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The Role of Muscle Quality as a Predictor of Falls: A Systematic Review

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Spokely, NJ; Allen, SMF; Danielson, T; Bansbach, A; Baker, BS.

Corresponding author:
Nicholas Spokely

nicholas.spokely@okstate.edu

Author Affiliation:
Musculoskeletal Adaptations to Aging and eXercise Lab at Oklahoma State University.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data extraction.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 29 March 2025 and was last updated on 29 March 2025.

INTRODUCTION

Review question / Objective Is muscle quality, within both the functional (strength per unit muscle mass) and morphological (non-contractile tissue infiltration derived from ultrasound, computed tomography, or magnetic resonance imaging) domains, able to predict falls in older adults (age 60 years or older)?

Rationale Falls are a leading cause of injury and mortality among older adults, significantly affecting their health, quality of life, and independence. As the global population ages, understanding the risk factors that contribute to falls is crucial for developing effective interventions to prevent them. Muscle quality, encompassing both functional and morphological aspects, has been proposed as a key determinant of fall risk. However, the relationship between muscle quality and fall incidence in older adults remains under-explored and not well defined.

Condition being studied The outcome being studied is falls. Falls are commonly defined as an event which results in a person coming to rest inadvertently on the ground or lower level.

METHODS

Search strategy Search terms, including Boolean operators were ("Muscle Quality" OR "Muscle Echogenicity" OR "Muscle Density" OR "Fatty Degeneration" OR "Fat Infiltration") AND ("Falls") AND ("Prediction" OR "Relationship" OR "Association").
Data bases searched included: Embase, PubMed, Google Scholar (first 1,000 results), Scopus.

Participant or population Participants will include any older adult (age 60 years or older).

Intervention N/A.

Comparator N/A.

Study designs to be included Observational studies (cohort studies, case-control studies, and cross-sectional studies).

Eligibility criteria Inclusion Criteria:
1. Original articles that are peer-reviewed and used an observational study design (cohort, cross-sectional, and case-control) written in English
2. Studies that used older adults (age ≥ 60 years)
3. Measurement of muscle quality in the functional (strength per unit muscle mass) or morphological (non-contractile tissue infiltration derived from ultrasound, computed tomography, or magnetic resonance imaging) domains and determination of retrospective or prospective fall incidence
4. Usage of odds ratios (case-control and cross-sectional studies) or hazard ratios (cohort studies) to explain the relationship between muscle quality and falls

Papers will be excluded if they are non-original research, not peer-reviewed (including grey literature), conducted in non-human subjects or on humans under the age of 60 years, failed to report fall incident or had unclear/irrelevant muscle quality measurements, and did not report appropriate statistical measures (odds ratios, hazard ratios, etc.).

Information sources Information will come from peer-reviewed manuscripts found in Embase, PubMed, Google Scholar (first 1,000 results), and Scopus.

Main outcome(s) Primary outcomes: self-reported retrospective or prospective fall incidence (an unexpected event in which the participants come to rest on the ground, floor, or lower level), functional muscle quality (muscle strength per unit muscle mass), and morphological muscle quality (non-contractile tissue infiltration assessed via ultrasound, magnetic resonance imaging, or computed tomography). Additionally, odds ratios or hazard ratios will be extracted as the effect measures for the association between fall incidence and functional and morphological muscle quality.

Additional outcome(s) Additional data extracted will include study characteristics (author, year of publication, journal, title, DOI, study type, setting, population, inclusion/exclusion criteria, and study quality (detailed below)) and participant characteristics (groups, sample sizes, age, sex, and ethnicity).

Data management Microsoft Excel will be used to manage records and data.

Quality assessment / Risk of bias analysis The National Heart, Lung, and Blood Institute Study Quality Assessment Tools will be used to determine study quality. Specifically, the NHLBI tools for observational studies. Further, a study will be rated "Good" if ≥80% of applicable critical appraisal questions receive a "Yes" response, "Fair" for 50%-79%, and "Poor" for ≤50%.

Strategy of data synthesis A meta-analysis will not be performed; however, odds ratios (for case-control and cross-sectional studies) and hazard ratios (for cohort studies) will be extracted to assess how well muscle quality can predict fall incidence.

Subgroup analysis There will not be a subgroup analysis.

Sensitivity analysis There will not be a sensitivity analysis.

Language restriction Articles must be written in English.

Country(ies) involved United States of America.

Keywords Muscle Quality; Falls; Older Adults.

Dissemination plans The findings from this systematic review will be disseminated through manuscript publication in a peer-reviewed journal (to be determined) and presentations at regional (Central States American College of Sports Medicine) and national conferences (National American College of Sports Medicine).

Contributions of each author

Author 1 - Nicholas Spokely - Conceptualized research question, performed literature search, read/appraised articles selected for full-text consideration, extracted and synthesized data, and drafted the manuscript.
Email: nicholas.spokely@okstate.edu
Author 2 - Shawn Allen - Performed literature search, read/appraised articles selected for full-text consideration, and edited final manuscript.
Email: shawn.m.allen@okstate.edu
Author 3 - Tyler Danielson - Assisted with conceptualization, performed literature search, and edited final manuscript.
Email: tyler.danielson@okstate.edu
Author 4 - Alexander Bansbach - Performed literature search and edited final manuscript.
Email: xandrosb@bu.edu
Author 5 - Breanne Baker - Drafted and edited final manuscript.
Email: bree.baker@okstate.edu