

Sarcopenia of Ageing: Does a Healthier Lifestyle Matter in Reversing the Trajectory? A Brief Narrative Review and a Call for Action in Saudi Arabia

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Abstract

The concept of health span is an emerging topic in recent years, with a truly palpable relevance to public health. With ageing comes a loss of skeletal muscle mass, strength, and performance, which is termed as sarcopenia. Sarcopenia is a major public health concern and poses a challenge to health-care systems. Modifiable lifestyle factors may be linked to the course of sarcopenia progression. Many countries developed diagnostic tools to accurately detect sarcopenia for its prevention, delay, or treatment. However, to date, there is no sufficient information regarding the status of sarcopenia in Saudi Arabia. The review aims to discuss sarcopenia and relevant updates in research and literature, the association with modifiable lifestyle factors, the implications of sarcopenia in a rapidly developing country such as Saudi Arabia, and the current state and need for research in Saudi Arabia in this domain along with future directions in combating this disease.

Keywords: Ageing, exercise, lifestyle, nutrition, muscular atrophy, prevention, Saudi Arabia, sarcopenia, treatment

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INTRODUCTION

Over the past century, the concept of quality of life has gained importance, as human health studies have shifted focus from extending lifespan (number of years lived) to extending the health span (the amount of time spent in a state of functional independence and freedom from major diseases).^[1] Saudi Arabia developed an ambitious Vision 2030 to ensure a thriving and progressive future for the country.^[2] The three noteworthy goals for Saudi Arabia's Vision 2030 are: 1) Increasing the average life expectancy from 74 years to 80 years, 2) Increasing participation

in physical activities and sports, and 3) Strengthening prevention against health threats.^[3]

A critical component to sustaining health span is preserving lean muscle mass and strength throughout the life, as skeletal muscles play an important role in maintaining cardio-metabolic health and functional capacity.^[4] Maintaining human skeletal muscle mass depends on the dynamic balance between muscle protein synthesis (MPS) and muscle protein breakdown (MPB).^[5] When MPS exceeds MPB (primarily through sufficient

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protein intake and physical exercise training) as a part of healthy lifestyle behaviors,^[6] progressive accretion of muscle mass (hypertrophy) will ensue. On the other hand, when MPB exceeds MPS over time in different scenarios such as disease, injury, or inactivity, muscle mass declines and as a result skeletal muscle wasting (or atrophy) develops [Figure 1].^[5]

In 2015, Prince *et al.*^[7] reported that musculoskeletal disease was the fourth leading contributor to disability in the older population, even surpassing neurological and mental diseases. It is well recognized that the musculoskeletal system undergoes an age-related loss in muscle mass and anabolic resistance (reduced MPS) that leads—among other factors^[8]—to a muscle disorder termed as a sarcopenia.^[9,10] Sarcopenia is the term used to indicate age-related progressive and generalized loss of muscle mass, strength, and/or functional capacity.^[11] Current estimates indicate that 50 million people worldwide suffer from sarcopenia, and the number will rise to 500 million by 2050.^[12] A recent systematic review and meta-analysis that included 41 studies with a total of 34,955 participants showed that the prevalence of sarcopenia globally in community-dwelling individuals was 11% in men and 9% in women. The prevalence was higher in nursing-home individuals, reaching 51% in men and 31% in women and in hospitalized individuals it was 23% in men and 24% in women.^[13] In Saudi Arabia, few studies have been conducted to assess the prevalence of sarcopenia among Saudis; however, they were based on subjective assessment^[14,15] or on the Asian Working Group for Sarcopenia (AWGS) criteria (not based on reference values for Saudis).^[16]

Sarcopenia has a considerable impact on the health-care system. In the United States, the total annual cost of hospitalization in 2019 for individuals with sarcopenia was US\$40.4 billion with an average per person cost of

US\$260.^[17] Nevertheless, reducing the prevalence of sarcopenia by 10% would account for over \$1 billion in savings per year.^[18] Although sarcopenia is becoming a public health issue, especially with increasing population age, limited research has been conducted on sarcopenia in Saudi Arabia,^[16,19,20] which will directly impact >1 million Saudis aged ≥65 years.^[21] In addition, some of these studies either did not use sufficient samples or included only young males from some specific region of the country or were not based on reference values from the same population. Furthermore, to date, there is no consensus on the associated risk factors for sarcopenia.

This present narrative review aims to present a brief literature review on sarcopenia, its associated comorbidities, and the impact of lifestyle behaviors on sarcopenia development and prevention. This review also discusses the implications of sarcopenia in a rapidly developing country such as Saudi Arabia and present a reference to the current state and need for research in this domain and future direction in combating this muscular disorder.

For this review, the authors searched PubMed, Scopus, and Web of Science using relevant keywords such as “sarcopenia,” “ageing,” “healthy lifestyle,” “exercise,” and “nutrition”. Only papers published in English and including humans to address the effects of lifestyle interventions on sarcopenia until February 2023 were included.

DEFINITION AND CORRELATES OF SARCOPENIA

Sarcopenia is a condition characterized by a progressive loss of skeletal muscle mass and function as well as loss of muscle strength.^[22] In 2016, sarcopenia was officially recognized as an independent disease entity by an International Classification of Disease, tenth revision,^[23] defined as the progressive and generalized loss of muscle strength, mass, and/or functional capacity.^[11] The revised European

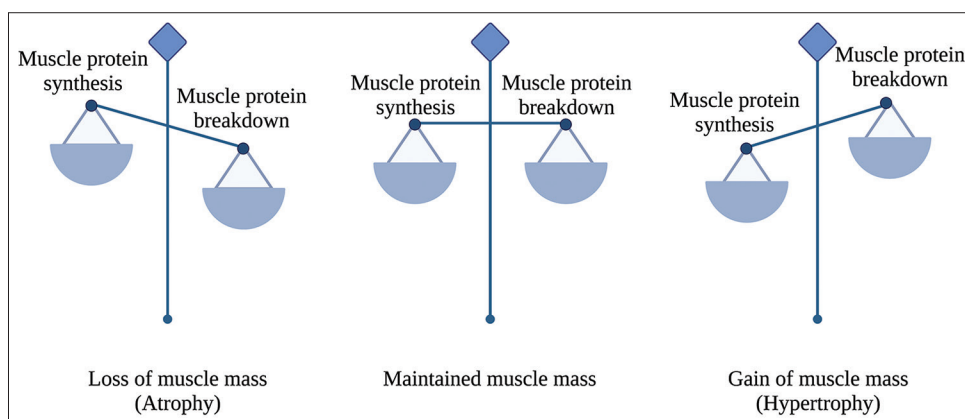


Figure 1: Muscle synthesis and Breakdown Mechanisms

consensus on definition and diagnosis of sarcopenia considers a low muscle strength as a key characteristic of sarcopenia.^[11] The major risk factors related to sarcopenia include older age, gender, and reduced level of physical activity. Sarcopenia was found to be significantly associated with an increased risk of falls, fractures, functional disability, cognitive impairment, reduced quality of life, and increased likelihood of premature mortality.^[24-26] Muscle mass is lost by approximately 1% per year beginning around the age of 50 years in individuals with sarcopenia, equating to about 10% loss per decade up to the age of 70 years, and thereafter increasing to 15% per decade.^[27,28] Therefore, to decrease the effect of this physiological change, muscle mass should be increased in young age, maintained in middle age, and measure should be undertaken to decrease loss in old age.^[29]

The prevalence of sarcopenia was found to be increasing globally especially in the last decades, due to the marked changes in the socio-demographic and epidemiological profile of populations.^[30] Several guidelines have been published to detect, diagnose, and manage sarcopenia, including the European Working Group on Sarcopenia in Older People (EWGOSP)^[11] and AWGS.^[31] However, cut-off points to detect and diagnose sarcopenia depend on the techniques used and the availability of reference studies from the same population. It is recommended that normative references for a population are based on the values of healthy young adults to accurately diagnose sarcopenia due to variation of hereditary, ethnicity, and body size.^[11,32] For example, hand grip strength is used as an assessment tool to diagnose sarcopenia;^[11] hand grip strength values are known to vary among individuals from different geographic regions. Values for hand grip strength are highest among populations from Europe/North America, and lowest among those from South Asia, Southeast Asia, and Africa. Individuals from China, South America, and the Middle East are in the middle of this spectrum.^[33] Concurrently, muscle function, measured as grip strength, in developing countries may be substantially lower than that in developed countries,^[34] and ethnic variations in muscle strength are apparent.^[33]

Therefore, other international criteria for sarcopenia detection and diagnosis may not apply to Saudi individuals, indicating the importance of region-specific reference values. Currently, there are only reference values for healthy Saudi young men^[19]—although this was not based on the current the EWGOSP definition of sarcopenia and without establishing physical performance (functional) cut-off points. Moreover, no cut-off points related to muscle mass and muscle function (strength and physical performance)

are available in young Saudi females. This is exceedingly important, knowing that Saudi females were shown to have a low physical activity level.^[35,36]

SARCOPENIA, FRAILITY, AND OSTEOPOROSIS

According to the “muscle-bone unit” theory for sarcopenia, muscle, bone, and general frailty interact intricately as people age. Sarcopenia and frailty frequently coexist, which worsens sarcopenia’s effects on general health and wellbeing. When referring to sarcopenia, the term “frailty” describes a condition of heightened vulnerability and diminished physiological reserves brought on by age-related muscle loss and weakness. It is characterized by decreased muscle functionality, strength, and endurance, which increases the likelihood of negative health consequences, disability, and dependency on others for daily tasks. On the other hand, osteoporosis, a disorder characterized by low bone mineral density and increased fracture risk, is strongly related to sarcopenia, which refers to the progressive loss of muscle mass, strength, and function. According to this view, osteoporosis develops as a result of a reduction in muscle mass and function and both diseases together cause frailty in elderly people.^[37]

There are a number of theories put forth to explain how sarcopenia, osteoporosis, and frailty are related. Sarcopenia patients lose muscle mass and strength, which reduces the mechanical pressure on their bones, lowers bone density and increases fracture vulnerability. Furthermore, the interaction between muscles and bones is influenced by hormonal changes brought on by ageing. For example, a decline in growth hormone, insulin-like growth factor 1, and sex hormones (such as estrogen and testosterone) is associated with a loss of muscle and bone mass. These hormonal abnormalities can hasten the development of osteoporosis and sarcopenia, which ultimately results in frailty.^[38]

ROLE OF LIFESTYLE BEHAVIORS ON SARCOPENIA DEVELOPMENT

Sarcopenia can be classified as primary or secondary, according to EWGOSP. When sarcopenia is just brought on by ageing, it is categorized as primary, and when it is also brought on by systemic diseases (such as cancer or organ failure) or risky lifestyle choices, it is categorized as secondary [Figure 2].^[39]

A number of lifestyle factors impact the progression and severity of sarcopenia. Two important factors are physical activity (or lack thereof) and diet.^[40-42] With age, physical activity often progressively declines: only 2.4% of adults aged ≥ 60

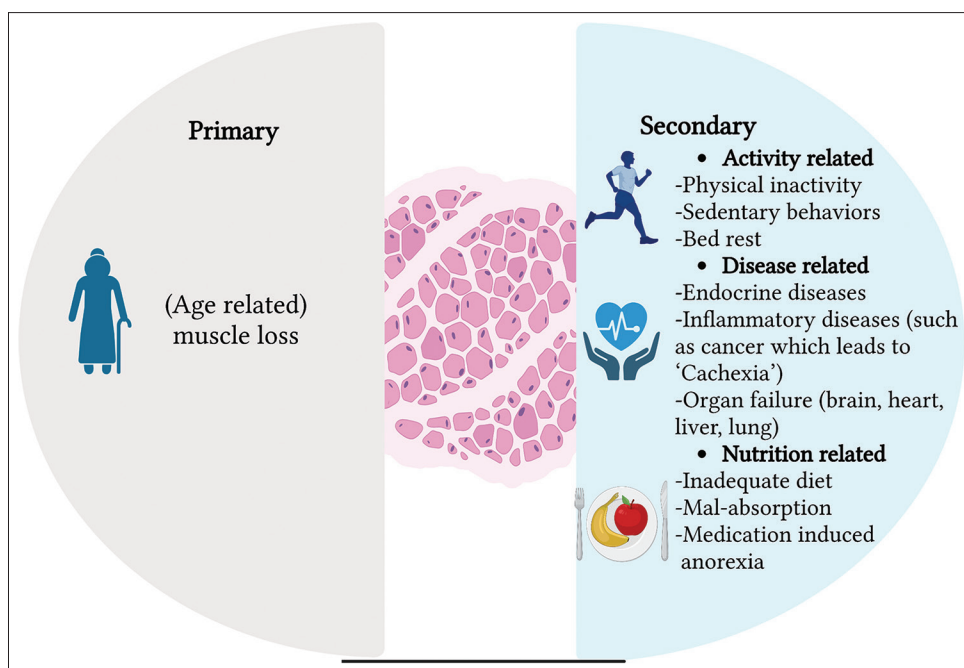


Figure 2: Primary and Secondary factors responsible for Muscle Loss

meet public health recommendations for sufficient physical activity.^[43] Inactive lifestyle is responsible for muscle weakness, which results in further reduction of physical activity levels and loss of muscle mass and strength.^[44] In Saudi Arabia, a cross-sectional study conducted on 363 males (Saudis and non-Saudis) to examine the association between physical activity patterns and sarcopenia in Arabs using the EWGOSP2 cut-off values found a significant difference between participants with and without sarcopenia in moderate-to-vigorous physical activity ($P < 0.039$).^[45]

Balanced nutrition is vital for maintaining optimal health; inadequate diet infers inadequate consumption of one or more of the five main food groups (fruits, vegetables, protein, grains, and dairy products). Poor nutrition is an essential factor in the development of both frailty and sarcopenia.^[46] The onset and course of sarcopenia are significantly influenced by frailty and protein energy deficiency (PEM). Frailty adds to the overall susceptibility and functional decline, and PEM, which is brought on by insufficient protein and calorie intake, can hasten muscle loss and further reduce muscular function, aggravating sarcopenia.^[47] However, no studies to date have investigated the association between sarcopenia and malnutrition among the Saudi population.

PREVENTION OF SARCOPENIA

Managing lifestyle behaviors

Preventing, treating, and even reversing sarcopenia clinically are possible.^[40,48] Similar to the factors related to the severity

of sarcopenia, physical activity (including exercise) and nutrition are at the forefront in combating this disorder.^[49,50] Indeed, physical activity decreases the risk of sarcopenia in older adults.^[51] Older adults are recommended to engage in a combination of regular aerobic, resistance, and balance exercise training as well as consume a healthy, balanced, and protein-sufficient diet to prevent, delay, or even treat the age-related muscle mass loss.^[52,53]

After loading the muscle (such as exercise training and physical activity), dietary proteins are the most essential anabolic stimulus for skeletal muscle.^[37] Around 10% of community-dwelling older adults do not meet the estimated average requirement (EAR) for daily protein intake. Therefore, attention should be taken in this regard,^[54] particularly when considering that protein intakes above EAR are recommended to counteract sarcopenia.^[49,55,56] Optimizing dietary intake during disuse periods has the potential to reduce impairments in muscle protein turnover, which, as a result, lead to reduced levels of muscle atrophy.^[38,57] Thus, ensuring optimal protein intake,^[58-61] consuming foods high in omega-3 fatty acids^[59,62] and aiming to be in energy balance (energy intake from food-energy expenditure from different bodily functions)^[61,63,64] seem to be most effective nutritional aspects in combating sarcopenia. Evidence supports the combination of physical activity and appropriate diet as the most effective strategy to prevent sarcopenia and physical dysfunction and preventing disability.^[65] However, to date, there is no interventional studies conducted in Saudi Arabia with the aim of preventing or treating this disease.

Managing medical comorbidities and polypharmacy

Having several chronic diseases makes older persons more likely to have polypharmacy. Taking certain drugs can have negative consequences on the health of muscles, such as muscle wastage, decreased strength, and diminished physical function. A higher risk of muscle loss has been linked to a number of drugs, including corticosteroids and several psychiatric drugs.^[66] Reviewing and enhancing drug regimens is critical for the effective management of sarcopenia. This can entail cutting back on needless medications, changing dosages, or switching to medications with a milder effect on muscular health. Health-care professionals can assist in attenuating the detrimental effects of drugs on muscular function and possibly prevent the evolution of sarcopenia by reducing polypharmacy.^[67]

Medical comorbidities are common in older people and frequently occur with sarcopenia. These conditions include cardiovascular disease, diabetes, and chronic renal disease. Through a variety of processes, such as inflammation, hormone imbalances, and decreased nutrition transport to muscles, these diseases can contribute to the onset and progression of sarcopenia.^[68] Effective medical comorbidity management is essential for promoting muscle health and preventing sarcopenia. To control and cure the underlying diseases, this entails using evidence-based therapies. For instance, ensuring that people with diabetes have appropriate blood glucose control can help to reduce muscle damage and preserve muscle mass. Similar to this, reducing sarcopenia risk and improving muscular function can be achieved by treating cardiovascular risk factors and preserving cardiovascular health.^[69]

THE SAUDI ARABIAN CONTEXT: THE WAY FORWARD

In the past four decades, the Kingdom of Saudi Arabia has experienced rapid economic growth, urbanization, and technological transformation. This has led to major negative changes in the people's lifestyle behaviors. Consequently, physical inactivity, sedentary behaviors, and increased consumption of caloric dense diet and sugar-sweetened beverages became prevalent among Saudi society.^[70,71] Such negative lifestyle behaviors contributed considerably to a rise in lifestyle-related non-communicable diseases in the country.^[70,72,73] However, the present review focused specifically on sarcopenia and lifestyle behaviors.

The Lifestyle and Health Research Center (LHRC) at Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia, was established in 2019 as the first center in the region focusing exclusively on lifestyle behavior and

health.^[74] Utilizing an interdisciplinary approach, LHRC aims to address the gaps in local and regional research in the field of healthy lifestyle promotion and disease prevention. It is also the mission of the LHRC to build local and international partnerships and collaboration. In this context, several research projects were initiated in LHRC to obtain normative values from young Saudis to aid in sarcopenia detection, examine the prevalence of sarcopenia in Saudis and its association with lifestyle behaviors, and in validating and translating questionnaires and forms related to both lifestyle behaviors and sarcopenia.^[75,76] We present the initial steps to understanding the prevalence of sarcopenia in Saudi Arabia and inform future interventional studies in the region, which are key to our understanding of this muscular disease.

CONCLUSION AND CALL FOR ACTION

Based on the above sections, it appears that the promotion of healthy lifestyles, in a rapidly developing country such as Saudi Arabia, is a national public health priority to combat sarcopenia. There is a pressing need for national policy and strategy focusing on musculoskeletal health, active living, and healthy eating, while reducing sedentary behaviors, especially among the elderly. Future research needs to address the determinants of sarcopenia and its associated factors among the older Saudi population, using both longitudinal and interventional research. Recognition of its prevalence will guide the future interventional studies aims to prevent, delay, or treat this disease. Moreover, it is necessary to uncover the complex relationships between lifestyle behaviors, housing environment, and musculoskeletal health within the relevant cultural context of the society. We call for national-level collaborations to explore sarcopenia, and indeed the broader domain of healthy ageing as part of Saudi Arabia's Vision 2030 to enhancing the quality of life in the country.

Peer review

This article was peer-reviewed by two independent and anonymous reviewers.

Data availability statement

Data sharing is not applicable for this article, as no new data were created or analyzed.

Author contributions

Conceptualization: A.F.A; Methodology: A.F.A and D.S.A; Writing—original draft preparation: A.F.A, D.S.A and H.M.A; Writing – review and editing: A.F.A, D.S.A and H.M.A; Supervision: A.F.A.

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Conflicts of interest

There are no conflicts of interest.

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