address the current lack of consistent standards across clinical and research settings, which hinders accurate prevalence estimates and identification of high-risk populations.

Future studies should strive to include more diverse populations to increase the generalizability of findings. Longitudinal studies are also needed to clarify the directionality and causality of the relationship between sarcopenia and cognitive impairment. There is also an urgent need to explore the association, leading to targeted interventions. This will have a significant impact on reducing cognitive decline and the occurrence of sarcopenia in older adults in the future.

1.8 Conclusion

In conclusion, this systematic review has highlighted a significant association between sarcopenia and cognitive impairment among older adults, underscoring the complex interplay between muscle degradation and cognitive health. The review has shown that while the prevalence and impact of these conditions are profound, the diversity in diagnostic criteria and populations studied highlights the need for further research in this field[25]. By addressing the gaps identified through this review, future research can provide deeper insights into effective strategies for prevention and treatment, ultimately enhancing the quality of life and independence of the older population[27]. The findings from this review should prompt healthcare professionals to integrate regular screening for sarcopenia and cognitive impairment into routine geriatric assessments, fostering early detection and comprehensive management of these conditions.

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Declarations

Ethics Approval and Consent to Participate: Not applicable. This study is a systematic review of previously published literature and does not involve any direct human subject research.

Consent for Publication: Not applicable.

Availability of Data and Materials: All data analyzed in this systematic review were extracted from previously published studies. No additional datasets were generated or analyzed.

Human Ethics and Consent to Participate declarations: Not applicable.

Clinical Trial Registration: Not applicable.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Appendix 1: Completed relevant reporting checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 3
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 3-6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 7
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 8
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 8
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 8-9
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 9
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 9
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 10
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 10-11
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 9
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 9-10
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 9-10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the	Page 9-10

Section and Topic	Item #	Checklist item	Location where item is reported
		model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 9-10
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 9-10
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 10-12
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 13-14
Study characteristics	17	Cite each included study and present its characteristics.	Page 15-19
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 15-19
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 23-26
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Page 23-26
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Page 23-26
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Page 23-26
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 27-33
	23b	Discuss any limitations of the evidence included in the review.	Page 35
	23c	Discuss any limitations of the review processes used.	Page 35
	23d	Discuss implications of the results for practice, policy, and future research.	Page 36
OTHER INFORMATION			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Appendix 2: Search strings

Copy of search strings and combinations as performed in database searches. Listed for each database separately (CINAHL, PubMed, Web of Science, Cochrane). **Table 2 Search strategy used in CINAHL database for identifying relevant studies**

Date: 23/02/2024 **Database: CINAHL**	**Research Topic: The Association Between Sarcopenia and Cognitive Impairment in Hospitalized Elderly** **Adults**	
Search Strategy	**Key Concepts**	**Synonyms/alternative terminology (consider regional variations here also)** **Combine terms using OR when considering one complete search string (S1)**

AND	TI (sarcopenia or sarcopenic or “muscle weakness” or “muscular atrophy” or “muscle loss”) OR AB (sarcopenia or sarcopenic or “muscle weakness” or “muscular atrophy” or “muscle loss”)
	TI (“cognitive impairment” OR “cognitive dysfunction” OR “cognitively impaired” OR dementia) OR AB (“cognitive impairment” OR “cognitive dysfunction” OR “cognitively impaired” OR dementia)
AND	TI (hospitalized OR hospitalized OR inpatient) OR AB (hospitalized OR hospitalized OR inpatient)
AND	TI (elderly OR aged OR older OR elder OR geriatric OR “elderly people” OR “old people” OR senior) OR AB (elderly OR aged OR older OR elder OR geriatric OR “elderly people” OR “old people” OR senior)
Total Number of Sources from CINAHL	**N= 10**

Table 3 Search strings for Web of Science

Date: 23/02/2024 **Database: Web of Science**	**Research Topic: The Association Between Sarcopenia and Cognitive Impairment in Hospitalized Elderly** **Adults**	
Search Strategy	**Key Concepts**	**Synonyms/alternative terminology (consider regional variations here also)** **Combine terms using OR when considering one complete search string (S1)**
	(TI= (Sarcopenia OR sarcopenic OR muscle weakness OR muscular atrophy OR muscle loss)) OR AB= (Sarcopenia OR sarcopenic OR muscle weakness OR muscular atrophy OR muscle loss)	
AND		
	(TI= (cognitive impairment OR cognitive dysfunction OR cognitively impaired OR dementia)) OR AB= (cognitive impairment OR cognitive dysfunction OR cognitively impaired OR dementia)	
AND		
	(TI= (hospitalised or hospitalized or inpatient)) OR AB= (hospitalised or hospitalized or inpatient)	
AND		
	(TI= (elderly or aged or older or elder or geriatric or elderly people or old people or senior)) OR AB= (elderly or aged or older or elder or geriatric or elderly people or old people or senior)	
Total Number of Sources from Web of Science	**N= 47**	

Table 4 Search strings for Cochrane

Date: 23/02/2024 **Database: Cochrane**	**Research Topic: The Association Between Sarcopenia and Cognitive Impairment in Hospitalized Elderly** **Adults**	
Search Strategy	**Key Concepts**	**Synonyms/alternative terminology (consider regional variations here also)** **Combine terms using OR when considering one complete search string (S1)**
	(sarcopenia or sarcopenic or muscle weakness or muscular atrophy or muscle loss): ti OR (sarcopenia or sarcopenic or muscle weakness or muscular atrophy or muscle loss): ab	
AND		
	(cognitive impairment OR cognitive dysfunction OR cognitively impaired OR dementia): ti OR (cognitive impairment OR cognitive dysfunction OR cognitively impaired OR dementia): ab	
AND		
	(hospitalised or hospitalized or inpatient): ti OR (hospitalised or hospitalized or inpatient): ab	
AND		
	(elderly or aged or older or elder or geriatric or elderly people or old people or senior): ti OR (elderly or aged or older or elder or geriatric or elderly people or old people or senior): ab	
Total Number of Sources from Cochrane	**N= 67**	

Table 5 Search strings for PubMed

Date: 23/02/2024 **Database: PubMed**	**Research Topic: The Association Between Sarcopenia and Cognitive Impairment in Hospitalized Elderly** **Adults**	
Search Strategy	**Key Concepts**	**Synonyms/alternative terminology (consider regional variations here also)** **Combine terms using OR when considering one complete search string (S1)**
	((((cognitive impairment[Title] OR cognitive dysfunction[Title] OR cognitively impaired[Title] OR dementia[Title]) OR (cognitive impairment[Title/Abstract] OR cognitive dysfunction[Title/Abstract] OR cognitively impaired[Title/Abstract] OR dementia[Title/Abstract])) AND ((sarcopenia[Title] OR sarcopenic[Title] OR muscle weakness[Title] OR muscular atrophy[Title] OR muscle loss[Title]) OR (sarcopenia[Title/Abstract] OR sarcopenic[Title/Abstract] OR muscle weakness[Title/Abstract] OR muscular atrophy[Title/Abstract] OR muscle loss[Title/Abstract]))) AND ((hospitalised[Title] OR hospitalized[Title] OR inpatient[Title]) OR (hospitalised[Title/Abstract] OR hospitalized[Title/Abstract] OR inpatient[Title/Abstract]))) AND ((elderly[Title] OR aged[Title] OR older[Title] OR elder[Title] OR geriatric[Title] OR elderly people[Title] OR old people[Title] OR senior[Title]) OR (elderly[Title/Abstract] OR aged[Title/Abstract] OR older[Title/Abstract] OR elder[Title/Abstract] OR geriatric[Title/Abstract] OR elderly people[Title/Abstract] OR old people[Title/Abstract] OR senior[Title/Abstract]))	
Total Number of Sources from PebMed	**N= 28**	

Appendix 3: Details of quality assessment tables

(Cohort Study 2017)

Reviewer__Yawen_Han_____Date__26/05/2024_____

Author: _Requena Calleja, M.A_et.al_____Year: 2019__ Record Number: 01

	Yes	No	Unclear	Not applicable
1. Were the two groups similar and recruited from the same population?	☑	☐	☐	☐
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	☐	☐	☑	☐
3. Was the exposure measured in a valid and reliable way?	☑	☐	☐	☐
4. Were confounding factors identified?	☑	☐	☐	☐
5. Were strategies to deal with confounding factors stated?	☑	☐	☐	☐
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	☑	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☑	☐	☐	☐
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	☑	☐	☐	☐
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	☑	☐	☐	☐
10. Were strategies to address incomplete follow up utilized?	☐	☑	☐	☐
11. Was appropriate statistical analysis used?	☑	☐	☐	☐

Overall appraisal: Include ☑ Exclude ☐ Seek further info ☐

(Analytical Cross-Sectional Study 2017)

Reviewer____Yawen_Han_____Date__26/05/2024_____

Author: Li, Feika et al._____Year__2022___ Record Number: 02

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☑	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☑	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☑	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☑	☐	☐	☐
5. Were confounding factors identified?	☑	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☑	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☑	☐	☐	☐
8. Was appropriate statistical analysis used?	☑	☐	☐	☐

Overall appraisal: Include ☑ Exclude ☐ Seek further info ☐

(Analytical Cross-Sectional Study 2017)

Reviewer____Yawen_Han_____Date__26/05/2024_____

Author:__Zhang , Kangrui et.al_____Year_____ Record Number: 03

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☑	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☑	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☑	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☑	☐	☐	☐
5. Were confounding factors identified?	☑	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☑	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☑	☐	☐	☐
8. Was appropriate statistical analysis used?	☑	☐	☐	☐

Overall appraisal: Include ☑ Exclude ☐ Seek further info ☐

(Analytical Cross-Sectional Study 2017)

Reviewer____Yawen_Han_____Date__26/05/2024_____

Author: Maeda, Keisuke et.al_____Year_2016_____ Record Number: 04

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☑	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☑	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☑	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☑	☐	☐	☐
5. Were confounding factors identified?	☑	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☑	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☑	☐	☐	☐
8. Was appropriate statistical analysis used?	☑	☐	☐	☐

Overall appraisal: Include ☑ Exclude ☐ Seek further info ☐

(Analytical Cross-Sectional Study 2017)

Reviewer____Yawen_Han_____Date__26/05/2024_____

Author: _ Bertschi, Dominic et.al_____Year__2021_____Record Number: 05

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☑	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☑	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☑	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☑	☐	☐	☐
5. Were confounding factors identified?	☑	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☑	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☑	☐	☐	☐
8. Was appropriate statistical analysis used?	☑	☐	☐	☐

Overall appraisal: Include ☑ Exclude ☐ Seek further info ☐