

Title

The association between echo intensity and muscle strength or physical performance in the older population: a scoping review

Authors

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Abstract

Objective: The purpose of this scoping review is to understand the extent and type of evidence in relation to the usefulness of muscle echo intensity using ultrasound imaging in the assessment of physical performance.

Introduction: Recently, there has been an increasing number of reports on the use of ultrasound imaging to assess muscle strength or physical performance. While indices such as muscle thickness are common, reports on the relationship between muscle echo intensity and physical function have increased in the last few years. In the absence of randomized controlled trials of sufficient quantity and quality, a comprehensive summary of these studies has yet to be reported.

Inclusion criteria: The participants should be healthy participants who are over 65 years old. The concept will be the investigation of the relationship between muscle echo intensity using ultrasound imaging and physical function such as muscle strength or physical performance (e.g., a sit and stand test or 6 minutes walking test). For context, only observational studies should be included.

Methods: MEDLINE, CENTRAL, CINAHL, and Web of Science will be systematically searched using the keywords “echo intensity,” “ultrasound,” and “geriatrics” until March 2021. In the first screening step, two independent reviewers will review all of the titles and abstracts to exclude irrelevant articles. The second screening step will be according to the same inclusion criteria.

Introduction

It is now a well-known fact that loss of muscle mass, which is muscle atrophy, progresses with aging(1).

It has been reported that physical functions such as muscle weakness and walking ability decline with muscle atrophy(2).

Interestingly, the decline in muscle function is thought to be associated not only with loss of muscle mass but also with qualitative changes in muscle(3).

The usefulness of ultrasound imaging for assessing physical function has been reported(4).

Advances in ultrasound technology allow static and dynamic evaluation of shoulder problems, and offer real-time, radiation-free guidance for therapeutic interventions(5)(6).

In the past, measuring muscle thickness was one of the most common methods for the evaluation of body tissue, using ultrasound images(7).

Research about the usefulness of measuring muscle echo intensity (EI) has been increasing in recent years(8).

Muscle EI can detect the connective tissue and adipose tissue within muscle tissue non-invasively(9). It has also been described as being related to muscle strength(10), physical fitness(11), level of daily activity(12), and functional performance(13).

It is easy to measure physical function in young people because the risk of adverse events such as falls is very low.

There is an increasing number of reports on the usefulness of muscle EI as a simple index of performance. Measurement of muscle EI might bring new possibilities in the evaluation of physical functions.

On the other hand, many of the previous studies have been insufficient in quality. Another concern is that methods used for EI evaluation have varied for each study.

There is one narrative review on muscle EI(14), but the purpose of this paper was to summarize the changes in EI in response to exercise, and future considerations of the usefulness of this measurement of EI.

Another invited review was conducted by searching papers from only two search databases, and this was one of the critical limitations for review quality(3).

At this time, there are few high-quality randomized controlled trials examining medium- to long-term changes in muscle EI due to exercise in the elderly. Thus, it is too early to conduct a systematic review of the intervention effects.

Review question

The purpose of this review is to summarize reports on the usefulness of muscle echo intensity measurements obtained from ultrasound images in assessing physical performance in elderly subjects.

Keywords

Ultrasound; Echo intensity; Physical performance; Elderly; Geriatric

Eligibility criteria

Participants

The participants should be elderly, aged over 65. Both adult healthy participants and any patients will be included.

Concept

The concept should be the investigation of the relationship between muscle echo intensity, using ultrasound imaging, and physical function such as muscle strength or physical performance (e.g., a sit and stand test or 6 minutes walking test). Only observational studies should be included in this review.

Context

No limitation on location, race, or gender has been imposed. Publication dates should include from January 2000 to March 2021.

Types of Sources

This scoping review will consider observational studies only.

Methods

This protocol was written in accordance with PRISMA-P. The proposed scoping review will be also conducted in accordance with the JBI methodology for scoping reviews(15).

Search strategy

The search strategy will aim to locate both published and unpublished studies. A systematic electronic search was conducted of the following databases: PubMed, Web of Science, Cochrane database of systematic reviews, and CINAHL. The words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy for the four databases (see Appendix).

Studies published in English will be included. Sources of unpublished studies / gray literature to be searched include ClinicalTrials.gov.

Study/Source of Evidence Selection

Following the search, all identified citations will be collated and uploaded into Endnote (Clarivate Analytics, PA, USA) and duplicates removed. Following a pilot test, titles and abstracts will then be screened by two or more independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant sources will be retrieved in full and their citation details imported into the Rayyan(16) (Qatar Computing Research Institute, Ar Rayyan, Qatar). The full text of selected citations will be assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of sources of evidence of full text that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved through discussion, or with an additional reviewer. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) flow diagram(17).

Data Extraction

Data will be extracted from papers included in the scoping review by two or more independent reviewers using a data extraction tool developed by the reviewers. The data extracted will include specific details about the participants, concept, context, study methods and key findings relevant to the review question.

A draft extraction form is provided. It contains information about author(s), year of publication, origin/country of origin, aims/purpose, population and sample size within the source of evidence, methodology, intervention type, outcomes and details of these, and key findings that relate to the scoping review question. The draft data extraction tool will be modified and revised as necessary during the process of extracting data from each included evidence source. Modifications will be detailed in the scoping review. Any disagreements that arise between the reviewers will be resolved through discussion, or with an additional reviewer/s. If appropriate, authors of papers will be contacted to request missing or additional data, where required.

Data Analysis and Presentation

The data will be presented graphically or in diagrammatic or tabular form. We will state the insights and evidence from the reviewed papers, separating each performance.

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None.

Conflicts of interest

There is no conflict of interest in this project.

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Appendix

Appendix: Search strategy

PubMed search strategy

El Keywords: (("muscle, skeletal"[MeSH Terms] OR "muscle"[Title/Abstract]) AND ("ultrasonography"[MeSH Terms] OR "ultrasonography"[Title/Abstract] OR "echogenicity"[Title/Abstract] OR "echo intensity"[Title/Abstract]))

Elderly Keywords: ("geriatric"[All Fields] OR "elder"[All Fields] OR "old-age"[All Fields] OR "pensioner"[All Fields]) AND ("geriatric"[All Fields] OR "elder"[All Fields] OR "old-age"[All Fields] OR "pensioner"[All Fields]).

Web of Science search strategy

El Keywords: (Muscle AND (echogenicity[tiab] OR "echo intensity"[tiab]))

Elderly Keywords: (Geriatric or Elder* or old - age or pensioner*)*

CENTRAL search strategy

El Keywords: (MeSH descriptor: [Muscles] explode all trees) AND (ultrasonography or echogenicity or "echo intensity"):ti,ab,kw

Elderly Keywords: (MeSH descriptor: [Geriatrics] explode all trees) OR (MeSH descriptor: [Aged] in all MeSH products)

CINAHL search strategy

El Keywords: (MH "Muscle, Skeletal") AND (TI (ultrasound or echogenicity or "echo intensity") OR AB (ultrasound or echogenicity or "echo intensity"))

Elderly Keywords: MH "Geriatrics" OR MH "Aged" OR (TI(Geriatric or Elder* or old - age or pensioner*)) OR (AB(Geriatric* or Elder* or old - age or pensioner*))*