

BMJ Open Dynapaenic obesity and its association with health outcomes in older adult populations: protocol for a systematic review

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ABSTRACT

Introduction Two major global health challenges are the rapidly ageing population and the high prevalence of obesity in all age groups. Older adults are also susceptible to age-related loss of muscle strength, termed dynapaenia. The co-occurrence of both obesity and dynapaenia, termed dynapaenic obesity (DO), has been associated with poorer health outcomes and increased healthcare usage compared with either state alone. The purpose of this systematic review is to quantify the prevalence and incidence of DO in older adult populations, and to explore the association between DO and health outcomes, specifically chronic disease and multimorbidity, functional disability and healthcare usage.

Methods and analysis Using the Meta-analyses Of Observational Studies in Epidemiology guidelines, we will conduct a systematic review of cross-sectional and longitudinal observational studies of older adults, which include measures of DO and specified outcomes. Detailed literature searches will be conducted using six electronic databases: Excerpta Medica dataBASE (EMBASE), PubMed, MEDLINE, SCOPUS, ScienceDirect and Cumulative Index of Nursing and Allied Health Complete (CINAHL), including articles published from database inception until February 2019. The reference lists of included articles will also be searched. Two independent reviewers will undertake a three-step screening and review process using the Population, Risk Factor, Outcome framework to define eligibility. The Newcastle Ottawa Scale for non-randomised studies will be used to assess risk of bias and to rate study quality. The findings will be synthesised in a narrative summary, and a meta-analysis will be conducted where appropriate.

Ethics and dissemination Ethical approval is not required for this systematic review. Findings from this research will be submitted for peer-reviewed publication in academic journals, and presented at relevant academic conferences.

PROSPERO registration number CRD42018112471.

INTRODUCTION Background

Two major societal challenges at a global level are the rapidly ageing population and the

Strengths and limitations of this study

- This is the first systematic review to investigate the frequency of dynapaenic obesity (DO) and associated health outcomes in older adult populations.
- This review will benefit from a comprehensive search of six electronic health and biomedical databases using an extensive search strategy.
- We expect heterogeneity between studies in terms of both the criteria for classification of DO and the reporting of health outcomes, which may lead to difficulties in conducting a meta-analysis.
- Results of this review will help to establish if DO is a significant risk factor for poor health outcomes in older adults, and may contribute to the design of future interventions to target those most at risk of this phenotype and its negative effects.

continual rise in obesity prevalence in people of all ages.^{1 2} The double burden of ageing and obesity therefore potentially represents a looming health sector crisis, whereby a greater number of older adults are living with multimorbidity³ and disability, much of which is related to modifiable risk factors such as obesity.

Evidence regarding the effect of obesity on morbidity and mortality in older populations is conflicting. While obesity is a recognised risk factor for chronic diseases such as cardiovascular disease, diabetes and some cancers,² a number of studies have suggested that excess weight may be protective against adverse outcomes in many chronic conditions. This phenomenon is referred to as the 'obesity paradox'⁴ and is based on the use of body mass index (BMI) to measure obesity. BMI is an imperfect measure in older adults as weight stability, or even weight loss, may mask an increase in fat mass and the redistribution of fat to the abdominal area.⁵ This central or visceral accumulation of fat mass

is more strongly associated with cardiometabolic disease than fat deposited at peripheral sites.⁶ Waist circumference (WC) measures, or a combination of WC and BMI, may therefore be a more useful measure of body composition in older adult populations.

In addition to changes in fat mass and its distribution, ageing is associated with a gradual decline in muscle mass, termed sarcopaenia and muscle strength, termed dynapaenia.⁷ Measures of sarcopaenia and dynapaenia are increasingly being investigated as predictors of functional decline and health outcomes in studies of older adults.⁸ However, as with the measurement of fat mass, it is difficult to directly measure sarcopaenia in large samples or routine clinical settings. Conversely, dynapaenia can be readily measured using grip dynamometry which is low cost, and commonly available in clinical settings. Dynapaenia is a component of the frailty syndrome,⁹ and obesity, measured by both BMI and WC has been associated with frailty in older adult populations.¹⁰ The co-occurrence of obesity and dynapaenia is termed 'dynapaenic obesity' (DO)¹¹; the co-occurrence of dynapaenia and central or abdominal obesity (measured using WC) is termed 'dynapaenic abdominal obesity' (DAO).¹² While both conditions can occur independently as a natural part of the ageing process, it has been hypothesised that obesity and muscle impairment (in this case decreased muscle strength) may be pathophysiologically connected. Specific mechanisms through which obesity may exacerbate the process of dynapaenia include decreased physical activity, chronic low-grade inflammation, insulin resistance, hormonal changes and malnutrition,¹³ which may also predispose older adults to specific health impairments. A recent study on an older Italian cohort demonstrated an association between DAO and worsening disability and increased risk of hospitalisation,¹⁴ while Batsis *et al*¹⁵ found DO to predict disability, functional decline and poorer quality of life in a study of US adults aged 45–79 years. Associations with type 2 diabetes prevalence¹⁶ and incidence,¹⁷ decreased bone mineral density¹⁸ and mortality¹² have also been shown. The increased activity in this area of research in recent years necessitates the conduct of a systematic review and meta-analysis to determine (1) the frequency of DO in older adults and (2) the totality of evidence exploring a link between DO and health outcomes in this population.

Objectives

The purpose of this systematic review is to (1) quantify the prevalence and incidence of DO in older adult populations and (2) explore the association between DO and health outcomes, specifically (a) chronic disease and multimorbidity, (b) functional disability and (c) healthcare usage.

METHODOLOGY

This protocol has been prepared following the Preferred Reporting Items for Systematic review and Meta-Analysis

Protocols 2015 checklist¹⁹ (online supplementary file 1), and has been registered with the international prospective register of systematic reviews (PROSPERO) database. Any protocol amendments will be declared in PROSPERO as they occur. The proposed systematic review and meta-analysis will be carried out according to Meta-analyses Of Observational Studies in Epidemiology guidelines.²⁰

Eligibility criteria

We will include observational studies of older adult populations using either cross-sectional or longitudinal (prospective or retrospective) designs. The Population, Risk factor, Outcome framework has been employed to define eligibility criteria as outlined below.

Population

Our target study population is adults aged 50 years and older.

Risk factor

The risk factor or exposure of interest for this review is DO or DAO). Studies with objective measures of obesity (classified according to BMI and/or WC) and muscle strength (measured by hand grip or knee dynamometry) will be included.

Outcome

Prevalence and/or incidence of DO/DAO will be recorded as a percentage (%) with 95% CI. Further outcomes of interest are the association between:

DO/DAO and chronic disease

Chronic disease will be defined as the presence of doctor diagnosed, long term health conditions. Several definitions of comorbidity and multimorbidity exist in the literature and all will be considered for inclusion in this review.

DO/DAO and functional disability

Studies which use a validated measure of disability, such as walking speed, the 36-item short-form health survey,²¹ the Katz activities of daily living ability scale²² or Lawton Instrumental Activities of Daily Living,²³ will be included in the review.

DO/DAO and healthcare usage

Specific indicators of healthcare usage will include general practitioner or family physician visits, outpatient and emergency department visits and hospital admissions.

Search strategy

A detailed literature search will be conducted in six electronic databases; Excerpta Medica dataBASE (EMBASE), PubMed, MEDLINE, SCOPUS, ScienceDirect and Cumulative Index of Nursing and Allied Health Complete. Grey literature including conference proceedings and institutional repositories will also be searched. The reference lists of included articles will be hand searched. Medical Subject Headings and synonyms relating to the study

objectives will be used to target our search. Searches will be restricted to studies published in the English language using human subjects only. Articles published from database inception until February 2019 will be included in the review. A preliminary EMBASE search strategy has been developed in conjunction with the University of Limerick Faculty of Education and Health Sciences librarian and is detailed in online supplementary file 2. This strategy will be adapted and refined for each of the remaining databases.

Data extraction

A detailed record of all search strategies and results will be maintained to ensure reproducibility of the review. All results will be imported into the Rayyan citation management software,²⁴ where duplicate citations will be screened and removed. A three stage reviewing process will be employed. Two reviewers (SL and RG) will screen all retrieved titles against the stated eligibility criteria. Following this, both reviewers (SL and RG) will independently screen all selected abstracts. SL and RG will then independently review the full text of included articles. A third reviewer (MC) will adjudicate on disagreements at all stages of the review process.

The following information will be extracted from included articles using a proforma template:

Study characteristics:

- ▶ Study design.
- ▶ Study location and setting.
- ▶ Sample size.
- ▶ Inclusion and exclusion criteria.
- ▶ Definition of risk factor/exposure, that is, whether DO or DAO was measured and what measurement tools were used.
- ▶ Definition of outcome measures.

Population characteristics:

- ▶ Age.
- ▶ Sex.
- ▶ Ethnicity.
- ▶ Prevalence/incidence of DO/DAO.
- ▶ Outcomes (association with disease/disability/healthcare usage).

Assessing study quality

The Newcastle Ottawa Scale for quality assessment of non-randomised studies²⁵ will be used independently by two reviewers (SL and RG) to assess risk of bias and to rate study quality. Disagreements will be adjudicated by a third reviewer (MC).

Data synthesis

Initial analysis will extract data on prevalence and/or incidence of DO/DAO from the included studies. Studies will then be grouped according to the three outcomes of interest: (1) association with chronic disease burden, (2) association with functional disability and (3) association with indicators of healthcare usage. These groupings may not be mutually exclusive.

A narrative synthesis will be conducted to summarise the characteristics of the included studies. If possible, a random effects meta-analysis of included studies will be carried out in consultation with a statistician. Outcomes will be recorded as crude or adjusted risk ratio or crude or adjusted OR with 95% CI, depending on the study type. Variables used to derive adjusted estimates will be recorded where relevant. In cases where CIs are not provided, variance estimates will be derived from p values as per standard methods.²⁶ Data will be pooled using Review Manager V.5.2, developed by the Cochrane Collaboration.²⁷ Forest plots will be generated and the pooled estimates of effect will be suppressed as required. Publication bias (eg, Kendall's tau) and heterogeneity (eg, the I² statistic) will also be examined. Subgroup analysis by sex, age group (eg, 50–64 years, 65 years+), DO definition (DO, DAO) and study design will be performed where possible. Finally, a sensitivity check will be conducted to determine the consistency and robustness of the findings based on the methodological quality of the included studies.

The Grading of Recommendations, Assessment, Development and Evaluation guideline will be used to assess the strength of the body of evidence, as recommended by the Cochrane Handbook.²⁸

Ethics and dissemination

This review constitutes secondary analysis of existing data and does not require ethical approval. The findings of this research will be submitted for peer-reviewed publication in academic journals, and presented at relevant seminars and conferences and through traditional and social media channels.

Patient and public involvement

Patients and public will not be involved in this study. The research questions addressed in this review arose from clinical observations of older adults. We anticipate that the findings of this review (which represents Phase I of the Medical Research Council framework for developing and evaluating complex interventions²⁹) will aid in the design of a pilot intervention to address the older population at risk of DO and associated adverse health outcomes. These subsequent phases will have a strong patient and public involvement (PPI) component.

DISCUSSION/CONCLUSION

This systematic review will synthesise existing evidence to quantify the prevalence and incidence of DO and associated health outcomes in older adult populations. This will help to establish if DO/DAO is a significant risk factor for poor health outcomes in older adults, and may contribute to the design of future primary care interventions to target those most at risk of this phenotype and its negative effects.

There are a number of potential strengths and limitations to the planned review that will be considered when

discussing the findings. Heterogeneity between studies, in terms of methodologies and outcome measures used, may limit our ability to conduct a meta-analysis or to draw reliable conclusions from the available evidence. Restricting included articles to the English language is also a potential limitation. The use of observational studies is a strength of our review as there is likely to be large sample sizes more likely to be representative of the overall population, aiding generalisability of the results. Our adherence to established guidelines for the conduct of systematic reviews and critical appraisal will also ensure the quality of the final review.

To the best of our knowledge, no reviews have been previously published exploring this research question. Should a relevant review be published during the preparation of our review, it will be incorporated into our review and meta-analysis if feasible.

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