Nutrition in the Elderly      Topic 36

Module 36.1

Undernutrition in the Elderly: Epidemiology and Consequences

Tommy Cederholm

Learning Objectives

- To know the prevalence of undernutrition according to the subject’s life setting;
- To know the main medical consequences of undernutrition;
- To know that elderly subjects are at risk for micronutrient deficiency.

Contents

1. Introduction
2. What is the prevalence of undernutrition in elderly subjects living in the community, in nursing homes and in elderly hospitalised patients?
3. What are the consequences of undernutrition in the elderly?
4. What about micronutrients?
5. Summary
6. References

Key Messages

- The prevalence of protein–energy undernutrition (PEM) varies according to the residence of the individual and the clinical setting. One to five per cent of community-dwelling elderly, 10-35% of nursing home residents and 20-50% of hospitalised elderly patients are reported to be undernourished.
- PEM is associated with increased morbidity, mortality and longer hospital stays. Undernutrition also increases the risk for hip fractures, infections and pressure ulcers.
- Elderly subjects are at risk of micronutrient deficiency (eg vitamin D and vitamin B12). Vitamin D deficiency increases the risk for osteoporosis and fractures, whereas the clinical consequences of other micronutrient deficiencies are not fully known as intervention studies have shown conflicting results.

1. Introduction

There is a physiological decline in food intake from the ages of 20 to 80 years (1). This has been termed the "anorexia of aging" and may be an appropriate response to the decrease in lean body mass, energy expenditure and in physical activity that occurs over the lifespan (2). However, low food intake places older men and women at high risk for developing pathological weight loss.

2. What is the prevalence in protein-energy undernutrition in the community, in nursing homes and in the hospital?

As in younger adults, the estimation of the prevalence of undernutrition in elderly subjects depends on the tools used to evaluate the nutritional status, and on the setting of the studied population. Authors have used anthropometry, reports of recent weight
loss, biochemical markers, the Mini Nutritional Assessment (MNA) or other composite nutritional evaluation tools. Studies have been performed in elderly subjects living at home, in nursing homes or in hospitalised elderly patients. The population-based Euronut-SENECA study in 2600 subjects aged 70-75 years from 12 countries in Europe showed that 10% of the subjects had a body mass index (BMI) <20 kg/m² (3). Two Swedish studies have shown prevalences of 3-5% of undernutrition in community-living older subjects (4,5). More recent studies using the MNA confirm overall occurrences somewhere between 1% and 6% in home-living elderly people (6,7).

Undernutrition becomes more frequent in populations with higher morbidity and care burden. About 8% of home-living older adults who needed help from domiciliary care services displayed undernutrition (8). Unintentional weight loss is reported in 8 to 13% of elderly free-living elderly subjects (9,10), and in 25% of functionally dependent elderly persons living in the community (11). Nursing home or elderly care residents are usually frail, and in the majority of cases show concurrent co-morbidities and cognitive decline. The care burden in such settings varies with social and cultural context, which is reflected in large variations in prevalence figures of undernutrition. Thus, ranges from 10% (12) to 35% are reported (7,13,14).

The National Diet and Nutrition Survey, based on 1368 subjects aged 65 and over, showed that 21% of institutionalised persons were undernourished, based on a composite measure of low BMI and recent weight loss (15). The NutritionDay initiative was recently extended to nursing homes and the first report from Austrian and German settings in >2000 residents disclosed staff-assessed undernutrition in 10% and BMI<20 kg/m² in 17% (16). High age, immobility, dementia and dysphagia were independent risk factors for undernutrition.

In the hospital, the prevalence of undernutrition is reported to be even higher, depending on the assessment tools that are used. In 324 hospitalised patients aged ≥70 years undernutrition was assessed by mid arm circumference (MAC) and albuminaemia. Moderate undernutrition (i.e. MAC <10th percentile or albuminaemia <35 g/L) was observed in 30% of the males and 41% the females, and severe undernutrition (MAC <10th percentile and albuminaemia <35 g/L) in 15.6% of the males and 21.4% of females (17). One third of patients hospitalised in a geriatric unit had a BMI <20 kg/m² (18). Among sub-acute care elderly patients, 18% had a BMI <19 kg/m², and 53% of the subjects had albuminaemia <35 g/L (19). Albuminaemia as an indicator of undernutrition has been questioned as it is mainly affected by ongoing inflammatory activity, but as such it reflects catabolic activity. Composite formulas such as MNA, Subjective Global Assessment (SGA), Nutritional Risk Screening 2002 (NRS2002) or Malnutrition Universal Screening Tool (MUST) are usually used. In 87 recently admitted geriatric patients the prevalence of PEM varied between 26 and 20 % by MNA and SGA (20). In a similar study using different tools to assess undernutrition in a sample of 60 hospitalised subjects the frequency of risk for undernutrition varied from 63%, as defined by the SGA, to 90% by the Nutritional Risk Index (21).

3. What are the consequences of undernutrition in the elderly?

Studies have consistently reported an association between morbidity and mortality, and nutritional status in elderly subjects, as assessed by BMI, weight loss or food intake (22). However, especially in older people, it is important to take into account other potential predictors of adverse outcomes, such as illness severity, co-morbidity and functional status.

Recent large-scale prospective observational studies clearly indicate that being underweight is a more potent threat to life than obesity in older adults. In ~9200 70-75 year-old Americans the highest 10-year survival was observed in those with a BMI between 25 and 30 kg/m². Mortality was higher among those with BMI <20 as compared to those with BMI >35 kg/m² (23). A similar 7-year follow-up study in ~13000 subjects >65 years of age indicated that the least risk of disability was found if the BMI was ~25 kg/m² at the start, whereas survival was highest if BMI was around 30 (24). In a prospective community-based study including 247 men aged 65 and over, the annual
incidence of a weight loss of 4% or more was 13%. Although the weight losing subjects were similar to the non-weight losers for age, BMI, health status, albumin and cholesterol measurements, they had a significantly greater 2-year mortality rate (RR=2.43; 95% CI=1.34–4.41) (10). In 288 elderly patients receiving home help services, weight loss was a significant predictor of mortality in a multivariate analysis including age, sex, BMI, weight loss and functional status (RR=1.76; 95%CI 1.15–2.71) (25). BMI, albumin and variables related to inflammation in 245 elderly subjects were included in a regression model: BMI and albumin in the lowest tertiles (<22.8 kg/m² and <36 g/L, respectively) were found to be independently associated with increased 6-year mortality (RR=2.3; 95%CI 1.3–4.4; and RR=2.1; 95% CI 1.1–3.9 for BMI and albumin, respectively) (26).

Mortality was studied as a function of BMI in 8428 hospitalised patients. In patients aged 20-40 years mortality doubled in the most underweight (BMI <18) compared to BMI groups 20-40; however, in patients aged 70-79 years, there was a tripling in mortality for BMI <18 compared to the BMI groups 32-40 (27) (Fig. 1).

![Figure 1 Association between BMI and mortality as a function of age in 8428 hospitalised patients. Reproduced from (27).](image)

In 109 patients admitted to a geriatric rehabilitation unit, the best predictor of mortality in the 1 year after admission and the 1 year after discharge from hospital was the percentage of usual body weight lost in the year prior to admission (28). Pre-admission weight loss was still predictive for mortality up to 4.5 years after discharge (29). In 400 consecutive geriatric patients BMI was the strongest independent predictor of 1-year mortality, a marker even stronger than diagnosis and age (30). In another study 102 (21%) of 497 patients 65 years or older had an average daily in-hospital nutrient intake of less than 50% of their calculated maintenance energy requirements. Admission illness severity, average length of stay, and admission albumin and transthyretin levels for this low nutrient group did not differ significantly from those of the remaining patients. However, the low nutrient intake group had a much higher in-hospital mortality rate (RR=8.0; 95% CI 2.8-22.6) and 90-day mortality (RR=2.9; 95% CI 1.4-6.1) (31). Similarly, data from the NutritionDay programme show that among the oldest hospitalized patients a reduced food intake increased the 40-day mortality from <2% in those who ate all that was served, to 16% among those who did not eat at all. The results remained significant after adjustment for illness severity (32).
In elderly subjects, weight loss and undernutrition have also been associated with other adverse outcomes such as length of hospital stay, hospital discharge to a higher dependency location, or time to readmission, infections, gait disorders, falls, fractures and poor wound healing (22).

Dependency in activities of daily living 3 months after discharge and the time spent in a nursing home during the year after discharge were more likely in severely undernourished hospitalised elderly patients (by SGA) than in well-nourished patients, again after controlling for illness severity, comorbidity, and functional status on admission (33).

Episodes of sepsis occurred significantly more often in severely undernourished hospitalised elderly patients as assessed by BMI and corrected muscle area (34). In 185 elderly hospitalised patients, low energy intake - as well as age, length of hospital stay and the presence of a urinary catheter - was an independent risk factor for nosocomial infections (35, 36). The immune system is highly susceptible to nutrient deficiency. The condition has been called the Malnutrition Associated Immune Deficiency Syndrome (MAIDS) and is in several aspects similar to the HIV-induced immune deficiency syndrome (37).

One prominent feature of undernutrition is loss of muscle mass, i.e. sarcopenia (38,39). Sarcopenia combined with osteoporosis, another condition related to PEM, paves the way to musculo-skeletal related incidents like gait disorders, falls and fractures. The fracture incidence is further promoted by:

- the effect of low protein and calcium intake and vitamin D depletion on bone mass;
- the decrease in fat mass that protects the bone in the case of a fall.

In the Study of Osteoporotic Fractures, 6754 women were weighed at baseline and after a mean of 5.7 years. After adjustment for age, cigarette smoking, physical activity, oestrogen use, medical conditions, health status, body weight, femoral neck bone mass, and rate of change in calcaneal bone mass, the women who had lost weight had a significant increased risk of fracture of the proximal femur, pelvis and proximal humerus (age adjusted RR per 10% decrease in weight: 1.68; 95% CI 1.17–2.41) (40). Moreover, the nutritional status of 75 older women admitted to hospital for hip fractures (Fig. 2) was compared to that of an age-matched independent-living group of females attending local day centres. Hip fracture patients had significantly lower BMI, mid upper arm circumference, triceps skinfold thickness, and serum albumin, as well as lower protein, energy and calcium intake (41).
Last but not least, undernutrition increases the risk of pressure sores (Fig. 3). Low protein and energy intake, BMI and hypoalbuminaemia are risk factors for the development of pressure sores in older patients (42-44). Importantly, a meta-analysis of 4 clinical studies showed that oral nutritional supplements could significantly reduce the incidence of pressure ulcer development in at-risk patients (odds ratio 0.75, 95% CI 0.62-0.89) (45). Published data are scarce and not entirely convincing on the effect of nutritional status on the healing of pressure ulcers (46); however, they suggest that undernutrition slows down the healing process and that an increase in protein and energy intake increases the rate of healing. Overall, there is a consensus that nutrition is important for wound healing (47).

![Figure 3 Stage 3 pressure sore in an undernourished elderly patient](image)

All these may partly account for the association between undernutrition and poor quality of life in elderly persons (13, 48-50).

4. What about micronutrients?

Elderly persons are at risk of micronutrient deficiency. This may be due to low food intake, chronic diseases or drugs. The second evaluation of the Euronut-SENECA study population took place in 1993 in 1005 subjects aged 74–79 years. In this population, 24% of the men and 47% of the women had low dietary intakes for at least one of the following micronutrients: calcium, iron, retinol, β-carotene, thiamine, pyridoxine or vitamin C (51). Plasma levels of vitamin D were low in 36% of the men and 47% of the women. Cobalamin deficiency was described in 23.8% of the subjects (52). In institutionalised and in hospitalised elderly persons, the prevalence of micronutrient deficiency appears to be higher, especially for thiamine, pyridoxine, cobalamin, folate, vitamin C, vitamin E and selenium (53).

Low calcium intake and low vitamin D levels increase the risk of osteoporosis. Several intervention studies have shown that the combination of calcium and vitamin D (at least 700 IU/d) supplementation reduces the incidence of hip fractures in elderly populations (54-57). Almost all cells in the body express vitamin D receptors, indicating a wide spectrum of potential effects from vitamin D. Recent meta-analyses indicate that vitamin D supplementation reduces the incidence of falls in older adults (58). Although it is suggested that vitamin D deficiency may play crucial roles in the development of immunological, neurological and psychiatric disorders, a recent evidence-based expert consensus from The American Institute of Medicine could not find sufficient data to recommend vitamin D supplementation for purposes other than fracture prevention in the older adult (59).

As in younger adults, severe micronutrient depletion leads to specific well-known clinical symptoms and must be treated. However, in the elderly, the micronutrient deficiencies described are mostly mild, the consequences of which are difficult to assess. For example, micronutrient deficiencies, and especially those of antioxidants, vitamins and trace elements, affect immunity (37,60). However, interventional studies designed to
assess the efficacy of micronutrient supplementation in preventing the occurrence or improving the clinical outcome of infections, have shown conflicting results. In one study of 725 elderly institutionalised subjects, the effect of supplementation with vitamins (vitamins C, E and ß-carotene), with trace elements (selenium and zinc), or with both, was compared with placebo over a 2 year period. Trace element supplementation reduced the incidence of respiratory tract infections. However, the incidence of urogenital infections was lower in patients who received only placebo. Survival analysis for the 2 years did not show any difference between the 4 groups (61). In 652 non-institutionalized elderly individuals, physiological doses of multivitamins and minerals, 200mg of vitamin E, both, or placebo were given for 2 years. The severity of infections was not influenced by the multivitamin-mineral supplementation. For vitamin E versus no vitamin E, the prognosis proved worse in terms of illness-duration, number of symptoms, the presence of fever, and restriction of activity (62).

5. Summary
Undernutrition is frequent in the hospitalized and institutionalized elderly. It has negative effects on morbidity, mortality, function and quality of life. Macronutrient and micronutrient status both play important roles.

6. References


44. Reed RL, Hepburn K, Adelson R, Center B, McKnight P. Low serum albumin levels, confusion, and fecal incontinence: are these risk factors for pressure ulcers in mobility-impaired hospitalized adults? Gerontology 2003;49:255-9.


47. EPUAP (European Pressure Ulcer Advisory Panel). www.epuap.org


