



# Malnutrition in older people

## Screening and management strategies



**Renuka Visvanathan, FRACP,** is Specialist Geriatrician, Spencer Gulf Rural Health School and Department of Medicine, University of Adelaide and Department of Geriatric and Rehabilitation Medicine, Royal Adelaide Hospital, South Australia.

**Jonathan W Newbury, MD, FRACGP,** is Associate Professor, Spencer Gulf Rural Health School, Department of General Practice and Rural Health, University of Adelaide, South Australia.

**Ian Chapman, PhD, FRACP,** is Senior Lecturer, Department of Medicine, University of Adelaide, and Senior Consultant, Department of Endocrine and Metabolic Medicine, Royal Adelaide Hospital, South Australia.

**BACKGROUND** Malnutrition in older people is not only common, but frequently overlooked. It can result in multiple medical complications, hospitalisation and even death.

**OBJECTIVE** This article focusses on the consequences, pathophysiology, diagnosis and management of this clinical syndrome.

**DISCUSSION** Nonphysiological causes of malnutrition include social, psychological, medical and medication related factors. With vigilance, early screening and the institution of simple therapeutic measures of correcting nonphysiological causes and following dietary guidelines for older people, the adverse effects of malnutrition may be minimised.

### Case history – John

John, 85 years of age, is seen by his general practitioner at the hostel where he resides. He has been a resident at this facility for more than 12 months and staff members have reported he has become increasingly forgetful. John has a significant past history of congestive cardiac failure and is on aspirin (100 mg per day), frusemide (40 mg per day), digoxin (62.5 µg per day), spironolactone (25 mg morning) and perindopril (2 mg morning) and was recently commenced on a nonsteroidal anti-inflammatory agent for knee pain. He has been complaining of fatigue, anorexia and has reduced his oral intake. John presents with a febrile illness and urinalysis was positive for leucocyte esterase. A full blood examination reveals a haemoglobin value of 10 g/L and a white cell count of  $9 \times 10^9/L$  ( $3.8 \times 10^9/L$  neutrophils,  $0.25 \times 10^9/L$  lymphocytes). A urine sample is sent for culture. John is treated with a short course of trimethoprim-sulfamethoxazole and his fever improves. It was also noted that his oral intake was poor and his body mass index was 21 kg/m<sup>2</sup>. Over the next couple of weeks, John refused his meals and lost 5 kg in weight. However, staff members were able to get him to take his medications. He became increasingly confused and 4 weeks later, he died.

Malnutrition in older people is common, frequently overlooked, and results in many negative health outcomes. It is projected that the proportion of older Australians (over 65 years of age) will increase from 13% of the total population in 2002 to 27–30% of the population in 2051.<sup>1</sup> Therefore, it can be anticipated that the absolute number of older people who are malnourished or at risk of developing malnutrition will increase.

### Prevalence

The prevalence of malnutrition increases with escalating frailty and physical dependence (*Table 1*).<sup>2,3</sup> The figures in *Table 1* are based on the diagnosis of malnutrition (score <17) as assessed by the Mini Nutritional Assessment (MNA). Many more people are at risk of developing malnutrition (score 17.0–23.5) in these settings.

**Table 1. Prevalence of malnutrition by the level of care**

Clinical setting	Prevalence (%) malnourished (MNA <17)
European community (healthy) <sup>2</sup>	1
Australian domiciliary care recipients <sup>3</sup>	4.8
Australian acute hospital <sup>40</sup>	20
Swedish acute geriatric unit <sup>41</sup>	26
Australian sub-acute care <sup>20</sup>	27.7
Group living (demented, Sweden) <sup>42</sup>	38
Swedish nursing home <sup>42</sup>	71

### The cost

Malnutrition affects both the individual and the community. It has been stated that people with gastrointestinal, respiratory and neurological disease related malnutrition have a 6% higher general practitioner consultation rate, are written 9% more prescriptions, and have a 26% higher hospital admission rate than people who are well nourished.<sup>4</sup> Malnourished older people are also at increased risk of experiencing falls, prolonged hospitalisation, institutionalisation, postoperative complications and infections, pressure ulcers and complicated wound healing, and dying.<sup>3,5-10</sup>

### Nutritional frailty in older people

Nutritional frailty (*Figure 1*) refers to the disability that occurs in old age due to the unintentional physiological or pathological loss of body weight and sarcopenia.<sup>11</sup> Sarcopenia is the decline in muscle mass and strength that may occur with healthy aging and is thought to be both a process and an outcome.<sup>12</sup> The anorexia of aging describes the physiological decrease in appetite and food intake that accompanies normal aging which may result in undesirable weight loss.<sup>13</sup> Compounding these physiological effects are numerous socioeconomic and health (nonphysiological) causes of malnutrition (*Table 2*). Essentially, a continuum exists and older adults comprise of a heterogeneous group ranging from the very robust to the very frail. With aging, there is a decreased margin of homeostatic reserve and an increased likelihood of experiencing numerous assaults to the homeostatic balance which in turn increase the risk of frailty.<sup>11</sup>

Nonphysiological causes should always be sought and rectified where possible. Socioeconomic status remains an important predictor of nutritional status.<sup>14</sup> Dwindling savings and decreased earning capacity puts

older people at increased risk of malnutrition. Polypharmacy is common in older people, especially with the increased likelihood of multiple, chronic medical ailments. Poor health and an increasing number of medical illnesses are also associated with impaired nutritional status.<sup>15</sup> Mood and cognition are vital determinants of an older person’s overall wellbeing. Social isolation not only leads to decreased nutrient intake but can also lead to depression.<sup>16,17</sup> Depression is an independent predictor of nutritional risk and perhaps antidepressant therapy may promote weight gain or prevent weight loss in elderly people. Dementia is more prevalent with increasing age and significant weight loss is frequently seen.<sup>18</sup>

### Case history – John

John possibly had several nonphysiological risk factors for developing under nutrition. Staff had complained that he was forgetful, and so underlying dementia or depression was very possible. Also, he was on many medications which increased his risk of developing anorexia, and was recently commenced on a NSAID and therefore at risk of developing peptic ulcers or gastritis. This combination of medications also increases the risk of renal failure which can result in digoxin toxicity and anorexia. Sulfa drugs can be nephrotoxic and should be avoided for the treatment of urinary tract infection in older people. A course of trimethoprim alone would suffice. With decreasing oral intake, dehydration is likely to worsen renal function and propagate the downward spiral.

### Screening and diagnostic tests

There is no generally accepted gold standard test for the diagnosis of nutritional depletion in older people. The detailed assessment of nutritional status usually involves a combination of:

- assessment of dietary intake
- anthropometric measures
- more detailed body composition analysis, and
- laboratory markers.

An example of an in-depth nutritional assessment method involving blood testing is shown in *Table 3*. However, for large scale use in the community, simpler screening methods that do not involve blood

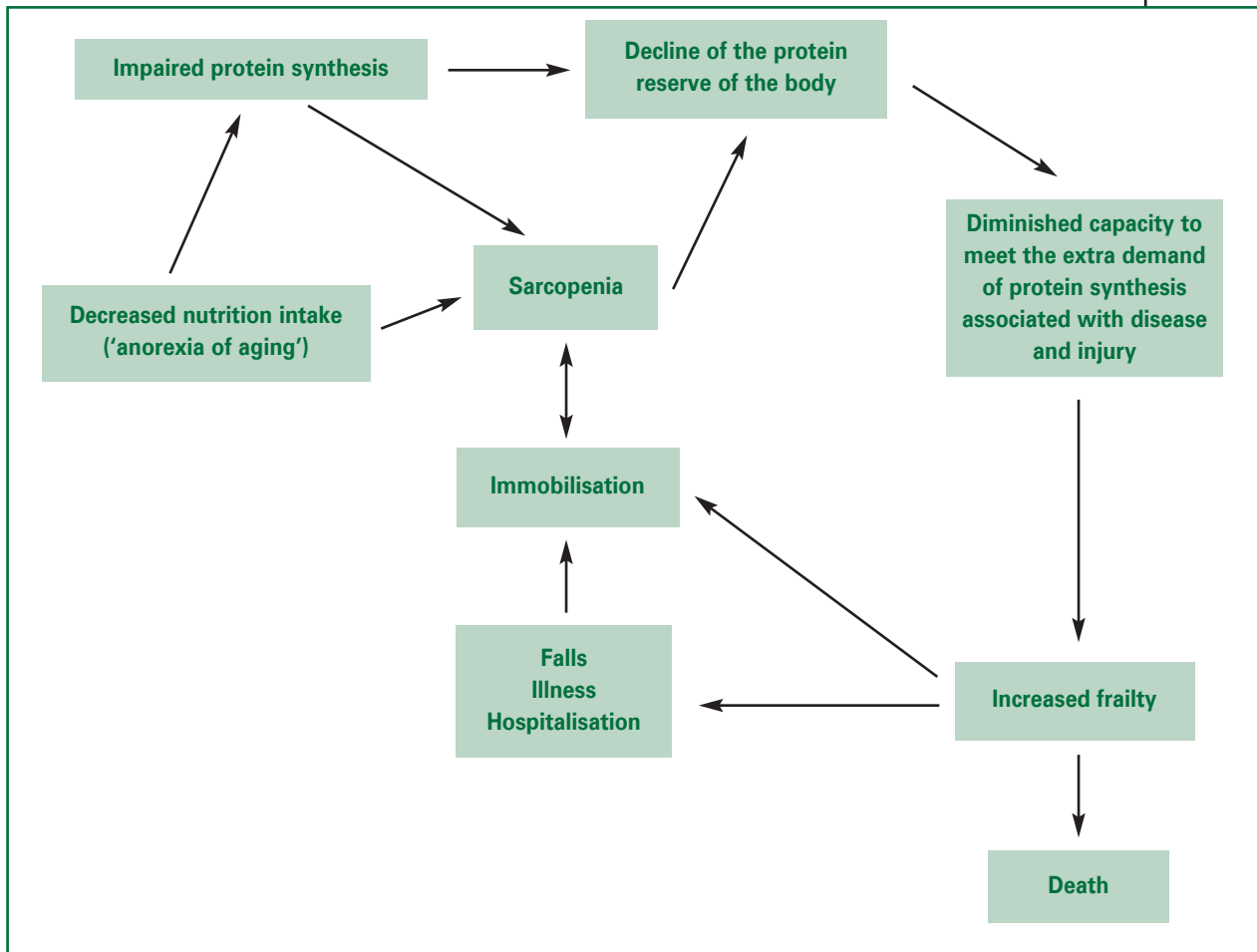


Figure 1. The downward spiral of nutritional frailty

sampling and are easily and quickly administered are preferred. Two screening methods easily incorporated into most clinical practices are discussed below.

### Rapid screen

The two question 'rapid screen' is positive if body mass index (BMI) is less than 22kg/m<sup>2</sup>, and/or there has been reported weight loss of more than 7.5% over the previous 3 months. Its predictive power, which is derived from the strong association between low body weight and, in particular, weight loss and poor outcomes in older people, is surprisingly high.<sup>19</sup>

We recently studied older patients in a rehabilitation facility and found the 'rapid screen' to have a sensitivity of 78.6% and specificity of 97.3% when compared to the more detailed nutritional assessment shown in Table 3. Patients with a positive rapid screen were also three times more likely to be re-hospitalised or transferred directly to a nursing home at discharge than those with a negative screen (56.5 vs. 19.1%,  $p=0.002$ ).<sup>20</sup>

### Mini Nutritional Assessment

The MNA consists of questions and some anthropometric measurements, but no blood tests. The questions can be completed by a carer if an older person is unable to answer them. The MNA can be used as a two tiered process (Figure 2). The MNA-SF (short form) consists of six questions and has a maximum score of 14. It takes approximately 3 minutes to administer and includes measurement of height and weight. An MNA-SF score of greater than 11 has been shown to predict the absence of malnutrition (ie. score >17 on the MNA) with a sensitivity of 100% and negative predictive value of 100%. Therefore, a score of 11 or less indicates a risk for under nutrition and the full MNA should be completed. The full MNA takes about 15 minutes to administer and has been shown in various settings, including among elderly recipients of domiciliary care services in Adelaide, to identify accurately older people at risk of increased mortality and morbidity.<sup>3</sup> It has a reported

**Table 2. Nonphysiological causes of under nutrition in older people<sup>13</sup>**

**Social factors**

- Poverty
- Inability to shop
- Inability to prepare and cook meals
- Inability to feed oneself
- Living alone, social isolation, or lack of social support network
- Failure to cater to ethnic food preferences

**Psychological factors**

- Alcoholism
- Bereavement
- Depression
- Dementia or Alzheimer disease
- Cholesterol phobia

**Medical factors (mediated through anorexia, early satiation, malabsorption, increased metabolism, cytokine mediated and impaired functional status)**

- Cancer
- Alcoholism
- Cardiac failure
- Chronic obstructive airways disease
- Infection
- Dysphagia
- Rheumatoid arthritis
- Parkinson disease
- Hypermetabolism (eg. hyperthyroidism)
- Malabsorption syndromes
- Gastrointestinal symptoms: dyspepsia, atrophic gastritis, vomiting, diarrhoea
- Constipation
- Poor dentition

**Medications**

- Nausea/vomiting
  - antibiotics, opiates, digoxin, theophylline, nonsteroidal anti-inflammatory agents (NSAIDs)
- Anorexia
  - antibiotics, digoxin
- Decreased sense of taste
  - metronidazole, calcium channel blockers, angiotensin converting enzyme inhibitors (ACE), metformin
- Early satiety
  - anticholinergic drugs, sympathomimetic agents
- Reduced feeding ability
  - sedatives, opiates, psychotropic agents
- Dysphagia
  - potassium supplements, NSAIDs, biphosphonates, prednisolone
- Constipation
  - opiates, iron supplements, diuretics
- Diarrhoea
  - laxatives, antibiotics
- Hypermetabolism
  - thyroxine, ephedrine

sensitivity of 96%, specificity of 98% and positive predictive value of 97% for malnutrition when compared to nutritional status determined by physicians using anthropometric, clinical biochemistry and dietary parameters.<sup>21</sup> An advantage of the MNA is that responses to the questions can guide simple management strategies. For example, a patient who is not eating three full meals a day can be encouraged to do so by various means, whereas attention might be focussed more on medication rationalisation in a person who loses points for polypharmacy.

**Case history – John**

John had a BMI of 21 kg/m<sup>2</sup>. There was also evidence lymphopaenia, anorexia, decreased oral intake and subsequent weight loss. Guided by the nutritional grid (*Table 3*), he would be classified as under nourished.

**Management strategies**

It is probably never too late to provide dietary advice. The older one becomes, the greater the age one is likely to live to.<sup>22</sup> By the time men and women reach the age of 75 years, life expectancy is still almost 10 years.<sup>22</sup> There are dietary guidelines for healthy eating in older Australians (*Table 4*). Booklets, posters and brochures may be obtained from the National Health and Medical Research Council (NHMRC) (see *Resources*). Patient education can result in improved nutritional intake and empowering older adults with the necessary knowledge may be the best way of preventing malnutrition. The introduction of individually tailored nutritional education programs has been shown to increase the consumption of fruit, vegetables and calcium rich food in community dwelling, functionally impaired, elderly people with consequent weight gain over 6 months.<sup>23</sup>

Nonphysiological factors (*Table 2*) should be assessed and where possible corrected. The provision of dentures to older people with no teeth or the treatment of underlying depression often results in increased food intake and may be sufficient to halt or reverse the nutritional decline.

Referral to ‘meals on wheels’ (MOW) may be beneficial for those who require some meal supplementation, as this may increase nutrient intake and weight, and maintain the performance of activities

of daily living. For the particularly under nourished however, this may not be enough. In a recent study, the traditional MOW program (consisting of five hot meals per week and meeting 33% of the daily reference index (IDRI)) was compared to a modified MOW (consisting of three meals and two snacks per day including a liquid nutritional supplement 7 days per week and meeting 100% of the DRI) in 203 new referrals to the MOW service.<sup>24</sup> Twenty-five percent of MOW recipients were rated as malnourished by the MNA at baseline. In these patients, those receiving the modified MOW diet were more than twice as likely as those receiving the standard MOW diet to have achieved a well nourished rating after 6 months (47% vs. 21%,  $p>0.05$ ).

Macronutrient supplementation (often high protein) is known to produce small but consistent weight gain, increased energy intake, reduced mortality, shortened hospitalisation, improved functional status, and reduced postoperative complications, especially in institutional or hospital settings.<sup>25–27</sup> For example, a recent Cochrane meta-analysis found an overall reduced mortality risk in supplemented groups in comparison to the control groups (relative risk [RR] 0.67, 95% confidence interval [CI] 0.52–0.87).<sup>25</sup> This strong significant reduction in mortality was also seen when subgroup analyses were performed looking at people over 75 years of age who were unwell or malnourished and were provided with supplementation for either 35 days or more, or greater than 400 calories of energy.<sup>25</sup> It has been recommended that further, larger and standardised studies are needed to confirm these findings. Nevertheless, this evidence supports the use of macronutrient energy supplementation in frail, unwell older people who may be at risk of malnutrition.

There is lack of evidence that micronutrient supplementation is beneficial, so its routine use cannot be recommended. The results of Cochrane meta-analyses indicate that:

- protein energy rich supplementation, zinc and vitamin C administration have not been shown to improve the healing of pressure and leg ulcers (venous and arterial)<sup>28</sup>
- high dose vitamin C administration appears to reduce the duration of flu symptoms<sup>29</sup>
- there is sufficient evidence to support further studies evaluating the benefits of vitamin E supplementation in patients with Alzheimer disease but not its use currently<sup>30</sup>
- there is presently no evidence that patients derive

**Table 3. Example of an in-depth nutritional assessment integrating various nutritional parameters: the Standard Nutritional Assessment<sup>20</sup>**

Criteria assessed	Normal (N)	Borderline (B)	Under nourished (U)
Total lymphocyte count ( $\times 10^9/L$ )	>1.5	1.2–1.5	<1.2
Serum albumin level (g/L)	$\geq 35$	28–34	<28
Total cholesterol level (mmol/L)	>4.15		<4.15
No of risk factors: nausea, vomiting, diarrhoea, constipation, difficulty chewing or swallowing, history of gastrointestinal disease	0, 1	2	3–6
% unintentional weight loss over 3 months (subjective)	0	1.0–7.5	>7.5
Body mass index ( $kg/m^2$ )	$\geq 22$	–	<22
Under nourished (mild) = 1U+2B or 2U+1B, under nourished (moderate-severe) = 3U(+any B/U)			

**Table 4. Key recommendations from the Australian dietary guidelines for older people<sup>39</sup>**

- Enjoy a wide variety of food
- Keep active to maintain muscle strength and a healthy body weight
- Eat at least three meals every day
- Care for your food: prepare and store it correctly
- Eat plenty of vegetables (including legumes) and fruit
- Eat plenty of cereals, breads and pastas
- Eat a diet low in saturated fat
- Drink adequate amounts of water and/or other fluids
- If you drink alcohol, limit your intake
- Chose foods low in salt and use salt sparingly
- Include foods high in calcium
- Use added sugars in moderation

cognitive benefit with vitamin B12, B6, thiamine and folic acid,<sup>31</sup> and

- there is no evidence that antioxidant and vitamin supplementation prevent or delay the development of macular degeneration.<sup>32</sup>

Various orexigenic agents including progestational drugs (eg. megestrol acetate) and cannabis-like derivatives (eg. dronabinol) that have been shown to improve weight and appetite in wasting, secondary to AIDS and cancer, are also beneficial when used in frail, older nursing home residents.<sup>33–34</sup> Unfortunately these agents have also been associated with serious adverse effects such as deep venous thrombosis, delirium and adrenal insufficiency.<sup>35,36</sup> Anabolic agents such as growth

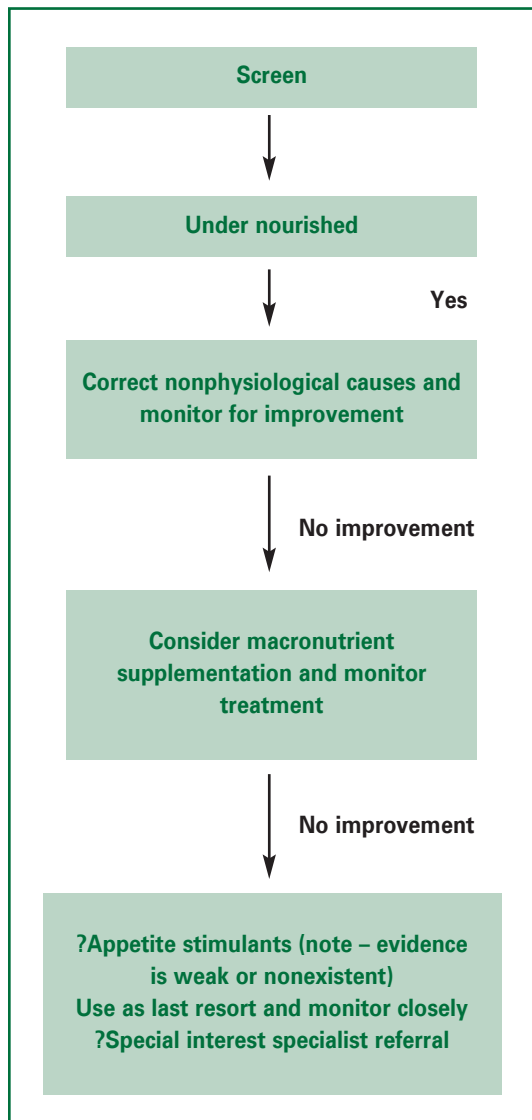


Figure 2. Suggested management pathway of under nutrition in older people

hormone have been shown to increase lean body mass and even biochemical nutritional markers (ie. albumin, hematocrit),<sup>37,38</sup> but functional benefits have not been demonstrated to date, and safety is uncertain in older people.<sup>38</sup> Other anabolic agents including testosterone are under investigation.

### Conclusion

Malnutrition in older people is common and often overlooked, but relatively easily diagnosed using simple measures. Educating older people about nutrition is a useful way of preventing and dealing with this problem. Correction of nonphysiological risk factors is essential. If risk still exists, then macronutrient supplementation may be beneficial. Referral to a specialist

for further management may be warranted if improvement is not seen.

### Summary of important points

- The prevalence of malnutrition increases with escalating frailty and physical dependence.
- Socioeconomic status remains an important predictor of nutritional status.
- Depression is an independent predictor of nutritional risk.
- The 'rapid screen' and 'Mini Nutritional Assessment' can easily be incorporated into general practice encounters with older patients.
- The introduction of individually tailored nutritional education programs can benefit the elderly.

### Resources

Commonwealth Department of Health and Aged Care. Eat well for life: a practical guide to the Dietary Guidelines for Older Australians. Available at: [www.nhmrc.gov.au/publications/synopses/n23syn.htm](http://www.nhmrc.gov.au/publications/synopses/n23syn.htm). Mini Nutritional Assessment. Available at: [www.mna-elderly.com](http://www.mna-elderly.com).

Conflict of interest: none declared.

### References

1. Australian Bureau of Statistics. Population projections, Australia (3222.0) 2003. Available at: [www.abs.gov.au](http://www.abs.gov.au).
2. de Groot LC, Beck AM, Schroll M, van Staveren WA. Evaluating the nutritional health checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. *Eur J Clin Nutr* 1998;52:877-883.
3. Visvanathan R, Macintosh C, Callary M, Penhall R, Horowitz M, Chapman I. The nutritional status of 250 older Australian recipients of domiciliary care services and its association with outcomes at 12 months. *J Am Geriatr Soc* 2003;51:1007-1011.
4. Martyn CN, Winter PD, Coles SJ, Edington J. Effect of nutritional status on use of health care resources by patients with chronic disease living in the community. *Clin Nutr* 1998;17:119-123.
5. Miller MD, Crotty M, Giles LC, et al. Corrected arm muscle area: an independent predictor of long term mortality in community dwelling older adults? *J Am Geriatr Soc* 2002;50:1272-1277.
6. Sullivan DH, Bopp MM, Roberson PK. Protein energy under nutrition and life threatening complications among the hospitalised elderly. *J Gen Intern Med* 2002;17:923-932.
7. Windsor JA, Hill GL. Risk factors for postoperative pneumonia. The importance of protein depletion. *Ann Surg* 1988;208:209-214.
8. Heymsfield SB, Bethel RA, Ansley JD, Gibbs DM, Felner JM, Nutter DO. Cardiac abnormalities in cachectic patients before and during nutritional repletion. *Am Heart J*

- 1978;95:584-594.
9. Bistrrian BR, Sherman M, Blackburn GL, Marshall R, Shaw C. Cellular immunity in adult marasmus. *Arch Intern Med* 1977;137:1408-1411.
  10. Wissing U, Ek AC, Unosson M. A follow up study of ulcer healing, nutrition, and life situation in elderly patients with leg ulcers. *J Nutr Health Aging* 2001;5:37-42.
  11. Bales CW, Ritchie CS. Sarcopenia, weight loss, and nutritional frailty in the elderly. *Annu Rev Nutr* 2002;22:309-323.
  12. Roubenoff R, Hughes VA. Sarcopenia: current concepts. *J Gerontol A Biol Sci Med Sci* 2000;55:M716-M724.
  13. MacIntosh C, Morley JE, Chapman IM. The anorexia of aging. *Nutrition* 2000;16:983-995.
  14. Nelson K, Brown ME, Lurie N. Hunger in an adult patient population. *JAMA* 1998;279:1211-1214.
  15. Guarnieri G, Antonione R, Biolo G. Mechanisms of malnutrition in uraemia. *J Ren Nutr* 2003;13:153-157.
  16. Walker D, Beauchene RE. The relationship of loneliness, social isolation, and physical health to dietary adequacy of independently living elderly. *J Am Diet Assoc* 1991;91:300-304.
  17. Brodaty H, Luscombe G, Parker G, et al. Increased rate of psychosis and psychomotor change in depression with age. *Psychol Med* 1997;27:1205-1213.
  18. Wolf-Klein GP, Silverstone FA, Levy AP. Nutritional patterns and weight change in Alzheimer patients. *Int Psychogeriatr* 1992;4:103-118.
  19. Powell-Tuck J, Hennessy EM. A comparison of mid upper arm circumference, body mass index and weight loss as indices of under nutrition in acutely hospitalised patients. *Clin Nutr* 2003;22:307-312.
  20. Visvanathan R, Penhall R, Chapman I. Nutritional screening of older people in a sub-acute care facility in Australia and its relation to discharge outcomes. *Age Ageing* 2004;33:260-265.
  21. Vellas B, Guigoz Y, Garry PJ, et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. *Nutrition* 1999;15:116-122.
  22. World Health Organisation. Food based dietary guidelines for older adults: healthy aging and prevention of chronic noncommunicable diseases (Annex 3). Available at: [www.who.int/nut/publications.htm#older](http://www.who.int/nut/publications.htm#older).
  23. Bernstein A, Nelson ME, Tucker KL, et al. A home based nutrition intervention to increase consumption of fruits, vegetables, and calcium rich foods in community dwelling elders. *J Am Diet Assoc* 2002;102:1421-1427.
  24. Kretser AJ, Voss T, Kerr WW, Cavadini C, Friedmann J. Effects of two models of nutritional intervention on homebound older adults at nutritional risk. *J Am Diet Assoc* 2003;103:329-336.
  25. Milne AC, Potter J, Avenell A. Protein and energy supplementation in elderly people at risk from malnutrition. *Cochrane Database Syst Rev* 2002;CD003288.
  26. Gray-Donald K, Payette H, Boutier V, Page S. Evaluation of the dietary intake of homebound elderly and the feasibility of dietary supplementation. *J Am Coll Nutr* 1994;13:277-284.
  27. Tkatch L, Rapin CH, Rizzoli R, et al. Benefits of oral protein supplementation in elderly patients with fracture of the proximal femur. *J Am Coll Nutr* 1992;11:519-525.
  28. Langer G, Schloemer G, Knerr A, Kuss O, Behrens J. Nutritional interventions for preventing and treating pressure ulcers. *Cochrane Database Syst Rev* 2003;CD003216.
  29. Douglas RM, Chalker EB, Treacy B. Vitamin C for preventing and treating the common cold. *Cochrane Database Syst Rev* 2000;CD000980.
  30. Tabet N, Birks J, Grimley Evans J. Vitamin E for Alzheimer disease. *Cochrane Database Syst Rev* 2000;CD002854.
  31. Malouf M, Grimley EJ, Areosa SA. Folic acid with or without vitamin B12 for cognition and dementia. *Cochrane Database Syst Rev* 2003;CD004514.
  32. Evans JR, Henshaw K. Antioxidant vitamin and mineral supplementation for preventing age-related macular degeneration. *Cochrane Database Syst Rev* 2000;CD000253.
  33. Simmons SF, Walker KA, Osterweil D. The effect of megestrol acetate on oral food and fluid intake in nursing home residents: a pilot study. *J Am Med Dir Assoc* 2004;5:24-30.
  34. Volicer L, Stelly M, Morris J, McLaughlin J, Volicer BJ. Effects of dronabinol on anorexia and disturbed behavior in patients with Alzheimer disease. *Int J Geriatr Psychiatry* 1997;12:913-919.
  35. Bennett RG. In re Megestrol acetate treatment. *J Am Geriatr Soc* 2001;49:339.
  36. Nelson KA, Walsh D, Sheehan FA. The cancer anorexia-cachexia syndrome. *J Clin Oncol* 1994;12:213-225.
  37. Chu LW, Lam KS, Tam SC, et al. A randomised controlled trial of low-dose recombinant human growth hormone in the treatment of malnourished elderly medical patients. *J Clin Endocrinol Metab* 2001;86:1913-1920.
  38. Blackman MR, Sorkin JD, Munzer T, et al. Growth hormone and sex steroid administration in healthy aged women and men: a randomised controlled trial. *JAMA* 2002;288:2282-2292.
  39. Commonwealth Department of Health and Aged Care. Eat well for life: a practical guide to the Dietary Guidelines for Older Australians. 2000. Available at: [www.nhmrc.gov.au/publications/synopses/n23syn.htm](http://www.nhmrc.gov.au/publications/synopses/n23syn.htm).
  40. Barone L, Milosavljevic M, Gazibarich B. Assessing the older person: is the MNA a more appropriate nutritional assessment tool than the SGA? *J Nutr Health Aging* 2003;7:13-17.
  41. Persson MD, Brismar KE, Katzarski KS, Nordenstrom J, Cederholm TE. Nutritional status using mini nutritional assessment and subjective global assessment predict mortality in geriatric patients. *J Am Geriatr Soc* 2002;50:1996-2002.
  42. Saletti A, Lindgren EY, Johansson L, Cederholm T. Nutritional status according to mini nutritional assessment in an institutionalised elderly population in Sweden. *Gerontology* 2000;46:139-145.

Email: [renuka.visvanathan@adelaide.edu.au](mailto:renuka.visvanathan@adelaide.edu.au) 