**TITLE: Exploration of the relationship between oral function and risk of sarcopenia: does dietary protein play a mediating role?**

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**BACKGROUND**: Adequate dietary protein intake is important in maintaining muscle functional in older age (65+ years) and in mitigating sarcopenia (Paddon-Jones et al 2015). Sarcopenia refers to the pathologic reduction in skeletal muscle mass and strength, and consequentially loss of function (Cruz-Jentoft et al 2010; Muscaritoli et al 2010). In older adults, poor oral function (e.g. tooth loss, reduced chewing and biting ability, low salivary flow, stomatitis, reduced tongue pressure) may impact on the ability to consume adequate dietary protein (Sheiham et al 2001; Inomata et al 2017) which could impact on risk of sarcopenia. It can be postulated that there is a bi-directional relationship between compromised oral function and sarcopenia; while compromised oral function may contribute to nutritional deficits that lead to sarcopenia, sarcopenia is a condition that affects the whole body including the muscles involved in mastication – thus impacting on food intake. The relationship between oral function and sarcopenia remains poorly investigated and there has been no scoping review to date conducted to compile the available research on this relationship in a systematic and reproducible manner.

**AIMS & OBJECTIVES**

The aim is to scope the existing published evidence pertaining to compromised oral health, intake of dietary protein and risk of sarcopenia

The objectives are:1) to identify existing peer reviewed published evidence pertaining to any relationship between compromised oral health and (i) risk of sarcopenia (ii) intake of dietary protein and (iii) both;

2) to map available data by:

* Type and volume of information
* Geographic location (country)
* Measures of exposure (oral health measures)
* Outcome measures used (e.g. to assess risk of sarcopenia (i.e. measures of both muscle mass and function) and dietary protein intake, to).
* Objective(s) of studies
* Population studied
* Key findings in relation to the research topic in question.

The review will be conducted according to PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews).

The outcomes of this scoping review will inform on existing evidence pertaining to oral function and risk of sarcopenia, and will inform whether there has been sufficient research in this area and where gaps in data exist. The results will inform future development of research studies in the area of oral health and sarcopenia.

**Population**

Participants will be older adults generally aged 65 years and over but including other defined age ranges including those aged 65+. Generally healthy, but including older adults diagnosed with Type 2 Diabetes Mellitus or with under- or over-nutrition.

Excluded are studies with a specific focus on participants with acute or chronic diseases such (e.g. cancer, kidney disease, liver disease, dementia)

**Concept**

The concept of interest is oral function in relation to sarcopenia and, or intake of dietary protein.

Included are studies measuring oral function as by tooth loss, reduced salivary flow (dry mouth, xerostomia), masticatory function, bite force, thickness and strength of muscles of mastication, tongue pressure and a measure of protein intake and or a measure of sarcopenia (measures of decreased muscle mass and function). Excluded from the main mapping are studies measuring muscle function only as a proxy for sarcopenia, but without measure of muscle mass. However, the volume of such studies will be recorded as a secondary outcome. Excluded are studies that measure dietary protein and risk of sarcopenia but with no measure of oral health/function. Studies that measure neuropathic dysphagia or presbyphagia (sarcopenic dysphagia) only, in relation to protein intake and systemic sarcopenia are excluded.

**Context**

The context is data from populations in any country from any type of intervention or epidemiological study dated from Year 2000 to the current date [January 2022].

**TYPES OF INFORMATION:** Included are peer reviewed studies ((RCT, non-randomised trial, quasi-experimental studies, and reviews that contain data relevant to the PCC) with at least an abstract written in English. Publication types such as protocols, abstracts, preprints, conference proceedings, thesis, grey literature, and any other non-peer reviewed articles will be excluded.

**SEARCH STRATEGY:** The search strategy prior to studies selection will be conducted through a three-steps approach. The first step is an initial limited search of appropriate online databases relevant to the topic. A decision about relevant databases was made at the commencement of the project which included PubMed, CINAHL, Embase and Scopus. The research topic was broken down into three key concepts – "Oral Function", "Sarcopenia", and "Dietary protein". Alternative terminologies for these concepts determined and recorded in a logic grid. This led to the generation of initial search terms. An initial scoping search was performed on PubMed using MeSH thesaurus terms and common terms to determine the search sensitivity and the need for more concept synonyms and variations to be added to the logic grid. This was replicated for the other databases (CINAHL, Embase and Scopus), by searching for the major concepts and their synonyms, while identifying more concepts synonyms and variations to be added. The logic grids were adapted to work accordingly to the specific rules of each online database (i.e. Emtree terms were identified in Embase and recorded in the logic grid created for Embase). The text words contained in the title and abstract of retrieved papers in the initial search will be analysed, in addition to all of the MeSH/Emtree terms used to index the articles. The second step includes a second search using all identified keywords and indexed terms (such as appropriate MeSH/Embase terms that articles were tagged with) across included databases. The final logic grids recorded for each online database will be reported in an Appendix to the main review. The reference list of identified reports and articles will be searched for additional sources following the secondary screening of articles in full-text. The PCC mnemonics (Population/Concept/Context) was used to define all searches across the chosen online databases to ensure useful searches were produced.

**STUDIES SELECTION:** In terms of study selection, PCC mnemonics (Population/Concept/Context) will guide the eligibility criteria for relevant studies.

Resulting hits will be imported into Covidence software after removal of duplicates. A primary screening of titles and abstracts will be conducted by two independent researchers to eliminate articles that were clearly outside of the inclusion criteria. Any differences between the reviewers' decisions will be resolved through discussion. If consensus is not reached, a third-party reviewer will be consulted.

A secondary screening on included full texts will then be conducted by one reviewer and a random sample of 10% of papers will be screened in duplicate and interrater reliability recorded. Reasons for exclusion will be recorded at this stage. The reference list of included studies will also be searched for additional studies. Any differences between reviewers' decisions will then resolved through discussion. If a high level of agreement is not reached the 10% double screening will be repeated, IRR calculated, and differences discussed until good agreement between reviewers is achieved. During this process, if consensus is not reached, a third-party reviewer will be consulted.

**DATA charting/mapping**

Data charting of included studies will be conducted by one reviewer and checked by a second reviewer. During data charting, a mapping spreadsheet will be developed using Microsoft Excel to ensure systematic data mapping process.

Key information will include:

* Author(s),
* Year of publication,
* Origin/country of origin (where the source was published or conducted),
* Aims/purpose,
* Population and sample size within the source of evidence,
* Expose variables relevant to the concept of this review and how measured (i.e. oral health measures)
* Outcome variables relevant to the concept of this review and how measured (i.e. methods to assess risk of sarcopenia and dietary protein intake).
* Duration of the study
* Key findings that relate to the topic (PCC).

Search Results will be displayed in a PRISMA flow diagram for scoping reviews.

Charting of the articles will be trialled by one reviewer for approximately 10% of the identified studies. A Microsoft Excel form for charting results will be modified accordingly to include relevant data across all articles. The results of included sources of evidence in relation to the review topic and in the context of the overall aim of the review will be described in a narrative.

References

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APPENDIX

**PubMed Logic Grid**

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| --- | --- | --- |
| **Oral Function** | **Sarcopenia** | **Dietary protein – Diet** |
| "Eating" [mh:noexp] OR "mastication" [mh] OR "Oral Health" [mh]  "Prosthodontics" [mh:noexp] OR "Dentures" [mh] OR  "Bite force" [mh] OR "Deglutition" [mh] OR "Mouth, Edentulous" [mh] OR "Tooth loss" [mh] OR "Xerostomia" [mh] OR  Masticat\* [tiab] OR Chewing [tiab] OR Eating [tiab] OR Oral Health [tiab] OR Oral function [tiab] OR Oral Condition [tiab] OR Dental health [tiab] OR Prosthodontics [tiab] OR Dentures [tiab] OR Masticatory force [tiab] OR Bite force [tiab] OR Occlusal force [tiab] OR Swallowing [tiab] OR Tongue pressure [tiab] OR Deglutition [tiab] OR Tooth loss [tiab] OR Edentulous [tiab] OR Dry mouth [tiab] OR Mouth dryness [tiab] OR Xerostomia [tiab] | "Muscular atrophy" [mh] OR "Frailty" [mh] OR "Muscle weakness" [mh] OR "Hand strength" [mh] OR "Walking speed" [mh] OR  Sarcopenia\* [tiab] OR Muscular atrophy [tiab] OR Muscular mass [tiab] OR Frailty [tiab] OR Hand grip strength [tiab] OR Walking speed [tiab] | "Dietary proteins" [mh] OR "Diet, Food, and Nutrition" [mh] OR "Malnutrition" [mh] OR  protein\* [tiab] OR diet\* [tiab] OR food intake [tiab] OR nutritional deficiencies [tiab] OR Nutrition [tiab] |

**Embase converted to Ovid syntax**

|  |  |  |
| --- | --- | --- |
| **Oral Function** | **Sarcopenia** | **Dietary protein – Diet** |
| Exp 'Eating' OR Exp 'mastication' OR Exp 'Dental Health' OR  Exp 'Prosthodontics' OR Exp 'Denture' OR Exp 'Swallowing' OR Exp 'Edentulousness' OR Exp 'Xerostomia' OR Chewing.ti,ab OR Eating.ti,ab OR 'Oral Health'.ti,ab OR 'Oral function'.ti,ab OR 'Oral Condition'.ti,ab OR 'Dental health'.ti,ab OR Prosthodontics.ti,ab OR 'Dental prosthetics'.ti,ab OR 'prosthetic dentistry'.ti,ab OR 'prostho-dontics'.ti,ab OR 'prosthodontic dentistry'.ti,ab OR Dentures.ti,ab OR 'Masticatory force'.ti,ab OR 'Bite force'.ti,ab OR 'Occlusal force'.ti,ab OR Masticat\*.ti,ab OR Swallowing.ti,ab OR 'Tongue pressure'.ti,ab OR Deglutition.ti,ab OR 'Tooth loss'.ti,ab OR 'Dental Loss'.ti,ab OR 'Tooth mobility'.ti,ab OR Edentulous\*.ti,ab OR 'Dry mouth'.ti,ab OR 'Mouth dryness'.ti,ab OR Xerostomia.ti,ab OR 'Oral Dryness'.ti,ab | Exp 'sarcopenia' OR Exp 'frailty' OR Exp 'Frail elderly' OR 'Muscle weakness' OR 'hand strength' OR 'Grip strength' OR Exp 'Walking speed' OR sarcopenia\*.ti,ab OR 'muscular atrophy'.ti,ab OR 'muscle strength loss'.ti,ab OR 'muscle weakening'.ti,ab OR 'muscular insufficiency'.ti,ab OR 'muscular weakness'.ti,ab OR 'weakness, muscle'.ti,ab OR frailty.ti,ab OR 'handgrip strength'.ti,ab OR 'hand strength'.ti,ab OR 'grip strength'.ti,ab OR 'grip power'.ti,ab OR 'gripping force'.ti,ab OR 'grasping strength'.ti,ab OR 'grasp force'.ti,ab OR 'walking speed'.ti,ab OR 'gait speed'.ti,ab | Exp 'Protein intake' OR Nutrition OR 'Geriatric nutrition' OR Malnutrition OR 'protein deficiency' OR 'protein calorie malnutrition' OR protein\*.ti,ab OR diet\*.ti,ab OR 'food intake'.ti,ab OR 'nutritional deficiencies'.ti,ab OR Nutrition.ti,ab OR 'food protein'.ti,ab OR 'protein nutrition'.ti,ab OR 'diet protein'.ti,ab OR 'animal proteins, dietary'.ti,ab OR 'dietary animal proteins'.ti,ab OR 'dietary protein\*'.ti,ab OR 'intake, protein'.ti,ab OR 'protein consumption'.ti,ab OR 'dietary intake'.ti,ab OR 'geriatric nutrition'.ti,ab OR 'diet, food and nutrition'.ti,ab OR malnutrition.ti,ab OR 'protein deficiency'.ti,ab |

**CINAHL**

|  |  |  |
| --- | --- | --- |
| **Oral Function** | **Sarcopenia** | **Dietary protein – Diet** |
| MH "Eating" OR MH "Eating behaviour" OR MH "Food intake+" OR MH "mastication" OR MH "bite force" OR MH "Oral Health+" OR MH "Prosthodontics" OR MH "Dentures+" OR MH "Deglutition" OR MH "Mouth, edentulous+" OR MH "Tooth loss" OR MH "Xerostomia+" OR TI Chewing OR AB Chewing OR TI Eating OR AB Eating OR TI "Eating behaviour" OR AB "Eating behaviour" OR TI "Food preferences" OR AB "Food preferences" OR TI "Food intake" OR AB "Food intake" OR TI "Oral Health" OR AB "Oral health" OR TI "Oral function" OR AB "Oral function" OR TI "Oral Condition" OR AB "Oral condition" OR TI "Dental health" OR AB "Dental health" OR TI "Prosthodontics" OR AB "Prosthodontics" OR TI Dentures OR AB Dentures OR TI "Masticatory force" OR AB "Masticatory force" OR TI "Bite force" OR AB "Bite force" OR TI "Occlusal force" OR AB "Occlusal force" OR TI Masticat\* OR AB Masticat\* OR TI Swallowing OR AB Swallowing OR TI "Tongue pressure" OR AB "Tongue pressure" OR TI Deglutition OR AB Deglutition OR TI "Tooth loss" OR AB "Tooth loss" OR TI Edentulous\* OR AB Edentulous\* OR TI "Dry mouth" OR AB "Dry mouth" OR TI "Mouth dryness" OR AB “Mouth dryness" OR TI Xerostomia OR AB Xerostomia | MH "Muscular atrophy" OR MH "Sarcopenia\*" OR MH "Frailty Syndrome" OR MH "Muscle weakness" OR MH "Grip strength" OR MH "Walking speed" OR  TI Sarcopenia\* OR AB Sarcopenia OR TI Muscular atrophy OR AB Muscular atrophy OR TI Muscular mass OR AB Muscular mass OR TI Frailty OR AB Frailty OR TI "Hand grip strength" OR AB "Hand grip strength" OR TI "Walking speed" OR AB "Walking speed" | MH "Dietary proteins" OR MH "Diet\*" OR MH "Nutritive value" OR MH "Diet, High protein" OR MH "Malnutrition" OR MH "Protein-energy malnutrition" OR MH "Protein deficiency" OR TI protein\* OR AB protein\* OR TI diet\* OR AB diet\* OR TI food intake OR AB food intake OR TI "nutritional deficiencies" OR AB "nutritional deficiencies" OR TI Nutrition OR AB Nutrition OR TI "Dietary proteins" OR AB "Dietary proteins" |

**Scopus**

|  |  |  |
| --- | --- | --- |
| **Oral Function** | **Sarcopenia** | **Dietary protein – Diet** |
| "Eating" OR "Eating behaviour" OR "Food intake" OR "Mastication" OR "Bite force" OR "Oral Health" OR "Prosthodontics" OR "Dentures" OR "Deglutition" OR "Mouth, edentulous+" OR "Tooth loss" OR "Xerostomia" OR "Chewing" OR "Eating behaviour" OR "Food preferences" OR "Food intake" OR "Oral function" OR "Oral Condition" OR "Dental health" OR "Masticatory force" OR "Bite force" OR "Occlusal force" OR "Masticat\*" OR "Tongue pressure" OR "Edentulous\*" OR "Dry mouth" OR "Mouth dryness" | "Muscular atrophy" OR "Sarcopenia\*" OR "Frailty Syndrome" OR "Muscle weakness" OR "Grip strength" OR "Walking speed" OR  "Muscular mass" OR "Frailty" OR "Hand grip strength" OR "Walking speed" | "Dietary proteins" OR "Diet\*" OR "Nutritive value" OR "Diet, High protein" OR "Malnutrition" OR "Protein-energy malnutrition" OR "Protein deficiency" OR "protein\*" OR "food intake" OR "nutritional deficiencies" OR "Nutrition" OR "Dietary proteins" |