Nutrition and Wound Healing

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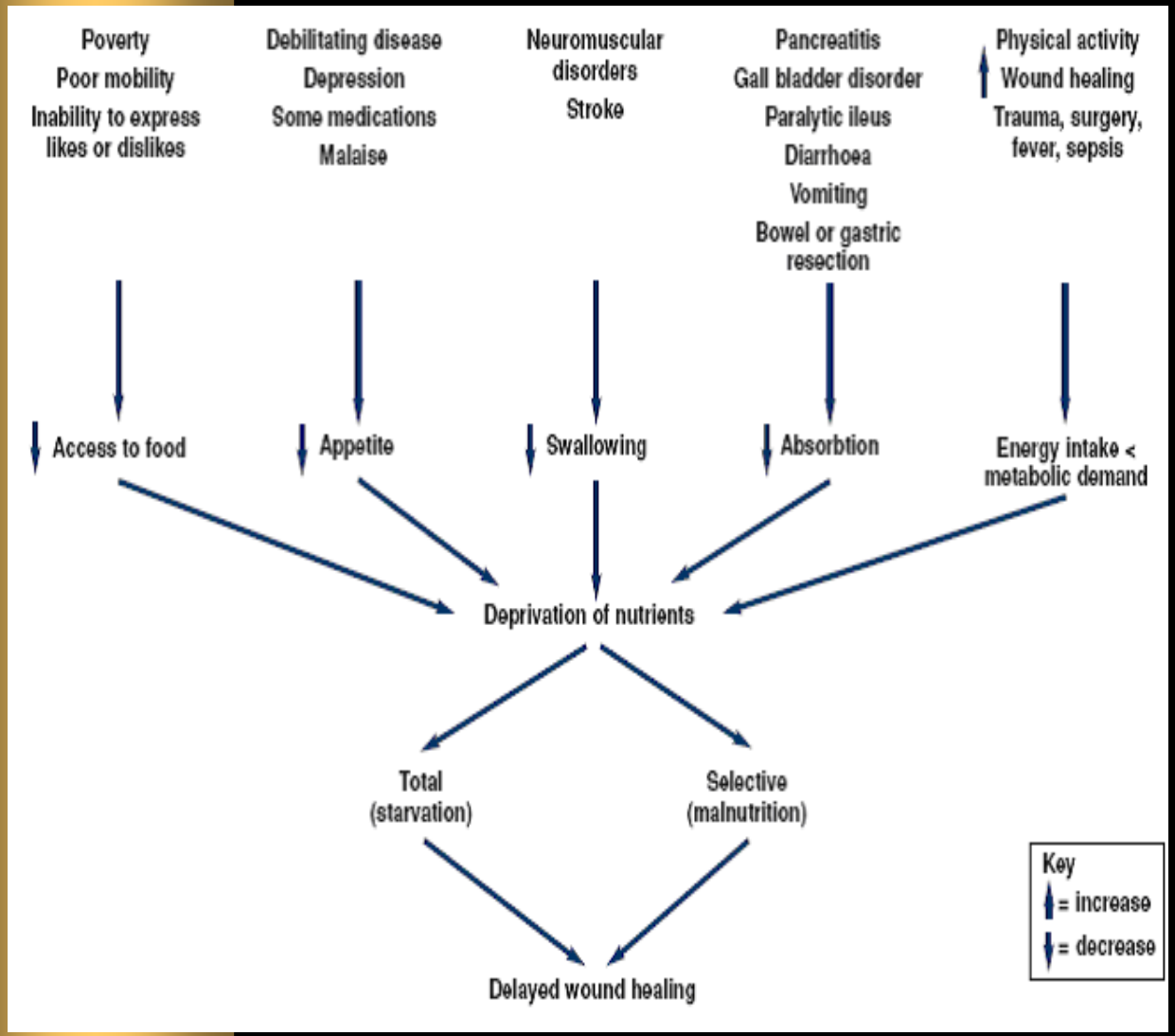
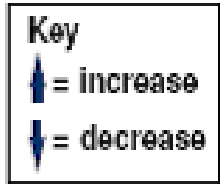
Factors Affecting Nutritional Status in Wound Healing



Poverty

Poor mobility

Inability to express likes or dislikes



The Importance of Nutrition for Wound Healing

- Nutrients are the building blocks of healing. When developing a pressure ulcer prevention or wound management protocol, nutrition is too often overlooked. This is a serious omission.

- Nutrition plays a role in virtually every phase of wound healing.

- An appropriate diet, combined with outstanding routine care, can prevent many pressure ulcers and speed the healing of existing wounds.

The Importance of Nutrition for Wound Healing

- **Malnutrition Effects:**
  - A diet lacking in critical nutrients places individuals at a higher risk of pressure ulcer development, infection and impaired healing.

- **Critical Nutrients:**
  - Certain nutrients play an important role in the wound management process. It is important for healthcare professionals to learn more about these critical nutrients and their healing properties.

The Importance of Nutrition for Wound Healing

- **Nutritional Guidelines:**
  - Adequate amounts of calories and critical nutrients help to speed the healing process.
- **Healing & Protein:**
  - Research shows that very-high-protein diets stimulate healing.

The Primary Goals of Nutritional Support

- Patients are given adequate nutrients to reduce the risk of developing pressure ulcers and to support healing.[1,2]
- To achieve this, nutritional support is designed to prevent or correct nutritional deficits, maintain or achieve positive nitrogen balance, and restore or maintain serum albumin levels.

1. Bergstrom N, Bennett MA, Carlson CE, et al. (1994).
2. Panel for the Prediction and Prevention of Pressure Ulcers in Adults. *Pressure Ulcers in Adults: Prediction and Prevention. Clinical Practice Guideline.* Number 3, Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research; 1992. AHCPR Publication No. 92-0047.

Critical Nutrients

- Much research has been done on the value individual nutrients play in the management of healing wounds.
- The following nutrients are considered important to the healing process:
  - Proteins
  - Lipids
  - Carbohydrates
  - Vitamins A, C & K
  - Zinc
  - Arginine
  - Manganese
  - Glutamine
  - Selenium

The Role of Nutrients in Wound Healing - Overview

- **Protein**
  - Tissue formation
  - Collagen synthesis
  - Wound remodelling
  - Immune support
- **Vitamin A**
  - Collagen synthesis
  - Epithelialisation
  - Immune support
- **Vitamin C**
  - Collagen synthesis
  - Antioxidant
  - Immune support
  - Capillary integrity

The Role of Nutrients in Wound Healing - Overview

- **Vitamin E**
  - Antioxidant
- **Zinc**
  - Collagen synthesis
  - Protein synthesis
- **Selenium**
  - Key mineral in the wound-healing process, involved in decreasing antibody response and protecting against immuno-suppression.
  - A cofactor with Vitamin E in protecting against lipid membrane damage.

Nutritional Require-ments for Wound Healing - Overview

NUTRIENT	ROLE	SOURCES
Proteins	Cell mitosis and migration; immune system responses; synthesis and secretion of intracellular and extra-cellular proteins, especially collagen; synthesis and secretion of growth factors	All meats, fish, dairy products, beans and pulses, cereals, bread, soya products
Carbohydrates	Provision of ATP for all cellular activity	Most food sources; body stores of fat and protein
Vitamin C	Collagen synthesis; cell mitosis and migration; immune system function	Citrus fruit, green vegetables, fruit juices, tomatoes
Zinc	Cell mitosis; protein synthesis; strengthening and maturation of collagen	Red meat, offal, nuts, some fortified breakfast cereals*
Vitamins A and B	Strengthening and maturation of collagen	A: yellow and green vegetables, liver, egg yolks, butter, milk B: yeast, liver, green vegetables, fortified breakfast cereals
Iron	Oxygen delivery to wound bed	Red meat, leafy green vegetables, fortified breakfast cereals

*Absorption of zinc from the gut may be reduced if the person is taking iron supplements at the same time

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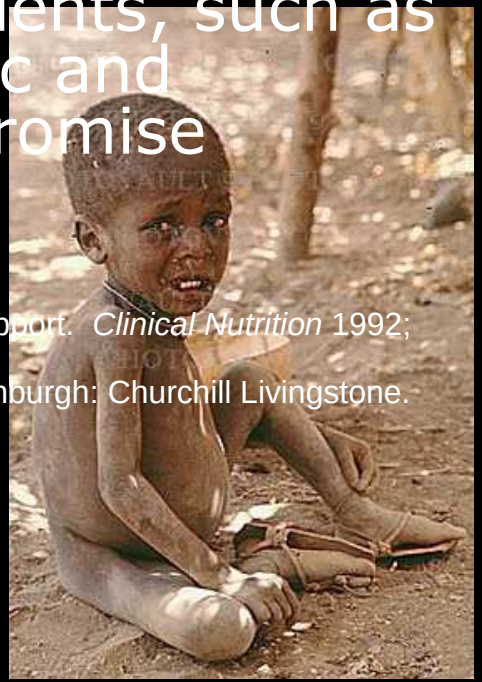
The Effects of Malnutrition

- If a person suffering from an illness loses 10-20% of their body weight, significant deterioration in body function can occur.[1,2]

- Diets that lack necessary nutrients, such as protein, vitamins A and C, Zinc and Selenium, can seriously compromise healing.



1. Allison, S.P. (1992). The uses and limitations of nutritional support. *Clinical Nutrition* 1992; 11: 319-330.
2. Hill, G.L. (1992) in *Disorders of nutrition and metabolism*. Edinburgh: Churchill Livingstone.

The Effects of Malnutrition

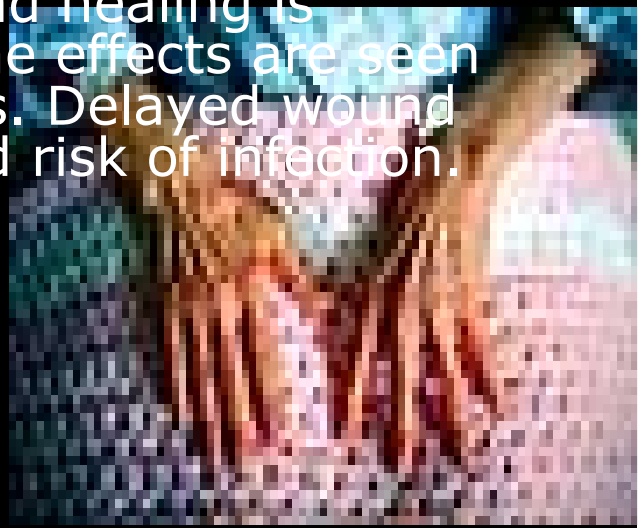
1. **Decreased or abnormal collagen accumulation:**
   - The steps necessary for the cross-linking of collagen are disrupted, leading to a weaker framework.

2. **Reduced wound strength:**
   - As collagen weakens or remodels ineffectively, the wound itself is weaker and may never attain 80 percent of the skin's previous strength. This puts the wound area at even higher risk of recurrence.

The Effects of Malnutrition

3. **Retarded epithelialisation:**
   - The wound will never be able to fully close and form a mature scar if the appropriate nutrients are not available to sustain the formation and migration of epithelial cells over it.

4. **Increased likelihood of infection:**
   - Because every phase of wound healing is influenced by malnutrition, the effects are seen throughout the entire process. Delayed wound healing leads to the increased risk of infection.



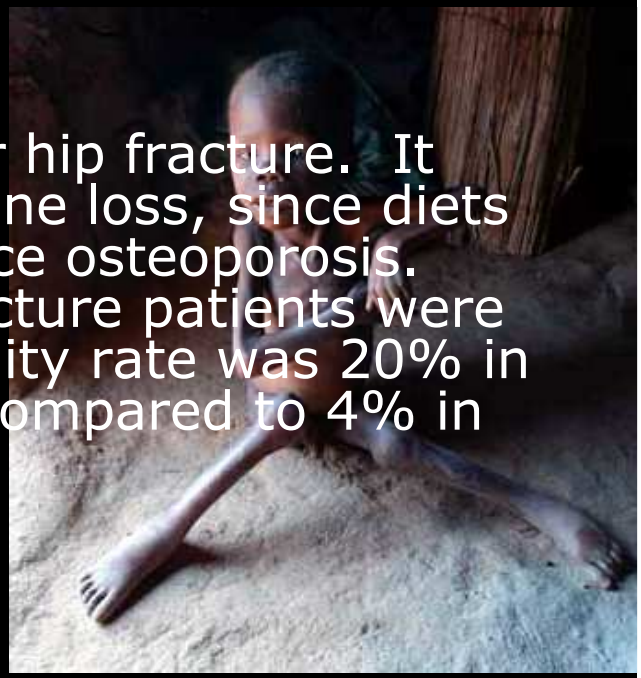
The Effects of Malnutrition

5.Loss of muscle strength:

- Loss of muscle leads to a reduction in mobility and independence which increases the incidence and persistence of complications, e.g. falls and pressure sores.[1,2]

6.Increase in fractures:

- Malnutrition is a risk factor for hip fracture. It accelerates age-dependent bone loss, since diets deficient in Calcium may induce osteoporosis. Bastow[3] found 20% of hip fracture patients were severely malnourished. Mortality rate was 20% in malnourished patients when compared to 4% in well nourished patients.

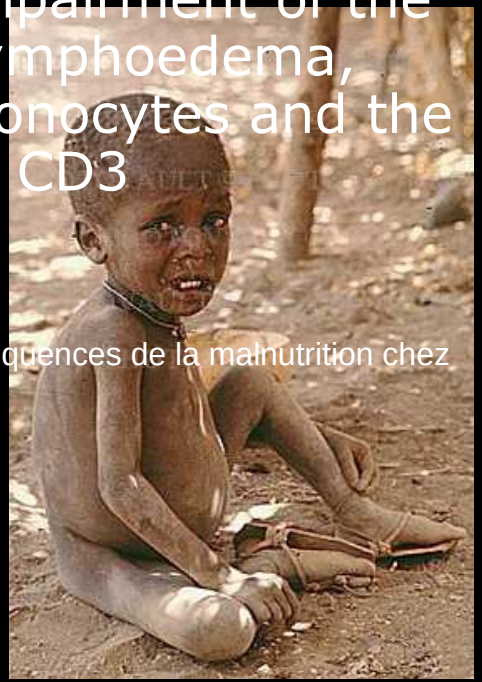


1. Ek, A-C, Unosson, M., Larrson, J. *et al.* (1991).
2. Bastow, M.D., Rawlings, J., Allison, S.P. (1983).

The Effects of Malnutrition

7.Impaired immune and hormone function:

- Malnutrition can lead to significant impairment of hormonal balance with both hypoinsulinism and hypothyroidism. It also causes impairment of the immune system with peripheral lymphoedema, reduced cytokine production of monocytes and the appearance of immature CD2 and CD3 lymphocytes[1].



1. Lesourd, B.M. et Club Francophone Gériatrie et Nutrition: Conséquences de la malnutrition chez le sujet âgé. *Rev de Gériatrie* 1995; 20: 329-323.

The Effects of Malnutrition

8.Increased incidence of pressure sores:

- Ek[1] found an incidence of pressure sores at admission of 34.8% among malnourished patients, as against 20.6% in those nourished. Pressure sore formation was consistently higher and healing of existing sores was consistently lower in the malnourished group, despite identical treatment and care.

1. Ek, A-C, Unosson, M., Larrson, J. *et al.* (1991)

The Four Phases of Wound Healing –

Stage I

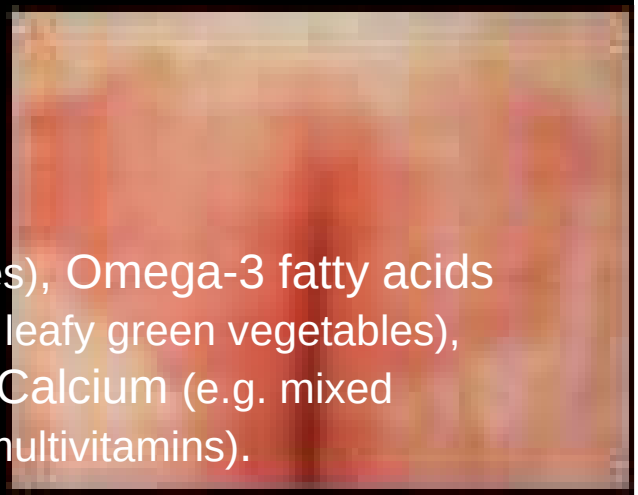
- **Stage I: Haemostasis**
  - **Description:**
    - Non-blanchable reddened area of erythema of intact skin. In individuals with darker skin, discolouration of the skin, warmth, oedema, induration or hardness may also be indicators.
  - **Protein needs:**
    - 1.0-1.25g/kg per day.

      i.e. 80 – 100g protein for an 80kg person per day

The Four Phases of Wound Healing –

Stage I

- **Stage I: Haemostasis**
  - **Activities**:
    - Bacteria and cellular debris removed
    - Coagulation
      - Platelets deposited
      - Start clotting process
      - Release growth factors
      - Stimulate new blood vessels
  - **Key Nutrients:**
    - Vitamin K (e.g. leafy green vegetables), Omega-3 fatty acids (e.g. Salmon, sardines, tuna, walnuts, leafy green vegetables), Protein (e.g. meat, legumes, lentils), Calcium (e.g. mixed vegetables) and Copper (e.g. most multivitamins).



The Four Phases of Wound Healing –

Stage II

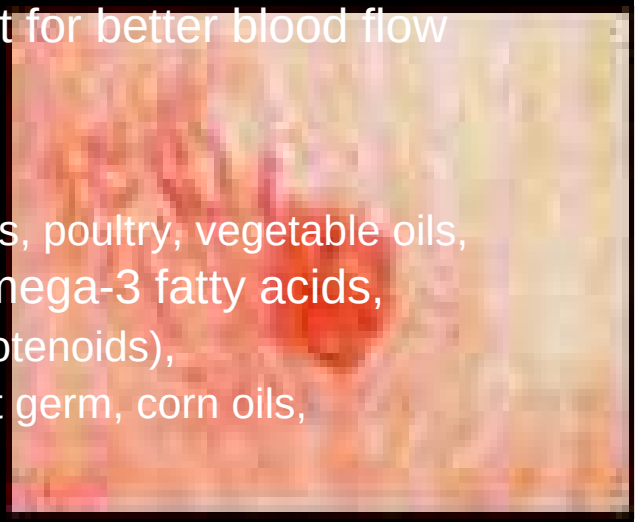
- **Stage II: Inflamatory Response**
  - **Description:**
    - Partial thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents clinically as an abrasion, blister or shallow crater.
  - **Protein needs:**
    - 1.25-1.5g/kg per day

      i.e. 100 – 120g protein for an 80kg person per day

The Four Phases of Wound Healing –

Stage II

- **Stage II: Inflamatory Response**
  - **Activities:**
    - Leukocytes
      - Move in and digest bacteria and necrotic tissue
      - Macrophages kill bacteria and direct healing
    - Angiogenesis
      - New blood vessel development for better blood flow and oxygenation
  - **Key Nutrients:**
    - Glucose, Omega-6 (e.g. cereals, eggs, poultry, vegetable oils, whole-grain breads and margarine), Omega-3 fatty acids, Antioxidants (e.g. vitamins E & C, carotenoids), Phytochemicals (e.g. rice bran, wheat germ, corn oils, soybeans) and Arginine



The Four Phases of Wound Healing –

Stage III

- **Stage III: Connective Tissue/ Proliferative/Granulation Phase**
  - **Description:**
    - Full-thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia. The ulcer presents clinically as a deep crater with or without undermining of adjacent tissue.
  - **Protein needs:**
    - 1.5-2.0g/kg per day

      i.e. 120 – 160g protein per 80kg person per day

The Four Phases of Wound Healing –

Stage III

- **Stage III: Connective Tissue/ Proliferative/Granulation Phase**

Activities:

- Period of new tissue development
- Macrophages remove clot or damaged tissue
- Fibroblasts deposit collagen to fill wound, which provides strength and granulation tissue
- Wound begins to contract

– **Key Nutrients:**

- Vitamin C (e.g. citrus fruits), Iron (e.g.dark green leafy veg), Zinc (found in most food and drinking water), Copper, Arginine, Pantotenic acid, Growth factors, Alpha-Ketoglutaric acid

The Four Phases of Wound Healing –

Stage IV

- **Stage IV: Epithelialisation/Maturation/ Remodelling Phase**
  - **Description:**
    - Full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone or supporting structures (e.g. tendon, joint capsule). Undermining and sinus tracts also may be associated with Stage IV pressure ulcers.
  - **Protein needs:**
    - 1.5-2.0 g/kg per day

      i.e. 120 – 160g protein per 80kg person per day

The Four Phases of Wound Healing –

Stage IV

- **Stage IV: Epithelialisation/Maturation/ Remodelling Phase**
  - **Activities:**
    - Involves remodelling of collagen and formation of mature scar
    - Usually more collagen is synthesised than destroyed and therefore wound gains strength
  - **Key Nutrients:**
    - Vitamin A, Zinc, Arginine, Growth factors, Alpha-Ketoglutaric acid

What to keep in mind…

- The importance of nutrition for wound healing.
- The affects of malnutrition on the body.
- Thorough nutritional assessment for all patients with wounds.
- The main nutrients important for wound healing in patient diet.
- Tailor-made patient diet even according to Stage of wound and healing process.

Thank you for listening