

Nutrition in the elderly

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Nutrition plays a key role in influencing the health and well-being of our ageing population, yet its importance is often underestimated or poorly understood. The general practitioner should have a sound knowledge of the nutritional requirements of the elderly and how to achieve and maintain such requirements. Nutritional status should be assessed regularly in elderly patients so that their quality of life can be improved. Thin and frail should not be accepted as part of the normal ageing process because appropriate eating habits and regular physical activity can prevent or reverse, at least in part, this situation.

■ Australia's ageing population is increasing. In 1991 the proportion of the population aged 65 years and over was 11.2% (and 4.4% of the population were 75 years and over). In 2031 the projected number of elderly who will be 65 years and over is expected to climb to 19.1% (and 9.0% of the population will be 75 years and over).

Maintenance of good health in the

elderly requires more effort than in younger adults because of the increased prevalence of disease, and age-related changes that occur in body composition and organ function. Additionally, the elderly are at greater risk of physical disability, memory loss, loneliness, social isolation and depression, all of which negatively impact on nutritional status. A sound knowledge and understanding of the nutritional requirements of the elderly, and how to achieve and maintain such requirements, are important in maximising the overall health and enjoyment of life in the elderly.

Factors affected by dietary intake

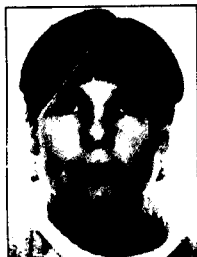
Functional status, body composition and disease susceptibility all change with age and are all affected by dietary intake (Figure 1). The assessment of dietary intake and body composition is central to the assessment of nutritional status in the elderly.

Functional status

Functional status, which includes immune function, cognitive function, muscle function and organ function, tends to decline with age. An adequate intake of food (energy, nutrients and non-nutrients) may assist in slowing and in some cases reversing this decline. Protein energy malnutrition in the elderly can alter their cognitive function; however, dietary causes are often overlooked when diagnosing this problem. Nutritional supplementation in the aged enhances immune function and reduces the risk of infection.

Body composition

Body composition alters as we age. There is a reduction in lean body mass, in particular skeletal muscle mass. In those aged 70 there is a 40% reduction in skeletal muscle compared with its peak weight in early adulthood.¹ While lean body mass declines with age, there is an accompanying increase in fat mass. Furthermore the distribution of fat becomes more central. An excessive intake of energy in relation to expenditure will ultimately lead to obesity. On the other hand, wasting occurs when energy expenditure



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Table 1. Functions affecting nutrition

Mobility
Food preparation
Shopping
Cognitive function
Eyesight
Feeding, chewing, swallowing

Protein energy malnutrition in the elderly can alter their cognitive function. This is often overlooked.

Table 2. Minimum daily nutritional needs of the elderly

Food group	Serves
Breads and cereals	Four or more serves with variety
Dairy (preferably low fat)	Three serves, e.g. 200 mL milk, 200 g (tub) yoghurt and 30 g (1.5 slices) cheese
Fruit	Two serves with variety (including one rich in vitamin C)
Vegetables	Five serves with variety
Meat, fish, poultry, eggs, cheese, pulses	One to two serves with variety
Water (including tea, juices)	Eight cups

exceeds intake. Both excesses and deficiencies impact on body composition unfavourably, which in turn can impact on functional and disease status. The estimation of energy requirements is confounded in the elderly by disease, loss of lean body mass (metabolically active tissue) and reduced physical activity.

Recent evidence suggests that a daily protein intake in the vicinity of 0.9 g/kg body weight per day for elderly women may describe a diet which enhances lean mass, muscle function and immune function.²

Disease

The prevalence of disease rises as we age. The onset of many chronic diseases such as coronary heart disease, certain cancers, noninsulin-dependent diabetes and osteoporosis are in part attributable to dietary habits. The risk

of developing certain cancers has been associated with low intakes of fruits and vegetables.

Good nutrition not only reduces the risk of developing certain diseases, it also improves the health outcome of elderly people who develop disease. For example, obesity is a risk factor in the development of noninsulin-dependent diabetes in older adults and good nutrition is essential in helping to manage this disease effectively. Other diseases may become nutritionally dependent, for instance wasting that occurs in cancer patients will become more rapid in those who have poor energy intakes.

If oxidative damage contributes to the process of age-related macular degeneration (AMD) then antioxidants may protect or slow the progression of this condition. However, studies of dietary carotenoids,

examining the relationship between plasma levels and AMD, have shown inconsistent results.^{3,5}

Nutrient supplements may not decrease mortality, as evidenced by the NHANES study in the United States.⁶ This evidence tempers the findings of reduced coronary mortality and higher vitamin E intakes in the studies on US nurses and male health care professionals.^{7,8} More attention will be required to ascertain how optimal micronutrient intakes from food or supplements may improve quality of life in the aged.

Functions affecting dietary intake

Activities that many of us take for granted play a very important role in the nutritional status of the elderly person. Functions that affect nutritional state include being mobile enough to shop for food (including the ability to get to and from the shops) and being able to prepare and eat the food that is purchased (see Table 1). Mobility, cognitive function, eyesight and muscle strength are often compromised in the elderly, making these simple tasks difficult (or impossible).

Nutrition-relevant effects of physical activity

Energy intakes of the elderly in affluent societies show a progressive decline that is more rapid than the decline in basal metabolic rates, suggesting reduced intakes are predominantly related to reduced physical activity.⁹ When physical activity is low or absent from the lifestyle of the elderly an adequate dietary intake is hard to achieve. Furthermore, physical activity increases the flexibility of diet. For instance, it may enable extra fat intake with less adverse effect on body weight. Physical activity brings many benefits and the nutrition-related

Table 3. Evaluation of weight loss*

Time	Significant weight loss (%)	Severe weight loss (%)
One week	1 to 2	> 2
One month	5	> 5
Three months	7.5	> 7.5
Six months	10	> 10

*Source: Blackburn GL, Bistrian BR, Maini BS, et al.¹⁶

In those aged 70 there is a 40% reduction in skeletal muscle compared with its peak weight in early adulthood.

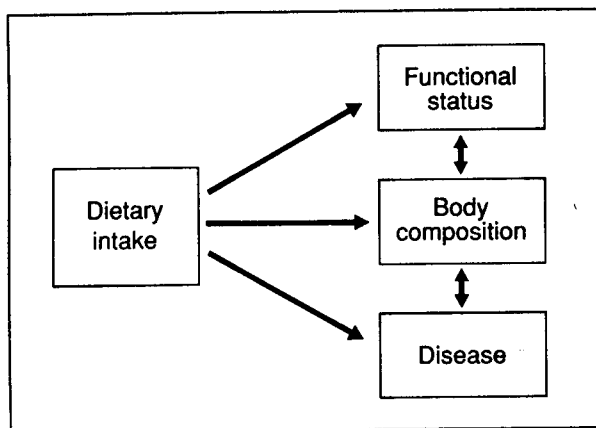


Figure 1 (above). Dietary intake affects the body in more than one way.

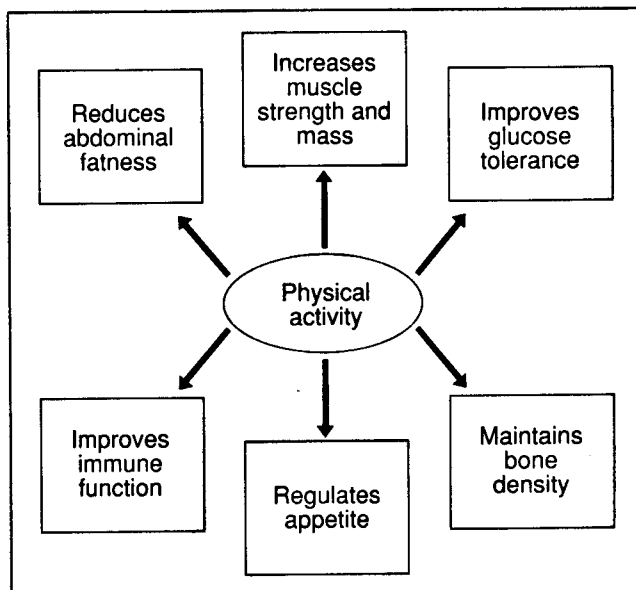


Figure 2 (right). Nutrition-relevant effects of physical activity in the aged.

effects are summarised in Figure 2.

Muscle strength and mass

Mobility increases a person's independence in many activities of daily living including those associated with food intake. A lack of mobility is likely to affect one's sense of well-being, increasing the risk of psychosocial problems such as social isolation. Impaired mobility in the aged relates closely to muscle weakness and reduced muscle mass; however, exercise training helps to maintain muscle strength and muscle mass, and is even capable of increasing both among frail elderly people in their nineties.¹⁰ Moreover, the value of nutrient support may be dependent on concomitant physical activity.¹⁰

Immune function

Infections are the fifth leading cause of death in the elderly, with respiratory tract infections being one of the most important causes of morbidity in this age group. Nutrient requirements are increased during these episodes of illness and if not met erode nutritional

status, often resulting in protein energy malnutrition. Minimising the occurrence of infections alleviates the stress placed on the nutritional status of the elderly. Specific nutrient deficiencies and/or protein energy malnutrition adversely affect immune function, in particular cell-mediated immune responses.¹¹ Additionally, moderate exercise has been shown to enhance immune function, although little is known about the mechanisms involved.

One nutrient that performs a useful role in immune function is glutamine. Glutamine is an important source of energy for lymphocyte and macrophage function. One of its principal storage sites is in skeletal muscle. It seems probable that poor dietary intakes of glutamine and muscle wasting may have an adverse effect on immune function in the aged. Good food sources of glutamine include lean meat, whole wheat flour and soya flour.

Abdominal fatness

Abdominal fatness is associated with glucose intolerance, insulin resistance, hyperinsulinaemia, dyslipoprotein-

aemias and hypertension. One possible explanation for these disturbances is that there is an increased flux of free fatty acids which reduces hepatic extraction of insulin and may contribute to increases in triglyceride production.¹² Excessive energy intake in relation to energy expenditure will over time lead to obesity, and in the

Warning signs of poor nutritional health*

- Disease
- Eating poorly
- Tooth loss or mouth pain
- Economic hardship
- Reduced social contact
- Multiple medicines
- Involuntary weight loss or gain
- Needing assistance with self-care
- Elder years, above age 80

*From the Australian Nutrition Screening Initiative patient handout and checklist entitled 'Determine your nutritional health', available from ANSI, c/o Level 7, 15 Blue Street, North Sydney, NSW 2060, telephone (02) 9966 1255, fax (02) 9966 1244.

The benefits of nutritional supplements such as vitamin E and carotenoids remain uncertain.

case of the elderly the distribution of fat becomes more central. Exercise has a twofold effect: first, it helps to balance energy intake with energy expenditure, thereby reducing the risk of obesity; second, it reduces abdominal fat. Exercise coupled with a reduction in energy intake (particularly fat) will improve metabolic disorders associated with abdominal obesity.

Glucose tolerance

Dietary intakes that contain a wide variety of foods are associated with less macrovascular disease.¹³ The development of macrovascular disease is also associated with impaired glucose tolerance which is more prevalent among the elderly population. Regular exercise increases insulin sensitivity in older people with impaired glucose tolerance.

Bone density

Osteoporosis is a common condition among the elderly, especially women. In Australia, it is estimated that one in every six women will endure a fracture due to osteoporosis over a lifetime. The increased incidence of fractures (especially of the hip) can leave many elderly seriously debilitated for months. Weight-bearing exercise not only assists in preserving bone mineral density but also improves

muscle strength, which has been linked to a reduction in falls.

Diets deficient in calcium can be expected to accelerate bone mineral loss, especially with ageing when the capacity to absorb calcium from the

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gastrointestinal tract is reduced. Other nutritional factors contributing to osteoporosis include excess intakes of sodium, caffeine and alcohol. High protein intakes of sulfur amino acids increase urinary calcium excretion; however, this effect is diminished if dietary protein has a high phosphorus content, like that found in meat and

dairy products. It seems feasible that a case may be made for plant-derived weakly oestrogenic compounds (like those found in soya products) having favourable effects on bone density. This conclusion is based on the finding that tamoxifen through its oestrogenic effect preserves bone mineral density.¹⁴

Appetite

Senses involved with the pleasurable aspects of eating, namely taste and smell, diminish with ageing. These changes, along with certain drugs and a lack of physical exercise, may be responsible for the depressed appetites often seen in elderly people. Poor appetites accompanied by lower intakes of food increase the risk of nutrient deficiencies. This may have a snowball effect when deficiencies in zinc and thiamine also suppress appetite. Sufficient exercise will help to stimulate appetite and improve food intake.

Assessment of nutritional status

The Australian Nutrition Screening Initiative has produced a list of warning signs or risk factors that may adversely affect the nutritional status of the elderly. The list is based on the mnemonic 'DETERMINE' (see the box on page 75). This is often a good starting point in helping to recognise those elderly people who are at risk.

Assessing food intakes

Finding out what an elderly person eats and an estimation of the quantities consumed is a key factor in the nutritional assessment, yet it can be challenging especially in an elderly person with impaired memory.

There are several methods that can be used to obtain this information, but the approach will depend on the person and the information you want. For example, if the person is a poor historian, a food diary kept for at least

Table 4. BMI values with the lowest health risk*

Age (years)	Body mass index (kg/m ²)
19 to 24	19 to 24
25 to 34	20 to 25
35 to 44	21 to 26
45 to 54	22 to 27
55 to 65	23 to 28
> 65	24 to 29

*The BMI values associated with the lowest health risk increase as a person ages. Based on data from the Committee on Diet and Health, National Research Council.¹⁸

When physical activity is low or absent from the lifestyle of the elderly, an adequate dietary intake is hard to achieve.

three days is perhaps the best method. If a food diary is used, clear instructions are essential. Foods eaten should be described accurately and quantified in household measures (cups, tablespoons and so on), and methods of cooking should be recorded when appropriate. For instance, 'two thin grilled sausages and half a cup of potato mashed with two teaspoons of butter and one tablespoon of whole milk' gives more useful information than simply recording 'meat and potato'.

For patients who have better recall, the practitioner can use a diet history to evaluate usual food intake by asking the patients to describe what they eat over the day. It is frequently accompanied by a checklist of foods or drinks that are commonly consumed but may be forgotten at the time of the interview, such as alcohol.

Both methods should provide information on meal patterns, cooking methods and types of foods consumed or absent from the diet.

Table 2 provides a guideline for meeting the minimal daily nutritional requirements for most elderly people. Body weight, activity level and age still need to be considered and the estimated requirements adjusted accordingly. Some elderly people may have difficulty consuming the suggested serving sizes at the traditional meal times (breakfast, lunch and dinner), especially in the nursing home environment where meals are often served over a short period of time to accommodate staff working hours. In this situation or when appetites are small, food intake can be improved with regular snacking.¹⁵

Measuring body composition

A set of scales, a tape measure and skinfold calipers are useful pieces of equipment for making quick, simple anthropometric measurements. Recording body weight over time is

a very simple yet effective means of monitoring changes in nutritional status. Table 3 shows the different levels over time at which percentage weight loss is significant or severe.¹⁶

Gerontological and geriatric population studies in Gothenburg, Sweden, related body mass index (BMI) at age 70 to survival between 70 and 80 years of age.¹⁷ In both men and

Reaching a nutritional diagnosis

Assessment of nutritional status can allow various nutritional diagnoses. Here are some diagnoses suggested by certain measurements of body composition and results of nutritional assessment.

Protein energy malnutrition

- Weight loss > 20%,²² or
- BMI < 18.5 kg/m², or
- MAMA < 30 cm² for women and < 44 cm² for men, or
- Serum albumin < 35 g/L (less definite than above indicators)

Abdominal obesity

(with or without noninsulin-dependent diabetes mellitus)

- Abdominal circumference ≥ 95 cm in women and ≥ 100 cm in men, or
- Abdominal hip ratio > 0.85 in women and > 0.95 in men

Micronutrient deficiencies

- Selective, collaborative haematological and biochemical data

Nutrient-dependent immunodeficiency

Deficiencies in:

- Protein, and specific amino acids such as glutamine
- Vitamins – B₆, B₁, B₂, B₁₂, folate, C, A, E
- Minerals – zinc, iron, selenium, copper

Osteoporosis

- Vitamin D-responsive osteopenia of impaired renal function (secondary to hyperthyroidism)

Formulas and definitions

Percentage weight change

% weight change = (usual weight – actual weight) ÷ usual weight x 100

Body mass index

BMI is used as an estimate of total body fatness

BMI = (weight in kg) ÷ (height in m)²

Mid-arm muscle area

MAMA is a measure of muscle mass

MAMA = [MAC – (3.14 x TSF ÷ 10)]² ÷ (4 x 3.14)

MAC is the mid-arm circumference (in cm) and TSF is the triceps skinfold thickness (in mm). The calculation for MAMA is in cm.²

Abdominal circumference

Abdominal circumference is a measure of abdominal obesity; it is measured midway between the lower bony rib cage and the iliac crest in a standing position.

Moderate exercise has been shown to enhance immune function, but little is known about the mechanisms involved.

women survival was significantly associated with a high BMI (around 28 kg/m² in men and 26 kg/m² in women), and there was a significant increase in mortality with a BMI less than 24 kg/m² (B. Steen, personal communication). As a person ages, the BMI range associated with the lowest health risk increases (Table 4).¹⁸ In the elderly, being overweight has less adverse effects on health than being underweight, so addressing changes in weight loss are more important. Health outcomes could be enhanced with early detection and intervention. Severely malnourished elderly patients will find it difficult, if not impossible, to consume sufficient quantities for weight gain.

Other measures of nutritional status

include skinfold and circumference measurements. The World Health Organization considers calf circumference (taken at the largest circumference of the calf) to be a more sensitive measure of muscle mass than mid-arm muscle circumference;¹⁹ however, reference values for the former are very limited. Mid-arm muscle area values less than the 10th percentile (30 cm² for women, 44 cm² for men) deserve attention (see the box on page 000). Again, serial measurements are useful in highlighting changes before they become serious.

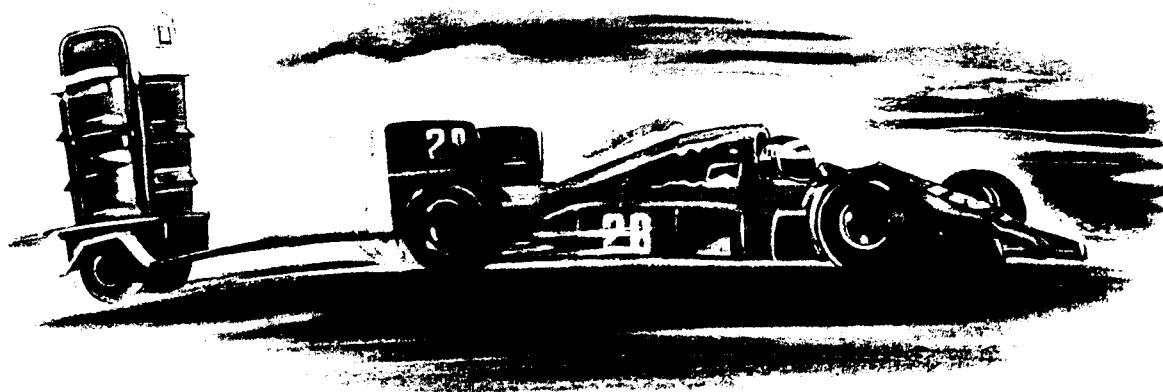
Biochemical, haematological and immunological tests

Medications, disease states, shifts in fluid balance and the ageing process

may affect biochemical and haematological measurements. Serum albumin, although affected by disease and fluid shifts, is a useful measure of nutritional status when used in conjunction with other nutritional assessments. Immune function tests are costly but useful in assessment. Tests to evaluate nutrient status (Table 5) are important if deficiencies seem likely, for instance in cases when elderly patients are taking medications known to interfere with vitamin status.

Psychosocial assessment

It is important to be aware of cultural factors, social networks, living conditions, lifestyle factors and the overall well-being of the elderly in care. Social isolation, bereavement, depression,



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Dietary intakes that contain a wide variety of foods are associated with less macrovascular disease.

Table 5. Tests to evaluate nutrient deficiencies and food sources to remedy them

Nutrient	Laboratory investigations	Good food sources
Vitamins		
Folate (folacin)	Haemoglobin and RBC indices, serum folate, RBC folate, serum homocysteine	Liver, leafy greens, peas, brussels sprouts, nuts, cauliflower, berries
Vitamin B ₁₂	Serum B ₁₂ , serum homocysteine	Liver, sardines, oysters, eggs, cheese, milk, fish, beef
Vitamin D	25-hydroxy-vitamin D	Cod liver oil, oily fish (salmon, tuna, sardines)
Minerals		
Iron	Haemoglobin and RBC indices, serum iron, transferrin, ferritin (unless acute phase reactant)	Meat, liver, kidney, egg, spinach
Zinc	Fasting serum zinc (allowing for serum albumin which is a zinc transport protein)	Meat, oysters, wholegrain bread, legumes
Essential fatty acids		
Omega 3	Platelets and RBC fatty acid pattern	Fish, seeds, lean meat
Omega 6	Platelets and RBC fatty acid pattern	Lean meat, nuts, seeds
Amino acids		
Glutamine*	Assessment of need based on knowledge of at-risk groups – aged, those with metabolic stress (e.g. perioperative or with sepsis)	Lean meat, whole wheat flour

*Glutamine can be synthesised from glutamic acid. Food proteins containing good sources of glutamic acid in descending order include: whole wheat flour, milk, maize flour, soya flour, lean beef, broad beans, potatoes, and egg. The protein content of these foods, however, varies considerably and in descending order include: soya flour, lean meat, egg, whole wheat flour, broad beans, milk, potato and maize flour.²⁰
RBC=red blood cell.

poverty and poor mobility can all have adverse effects on nutritional status and so it is important to address these problems as soon as possible.

Medication review

Elderly people are often on many medications that should be reviewed regularly (including over the counter medications). Medications may alter appetite, taste, and availability or metabolism of nutrients. Laxatives containing paraffin oil or phenolphthalein may affect vitamin D and calcium status. Optimising bioavailability of these two nutrients is especially important in the elderly when bone density is diminishing.

A few simple questions relating to food and beverage variety, as an index of dietary nutritional quality, may identify potential deficiencies that are

easily preventable. If constipation cannot be corrected through diet, dietary fibre-based laxatives such as ispaghula husk (Fybogel) and psyllium hydrophilic mucilloid (Metamucil,

Agiofibe) may be recommended.²¹ For particular nutrients at risk of deficiency (iron, folate, B₁₂, calcium, vitamin D and zinc) good food sources are worth knowing (Table 5).

Practice points

- Be aware of risk factors such as disease, poor dietary intake, socioeconomic obstacles, multiple medication.
- Do a nutritional assessment, including dietary intake, body composition, (anthropometry), biochemical, haematological, immunological tests, psychosocial assessment, medication review.
- Diagnose the problem; possibilities are: undernutrition (protein energy malnutrition, specific nutrient deficiencies), abdominal obesity, micronutrient deficiencies, nutrient-dependent immunodeficiency, osteoporosis.
- Use various elements of management: lifestyle, psychosocial factors, nutrient-dense foods, food variety, food and nutrient supplements, physical activity.
- Review your patient regularly.

In the elderly, being overweight has less adverse effects on health than being underweight.

Key elements in management

- Remove or alleviate obstacles that may hinder nutritional progress by treating depression, correcting inappropriate food habits, and encouraging participation in social activities.

- Encourage intakes of nutrient dense foods. Nutrient dense foods maximise nutrient intake while minimising the risk of excessive weight gain. They have a high nutrient intake in relation to their energy content. Such foods include low fat milk, eggs, liver, lean meats, fish, chicken, most fruits and vegetables, wholemeal breads, wholegrain cereals, and yeast-based products like Vegemite (although high in sodium).

- Ensure dietary intakes encompass a broad range of foods. Food variety guarantees the consumption of a wide range of nutrients and non-nutrients that may have potential health benefits. For example, evidence is emerging that phytoestrogens (a class of non-nutrients found notably in soya bean products) may reduce the risk of breast cancer.

- Recommend high protein and energy food supplements (available in some supermarkets) for those elderly unable to consume sufficient quantities to meet their nutritional requirements. Comprehensive multivitamin and mineral supplements at the level of RDIs (recommended daily intakes) may be used when energy intakes are adequate but nutrient density is not, or when energy intakes are low and the micronutrient content of the protein and energy supplement of the diet is inadequate.

- Recommend regular exercise such as walking. Physical educationists and physiotherapists can help to plan appropriate exercise programmes for those with physical disabilities.

- Review the patient regularly.

Conclusion

Nutritional status in the elderly should be assessed regularly to improve quality of life. This requires an awareness of risk factors associated with nutritional problems, and

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the appropriate equipment and skills to make a nutritional assessment. Once problems have been identified and diagnosed, nutritional management can, with attention to physical activity, be implemented and reviewed regularly to ensure its effectiveness. ■

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