

# Nutrition and wound healing

A guide for healthcare professionals



Wound management is a significant and growing health burden on the community.<sup>1</sup> Delayed wound healing and wound infection place a substantial financial burden on healthcare systems, as a result of increasing dependency and increased hospital admissions. Chronic wounds also have a very large social and quality of life impact on individuals and carers.<sup>2</sup>

Nutrition plays an essential role in wound healing and wound care practices, and nutritional support needs to be considered a fundamental part of wound management. Attending to nutrition in wound care is also cost-effective.<sup>3</sup>

Poor nutrition before or during the healing process may delay healing and impair wound strength, making the wound more prone to breakdown. Neglecting the nutritional health of an individual with a wound can compromise the entire wound management process.<sup>3</sup>

By combining knowledge of the wound healing process together with best practice provision of nutrition, healthcare professionals can help decrease the morbidity and mortality associated with chronic wounds as well as reducing their cost and impact.<sup>3</sup>

### **The guide aims to:**

- Provide simple advice on the role of nutrition in wound healing for healthcare professionals involved in the management of wounds;
- Summarise the evidence for the relationship between nutrition and wound healing;
- Provide practical guidance on when and how to implement nutritional support to help promote wound healing.



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The content of this document has been developed by health experts using available medical evidence and should be used as a guide only. Specific treatment advice should be sought from an expert in your wider healthcare team.

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# Wound burden in Australia – the facts

## Chronic wounds are a large social, economic and healthcare burden in Australia, and around the world.<sup>1</sup>

Chronic wounds can be defined as wounds that take more than 4–6 weeks to heal.<sup>4</sup>

### Examples of wounds that may become chronic:

- Pressure injuries
- Postoperative wounds
- Wounds in people with diabetes
- Arterial ulcers on legs and feet
- Venous leg ulcers
- Extended burns
- Stomas
- Amputation wounds



## Risk factors

Chronic wounds may occur in any individual but are more frequent in the elderly and chronically ill. With an ageing population and a dramatically increasing prevalence of chronic disease, wound care will inevitably become an even more significant issue for health systems.<sup>5,6</sup>

Diabetes is a predisposing factor for wounds (ulcers on legs and feet), which is a major issue considering the increasing number of people with diabetes.<sup>1</sup> The frequency of ulcers and lower limb amputations caused by chronic ulcers in people with diabetes has constantly increased in Australia.<sup>7</sup> In Australia, diabetes is the most common cause of lower limb amputation, not caused by trauma.<sup>8</sup>

It is estimated that 1.7 million people (including all types of diabetes) in Australia have diabetes.<sup>8</sup> Diabetes is the fastest growing chronic condition in Australia with 280 Australians developing diabetes every day.<sup>8</sup> Diabetes is often underdiagnosed and undertreated.<sup>8</sup>

Individuals with hip fractures, knee replacement or other surgical procedures are at higher risk of developing pressure injuries,<sup>9</sup> as are individuals<sup>9</sup> with neurological impairment and those who are immobile and/or requiring prolonged bed rest.<sup>10</sup> Other wounds at risk of delayed healing are wounds in oncology patients and stomas.



### Summary of risk factors for delayed wound healing:

- Arthritis
- Chronic liver disease
- Diabetes
- Excess alcohol intake
- Difficulty with showering/bathing
- Difficulty eating a healthy diet with a variety of foods
- Inflammatory disease
- Rheumatoid arthritis
- Older age (over 65 years)
- Taking multiple medications
- Poor venous circulation and peripheral vascular disease
- Neurological decline or impairment
- Renal failure
- Smoking
- Vascular disease
- Weakened immune system<sup>11</sup>
- Malnutrition and nutritional deficiencies<sup>12</sup>

## Prevalence

There is limited published data on the prevalence of chronic wounds in Australia, but with an ageing population and rise in obesity, it is likely that the prevalence of chronic wounds has increased recently.<sup>13</sup> Chronic wounds include arterial ulcers, diabetic foot ulcers, venous leg ulcers, pressure injuries and leg ulcers.<sup>13</sup> Chronic wounds are a significant national healthcare problem affecting the quality of life of many Australians. It is estimated that 433,000 Australians have some form of a chronic wound at any time.<sup>14</sup>

In 2017, NSW Health undertook a comprehensive pressure injury prevalence survey; 172 inpatient facilities, 67 RAC facilities and 79 community and outpatient services participated in the survey.

84% of people eligible for the survey consented to a skin inspection (13,672 people) and are included in the results. In 2017, the overall prevalence of pressure injury for people consenting to a skin inspection was 7.9%.

The NSW Health 2017 pressure injury prevalence survey showed 7.7% overall pressure injury prevalence in inpatients in hospitals, a 7.8% overall pressure injury prevalence in residential aged care, and a 9.3% overall pressure injury prevalence in community and outpatient facilities. The majority of pressure injuries in hospitals, residential aged care and community and outpatient pressure injury facilities were located on the sacrum, buttocks or heels.<sup>15</sup>

## Burden

**2% of the national health expenditure is spent on wounds, which is an estimated \$4.22 billion per year. Of the \$4.22 billion, \$2.45 billion is allocated to the costs of pressure injuries per year.<sup>16</sup>**

In human costs, pressure injuries are associated with pain, discomfort, decreased mobility, loss of independence and social isolation.<sup>17,18</sup> Older persons with pressure injuries also suffer higher death rates.<sup>18</sup>

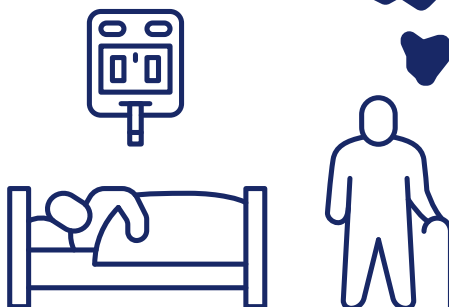
Diabetes related lower limb amputation, following an infected ulcer, is a significant personal and public health cost in Australia.<sup>19</sup> Half of all amputations occur in people with diabetes.<sup>20</sup>

**Chronic wounds cause significant health, social and financial burden.<sup>1</sup>**

**Estimated pressure injury prevalence in care settings is 7.9%.<sup>15</sup>**

**Chronic wounds particularly affect the elderly, people with diabetes, the chronically ill and others at risk.<sup>13</sup>**

**It is estimated that pressure injuries cost Australia around \$2.45 billion each year.<sup>16</sup>**



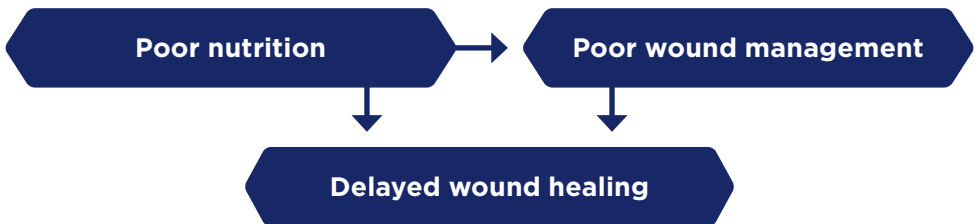
# Nutrition in wound healing

**There is a large body of evidence demonstrating the essential role of nutrition in wound healing. Without adequate nutrition, healing may be impaired and prolonged. Improved nutritional status enables the body to heal wounds,<sup>2</sup> such as the accelerated wound healing seen with nutritional supplementation.<sup>3</sup>**

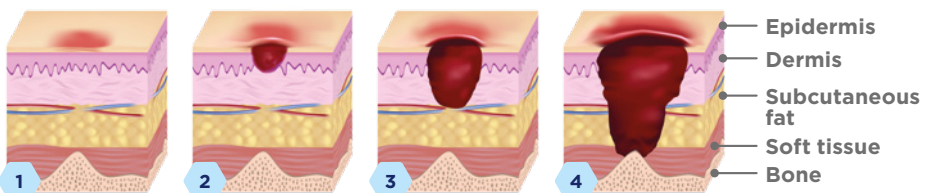
Wound healing is a complex process that involves high cell turnover and important tissue deposition, replacing injured tissue with new tissue produced by the body, which demands an increased consumption of energy and nutrients, particularly protein and calories.<sup>6,21</sup>

A wound elicits a number of changes in the body that can affect the healing process, including changes in energy, protein, carbohydrate, fat, vitamin and mineral metabolism. When the body sustains a wound, stress hormones are released in a fight-or-flight reaction and the metabolism alters in order to supply the injured area with the nutrients it needs to heal – known as the catabolic phase.<sup>2,21</sup> The body experiences an increased metabolic rate, loss of total body water, and increased collagen and cellular turnover.<sup>2</sup> These effects can be pronounced even with a small wound.

If the catabolic phase is prolonged and/or the body is not provided with adequate nutrient supplies, then the body can enter a protein-energy malnutrition (PEM) state. Factors causing prolonged catabolism include the severity of the wound and the preexisting nutritional status of the individual.<sup>3</sup>



## Stages of pressure injury



Protein-energy malnutrition (PEM) is the most serious type of malnutrition, it occurs when there is inadequate intake or impaired absorption of both protein and energy. PEM causes the body to break down protein for energy, reducing the supply of amino acids needed to maintain body proteins and healing, and causing loss of lean body mass. Therefore PEM may be directly linked to wounds that aren't healing.<sup>6,22</sup> PEM can be defined as low Body Mass Index (BMI) or unintentional weight loss (of 5% or more) with loss of subcutaneous fat and/or muscle wasting.<sup>22,23</sup>



As an individual loses more lean body mass (LBM), wound healing is more likely to be delayed. With a 20% or greater loss of LBM wounds compete with muscles for nutrients. If LBM loss reaches 30% or more the body will often prioritise the rebuilding of body tissue over wound healing with available protein.<sup>22</sup> This cascade demonstrates the severely negative impact poor nutrition can have on chronic wound healing.

**Acute injury or infection-induced weight loss<sup>25</sup>**

| Loss of lean body mass (%) | Complications                                                     | Associated mortality (%) |
|----------------------------|-------------------------------------------------------------------|--------------------------|
| 10%                        | Impaired immunity, increased infection                            | 10%                      |
| 20%                        | Decreased healing, weakness, infection                            | 20%                      |
| 30%                        | Too weak to sit, pressure injuries develop, pneumonia, no healing | 50%                      |
| 40%                        | Death, usually from pneumonia                                     | 100%                     |

Even in today's society where we are fortunate to have access to a variety of nutritious foods, older people often suffer from malnutrition.<sup>2,3</sup> In fact, it has been estimated that up to 60% of older patients in hospitals are malnourished, or at risk of malnutrition. Of those in nursing homes, between 40% and 85% have malnutrition, and 20% to 60% of home care patients are malnourished.<sup>22,26,27</sup>



**This is an important consideration as elderly people are more likely to have slow-to-heal wounds and are more likely to be malnourished.<sup>28</sup>**

Nutrition for chronic wounds needs to be assessed on an individual basis, however pressure injuries – especially larger or multiple injuries – and ulcers on legs in people with diabetes place high demand for nutrients on the body.

As such, these types of chronic wounds may be a priority for healthcare professionals in terms of providing nutritional support and supplementation.

Infected wounds also increase both energy and nutrient demand.<sup>6</sup> Nutritional status can influence the level of infection given the key role of some nutrients in supporting the immune system against microbial attack.<sup>2</sup> If an infection is not identified early and treated, it can increase the risk of developing sepsis, which has been shown to further delay wound healing. The presence of sepsis also has profound negative impact on the nutritional status of the patient. Septic patients display a set of well known metabolic responses that can lead to protein catabolism and muscle wasting.<sup>2</sup>

Protein loss via wound exudate needs to be monitored. If dressings are being changed frequently due to the amount of exudate, protein is being lost at a high rate and therefore protein replacement should be considered.<sup>29,30</sup>

**Frequent  
dressing  
changes**

=

**Protein  
loss**

=

**Impaired  
nutritional  
status**



# The nutritional evidence

**There are a number of nutrients that play an important role in wound healing. The following is a summary of these nutrients.**

## Protein

Protein is essential for the maintenance and repair of body tissue. Depleted protein levels will cause a decrease in collagen development, slowing the wound healing process. Adequate protein levels will help achieve optimal wound healing rates.<sup>2,29,31</sup>

Protein requirements should be calculated on an individual basis, and they should be monitored closely. This needs to happen along with the provision of energy in the form of calories/kJ, because if energy needs aren't met the body will use protein for energy rather than for wound healing.<sup>29</sup>

- In slow to heal/chronic wounds, a recommended daily intake of 1.25-1.5g/kg/day will meet the protein needs of most individuals.<sup>6,12</sup>
- Sources of protein include red and white meats, fish, eggs, liver, dairy products (milk, cheese, yoghurt), soy beans, legumes, seeds, nuts and grains.<sup>6</sup>



## Amino acids

### L-arginine

L-arginine is an amino acid that has several properties that enhances a number of the pathways involved in wound healing, such as its role in structural protein synthesis.

As the body needs more protein during wound healing the demand for normally non-essential amino acids, such as L-arginine, becomes essential.

Dietary supplementation with arginine has been shown to enhance protein metabolism, helping to decrease muscle loss, and collagen synthesis, which helps to increase the strength of the wound.<sup>1,3,18,22</sup>

In addition, L-arginine is essential for the stimulation of the nitric oxide pathway, which is in turn important for collagen deposition in wound healing.<sup>18,32,33</sup>

L-arginine supplementation has also been shown to enhance the immune system and improve the secretion of growth hormone and insulin that are also involved in wound healing.<sup>3</sup>

People with pressure injuries who have been treated with nutrition supplements containing arginine show a significantly improved rate of ulcer healing.<sup>18,34,35,36</sup> L-arginine is also effective in healing chronic ulcers in people with diabetes (ultimately helping to reduce leg amputations).<sup>1</sup>

- Supplementing with 9g of L-arginine has been shown to help promote wound healing.<sup>18,34,35,36</sup>
- An average dietary intake provides about 4g L-arginine per day.<sup>37</sup>
- Arginine is conditionally essential, meaning that when we are healthy our bodies produce sufficient arginine however, during wound healing requirements increase to a level where supplementation is recommended.<sup>3</sup>

### Side effects

L-arginine supplementation can cause diarrhoea. Giving ARGINAID® one-hour post-meal may decrease the incidence of diarrhoea.<sup>38</sup>

## Energy

The main sources of energy for the human body – and for wound healing – are carbohydrates and fats. The main demand for energy from a wound is for collagen synthesis. Caloric needs for healing increase according to increasing size and complexity of the wound.<sup>2</sup>

- For patients with wounds, energy requirements are estimated at 30–35kcal/kg.<sup>12</sup>
- Energy requirements vary according to gender, age, activity and clinical status.



## Fats

Fats, including mono- and polyunsaturated fats, provide fuel for wound healing. Fats are a safe and concentrated source of energy. For example, fat has more energy at 9cal/g than carbohydrate at 5cal/g.<sup>39</sup> Importantly, adequate fats are needed to prevent the body using protein for energy.<sup>29</sup>

Fatty acids are a major component of cell membranes,<sup>29</sup> and demands for essential fatty acids increase after injury.<sup>2</sup> Essential unsaturated fatty acids must be supplied in the diet as the body cannot synthesise enough for the needs of wounds.<sup>2</sup> The benefit of omega 3 fatty acid supplementation in wound healing is still not clear and there is some evidence this may reduce wound strength.<sup>29,40</sup>

- Good sources of fat to promote wound healing include lean meats, dairy – cheese and yoghurt, nuts, seeds, extra virgin olive oil, avocado and oily fish like salmon.
- If an individual is overweight, then low fat varieties may be better choices. However, it is important to consider recent weight changes as individuals who have recently lost weight may also be malnourished, and in this case mono- and polyunsaturated fat sources should be prioritised.
- Aim for weight maintenance during wound healing. If a person is overweight they should not try to lose weight until their wound has completely healed. A person who is underweight should try to put on enough weight to bring them into the normal range.<sup>39</sup>



**Underweight**

**Gain weight to normal range**

**Overweight**

**Aim for weight maintenance**

### Diets and wound healing

In clinical practice, there can often be conflicting nutritional goals that interfere with goals for healing. Specialised diets in particular can be a risk factor for delayed wound healing. It is not appropriate for people with wounds to follow diets that limit intake, such as diets to reduce cholesterol or weight and diets that avoid entire food groups such as carbohydrates.

People with vegetarian or vegan diets, food allergies, or on dialysis need careful consideration and in these situations it is recommended that you seek the help of a dietitian.

## Carbohydrates

Carbohydrate is a major source of calories for use by the body, and its availability is essential to prevent other nutrients (e.g. protein) from being converted into energy. It is not clear how carbohydrate deficiency influences wound healing but increased carbohydrate intake provides energy that is essential for optimal healing.<sup>2</sup> This needs to be undertaken with caution in people with diabetes, and monitoring (e.g. blood glucose levels, glycated haemoglobin) will be required. Low glycaemic index (GI) choices are the best options to maintain stable glycaemic control.

- Carbohydrate sources include wholegrain cereals, breads, potatoes, rice, pasta, biscuits.<sup>5</sup>

## Antioxidants



### Vitamin C

Vitamin C plays an important role in collagen synthesis and subsequent crosslinking, as well as the formation of new blood vessels (angiogenesis). Adequate vitamin C levels help strengthen the healing wound.<sup>2,22,29,40</sup>

Vitamin C has important antioxidant properties that help support the immune system. It also increases the absorption of iron.<sup>29</sup>

Vitamin C deficiency impairs wound healing and has also been associated with an increased risk of wound infection.<sup>2</sup> Research has shown vitamin C supplementation helps promote pressure injury healing.<sup>22</sup>

- Recommended vitamin C supplementation for deficient patients is 60–200mg daily. Doses over 200mg a day are not necessary as tissue saturation occurs at this point.<sup>29</sup>
- Vitamin C is found mostly in fruit and vegetables, especially oranges, grapefruit, tomatoes, and leafy vegetables. Fruit juices with added vitamin C are also a good source, although often they contain only small amounts of vitamin C.<sup>29</sup>

### Side effects

Vitamin C supplementation can cause diarrhoea.

If a person has been on high supplementary doses of vitamin C they may be at risk of developing scurvy when supplementation ceases.



### Vitamin A

Vitamin A increases the inflammatory response in wounds, stimulating collagen synthesis. Low vitamin A levels can result in delayed wound healing and susceptibility to infection.<sup>2,22</sup>

It has also been shown that vitamin A can restore wound healing impaired by long-term steroid therapy or by diabetes. Serious stress or injury can cause an increase in vitamin A requirements. While the mechanisms of vitamin A in wound healing are still not well understood, it is clear that it plays an important role.<sup>2</sup>

Supplementation with vitamin A requires caution, as there is a risk of toxicity, this should only be done under medical supervision where a deficiency has been diagnosed.<sup>22</sup>

- Vitamin A is found in milk, cheese, eggs, fish, dark green vegetables, oranges, red fruits and vegetables.<sup>6</sup>
- The recommended dose in cases of vitamin A deficiency is 700–3000 IU – the higher range being for males.<sup>22</sup>



## Vitamin E

It is possible that vitamin E can reduce injury to the wound by controlling excessive free radicals.<sup>2,29</sup> Contrary to popular opinion, there is limited evidence for the benefits of vitamin E in decreasing scar formation. There is also some evidence that suggests oral supplementation of vitamin E over 400mg/day has an increased health risk.<sup>41</sup>

- Vitamin E supplementation or topical application is rarely needed for wound healing.<sup>22</sup>

## Minerals



## Zinc

Zinc is a trace element, present in small amounts in the body, which has a well-established role in wound healing because of its action with many enzymes that directly influence wound healing.

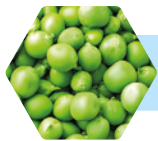
Zinc plays a key role in protein and collagen synthesis, and in tissue growth and healing.<sup>2,22</sup> Zinc deficiency has been associated with delayed wound healing, reduced skin cell production and reduced wound strength.<sup>29</sup>

Zinc levels of less than 100µg/100mL have been associated with impaired wound healing, but supplementation in people who are not zinc deficient generally has no benefit.<sup>2</sup> Insufficient dietary intake of zinc can be further exacerbated by zinc loss from excess wound drainage.<sup>22</sup> Assessing zinc deficiency can be difficult as serum/plasma levels may not be a true indication of zinc levels at the wound itself when serum protein levels are low. High dose zinc supplementation should be avoided unless deficiency is diagnosed or oral intake is inadequate, as it interferes with copper absorption, in turn decreasing the strength of new collagen formed.<sup>42</sup>

- The recommended intake of zinc for non-healing pressure injuries is 15mg/day. With larger non-healing wounds, 25–50mg daily can be used, but this should be limited to 14 days, as excess zinc can interfere with wound healing.<sup>22</sup>
- Dietary zinc sources include red meat, fish and shellfish, milk products, poultry and eggs.

### Side effects

Excess zinc supplementation can cause gastrointestinal complaints.<sup>29</sup>



## Iron

Iron is part of the system that provides oxygen to the site of the wound, therefore iron (haemoglobin) deficiency can impair healing. Iron deficiency can also result in impaired collagen production and strength of the wound.<sup>2,5,29</sup>

Iron absorption from non-meat sources can be enhanced with vitamin C.<sup>29</sup> Zinc and iron compete for absorption, therefore if someone is receiving supplements of both, the zinc and iron should be given with meals but not at the same time.<sup>30</sup> Dietitian input can be useful.

- Recommended iron intake for the general population is 8mg/day and for females aged 19–50 years this increases to 18mg/day.<sup>43</sup>
- The best sources of iron in the diet are red meat, offal, fish, eggs, wholemeal bread, dark green leafy vegetables, dried fruits, nuts and yeast extracts.

### Side effects

Excess iron intake can cause nausea and constipation.<sup>44</sup>

## Other important factors

Hydration is important in wound healing as dehydrated skin is less elastic, more fragile and more susceptible to breakdown. Dehydration will also reduce efficiency of blood circulation, which will impair the supply of oxygen and nutrients to the wound.<sup>29</sup>

One of the main risk factors for dehydration is poor oral intake.<sup>45</sup> Additional water/fluid may be appropriate in individuals with dehydration, are febrile, vomiting, diarrhoea and high exudating wounds.<sup>12</sup>



**In long-term care, dehydration is one of the most common problems affecting good nutrition.<sup>30,45</sup>**

- A general guide to providing fluids is 30–35mL/kg/day, with a minimum of 1500mL or 6–8 cups/day.<sup>29</sup> Air fluidised beds and heavily air-conditioned environments may increase hydration requirements.
- Sources of hydration include water, juice, milk, jelly, ice-cream, yoghurt and soup. While it is best to offer non-caffeine beverages first, caffeinated drinks – e.g. tea, coffee – can be included.

**Please note:** Fluid restrictions need to be adhered to if medically advised.

Dehydration will also reduce efficiency of blood circulation, which will impair the supply of oxygen and nutrients to the wound.<sup>29</sup>



# Implementing nutrition support to help promote wound healing

## **Optimising nutrition is important to best practice care in wound management.<sup>25</sup>**

The overall goal for the healthcare team should be to make sure the patient is in the optimum nutritional state to give wounds the best chance to heal.<sup>2</sup> This can be achieved by providing the individual with adequate calories and nutrients, preventing protein-energy malnutrition, and promoting wound healing.<sup>6</sup>

Holistic wound management must include both nutritional support and supplementation where necessary, according to an individual's needs.<sup>3,29</sup> A nutrient-rich diet is fundamental, but sometimes it is not possible to achieve adequate levels of essential nutrients through normal consumption of food and fluids. In these cases, tailored nutritional supplementation has been shown to promote wound healing.<sup>2,6</sup>

## **A minimum standard of nutritional care encompasses three steps – assessment, intervention and evaluation.**





### Assessment

- Nutritional assessment with validated screening tool e.g. Malnutrition Universal Screening Tool (MUST) ([www.bapen.org.uk/pdfs/must/must\\_full.pdf](http://www.bapen.org.uk/pdfs/must/must_full.pdf)), Mini Nutritional Assessment® ([www.mna-elderly.com](http://www.mna-elderly.com))
- Regular weighing
- Skin assessment
- Baseline healing score e.g. measured using the PUSH tool (Pressure Ulcer Scale for Healing)
- Complete thorough wound assessment including: tissue type, exudate, wound edges and wound size
- Energy expenditure e.g. activity level
- Co-morbidities e.g. diabetes
- Documentation of food and fluid intake

### Intervention

- Develop goals of care collaboratively with the individual ensuring their preferences are included
- Educate the individual on their nutritional requirements to ensure active participation in their care
- Improve intake of high nutritional quality food and fluids
- Improve nutritional quality of the food, i.e. food fortification
- Remove barriers to food consumption
- Supplementation where requirements cannot be met by diet alone

### Evaluation

- Regular assessment and evaluation of nutritional intake
- Measure success by improvements in measures (e.g. weight, skin condition, PUSH score) compared to initial assessments
- Success can also be indicated by subjective assessment of wound healing and lack of development of new wounds
- Biochemistry and correction of nutrient deficiencies



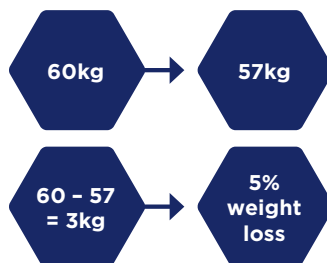
## Assessment

Nutritional screening including a clinical review and diet history should be conducted on admission and when there is any change to the patient's condition. This includes a wound developing, any change in medical condition, delayed healing, any new co-morbidities, annually and when any of the following are present:<sup>3,6,22,28</sup>

### Triggers for nutritional screening:

- Any unintentional weight loss, including:<sup>12,22,28</sup>
  - Unintentional weight loss of 5% or more in one month;
  - Unintentional weight loss of 10% or more in six months.
- Poor appetite – e.g. eating less than 50% of meals, or refusal to eat a meal, or refusal to eat for 3 days or more;
- Nausea or vomiting for more than 3 days;
- Loss of skin integrity;
- Development of any new wounds including on legs and feet;
- Deterioration of an existing wound;
- Levels of nutritionally relevant laboratory values (see table next page) suggestive of malnutrition or that have recently changed significantly;
- Admission/readmission to hospital;
- Entry into long-term care.

### Example of weight loss calculation:



It is important to set timeframes at the beginning of any intervention. As a minimum it is a good idea to weigh the person on a weekly basis. It is important to check at least every four weeks if nutritional intervention is working or more frequently if there are other complications or co-morbidities.<sup>12</sup>

### Practical tips:

- Ensure scales used to weigh patients have been calibrated for reliability of measures. A simple way to do this is for one staff member of stable weight to weigh themselves weekly and note any discrepancy.
- Aim to use the same set of scales each time weight is taken and at a similar time of day.

### Normal laboratory values of nutrients<sup>46</sup>

| Nutrient/biochemical markers    | Normal value (reference range)                 |
|---------------------------------|------------------------------------------------|
| Albumin (S/P)                   | 36–48g/L                                       |
| Prealbumin (S)                  | 0.17–0.35g/L                                   |
| C Reactive Protein (S/P)        | 0.33–1.47 nmol/L                               |
| Folate                          | >6.8 nmol/L                                    |
| Haemoglobin                     | 130–180g/L male<br>115–165g/L female           |
| Iron (S)                        | 8.1–32.6 µmol/L male<br>5.0–30.4 µmol/L female |
| Lymphocytes x10 <sup>9</sup> /L | 1.0–4.0                                        |
| Potassium                       | 3.5–5.3 mmol/L                                 |
| Sodium                          | 135–148 mmol/L                                 |
| Vitamin D                       | >75 nmol/L                                     |

S: Serum, P: Plasma.

Screening and assessment of nutritional status can be performed using one of a number of validated tools (e.g. Malnutrition Screening Tool, Mini Nutritional Assessment®). Height and weight measures may be difficult to obtain depending on the ambulatory ability of the individual and height measures in particular should be interpreted with caution. If obtaining a height and/or weight is not possible, there are alternative methods that can be used. More information can be found at: [www.bapen.org.uk/pdfs/must/must\\_page5.pdf](http://www.bapen.org.uk/pdfs/must/must_page5.pdf) Any unintentional weight loss is of concern (refer to Nutrition in wound healing on pages 7–9). For people with limited mobility, recent food and fluid intake may be a better indicator of nutritional status.

## Mini Nutritional Assessment® 47

Online form available at: [www.mna-elderly.com/forms/mini/mna\\_mini\\_english.pdf](http://www.mna-elderly.com/forms/mini/mna_mini_english.pdf)

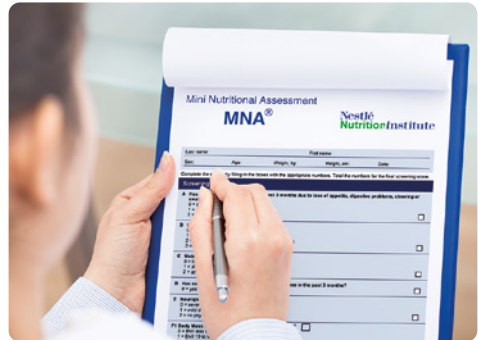
This screening tool is quick, non-invasive, validated for those over 65 years and is easy to administer to determine malnutrition risk.

It involves 6 questions which result in a screening score which correlates with the level of malnutrition risk over the last 3 months.

|                   |                                                         |
|-------------------|---------------------------------------------------------|
| <b>Question A</b> | Assesses food intake                                    |
| <b>Question B</b> | Assesses weight loss                                    |
| <b>Question C</b> | Assesses mobility                                       |
| <b>Question D</b> | Assesses psychological stress or acute illness          |
| <b>Question E</b> | Neuropsychological problems e.g. dementia or depression |
| <b>Question F</b> | Body Mass Index                                         |

It is important to note that overweight or obese individuals can still have protein and nutrient deficiencies that can often be missed. Unplanned weight loss in these individuals may be equally detrimental as they will lose protein stores instead of fat, a decrease in mobility may be an early indicator that this has already started to occur.<sup>3,12,28,29</sup>

An individual's energy requirement should be calculated and compared with their intake, so that any deficiency can be addressed. Dietitian input can be useful.<sup>12</sup>





## Nutritional intervention

When an individual is found to be malnourished or at risk of malnutrition, the multidisciplinary healthcare team will need to consult with patients on their goals to develop an individualised nutrition plan to better address wound repair.

Following assessment, a plan of appropriate support and/or supplementation should be developed to meet individual needs. The plan should include an evaluation date and plans for regular monitoring and reassessment.<sup>12</sup>

Increasing protein and energy intake may be achieved with a normal diet, but if this is not possible or intake is impaired, additional oral nutritional supplementation may be required. The increased need for some nutrients, for example L-arginine can be challenging to meet with diet alone.

### Examples of high protein and/or high energy foods/drinks:<sup>5,6</sup>

- High quality meats;
- Cheese, full cream milk;
- Bread, wholegrain cereals;
- Milkshakes, smoothies, powder (e.g. milk powder, soy powder).

### Minimum energy intake to provide essential nutrients:

- For adults with pressure injuries at moderate to high risk for delayed healing:
  - 30–35kcal (126–145kJ)/kg body weight/day.<sup>12</sup>
  - For a 70kg male: 2100–2450kcal/day (8820–10,290kJ/day).

N.B. These values may need to be adjusted based on the objectives for weight of that individual.





**There are some people in particular who may benefit from nutrition supplementation. For example:**

- Nutritional demands may be greater with certain complex non-healing wounds or adults with pressure injury who are malnourished or at risk of malnutrition. The provision of high-energy, high protein, l-arginine, zinc and antioxidant oral nutrition supplementation can have a positive effect on healing;<sup>12</sup>
- People with diabetes who have ulcers on their feet and lower extremities have been shown to benefit from l-arginine supplementation;<sup>1</sup>
- People who eat little or no meat or other foods high in iron, protein and zinc may require supplementation containing these nutrients;
- For malnutrition, a high energy and protein oral nutrition supplement or a nutritionally complete oral nutrition supplement can be given.<sup>22</sup> A dietitian referral is recommended for all cases of malnutrition, especially where a chronic wound is present.<sup>12</sup>

Extra care needs to be taken when addressing the nutritional needs of an individual with diabetes. Diabetes may delay wound healing especially when there is suboptimal glycaemic management. While people with diabetes need adequate energy for wound healing, optimal glucose management is also important. For this reason when any nutritional support for people with diabetes is planned, other therapies they are taking must be considered.<sup>29</sup>

**Factors that may hinder adequate nutrient intake:<sup>6,29</sup>**

- |                                                                                                         |                                                                |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| • Confusion and/or altered level of alertness;                                                          | • Taste changes, reduced appetite, early satiety;              |
| • Difficulty swallowing, e.g. due to Parkinson's disease or other neurological conditions;              | • Feeding routines in institutions e.g. tray collection times; |
| • Individual food preferences e.g. cultural food choices, vegetarian;                                   | • Poor eyesight;                                               |
| • Lack of manual dexterity e.g. due to arthritis, peripheral vascular disease, neurological conditions; | • Anxiety;                                                     |
| • Isolation, low socio-economic status and access to food;                                              | • Poor dentition;                                              |
|                                                                                                         | • Pain;                                                        |
|                                                                                                         | • Eating environment;                                          |
|                                                                                                         | • Packaging of food;                                           |
|                                                                                                         | • Psychological – mood, stress.                                |

### Ideas to improve nutritional status include:<sup>6,29</sup>

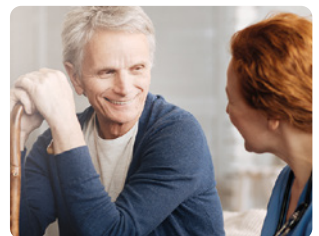
- Offer food and fluids in a variety of textures and consistencies. Use of the EAT-10 screening tool may assist identification of swallowing disorders requiring Speech Pathology intervention;
- Offer assistance and allow sufficient time for meals and enlist family members or volunteers to help;
- Source equipment to aid in supporting the individual with nutrition e.g. plate guards, modified cutlery and bottle openers;
- Refer for social support to access food e.g. social worker, emergency food assistance arrangements;
- Provide encouragement, without pressuring;
- Offer a variety of nutrient-dense, high-calorie and high-protein meals;
- Encourage grazing – small frequent meals/snacks;
- Encourage frequent drinking of fluids;
- Provide hydration stations for patients to access drinks at any time;
- Provide foods that patients like;
- Position upright when eating;
- Allow time for individuals to eat in a relaxed manner, with time to chew, feed themselves and finish their meal;
- Provide a pleasant mealtime environment;
- If the individual has dentures, ensure that these are well fitted as well as monitor and manage oral health;
- Explain that eating well and eating the right foods will aid recovery;
- Provide assistance with the opening of containers, lids.



## Evaluation

Nutrition intervention should be reviewed as part of the individual's overall care plan and success can be measured by outcomes such as increased weight, improved functional ability, enhanced health-related quality of life, reduced incidence of new wounds such as pressure injuries and/or healing of chronic wounds.<sup>12</sup>

Regular ongoing evaluation is necessary, especially as the benefits of nutritional support may take time to appear in those who are malnourished and have chronic wounds.<sup>12</sup>



# Nutrition and wound management in practice

**Implementing the nutritional plan and providing appropriate nutritional support to the individual requires involvement of the whole wound management team, and effective communication between all members of that team.<sup>6</sup>**

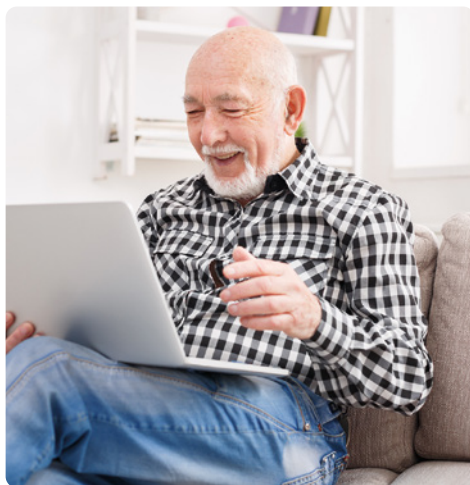
**The wound management team is multidisciplinary and, as well as the individual, should include:<sup>17,28</sup>**

- Physicians
- Nurses
- Dietitians
- Speech Pathologist where swallowing issues are identified
- Physiotherapists
- Podiatrists
- Occupational therapists
- Pharmacists
- Family and/or other carers

For optimal wound healing it is the team's responsibility to ensure that the individual concerned has optimal nutritional support no matter what their setting; be it home, hospital or residential aged care.<sup>3</sup>

## Useful links

- Wounds Australia  
**[www.woundsaustralia.com.au](http://www.woundsaustralia.com.au)**
- National Pressure Injury Advisory Panel (NPIAP)  
**[www.npiap.com](http://www.npiap.com)**
- European Wound Management Association  
**[www.ewma.org](http://www.ewma.org)**
- European Pressure Ulcer Advisory Panel  
**[www.epuap.org](http://www.epuap.org)**
- EAT-10 screening tool  
**[www.nestlehealthscience.com/health-management/gastro-intestinal/dysphagia/eat-10](http://www.nestlehealthscience.com/health-management/gastro-intestinal/dysphagia/eat-10)**
- Malnutrition Universal Screening Tool  
**[www.bapen.org.uk/pdfs/must/must\\_full.pdf](http://www.bapen.org.uk/pdfs/must/must_full.pdf)**



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