

Original Article

The Epidemiology of Sarcopenia

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Abstract

The aim of this review is to describe the epidemiology of sarcopenia, specifically prevalence, health outcomes, and factors across the life course that have been linked to its development. Sarcopenia definitions involve a range of measures (muscle mass, strength, and physical performance), which tend to decline with age, and hence sarcopenia becomes increasingly prevalent with age. Less is known about prevalence in older people in hospital and care homes, although it is likely to be higher than in community settings. The range of measures used, and the cutpoints suggested for each, presents a challenge for comparing prevalence estimates between studies. The importance of sarcopenia is highlighted by the range of adverse health outcomes that strength and physical performance (and to a lesser extent, muscle mass) have been linked to. This is shown most strikingly by the finding of increased all-cause mortality rates among those with weaker grip strength and slower gait speed. A life course approach broadens the window for our understanding of the etiology of sarcopenia and hence the potential intervention. An example is physical activity, with increased levels across midadulthood appearing to increase muscle mass and strength in early old age. Epidemiologic studies will continue to make an important contribution to our understanding of sarcopenia and possible avenues for intervention and prevention.

Key Words: Sarcopenia; Epidemiology; Muscle strength; Physical performance.

Introduction

The term sarcopenia was initially used to describe the loss of muscle mass with age, and more recent definitions have come to incorporate the loss of muscle strength and physical performance (1). Its importance is highlighted by findings such as those of middle and older ages with weaker grip strength have, on average, shorter survival times than stronger individuals (2). There are a wealth of epidemiologic studies

that have investigated risk factors for, and consequences of, low muscle mass, strength, and physical performance. The aim of this article is to describe the epidemiology of sarcopenia, both in terms of individual measures and the more recently developed diagnostic criteria. We begin by considering the prevalence of sarcopenia.

Prevalence

This section aims to address the questions: how common is sarcopenia, and how does its prevalence vary with age and setting? To do this, we draw on results from studies of components of sarcopenia: muscle mass, muscle strength, and physical performance, as well as studies combining these measures using the European Working Group on Sarcopenia in Older People (EWGSOP) definition.

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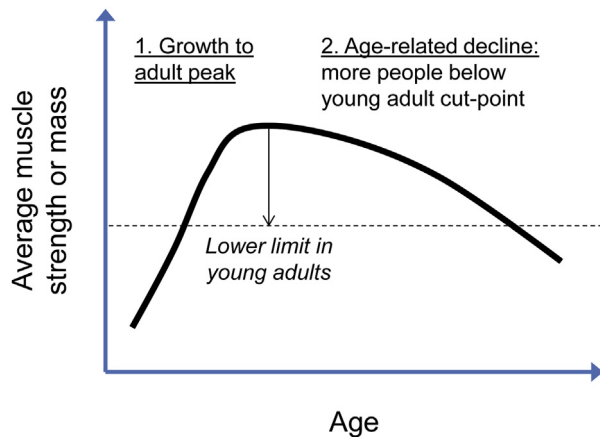


Fig. 1. A life course approach to sarcopenia. On average, peak muscle mass and strength are reached in early adult life before decline. The dashed line shows the use of the normal range encountered in young adult life (analogous to the T-score approach in osteoporosis) to produce cut points for low muscle mass or strength. The prevalence below this cut point inevitably rises with age, as average mass or strength declines.

Cut points have been proposed for what constitutes pathologically low values for these measures. These cut points have been derived in 2 ways: first approach by considering the normal range encountered at the peak of function in young adult life. This is analogous to the T-score approach used for measurements of bone density in the diagnosis of osteoporosis in women and is illustrated in Fig. 1. The second approach has been to select cut points based on the optimum balance of sensitivity and specificity for predicting a relevant outcome, such as mobility disability. As the population average value for a given measure declines with age, the proportion of individuals below a given cut point increases (also illustrated in Fig. 1). So as one would expect, the prevalence of sarcopenia increases with age.

Muscle Mass

To estimate the prevalence of low muscle mass, sufficiently large samples of the general population are required. Techniques for assessing muscle mass in such settings include anthropometry, bioelectrical impedance (BIA), and dual-energy X-ray absorptiometry (DXA). Anthropometric measures may be prone to error in older people (1). BIA produces estimates of total fat mass and nonfat mass and has the advantage over DXA that the equipment used is portable. However, it has been questioned to what extent BIA provides additional information beyond that from anthropometric measurements. DXA is able to divide total body mass into estimates of fat mass, bone mass, and lean mass (which includes muscle tissue and solid organs). DXA has the advantage that its estimates can be restricted to an area of the body, such as the arms and legs and hence avoid measuring the lean mass of

the solid organs. This section now focuses on estimates of the prevalence of low muscle mass from DXA scans.

Cut points for DXA have typically come from young adult values, specifically 2 standard deviations below the sex-specific young adult mean appendicular lean mass (ALM) divided by height squared. Example of cut points are 7.23 kg/m² in males and 5.67 kg/m² in females. Applying these cut points to older populations gives estimates of prevalence such as of 20% of those aged 70–79 and 30% of those aged older than 80 yr.

More recently, the Foundation for the National Institutes of Health Sarcopenia Project have proposed cut points for ALM from DXA based on its relationship with weak grip strength at ages 65 and older. Specifically, ratios of ALM to body mass index of below 0.789 in men and 0.512 in women were found to provide the optimum balance of sensitivity and specificity for the detection of weak grip strength. The prevalence in their sample below these cut points was 20% of men and 16% of women.

Muscle Strength

Several measures exist for the measurement of muscle strength. Grip strength has been recommended as the most practical method of measuring muscle strength in the clinical setting (1) and has been found to correlate physical performance measures in the lower limbs. Data from the Invecchiare in Chianti study have been used to produce grip strength cut points of 2 standard deviations below a gender-specific young adult mean, showing a high prevalence of weak grip at age 65–74: around 60% of men and 40% of women fell below cut points of approx 40 and 18 kg, respectively. In the same study, the receiver operating characteristic method was used to identify optimal cut points for the detection of slow gait speed in older people of 30 kg in men and 19 kg in women, although the prevalence of those at or below these values was not stated.

The Foundation for the National Institutes of Health Sarcopenia Project found that cut points of 26 kg in men and 16 kg in women best identified individuals with mobility disability (assessed using slow gait speed) at ages 65 and older (3). The prevalence below these cut points in their community-dwelling sample was 5% of men and 18% of women. Mean grip values for hospitalized older patients admitted for rehabilitation and nursing home residents suggest that most individuals in these groups fall below the cut points described in this section (4).

Physical Performance

The most commonly described measure of physical performance in the assessment of sarcopenia is gait speed. Other measures include standing balance and chair rise times, which can be combined with gait speed in the form of the Short Physical Performance Battery, the results of which are predictive of aging outcomes. However, there is also evidence that gait speed alone may have similar predictive power to the complete battery of tests.

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