

# Sarcopenia



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## Abstract

Sarcopenia is a greek letter meaning the decrease in the muscle mass effects both sexes equally. Prevalence is >50% in elderly cases. It is a really debilitating condition of the elderly age group and may lead to further complications like fractures, increased hospitalisation, etc. It may be physiological or pathological. Diagnosis is based on the ratio of the fat muscle mass to the lean muscle mass. Management includes exercises, physical therapy, hormonal and pharmacotherapy. Through this mini review we are trying to shed some light to this dangerous but neglected condition.

**Keywords:** Sarcopenia; Muscle Mass; Pharmacotherapy; Growth Hormone (GH); Somatostatin

## Introduction

The change in the muscles with age was first noticed by Hippocrates. After being ignored for so long now the attitude of the scientists towards sarcopenia is changing. Irwin Rosenberg in 1989 came up with “sarcopenia” which is a greek letter (‘sarx’ flesh + ‘penia’ loss) meaning the decrease in the muscle mass. According to Center for Disease Control (CDC), sarcopenia has been recognized as one of the main risk factors for population over 65 years [1]. Patients with age between 70-80 years with the lowest muscle density had 51% more chances of hospitalisations than patients of the same age group having higher muscle mass, this explains the risk entailed by sarcopenia [2-6].

## Epidemiology

Sarcopenia affects both sexes equally. The prevalence of sarcopenia in US and Europe rises from 5-13% in patients of 60-70 years to 11%-50% in those over 80 years [7]. In a Study (NMEHS) done in New Mexico it was seen that the prevalence of sarcopenia increased from 15% in males and 24% in females at 65-70 years to >50% in both sexes over 80 years. In the Asian countries it has been seen that the incidence ranges from 8-22% in females and 6-23% in males [7-9].

## Mechanisms of Sarcopenia

This can be divided under 2 headings, the primary (physiological) and secondary (pathological). Physiological sarcopenia generally develops with age and there are no

predisposing factors which act on it. Pathological sarcopenia occurs as a consequence of exposure to one or more factors which effect the muscles, like concomitant disease etc. [10-15].

## Diagnosis of sarcopenia

Estimation is done with the help of estimation of the ratio of the fat and fat free muscle mass. The gold standard for the diagnosis is Ct scan and MRI. DEXA may also be used for the diagnosis of the same by the measurement of the fat mass and the skeletal mass. The difference in the precision of the data obtained by means of DXA and CT or MRI is less than 5% [15-22].

There is no definition sarcopenia which has gotten acceptance. Richard Baumgartner [1] (1988) attempted to define sarcopenia by dividing the muscle mass (by DEXA) by square of the height, this is being used still. To calculate for sarcopenia the muscle of all the four limbs is calculated by DXA and the skeletal mass is calculated by the formula – ASM/height<sup>2</sup>. A value 2 SD below is defined as the cut off value for sarcopenia. This value has been calculated as 7.26 kg/m<sup>2</sup> for men and 5.45 kg/m<sup>2</sup> for women [1].

In 2009 the EWGSOP (European Working Group on Sarcopenia in Older People), gave a practical clinical definition for sarcopenia (Table 1). It was defined as a generalized and progressive loss of skeletal muscle mass and strength with risk of adverse outcomes such as physical disability, poor quality of

life and death [10]. A number of techniques can be used to assess muscle mass, strength and performance (Table 2) [10].

**Table 1:** EWGSOP stages of sarcopenia (EWGSOP, 2009) [10].

	Muscle Mass	Muscle Strength	Functional Status
Pre Sarcopenia	↓		
Sarcopenia	↓	↓ or	↓
Severe Sarcopenia	↓	↓	↓

**Table 2:** Measurement of the various components of sarcopenia (EWGSOP) [10].

	Research	Clinical
Muscle mass	CT MRI DEXA Bioimpedance studies	Bioimpedance studies DEXA Anthropometry
Muscle Strength	Hand grip strength Knee flexion/extension Peak expiratory flow	hand grip strength
Function/physical performance	Short physical performance Battery Gait speed Timed get up and go test Stair climb power test	Short physical performance Battery Gait speed Timed get up and go test.

## Management of Sarcopenia

### Exercise and physical activity

Aerobic exercises have a positive impact on the fat and lean body mass ratio. Muscle-strengthening anaerobic exercises prevent both osteoporosis and sarcopenia. Training sessions lasting for 30 minutes twice a week for a duration of 10-12 weeks results in significant increase of muscle strength. The effectiveness increases by combination of exercise with other forms treatment like hormone replacement therapy, nutrition correction, etc. [23-25].

### Nutrition

With the increase in age the appetite decreases and leads to age-related anorexia, influenced by visceral, hormonal, neurological, pharmacological and psychosocial factors. On consuming  $\leq 0.45$  g/kg/day of protein leads to progressive loss of lean muscle mass along with decrease in the functional status of muscle. Solerte S. (2008) in a study concluded that an additional dose of protein of 0.25 g/kg/day increased the lean muscle mass significantly in patients of sarcopenia. The optimal amount of protein in diet has been found for elderly to be 1.2-1.5 g/kg/day, for middle aged – 0.8 g/kg/day. Results in a recently published study found the optimal amount of protein to be 25-30 g per meal, higher protein content do not cause stimulation of protein synthesis in a muscle tissue [26-28].

### Pharmacotherapy

There is an increased risk of sarcopenia (>2 times) with vitamin D deficiency (less than 25 nmol/l). Vitamin D supplementation prevents the development of sarcopenia which causes physical disability and decreases the risk of falls. However, larger RCTs are needed to evaluate the safety profile of vitamin D supplementation and also to find out the use in the management of sarcopenic patients [10,26,29,30].

Many studies have concluded that there is a definite association between sarcopenia and the levels of testosterone and estrogen. Sarcopenia is seen with decreased levels of both estrogen and testosterone. The mechanism may be due to the decreased anabolic effect and also increased production of pro-inflammatory cytokines which increases the catabolic effect on the muscles. However, there was no significant effect on the female muscle strength with the use of estrogen and testosterone-based drugs. Several studies have shown increase in the lean muscle mass on adding testosterone in hypogonadal young men. These studies have also shown an increase in muscle strength from 10 to 25%. However, low dose testosterone is associated with a risk of developing prostate cancer [17,26].

Growth hormone (GH) has been shown to have an indirect anabolic effect on the muscles via IGF-1. IGF-1 has been shown to increase the muscle satellite cells along with the increased production of muscle contractile proteins. Generally the levels of GH and IGF-1 decreases with age. This is the basis of the hypothesis that growth hormones may prove effective in elderly patients by preventing muscle loss. However, studies have shown that this hypothesis is not correct and that the GH is not associated with increase in muscle mass and function. In studies where the muscle mass has increased there is no improvement in the muscle function seen. Boonen et al. [3] noted that the use of IGF in older women having a fracture neck of femur lead to an increase in the muscle mass. However, the evidence to use GH in old patients for sarcopenia management is weak. Also it has been seen that GH replacement has been associated with an increase in the side effects like increased fluid retention, gynecomastia, orthostatic hypotension, and carpal tunnel syndrome [3].

The latest pharmacological treatment includes administration of myostatin inhibitors along with selective androgen receptor modulators etc. [3,10]. In elderly it is seen that a single dose of soluble ActRIIB (myostatin inhibitor) increased the body mass by >1kg and as it is specific to skeletal muscles hence, it doesn't affect the visceral musculature. However, further large scale studies are required to find out the adequate and safe dosage of myostatin inhibitor along with a safe method of administration for it to become useful [31].

### Conclusion

Sarcopenia is a debilitating condition observed in elderly and senile patients reducing their physical abilities along

with quality of life. This is also associated with increase in the incidence of falls which eventually lead to a decrease in the risk of osteoporotic fractures.

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