

Nutrition, sarcopenia and frailty: a complex relationship

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The terms sarcopenia and frailty represent conditions that are common and overlapping in older people; both conditions are strongly influenced by nutritional status. In this presentation, the clinical features of sarcopenia and frailty are discussed, and the link with nutrition is reviewed.

Sarcopenia is a condition of lowered muscle mass and decreased muscle strength. It can be age-associated, but can also be caused by clinical conditions that are independent of the aging process, including chronic disease and under-nutrition.¹ Age-related sarcopenia can result from a complex interplay of disease and nutritional causes, along with other age-related influences such as environmental effects, neurological changes, and genetic predisposition.² Sarcopenia is a relevant factor that contributes to poor outcomes such as frailty and death; muscle function and frailty are closely associated.³ Although age-related sarcopenia has been recognized since the 1980s, it has not been universally recognized because a consensus clinical definition is lacking.

The term frailty is more commonly used by those involved in the care of elderly patients, especially because there is a clinical understanding to support its use. Frailty is currently interpreted as “a geriatric syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, causing vulnerability to adverse health outcomes including falls, hospitalization, institutionalization and mortality.”¹ This definition implies an underlying specific pathogenesis, yet some of the characteristics of frailty are the same as common aging processes, and it may not be possible to unambiguously distinguish frailty from usual aging.¹ However, Fried⁴ et al developed a phenotypic definition of frailty based on readily identifiable physical aspects (Table 1).

Table 1. Criteria for the phenotypic definition of frailty developed by Fried et al (2001)

Unintended weight loss	>10 lb or 5% in past year
Exhaustion	Self-reported, based on 2 CES-D depression-scale questions (2 points)
Weakness	Grip strength (lowest 20%)
Gait speed	5 m walking speed (slowest 20%)
Low physical activity	kcal/week (lowest 20%)
Diagnosis of frailty: 3 or more criteria met	
Diagnosis of pre-frailty: 1-2 criteria met	

The general concept of frailty, however, goes beyond physical factors to encompass psychological and social dimensions as well, including cognitive status, social support and other environmental factors (Figure 1).¹ Most research to this point has focused on the physical and disease-related aspects of frailty, but it is easy to envision the significant impact of social support and psychological well-being on activity levels and the physical well-being of the elderly.

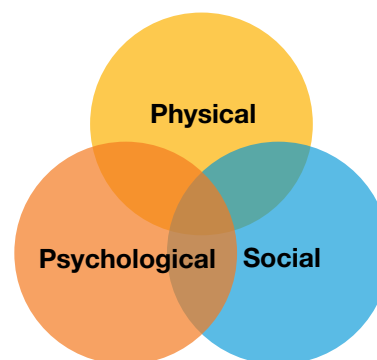
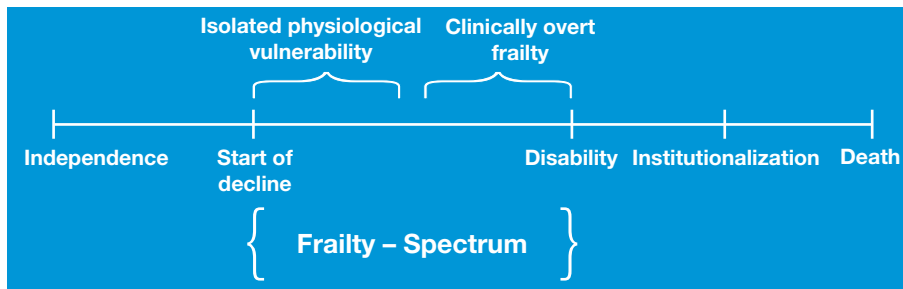


Figure 1. Frailty as a multidimensional condition

The stages of frailty can be arrayed on a continuum (Figure 2). In its early stages, frailty will be obvious only when the individual faces external stressors. In its late stages, the impact of full-blown frailty is readily apparent because it interferes with daily activities to the point of disability.⁵

Figure 2. The continuum of frailty



As people age, energy requirements decline; this decline results mostly from lowered physical activity levels. In many people over the age of 65, however, caloric intake may be reduced beyond the point of lowered needs, thus creating a macronutrient deficit. In addition, vitamin and mineral requirements do not decline with aging, so older people are at risk for deficient intake of micronutrients. Studies have identified links between frailty and low protein intake⁶ as well as with deficits in vitamins D, E, and other vitamins.⁷⁻⁹

In conclusion, sarcopenia is a fundamental component of frailty, but it is only one dimension of additional interrelated factors that have to be considered. Nutritional deficiencies are causative for both sarcopenia and frailty, and both conditions lead to poor clinical outcomes such as disability and death.

Take-home messages

- Malnutrition causes deteriorating functionality in older persons.
- Sarcopenia and frailty are closely interrelated with regard to etiology and diagnosis.
- Deficiencies in both macronutrients and micronutrients predispose older people to development of sarcopenia and frailty.

References

1. Bauer JM, Sieber CC. Sarcopenia and frailty: a clinician's controversial point of view. *Exp Gerontol*. Jul 2008;43(7):674-678.
2. Walston J, Hadley EC, Ferrucci L, et al. Research agenda for frailty in older adults: toward a better understanding of physiology and etiology: summary from the American Geriatrics Society/National Institute on Aging Research Conference on Frailty in Older Adults. *J Am Geriatr Soc*. Jun 2006;54(6):991-1001.
3. Cesari M, Leeuwenburgh C, Lauretani F, et al. Frailty syndrome and skeletal muscle: results from the Invecchiare in Chianti study. *Am J Clin Nutr*. May 2006;83(5):1142-1148.
4. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. Mar 2001;56(3):M146-156.
5. Whitson HE, Purser JL, Cohen HJ. Frailty thy name is ... Phrailty? *J Gerontol A Biol Sci Med Sci*. Jul 2007;62(7):728-730.
6. Bartali B, Frongillo EA, Bandinelli S, et al. Low nutrient intake is an essential component of frailty in older persons. *J Gerontol A Biol Sci Med Sci*. Jun 2006;61(6):589-593.
7. Ble A, Cherubini A, Volpato S, et al. Lower plasma vitamin E levels are associated with the frailty syndrome: the InCHIANTI study. *J Gerontol A Biol Sci Med Sci*. Mar 2006;61(3):278-283.
8. Bischoff-Ferrari HA, Dietrich T, Orav EJ, et al. Higher 25-hydroxyvitamin D concentrations are associated with better lower-extremity function in both active and inactive persons aged > or =60 y. *Am J Clin Nutr*. Sep 2004;80(3):752-758.
9. Michelon E, Blaum C, Semba RD, Xue QL, Ricks MO, Fried LP. Vitamin and carotenoid status in older women: associations with the frailty syndrome. *J Gerontol A Biol Sci Med Sci*. Jun 2006;61(6):600-607.

Discussion

Abellan van Kan Gabor: I do not think you need to be sarcopenic to be frail, but if you are sarcopenic you are frail. So I think the three [Fried] criteria identify all sarcopenic people, but don't identify the full spectrum of all the frail people. To identify all frail people, we need more than three criteria.

Juergen Bauer: I agree you don't need to be sarcopenic to be frail, but I think it is true vice versa, you can be sarcopenic but not frail.

Alfonso Cruz: In my opinion, the definition of frailty used by Fried should actually be called "physical frailty." There are more elements that can make you frail without physical frailty, that is cognition or even social problems.

Marjolein Visser: It is not possible to study entire populations of older people and treat them all the same. As we define conditions, we need to choose populations that can benefit from a certain intervention.

Juergen Bauer: Yes, I agree that we need to be very precise about our target group. We definitely need specific qualifications for diagnosis, along with specific therapies for people who meet these qualifications. For this reason, I would not choose the frailty syndrome as a basis for clinical intervention at this time.

Mercedes Planas Vila: The problem is that we need a clear definition of sarcopenia and how it has to be quantified; frailty seems to be too wide, and we need something more circumscribed at the moment.