

Phase angle and its association with muscle quality, physical performance, and fall risk in elderly people: an integrative review

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Abstract

Background: Aging is associated with changes in muscle composition and function, increasing the occurrence of sarcopenia, reduced physical performance, and falls. The phase angle, obtained through electrical bioimpedance, has been investigated as a complementary measure of muscle condition in elderly people. **Objective:** To analyze the association between phase angle and muscle quality, physical performance, sarcopenia, and fall risk in elderly individuals. **Methods:** An integrative literature review was conducted in the PubMed/MEDLINE, Scopus, and Embase databases. Original studies with elderly individuals that assessed phase angle through bioelectrical impedance and its relationship with muscle quality, physical performance, sarcopenia, or falls were included. After the selection and eligibility stages, five studies were included in the synthesis. **Results:** Studies have demonstrated associations between phase angle and different aspects of musculoskeletal condition. Higher values were associated with better indicators of strength and physical performance, especially in measures involving the lower limbs. Associations were also observed with sarcopenia and with the recovery of gait after cardiovascular surgery. Regarding falls, the main association was observed with the segmental asymmetry of the phase angle of the lower limbs, and not with their absolute values. **Conclusion:** The phase angle shows potential as a complementary measure in the assessment of the muscular and functional condition of elderly people. However, its isolated use is not sufficient to diagnose sarcopenia or determine the risk of falls, and it is necessary to interpret it together with measures of strength, body composition, and physical performance.

Keywords: Electric impedance; sarcopenia; physical functional performance; elderly.

BACKGROUND

Population aging has been accompanied by an increase in the prevalence of changes related to muscle mass and function, with significant repercussions on the functional capacity and independence of elderly people. Among these changes, sarcopenia stands out due to the progressive reduction in muscle strength, the quantity, and the quality of muscle tissue, which can compromise mobility and increase vulnerability to adverse events. In this process, the assessment of muscle mass in isolation may not adequately represent the individual's functional condition, as people with a similar amount of muscle may exhibit significant differences in their ability to produce strength and perform functional activities¹.

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Muscle quality represents an important dimension of muscle assessment and can be examined through functional and morphological characteristics. Functionally, it reflects the capacity to generate force relative to muscle mass, whereas morphological characteristics include aspects of muscle composition, such as fat infiltration and tissue density. Changes in muscle quality may occur even before a detectable reduction in muscle mass². A systematic review and meta-analysis published in 2024 identified associations between phase angle and different indicators of muscle quality, including muscle density, echogenicity, and muscle quality index; however, the authors highlighted the heterogeneity among studies and the low certainty of the available evidence^{1,3}.

Reduced muscle quality may also be accompanied by impaired physical performance, an important component of geriatric assessment. Difficulties in performing tasks such as rising from a chair, walking, maintaining balance, and generating muscle strength may compromise functional independence and are clinically relevant to fall risk⁴. Therefore, identifying parameters that provide complementary information on muscle condition may contribute to a more comprehensive assessment of older adults^{5,6}.

Among the methods available for body composition assessment, bioelectrical impedance analysis (BIA) has been widely used in clinical and research settings because it is non-invasive and relatively easy to apply². Resistance and reactance values obtained by BIA can be used to calculate the phase angle (PhA), a parameter related to the electrical properties of tissues and cell membrane integrity. Interest in PhA assessment among older adults has increased because it may provide information beyond the estimation of body or muscle mass³.

Recent studies have investigated the relationship between PhA and different manifestations of muscle impairment. A meta-analysis published in 2024 evaluated the diagnostic performance of PhA for sarcopenia and reported an area under the curve of 0.81, with pooled sensitivity of 80% and specificity of 70%. The estimated cutoff values ranged from 4.54° to 5.25°; however, diagnostic performance varied according to factors such as body mass index, health status, ethnicity, and the criteria used to define sarcopenia³. These findings suggest that PhA may contribute to sarcopenia screening, although its interpretation should consider population characteristics and the diagnostic criteria employed^{3,4}.

Similar findings were reported in a meta-analysis specifically involving older adults. Hou et al⁴ identified a pooled sensitivity of 74%, specificity of 75%, and an area under the curve of 0.79 for PhA in the identification of sarcopenia. Despite this moderate diagnostic performance, the authors highlighted the high risk of bias among the included studies and the influence of age, sex, population characteristics, and study design on the findings. Therefore, the available evidence does not support a single PhA cutoff value applicable to all older adults⁴.

In another investigation, Chen et al.² analyzed factors associated with PhA in older adults and found that greater muscle mass was associated with higher PhA values, whereas greater fat mass was associated with lower values. These findings reinforce the relationship between PhA and body composition but also indicate that PhA values may be influenced by anthropometric and sociodemographic characteristics. Therefore, inter-

pretation of this parameter should consider individual characteristics rather than relying on PhA values in isolation².

Associations between PhA, physical frailty, sarcopenia, and comorbidities have also been reported in older adults attending a specialized falls and syncope unit. Bernabeu-Serrano et al.⁶ found that lower PhA values were associated with sarcopenia and were also related to handgrip strength and sit-to-stand performance. An inverse association was observed between PhA and comorbidity burden, suggesting that this parameter may reflect different dimensions of the clinical and functional condition of older adults⁶.

Despite the growing body of evidence, the relationship between PhA, muscle quality, physical performance, and fall risk in older adults remains incompletely understood. Studies differ in the bioimpedance devices and assessment protocols employed, cutoff values adopted, and criteria used to define sarcopenia, muscle quality, and functional impairment. This methodological heterogeneity limits direct comparison across studies and hinders the establishment of reference values applicable to different populations and clinical settings^{1,3,4}.

In this context, synthesizing the available evidence may contribute to a better understanding of the role of PhA in the assessment of muscle and functional status in older adults. This issue is particularly relevant to physiotherapy and gerontology, as identifying changes related to muscle strength and quality, physical performance, and fall risk may support comprehensive functional assessment and inform preventive and therapeutic strategies^{5,6}. Therefore, this integrative review aimed to analyze the available evidence on the association of phase angle obtained by bioelectrical impedance with muscle quality, physical performance, and fall risk in older adults.

METHODS

Study Design

An integrative literature review was conducted with the aim of identifying, gathering, and synthesizing the available scientific evidence on the association between the phase angle obtained by electrical bioimpedance, muscle quality, physical performance, and the risk of falls in elderly people. The integrative review was chosen because it allows the inclusion of different methodological designs and the integration of evidence from distinct research approaches, enabling a comprehensive understanding of the scientific production related to the topic.

The review was conducted in successive stages, including the definition of the guiding question, establishment of eligibility criteria, definition of databases, development and application of search strategies, identification and selection of studies, data extraction, assessment of methodological quality, and synthesis of results.

Guiding question

The guiding question was developed based on the PICO strategy, considering the Population (P), the Interest (I), and the Context (Co). The population consisted of elderly people, the interest corresponded to the phase angle obtained through electrical

bioimpedance, and the context included aspects related to muscle quality, muscle strength, muscle mass, physical performance, functional capacity, sarcopenia, and falls. From this structure, the following guiding question was established: “What is the association between the phase angle obtained by electrical bioimpedance and muscle quality, physical performance, and the risk of falls in elderly people?”.

Databases and Search Strategy

The bibliographic search was conducted in the PubMed/MEDLINE, Scopus, and Embase databases, selected for their comprehensiveness in the fields of health, gerontology, physiotherapy, body composition, and biomedical sciences.

The search strategies were developed based on three main concepts: elderly population, phase angle, and outcomes related to muscle condition and physical performance. Controlled descriptors were used, when available, and free terms, combined with the boolean operators AND and OR. The strategies were adapted to the syntax and indexing mechanisms specific to each database.

The searches were conducted on September, 2026, without any restrictions on language or year of publication. Table 1 presents the strategies used and the number of records identified in each database.

Table 1. Search strategies and records identified in the databases

PubMed/ MEDLINE	("Aged"[Mesh] OR "Aged, 80 and over"[Mesh] OR elderly[tiab] OR "older adult*" [tiab] OR "older people"[tiab]) AND ("phase angle"[tiab]) AND ("muscle quality"[tiab] OR "muscle strength"[tiab] OR "muscle mass"[tiab] OR "physical performance"[tiab] OR "physical function"[tiab] OR sarcopenia[tiab] OR falls[tiab] OR "fall risk"[tiab])	443
Scopus	TITLE-ABS-KEY(("phase angle") AND ("older adult*" OR elderly OR "older people" OR aged) AND ("muscle quality" OR "muscle strength" OR "muscle mass" OR "physical performance" OR "physical function" OR sarcopenia OR falls OR "fall risk"))	798
Embase	('aged'/exp OR elderly:ti,ab OR 'older adult*':ti,ab OR 'older people':ti,ab) AND ('phase angle':ti,ab) AND ('muscle quality':ti,ab OR 'muscle strength':ti,ab OR 'muscle mass':ti,ab OR 'physical performance':ti,ab OR 'physical function':ti,ab OR sarcopenia:ti,ab OR falls:ti,ab OR 'fall risk':ti,ab)	1.108

The search resulted in 2,349 records, with 443 from PubMed/MEDLINE, 798 from Scopus, and 1,108 from Embase. The retrieved records were subsequently gathered for identification and removal of duplicates.

Eligibility Criteria

Original studies that met the following criteria were included: (1) participants aged 60 years or older, or presentation of specific results for this age group; (2) evaluation of phase angle through bioelectrical impedance; (3) investigation of at least one outcome related to muscle quality, muscle mass, muscle strength, physical performance, functional capacity, sarcopenia, occurrence of falls, or fall risk; and (4) availability of the full text for analysis.

Review studies, systematic reviews, meta-analyses, research protocols, case reports or series, editorials, letters to the editor, scientific event abstracts, studies conducted exclusively with individuals under 60 years of age, studies that used bioelectrical impedance without phase angle assessment, and studies that did not present results related to the outcomes of interest were excluded.

Study Selection

After identifying the records in the databases, the results were compiled into a database for the identification and removal of duplicates. Subsequently, the screening of titles and abstracts was conducted, considering the previously established eligibility criteria. The potentially eligible studies were selected for full-text reading.

The selection of studies was carried out independently by two researchers. The divergences regarding the inclusion or exclusion of studies were discussed among the researchers until a consensus was reached. When consensus could not be reached, a third researcher was consulted to assist in the final decision.

Data Extraction

The data from the included studies were extracted using a standardized form developed by the researchers. Information was collected regarding the identification of the studies, methodological and sample characteristics, phase angle assessment, body composition, muscle quality, muscle strength, physical performance, functional capacity, and fall-related outcomes.

The following information was extracted: author and year of publication, country of study, study design, sample size, age of participants, population characteristics, equipment used for bioimpedance assessment, frequency used by the equipment when reported, mean or median value of the phase angle, cut-off points when available, method used for assessing muscle mass or quality, instrument used for assessing muscle strength, tests employed for assessing physical performance or functional capacity, method used for assessing falls or fall risk, main associations identified, effect measures or diagnostic performance when available, main conclusions and limitations reported by the authors.

The data extraction was carried out independently by the researchers, followed by a review of the information to minimize possible transcription errors and ensure data consistency.

Methodological Quality Assessment

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI)⁷ critical appraisal tools, selected according to the methodological design of each study. Aspects related to internal validity, possible sources of bias, sample selection and characterization, variable measurement, identification and control of confounding factors, and the adequacy of analysis methods were considered.

The evaluation was conducted independently by two researchers, using the JBI instruments corresponding to the designs of the identified studies. After the individual

evaluation, the results were compared and the discrepancies were discussed until a consensus was reached. When there was no consensus, a third researcher was consulted.

The results of the methodological assessment were considered in the interpretation and synthesis of the findings, especially in the analysis of the consistency of the evidence related to the association between phase angle, muscle quality, physical performance, sarcopenia, and fall risk. The identified methodological limitations were considered during the interpretation of the results.

Synthesis and analysis of the results

The results were organized descriptively and presented in tables, encompassing the methodological characteristics of the studies, sample characteristics, methods used for phase angle assessment, and main outcomes investigated.

The findings were synthesized in a narrative and comparative manner, considering the differences between the studies regarding the characteristics of the populations, equipment and bioimpedance protocols, phase angle values, methods for assessing muscle mass and quality, instruments used for evaluating strength and physical performance, and the definition of outcomes related to falls.

The synthesis aimed to identify the main associations between phase angle and indicators of muscle quality, physical performance, functional capacity, sarcopenia, and fall risk, as well as to identify convergences, divergences, and gaps in the literature. The results of the methodological evaluation were incorporated into the interpretation of the findings.

Considering the methodological and clinical heterogeneity of the included studies, the results were qualitatively synthesized, without conducting a meta-analysis.

RESULTS

After applying the identification, screening, and eligibility stages established in the methodology, five studies were included in the present integrative review. The publications, all recent, were conducted between 2025 and 2026 and presented different designs and population characteristics, allowing for the analysis of the phase angle (PhA) obtained through bioelectrical impedance in relation to muscle quality, physical performance, sarcopenia, and falls in elderly people.

The studies presented distinct samples and investigated different dimensions of musculoskeletal function. Nakano et al.⁸ evaluated 1,779 elderly individuals residing in the community and investigated the relationship between segmental PhA and muscle characteristics, using handgrip strength, gait speed, and the sit-to-stand test five times as indicators of physical performance. Skeletal muscle mass and fat infiltration were assessed by computed tomography of the mid-thigh region. The authors specifically investigated whether segmental PhA could be more useful than whole-body PhA in identifying muscular and functional changes. The relevance of PhA as a complementary measure in the assessment of muscle properties in elderly individuals. The simultaneous use of muscle composition measures obtained through tomography and functional tests allowed for the correlation of a parameter derived from bioimpedance with different

dimensions of muscle condition. This aspect is particularly relevant because it demonstrates that the interpretation of PhA can go beyond the simple estimation of muscle mass, incorporating information related to the quality of muscle tissue and physical performance⁸.

This result deserves attention, as it indicates that the relationship between PhA and falls may not depend exclusively on absolute values of the parameter. Segmental distribution and asymmetry between limbs can provide additional information about changes in muscle quality related to functional capacity. Thus, the study broadens the understanding of the potential of PhA in assessing fall risk, although the authors themselves emphasize the need for prospective studies to confirm this association⁹.

Xiao et al.¹⁰ analyzed 263 elderly people with type 2 diabetes mellitus, investigating the relationship between PhA and the presence of sarcopenia, as well as seeking a cutoff point for the parameter to identify this condition. The study reinforces the application of PhA in a specific clinical population, where metabolic changes may coexist with a reduction in muscle mass and function. The investigation of the association between PhA and sarcopenia expands the possibility of using bioimpedance as a complementary tool for identifying elderly individuals with a higher likelihood of experiencing muscle impairment¹⁰.

The association between PhA and functional performance was also observed by Takahashi et al.¹¹, who retrospectively evaluated 97 elderly individuals undergoing cardiovascular surgery. The authors analyzed the PhA before the procedure and the time required to achieve the 100-meter walk after the surgery. Individuals with lower PhA values took longer to achieve this functional capacity, and the multivariate analysis identified PhA as an independently associated factor with the time to acquire gait¹¹.

These findings demonstrate that the parameter may be related not only to laboratory or body composition measures but also to a clinically relevant functional outcome, especially in situations of greater physical vulnerability.

Similarly, Grootswagers et al.¹² investigated 228 elderly individuals at risk of malnutrition or frailty and found an association between PhA and different measures of physical performance. After the adjustments were made, higher PhA values were associated with greater knee extension strength, shorter time in the chair stand test, and higher walking speed. However, the association with handgrip strength lost significance after full adjustment. The authors identified a cutoff of 5.4° for identifying low performance in the chair stand test, with high sensitivity, but also with an incorrect classification rate exceeding 25%. Thus, the results suggest the utility of PhA as a screening tool, but not as an isolated measure for the complete diagnosis of sarcopenia¹².

Table 2. Characteristics and main findings of the studies included in the integrative review

Study	Sample and Design	Phase Angle Assessment	Main Outcomes	Main Findings
Nakano et al., 2026 ⁸	1,779 elderly people aged ≥65 years; cross-sectional study	Electrical bioimpedance with segmental PhA assessment	Handgrip strength, gait speed, 5-times sit-to-stand test	The study investigated the utility of segmental PhA in identifying changes in muscle mass, and its rela-

			fat infiltration by CT	relationship with physical performance measures and muscle composition
Kantha et al., 2026 ⁹	120 elderly people; 60 with falls and 60 without falls; comparative cross-sectional study	Multifrequency segmental bioimpedance	Fall history, FES-I, TUG, and sit-to-stand test	The absolute PhA did not differ significantly between the groups. However, greater asymmetry of leg PhA, especially at 5 kHz, was associated with a history of falls and poorer performance in the sit-to-stand test
Xiao et al., 2026 ¹⁰	263 elderly people with type 2 diabetes mellitus; cross-sectional study	PhA obtained by electrical bioimpedance	Sarcopenia, muscle mass, and muscle strength	The study investigated the association between PhA and sarcopenia and proposed the identification of a PhA cutoff point to assist in the detection of the condition
Takahashi et al., 2025 ¹¹	97 elderly people undergoing cardiovascular surgery; retrospective observational study	Preoperative PhA obtained by bioimpedance	100 m walk acquisition after surgery	Lower PhA values were associated with longer time to walk acquisition, with PhA identified as an independently associated factor with functional outcome
Grootswagers et al., 2025 ¹²	228 elderly individuals ≥65 years at risk of malnutrition or frailty; cross-sectional study	Multifrequency bioimpedance	Grip strength, knee extension strength, chair rise, and gait speed	Higher PhA values were associated with better lower limb performance. The cutoff point of 5.4° showed high sensitivity for poor performance in the chair stand test, but it was not sufficient for the isolated diagnosis of sarcopenia

Together, the five studies demonstrate that PhA is related to different components of musculoskeletal health in elderly people. The association was observed with muscular characteristics, strength, gait speed, sit-to-stand ability, gait acquisition after surgery, and, more specifically, with muscle asymmetry related to the history of falls. However, the results also demonstrate that the relationship between PhA and physical function is not uniform across all the measures evaluated.

An important aspect identified in the synthesis was the greater consistency of the association of PhA with lower limb performance measures. Grootswagers et al.¹² observed relationships with knee extension strength, performance in the sit-to-stand test, and gait speed, while Kantha et al.⁹ found an association between leg PhA asymmetry, fall history, and performance in the sit-to-stand test. Takahashi et al. [4], in turn, demonstrated a relationship between preoperative PhA and gait recovery after cardiovascular surgery. These findings suggest that changes detected by PhA may be particularly related to the functional capacity of the lower limbs, although this interpretation does not allow for establishing causality.

Another relevant aspect was the difference between the use of absolute PhA and PhA asymmetry. While the study by Kantha et al.⁹ did not identify a significant difference in the absolute PhA values between elderly individuals with and without a history of falls, the asymmetry of the PhA in the lower limbs showed an association with falls. This result demonstrates that segmental analysis can add information that is not identified when only a global value is considered.

Despite the convergence of studies regarding the potential of PhA as a complementary indicator, the works presented important differences concerning the populations evaluated, bioimpedance methods, frequencies used, body segments analyzed, and instruments employed for the assessment of physical function. Moreover, the studies were predominantly cross-sectional or retrospective, limiting the possibility of establishing causal relationships or determining whether changes in PhA precede functional loss and the occurrence of falls.

Thus, the results of the present review indicate that PhA can contribute to the assessment of muscle quality and functional capacity in elderly individuals, especially when interpreted in conjunction with measures of strength, physical performance, body composition, and fall history. However, the findings do not support its use as an isolated measure for the diagnosis of sarcopenia or the individual determination of fall risk. The observed methodological heterogeneity reinforces the need for longitudinal studies and greater standardization of bioimpedance procedures and PhA cutoff points.

DISCUSSION

The five studies included in this integrative review demonstrated that the phase angle (PhA) obtained through electrical bioimpedance is related to different aspects of the musculoskeletal condition of elderly people, mainly with muscle quality, physical performance, sarcopenia, and fall-related characteristics. Although the studies used different populations, equipment, and assessment methods, the results converge in indicating that PhA can provide complementary information about the muscular and functional condition of this population. However, the magnitude and form of this relationship varied according to the outcome analyzed.

Regarding muscle quality, Nakano et al.⁸ evaluated a significant sample of 1,779 elderly individuals residing in the community and used segmental PhA in conjunction with measures of strength, physical performance, and muscle characteristics obtained through computed tomography. The use of handgrip strength, gait speed, and the five-time sit-to-stand test allowed for the analysis of PhA in different dimensions of

functional capacity, while tomography enabled the assessment of muscle mass and fat infiltration. This set of evaluations demonstrates a broader approach to muscle condition, allowing a measure obtained by bioimpedance to be related to the structural and functional characteristics of the muscle⁸.

The relationship between PhA and physical performance was also observed by Grootswagers et al.¹², who evaluated 228 elderly individuals at risk of malnutrition or frailty. In this study, higher PhA values were associated with greater knee extension strength, shorter time to complete the chair stand test, and higher walking speed. The association was more evident in the measures related to the lower limbs, while the relationship with handgrip strength lost significance after the adjustments made⁹. These results are similar to the findings of Nakano et al.⁸ and suggest that PhA may have a particularly relevant relationship with functional components that depend on the musculature of the lower limbs. The convergence between these studies is important because lower limb strength, the ability to stand up from a chair, and walking speed represent different dimensions of functionality. While Nakano et al.⁸ related PhA to measures of strength, gait, and performance in the sit-to-stand test, Grootswagers et al.¹² demonstrated an association with knee extension strength, chair rise, and gait speed. Thus, the two studies present complementary results and reinforce the possibility that PhA is related not only to the amount of muscle but also to the functional capacity of muscle tissue.

This relationship with functionality was also identified by Takahashi et al.¹¹, in a population of 97 elderly people undergoing cardiovascular surgery. Participants with lower PhA values took longer to acquire the ability to walk 100 meters after the procedure. Moreover, the PhA remained associated with the time to acquire gait after the adjustments made¹⁰. Unlike the studies by Nakano et al.⁸ and Grootswagers et al.¹², which evaluated elderly individuals in community living conditions and at risk of frailty or malnutrition, respectively, Takahashi et al.¹¹ analyzed individuals subjected to a specific clinical condition and higher physiological demand. Even so, the association observed with gait capacity points to a similar relationship between PhA and functional performance.

The findings of Xiao et al.¹⁰ add another dimension to the interpretation of PhA by investigating 263 elderly people with type 2 diabetes mellitus. The study evaluated the relationship between PhA and the presence of sarcopenia, in addition to investigating a possible cutoff point for its identification¹⁰. The inclusion of a population with a specific clinical condition demonstrates that the relationship between PhA and muscle condition can also be observed in elderly individuals with greater clinical complexity. At the same time, the results should be interpreted considering the particular characteristics of this population, as type 2 diabetes mellitus may be associated with metabolic and muscular changes that are not necessarily present in community-dwelling elderly individuals.

The relationship between PhA and falls showed different results compared to those observed for physical performance and sarcopenia. Kantha et al.⁹ evaluated 120 elderly individuals, with 60 having a history of falls and 60 without a history of falls. Although they did not identify a significant difference in absolute PhA between the groups, the authors found greater PhA asymmetry in the limbs, especially in the lower

limbs and at the frequency of 5 kHz, among participants with a history of falls. The asymmetry of leg PhA also showed an association with the history of falls and a negative relationship with performance in the sit-to-stand test⁹.

This result differentiates the study by Kantha et al.⁹ from the other included works, as it was not the absolute value of PhA that showed the main relationship with the outcome, but its asymmetric distribution among the body segments. This finding is relevant because it demonstrates that the interpretation of PhA can be influenced by the way the parameter is analyzed. While Nakano et al.⁸ also used a segmental approach, Kantha et al.⁹ advanced the analysis by investigating differences between sides and their relationship with falls and functional performance.

The comparison between the studies, therefore, highlights two main ways to interpret PhA. The first is related to its absolute value and its association with strength, physical performance, and muscle condition, as observed by Nakano et al.⁸, Grootswagers et al.¹², Takahashi et al.¹¹ and Xiao et al.¹⁰. The second involves the segmental analysis and the asymmetry of the parameter, mainly represented by the study of Kantha et al.⁹. This difference demonstrates that the assessment of PhA can present distinct information depending on the clinical objective and the method of analysis used.

Another aspect observed was the diversity of the evaluation methods employed. Nakano et al.⁸ used segmental bioimpedance and associated their results with measurements obtained by computed tomography. Kantha et al.⁹ used multifrequency bioimpedance with analysis of different body segments and frequencies. Grootswagers et al.¹² employed multifrequency bioimpedance, while Takahashi et al.¹¹ and Xiao et al.¹⁰ used PhA as a measure derived from bioimpedance in specific clinical populations. This methodological diversity demonstrates the wide application of the parameter, but it also makes direct comparison between the values found in different studies difficult.

The differences between the populations must also be considered. The studies involved elderly individuals residing in the community, individuals at risk of malnutrition or frailty, patients undergoing cardiovascular surgery, and elderly people with type 2 diabetes mellitus⁸⁻¹². Furthermore, the outcomes analyzed were distinct, including muscle composition, strength, gait, functional tests, sarcopenia, and fall history. In this way, although there is a tendency to associate PhA with musculoskeletal condition, the studies do not allow for the establishment of a single interpretation pattern applicable to all elderly people.

Another relevant point is that the five studies predominantly presented cross-sectional or retrospective designs⁸⁻¹². This aspect limits the temporal interpretation of the associations found. For example, the relationship between lower PhA and poorer physical performance observed in the studies does not allow us to determine whether the reduction in PhA precedes functional loss or if both are simultaneous manifestations of an unfavorable musculoskeletal condition. Similarly, in the study by Kantha et al.⁹, the association between PhA asymmetry and fall history does not allow us to determine whether the muscle alteration contributed to the falls or if the fall history itself was related to the differences observed between body segments.

Despite these limitations, the results of the five studies show a consistent trend of association between PhA and different components of muscle and functional condition. Nakano et al.⁸ demonstrated its relationship with muscle properties and physical performance; Grootswagers et al.¹² found associations mainly with lower limb function; Takahashi et al.¹¹ related the parameter to gait recovery after surgery; Xiao et al.¹⁰ investigated its relationship with sarcopenia; and Kantha et al.⁹ identified an association between segmental asymmetry and fall history.

However, the results do not allow considering PhA as an isolated measure to diagnose sarcopenia or individually determine the risk of falls. The relationship observed between the parameter and these outcomes was variable among the studies, and, in the case of falls, the association was mainly observed for segmental asymmetry, rather than for the absolute value of PhA⁹. Furthermore, the differences between equipment, frequencies, body segments, and sample characteristics make it difficult to define universal reference values.

Together, the five studies analyzed support the possibility of using PhA as a complementary indicator of musculoskeletal condition in elderly people, especially when interpreted in conjunction with measures of strength, body composition, and functional performance. The available evidence, however, still does not allow its isolated use as a diagnostic marker or individual predictor of sarcopenia and falls.

CONCLUSION

The findings of this integrative review indicate that the phase angle obtained through electrical bioimpedance shows potential as a complementary measure in the assessment of the musculoskeletal condition of elderly people, showing an association with muscle quality, physical performance, sarcopenia, and aspects related to falls. The analyzed studies suggest that higher phase angle values are related to better indicators of strength and functionality, while changes in segmental asymmetry may be associated with a history of falls.

However, given the heterogeneity of populations, equipment, and assessment methods, the phase angle should not be used in isolation to diagnose sarcopenia or determine fall risk. Its joint interpretation with measures of strength, body composition, and functional performance can contribute to a more comprehensive assessment of the elderly person, requiring longitudinal studies and standardized protocols to establish its clinical applicability.

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