General Nutrition and Dietary treatment
Nation-wide guideline, Version: 2.0

Date of approval: 01-06-2012
Method: Consensus based
Justification: Dutch Dieticians Oncology Group
# Table of contents

**Introduction**...................................................................................................................................................1

**Prevention**...................................................................................................................................................3

  - Overweight and body fat percentage.................................................................................................3
  - Physical activity......................................................................................................................................3
  - Sugary drinks and high-calorie food......................................................................................................4
  - Plant foods...........................................................................................................................................4
  - Red and processed meats....................................................................................................................4
  - Alcohol..................................................................................................................................................5
  - Salt.......................................................................................................................................................5
  - Dietary supplements..............................................................................................................................5

**Nutritional status**..........................................................................................................................................6

  - Nutritional status..................................................................................................................................6
  - Malnutrition/ Cachexia...............................................................................................................................6
    - Causes................................................................................................................................................7
    - Insufficient intake of nutrition............................................................................................................7
    - Inflammation and metabolic dysregulation..........................................................................................8
    - Anorexia-cachexia syndrome................................................................................................................9
  - Sarcopenia/sarcopenic obesity.................................................................................................................9
  - Tumour growth......................................................................................................................................10

**Screening and assessment**.........................................................................................................................12

  - Screening.............................................................................................................................................12
  - Nutritional assessment...........................................................................................................................13
  - Considerations......................................................................................................................................14
  - Dietary diagnosis..................................................................................................................................14

**Nutritional requirements**................................................................................................................................16

  - Energy....................................................................................................................................................16
    - Resting energy expenditure...................................................................................................................16
    - Activity...............................................................................................................................................17
  - Protein...................................................................................................................................................17
  - Fat and carbohydrates.............................................................................................................................18
  - Dietary fibre.........................................................................................................................................18
  - Vitamins, minerals and antioxidants.......................................................................................................18
    - Vitamins..........................................................................................................................................19
      - Vitamin A.......................................................................................................................................19
      - Beta-carotene.................................................................................................................................19
      - Vitamin B1..................................................................................................................................19
      - Vitamin B6...................................................................................................................................20
    - Folic acid..........................................................................................................................................20
    - Vitamin B12.....................................................................................................................................20
    - Vitamin C.........................................................................................................................................20
    - Vitamin D.........................................................................................................................................21
    - Vitamin E.........................................................................................................................................21
    - Minerals..........................................................................................................................................21
      - Calcium.......................................................................................................................................22
      - Magnesium....................................................................................................................................22
      - Zinc................................................................................................................................................22
    - Selenium.........................................................................................................................................22
    - Antioxidants.....................................................................................................................................23
    - Combinations...................................................................................................................................23
    - Recommendations.............................................................................................................................23
  - Fluid intake..........................................................................................................................................24
  - Disease specific formulas......................................................................................................................24
    - EPA-enriched formulas.......................................................................................................................24
    - Immunonutrition.................................................................................................................................24
  - Health products and ‘alternative’ diets....................................................................................................25
# Table of contents

## Nutritional interventions
- Dietary features .......................................................... 27
  - Healthy eating ......................................................... 27
  - Adequate diet ........................................................ 28
  - Protein-energy enriched diet .................................... 28
  - Protein enriched diet ............................................... 29
  - Palliative nutritional support .................................... 29
  - Nutritional counselling and physical activity ............... 30
- Treatment ........................................................................ 30
  - Malnutrition ............................................................ 30
  - Sarcopenia/sarcopenic obesity .................................... 31
  - Patient queries ......................................................... 32
  - Perioperative nutritional support ............................... 32

## Symptoms and advice
- Weight loss .................................................................... 34
  - Anorexia and early satiety ........................................ 35
  - Alterations in taste and smell ...................................... 36
  - Nausea and vomiting ................................................ 38
  - Dry mouth (xerostomia) ............................................. 39
  - Difficulties in chewing and swallowing ....................... 40
  - Mucositis .................................................................... 41
    - Oral mucositis ......................................................... 41
    - Intestinal mucositis ................................................ 43
  - Excess mucus ............................................................. 43
  - Obstructive symptoms ................................................ 44
    - Dysphagia ................................................................ 44
    - Intestinal obstructions ............................................. 45
  - Endoscopic stenting .................................................... 46
  - Gastro-oesophageal reflux .......................................... 47
  - Constipation ............................................................... 47
  - Diarrhoea .................................................................... 49
  - Weight gain/overweight ............................................. 49
  - Fatigue and muscle weakness ...................................... 50
  - Immunocompromised patients .................................... 51

## Clinical nutrition
- Clinical nutrition .......................................................... 54
  - Refeeding syndrome .................................................. 54
  - Food fortification ....................................................... 55
  - Oral nutritional supplements ...................................... 57
- Tube feeding ................................................................. 57
  - Enteral formulas ......................................................... 58
  - Tubes and access ....................................................... 58
  - Administration and advancement ............................... 59
  - Evaluation .................................................................... 60
- Complications ............................................................... 60
  - Transition to oral nutrition .......................................... 64
- Parenteral nutrition ........................................................ 64
  - Composition .............................................................. 64
  - Access ........................................................................ 66
  - Medication ................................................................. 68
  - Evaluation .................................................................... 68
- Complications ............................................................... 69
  - At home ....................................................................... 70
  - Stopping ...................................................................... 70
Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition Care Process</td>
<td>71</td>
</tr>
<tr>
<td>Nutrition Care Process</td>
<td>71</td>
</tr>
<tr>
<td>Tasks and responsibilities</td>
<td>71</td>
</tr>
<tr>
<td>Elderly patients</td>
<td>73</td>
</tr>
<tr>
<td>Elderly patients</td>
<td>73</td>
</tr>
<tr>
<td>Frailty</td>
<td>73</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>74</td>
</tr>
<tr>
<td>Functional domain</td>
<td>74</td>
</tr>
<tr>
<td>Psychological domain</td>
<td>74</td>
</tr>
<tr>
<td>Social domain</td>
<td>75</td>
</tr>
<tr>
<td>Physical domain</td>
<td>75</td>
</tr>
<tr>
<td>Nutritional care process</td>
<td>76</td>
</tr>
<tr>
<td>Screening</td>
<td>76</td>
</tr>
<tr>
<td>Dietary requirements</td>
<td>76</td>
</tr>
<tr>
<td>Nutritional intervention</td>
<td>77</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>80</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>80</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>80</td>
</tr>
<tr>
<td>Background and treatment</td>
<td>80</td>
</tr>
<tr>
<td>Nutritional status</td>
<td>81</td>
</tr>
<tr>
<td>Clinical nutrition</td>
<td>82</td>
</tr>
<tr>
<td>Diabetes</td>
<td>82</td>
</tr>
<tr>
<td>Background and treatment</td>
<td>83</td>
</tr>
<tr>
<td>Nutritional status</td>
<td>83</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>83</td>
</tr>
<tr>
<td>Clinical nutrition</td>
<td>84</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>85</td>
</tr>
<tr>
<td>Hyperglycaemia following surgery</td>
<td>86</td>
</tr>
<tr>
<td>Aftercare</td>
<td>87</td>
</tr>
<tr>
<td>Aftercare</td>
<td>87</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>88</td>
</tr>
<tr>
<td>Overweight</td>
<td>88</td>
</tr>
<tr>
<td>Health promotion</td>
<td>88</td>
</tr>
<tr>
<td>Cancer rehabilitation</td>
<td>89</td>
</tr>
<tr>
<td>Diet and exercise</td>
<td>89</td>
</tr>
<tr>
<td>Palliative care</td>
<td>91</td>
</tr>
<tr>
<td>Palliative care</td>
<td>91</td>
</tr>
<tr>
<td>Nutrition</td>
<td>92</td>
</tr>
<tr>
<td>Weight loss and anorexia</td>
<td>92</td>
</tr>
<tr>
<td>Clinical nutrition</td>
<td>94</td>
</tr>
<tr>
<td>Intestinal obstruction and ileus</td>
<td>95</td>
</tr>
<tr>
<td>Ascites</td>
<td>95</td>
</tr>
<tr>
<td>Dehydration</td>
<td>96</td>
</tr>
<tr>
<td>Stopping</td>
<td>96</td>
</tr>
<tr>
<td>Communication</td>
<td>98</td>
</tr>
<tr>
<td>Conversations with the patient</td>
<td>98</td>
</tr>
<tr>
<td>Delivering bad news</td>
<td>99</td>
</tr>
<tr>
<td>Behavioural changes</td>
<td>99</td>
</tr>
<tr>
<td>References</td>
<td>101</td>
</tr>
<tr>
<td>Appendices</td>
<td>111</td>
</tr>
</tbody>
</table>
Table of contents

Disclaimer..................................................................................................................................................112
Introduction

The first version of the guideline general and tumour specific nutritional and dietary treatment (1.0) was written in 2006 based on the dietary protocols in the Guide for dietetic counselling in cancer patients (Leidraad voor voedingsdeskundigen bij kanker, 2006), and the Dietetic Guideline Cancer (Dieetbehandelingsrichtlijn Kanker, 2003). This version was approved by the Dutch Dieticians Oncology Group (Landelijke Werkgroep Diëtisten Oncologie, LWDO).

The current revised guideline general and tumour specific nutritional and dietary treatment (2.0) is based on the Manual Nutrition in cancer, 2012 (Handboek Voeding bij kanker 2012). An expert group (see appendix 1) of registered dieticians specialized in oncology from hospitals and medical centres in the Netherlands composed this manual. These guidelines have also been approved by the Dutch Dieticians Oncology Group (Landelijke Werkgroep Diëtisten Oncologie, LWDO) in cooperation with the Surgical Association Dieticians Academic Hospitals (Chirurgisch Overleg Diëtisten Academische Ziekenhuizen, CHIODAZ) and the Dutch Dieticians Haematology and Stem Cell Transplants Group (Landelijk Overleg Diëtisten Hematologie en Stamceltransplantatie, LODHS).

Scope

Cancer patients, like everybody else, need a well-composed, sufficient and attractive diet, to keep their nutritional status in balance. Disease and treatment have an negative influence on nutritional status and body composition and cause a negative effect on treatment response and quality of life. In illness and treatment the capacity of a cancer patient to eat well is limited which can lead to moderate of severe malnourishment. Nutritional and dietary treatment is therefore an important supportive therapy to achieve cure or good palliative care.

Goal

The guideline aims to give insight into the current knowledge of nutrition, nutritional symptoms and the nutritional care process in cancer.

Target group

The guideline is intended mainly for dieticians as support in their treatment of cancer patients. But it is also intended for other professionals who take care of the nutritional status of a cancer patient such as medical specialists, general practitioners and (specialised) nurses.

Abstract

The guideline consist of two parts. The first part General nutritional and dietary treatment (2.0) include aspects of the nutritional care process that concern most cancer patients and treatments that focus on nutritional status, nutritional requirements and dietary advice for symptoms in general. The second part, Tumour specific (2.0), includes specific information on treatment policy and nutritional advice in different stages and treatments of the specific tumour.

Working method

If possible nutritional interventions in cancer are based on the most current nutritional research in oncology, but scientific evidence is not always available. Dietary advice is often best practice-based: a mix of scientific research and practical experience.

- Clinical questions. A nationwide survey was initiated to obtain insight into the most relevant clinical nutritional questions in the daily practice of dieticians.
- Scientific evidence. The general part is mostly based on the scientific conclusions, considerations and recommendations of the evidence based Dutch guideline Malnutrition in cancer patients (Ondervoeding bij patienten met kanker) by the Comprehensive Cancer Centres of the Netherlands (IKNL). For other chapters of the general part and the tumour specific part systematic searches were performed by research bureau ‘Wetenschap en Voeding’ in Haarlem. For each chapter a selection has been made from the most relevant references.
- Practical expertise. The guideline incorporates the practical experiences and competences of dieticians in the Netherlands specialised in oncology. Also nutritional guidelines from the cancer centres in the USA, United Kingdom, Germany and Australia were used.
- Cancer patients. An online survey was designed to give insight into the wishes and needs of cancer patients.
The guideline connects to the recently developed nutritional guidelines in the Netherlands: *Malnutrition in cancer patients* (*Ondervoeding bij patiënten met kanker, 2012*), *National Primary Care Collaboration Agreement* (*Landelijke Eerstelijns Samenwerking Afspraak Ondervoeding (LESA), Ondervoeding, 2010*) and *Screening and Treatment of Malnutrition* (*Screening en behandeling van Ondervoeding, 2011*).
Prevention

Nutrition is an important focus in the prevention of cancer. The most important nutrition-related factor that can increase the risk of cancer is a diet's overall composition, such as excess energy-intake resulting in overweight, excess alcohol consumption and a reduced fruit and vegetable intake. Carcinogenic elements in food can be a result of the method of preparation used. Barbecuing or grilling meat at high temperatures can lead to the formation of chemicals (polycyclic hydrocarbons and heterocyclic aromatic amines) which have been shown to cause DNA-damage in animal studies.

Recommendations

In 2001 the report *Food, nutrition, physical activity and the prevention of cancer: A global perspective* was published by the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research. Recommendations were made based on the systematic literature review of over 7000 studies from around the world on the influence of nutrition, diet, exercise and body composition on the risk of developing cancer. The report's recommendations also take into account the current insights into the prevention of other chronic diseases such as diabetes and cardio-vascular disease. Dutch scientists from the University of Wageningen Research Centre also contributed to this report. The Continuous Update Project (CUP) was conceived to determine whether new studies should lead to adjustment of the cancer prevention recommendations. The CUP has combined all of the reviewed literature in a central database, facilitating the entry of new studies into this database. New reports of breast cancer (2008) and colorectal tumours (2010) have since been published, confirming and/or strengthening the earlier WCRF-report's conclusions. When the central database has been completely updated (in 2015) the recommendations for the prevention of cancer will also be updated. The most recent information on this subject can be found on the website *Diet and cancer report*.

Recommendations for cancer prevention

1. Be as lean as possible within the normal range of body weight.
2. Be physically active as part of everyday life.
3. Limit consumption of energy-dense foods. Avoid sugary drinks.
4. Eat mostly foods of plant origin.
5. Limit intake of red meat and avoid processed meat.
7. Limit consumption of salt.
8. Aim to meet nutritional needs through diet alone.

Overweight and body fat percentage

Obtaining or maintaining a healthy bodyweight is one of the most important methods of reducing the risk of developing cancer. There is strong evidence suggesting that excess body fat leads to an increased risk of colorectal, oesophageal, pancreas, endometrial, kidney and postmenopausal breast cancer. The distribution of fat throughout the body plays an important role in this risk increase. Excess abdominal fat is associated with a 70% risk increase of developing colorectal cancer and is most likely associated with an increased risk of developing postmenopausal breast cancer, pancreatic cancer and endometrial cancer. There are several potential explanations for the link between excess body fat and cancer. An example is the relationship between excess body fat and the body's hormonal status. Body fat can directly influence the level of hormones such as insulin, insulin growth factor and oestrogen, resulting in an environment that favours tumour formation and inhibits cell death. For the prevention of cancer it is advised to be as lean as possible within the normal range of body weight. It is advised to maintain a BMI of ≤ 25, since a BMI of greater than 25 is associated with an elevated risk of the development of several forms of cancer.

Physical activity

Due to the industrialization, urbanization and mechanization of society, people have assumed a more sedentary lifestyle. Up until the first half of the twentieth century, people in the Netherlands still performed vigorous physical activity in factories, on farm land or in their homes. This started to change in the second
half of the twentieth century. Many of the jobs in the city didn’t require much physical activity and families became smaller. Now there are all sorts of appliances that perform heavy household work, cars and public transport have become our main mode of transportation and we spend most of our free time sitting in front of a television or computer.

Physical exercise, in whichever form, decreases the risk of developing cancer. The WCRF-report presents strong evidence that physical exercise - independent of the effect on body weight - protects against the development of colorectal cancer and possibly also against the development of postmenopausal breast cancer and endometrial cancer. The underlying mechanism has not been elucidated yet. Research shows that regular physical exercise induces beneficial changes in sex hormone and growth factor levels. Physical exercise can also strengthen the immune system and shorten gastrointestinal transit time, allowing carcinogenic chemicals less time to damage the gastrointestinal mucosa.

It is advised to engage in moderate physical activity for at least thirty minutes per day on a daily basis, besides decreasing the time spent sedentary. Moderate physical activity includes anything that increases the heart rate and deepens breathing such as swimming, dancing, walking, cycling, climbing stairs, domestic tasks such as sweeping or vacuuming and gardening. In the case of overweight it is advised to engage in more than thirty minutes of moderate physical activity per day. The recommendation is sixty minutes or more of light physical activity per day or thirty minutes or more of vigorous physical activity. When engaging in vigorous physical activity the heart rate increases, we feel hot, start to sweat and get out of breath. Examples include jogging, fast walking, fast cycling, aerobics and fitness.

**Sugary drinks and high-calorie food**

The general recommendation to reduce consumption of sugary drinks and high-calorie food is primarily meant to combat and prevent weight gain, overweight and obesity.

The combined evidence shows that not the specific nutritional components, but their contribution to the energy density of a diet is detrimental.

There are many misconceptions about the carcinogenic effect of sweeteners such as saccharin, cyclamate and aspartame. The assumption that they are carcinogenic is incorrect. A safely acceptable daily intake (ADI) has been established for all sweeteners. Because children are more at risk than adults, their ADI is much lower. Aspartame can be harmful for people with phenylketonuria.

**Plant foods**

Plant foods often contain a lot of water and fibre with few calories, ensuring that they help maintain a healthy body weight. Studies have shown that fruit and vegetables potentially offer protection against several forms of cancer, among which are cancer of the mouth, pharynx, larynx, oesophagus and stomach. Nutrients rich in fibre could possibly lower the risk of colorectal cancer. The beneficial effects of fruit and vegetables could be explained by the positive effects of specific vitamins, minerals and bioactive components such as carotenoids, folate, flavonoids and glucosinolates. The recommendation is to consume at least five portions (at least 400 grams) of different sorts of fruit and vegetables per day, to consume unprocessed grains or legumes with every meal and to limit the consumption of refined starch products. Variation also reduces the risk of developing cancer. With a varied diet, there is a good chance that all the nutrients that contribute to the prevention of cancer are ingested and none are missed. Food always contains harmful components. A varied diet ensures that there is a small chance that these components are ingested in harmful concentrations.

**Red and processed meats**

People with various vegetarian diets are all at low risk for a number of diseases, among which certain types of cancer. The WCRF-report provides convincing evidence that red meat (beef, pork, lamb and horse meat) and processed meat increase the risk of developing colorectal cancer. Processed meat is smoked, salted or otherwise preserved by for example the addition of preservatives. Since most of the studies were performed in the United States, where the consumption of red meat is higher than in the Netherlands and the composition of processed meat is different, there is an ongoing discussion on the relevance of the recommendations on red and processed meat for the Dutch situation as the results were not verified in European studies. A possible mechanism for the risk increasing effect of red meat is that heme iron, the component that gives meat its red colour, can damage the colon wall. Furthermore, studies show that people who eat large amounts of meat often consume less plant foods and therefore ingest fewer nutrients.
that protect them from cancer. Nutrition which is high in animal fats is often relatively energy-dense, increasing the risk of weight gain. Preserving meat by smoking, salting or otherwise processing can lead to the production of carcinogenic elements such as N-nitroso compounds. These compounds are known to damage intracellular DNA, which can eventually lead to cancer.

To reduce the risk of cancer, a maximum weekly intake of 500 grams (weight after preparation) of red and processed meat should be maintained. This is in accordance with the Health Council of the Netherlands’ Guidelines for a healthy diet 2006 which recommends an intake of 100 to 125 grams of meat, processed meat, fish, poultry and eggs per day. Fish should be eaten twice a week and meat should be prepared correctly (do not burn; grill, roast and barbecue with care).

**Alcohol**

The consumption of alcohol has been on the rise in the Netherlands since the fifties due to increased wealth and leisure time and the more widespread availability of alcohol. Convincing evidence suggests that alcohol increases the risk of developing mouth, pharynx, larynx, oesophageal, stomach, colorectal, breast and liver cancer. A possible explanation for the link between alcohol and cancer is the alcohol’s directly damaging effect on DNA, thereby increasing the risk of developing cancer. The combination of alcohol and tobacco smoke is especially dangerous. The available data do not indicate a significant difference between the various types of alcoholic beverages such as beer, wine and liquors. The most important factor is the amount of pure ethanol consumed. A standard sized drink contains approximately 10 grams of ethanol. In order to prevent cancer, it is best to not consume any alcohol at all. Research shows that there is no threshold level under which there is no risk of developing the cancers caused by alcohol. This means that, when only taking into account the risk of cancer, even small amounts of alcoholic beverages should be avoided. However, when drafting its recommendations the panel also took into account the established protective effect of limited amounts of alcohol against cardio-vascular disease. Therefore the recommended maximum daily intake is one glass of alcohol for women and two for men.

**Salt**

The consumption of salt and salted food is most likely associated with an increased risk of developing stomach cancer. This is the case in certain countries with an extremely high salt intake due to the use of salt in preserved meat and fish products. Studies have shown that excess salt can damage the stomach lining, a possible mechanism for the increased risk of stomach cancer. After the introduction of the refrigerator and its subsequent widespread use, the consumption of fresh fruit and vegetables increased while the consumption of smoked and salted food declined, reducing the risk of developing stomach cancer.

The amount of salt that we consume should be under 6 grams; this is already much higher than the necessary daily intake of salt (approximately 1-2 grams). On average the Dutch consume significantly more than this, namely 10 to 12 grams of salt per day. In the Netherlands, a reduction of the average salt intake is mainly of interest in the prevention of hypertension as opposed to the prevention of cancer.

**Dietary supplements**

Dietary supplements such as vitamins and minerals do not appear to benefit the prevention of cancer. While certain supplements do not appear to have a connection with cancer, others appear to have a risk augmenting effect, such as beta-carotene supplements which increase the risk of lung cancer in heavy smokers and selenium supplementation which increases the risk of prostate cancer in healthy males. Other studies have shown that dietary supplements can potentially protect against certain forms of cancer. However as these studies were often performed in a very specific group of people their results cannot be extrapolated to the general population.

Although dietary supplements contain a number of important nutrients, scientists are still divided on the issue of whether their quality is equal to that of nutrients naturally present in food. More research is needed to be able to differentiate between supplements with high and low doses of vitamins and minerals and the effects of natural versus synthetic supplements. Furthermore, the supplement's composition, the combination of various vitamins and minerals, is deemed important. Therefore, in order to reduce the risk of cancer a varied and balanced diet is advised instead of the use of dietary supplements. A healthy diet with sufficient amounts of fruit, vegetables and other plant foods provides all of the necessary nutrients. The use of dietary supplements in order to prevent cancer is not recommended.
Nutritional status

This chapter is divided into the following parts.

- Nutritional status
- Malnutrition / Cachexia
  - Causes
    - Insufficient intake of nutrition
    - Inflammation and metabolic dysregulations
  - Anorexia-cachexia syndrome
- Sarcopenia/sarcopenic obesity
- Tumour growth

Nutritional status

Nutrition and diet do not directly affect uncontrolled cell division, malignant tumour growth and development and growth of metastases. Nutrition has an important supporting role. Food of sufficient quantity and quality is needed to stay alive, to function and to undergo the necessary treatments in the most optimal nutritional status. However, sufficient intake and being able to eat are not always self-evident. Cancer can have a negative impact on nutritional status and body composition. In addition, oncological treatment modalities can seriously disturb the possibility to eat sufficiently, causing a deterioration of the nutritional status. Considerable differences in the nutritional status of cancer patients are not uncommon. The traditional image of a cancer patient is one of a patient who doesn't eat enough, becomes malnourished and in the shorter or longer term is in a poor condition. The patient has difficulty with eating, has virtually no appetite, or has a feeling of early satiety after starting to eat. This situation can become permanent when damage is caused by continuous treatment. In addition to these patients who have visible weight loss and a deteriorating health, there are also patients, during or after treatment of cancer, whose appetite doesn't change or only changes temporarily. Their weight remains stable or even increases. Upon closer inspection their health has however worsened and an unfavourable body composition has been developed due to an increase in fat mass and a decrease in muscle mass. There are also patients who suffer few effects and whose appetite, weight and condition hardly change.

Malnutrition/ Cachexia

Malnutrition in cancer is more than just a too low body weight. Even a patient with a normal or even high body weight can be malnourished and in a bad physical condition. Malnutrition occurs in more than half of all patients with cancer and is an unfavourable factor.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malnutrition</td>
<td>Nutritional status where there is a deficiency or imbalance of energy, protein and/or other nutrients, leading to measurable adverse effects on body size and body composition, functioning and clinical results.</td>
<td>• unintended weight loss ≥ 10% in six months, or ≥ 5% in one month; • BMI ≤ 18.5 (65 years and older ≤ 20)</td>
</tr>
<tr>
<td>Precachexia</td>
<td>Early stage in the cachexia process where the weight loss is still limited but additional metabolic dysregulations.</td>
<td>• limited unintentional weight loss ≤ 5%, in combination with  ♦ anorexia (loss of appetite)  ♦ biomedical abnormalities such as an increased CRP (C-reactive protein), anaemia or decreased albumin</td>
</tr>
</tbody>
</table>
Cachexia

Very severe malnutrition due to illness. Characteristics of cachexia are progressive and serious weight loss and extreme malnutrition, which means that both the fat mass and the lean body mass have decreased and that muscle atrophy and severe loss of muscle strength occurs.

- serious unintended weight loss ≥ 10%;
- in combination with at least three of the following additional phenomena:
  - anorexia (loss of appetite) with a seriously reduced intake;
  - decreased muscle mass;
  - decreased muscle strength;
  - severe fatigue;
  - biochemical abnormalities, such as a high CRP, anaemia, or low albumin.

Refractory cachexia

Cachexia in an advanced stage of the disease with a low performance score and limited survival.

- criteria as cachexia
- Karnofsky score ≤ 40 or WHO-performance score 3 or 4
- survival ≤ 3 months

Asthenia

General weakness characterized by fatigue, physical and psychological exhaustion, as manifested in concentration disturbances, memory loss and emotional instability.

Causes

Malnutrition in cancer is caused by inadequate intake of food, by inflammation with metabolic dysregulations, or a combination of both. Malnutrition as a result of inflammation and metabolic dysregulations is different from malnutrition caused by inadequate intake alone. Insufficient intake of energy and nutrients especially causes loss of fat mass which is used for the energy requirements. Lean body mass (organs and muscles) is initially spared. Only after prolonged fasting, the muscle mass will be used for energy requirements, and is also broken down. However, when inflammation and metabolic dysregulations occur, both the fat and fat-free mass are broken down. This results in not only the loss of body weight, but also the loss of muscle mass and muscle strength. Loss of muscle mass and muscle strength leads to severe fatigue, muscle weakness, a decrease of health and decreased exercise tolerance, resulting in a decline in physical activity. This increases the loss of muscle mass even more, increases fatigue and creates a feeling of exhaustion, furthermore accompanied by emotional instability and concentration disorders. This situation is known as asthenia: general weakness characterized by severe fatigue and exhaustion.

Insufficient intake of nutrition

Insufficient intake of nutrition is when the patient doesn't consume sufficient energy and nutrients to maintain body weight and nutritional status: the balance between intake and expenditure is disrupted. This form of malnutrition arises when a patient eats less than he/she is used to, also known as starvation. Insufficient intake of nutrition is also seen when the patient has higher nutritional requirements than normal in order to maintain the nutritional status. Causes of malnutrition can occur separately but also simultaneously and can be mutually reinforcing.

Anorexia

Anorexia is experienced by the patient as an annoying loss of appetite. Anorexia is often accompanied by early satiety, changes in taste and smell and an aversion to certain foods. Anorexia is caused by and is a symptom of the cancer process itself. In addition, a poor appetite is a result of a whole series of complaints and often occurs during the treatments.

Obstruction and function loss

In tumours in the mouth and throat, oesophagus or stomach ordinary food cannot or can only be consumed with great difficulty. When a tumour in the mouth or throat occurs chewing and swallowing can be difficult. When a tumour in the oesophagus or stomach occurs, an obstruction can lead to the inability to pass both
solid and liquid food or problems of gastric emptying can occur. Tumours located in the abdomen may cause problems such as gastrointestinal obstruction, disturbed digestion and malabsorption. Also the treatments can cause obstructions and dysfunction of mouth, oesophagus, stomach or intestines. If a patient is restricted to a liquid diet, the intake is almost always insufficient. Liquid nutrition has a lower nutrient density than solid food by nature and therefore contains less energy, protein and other nutrients. Due to the volume of liquid food there is also an earlier feeling of satiety.

Problems of the digestive tract
Problems such as a dry mouth, inflamed mucous membranes, annoying mucus formation or dental problems make the intake of adequate nutrition problematic. Gastro-intestinal problems that decrease the nutritional intake and digestion are nausea, vomiting, gastroparesis, diarrhoea and constipation.

Pain, shortness of breath, fatigue
With pain and fatigue it can be difficult to relax and enjoy eating. If the food itself causes pain, for example with inflammations in the mouth and throat or when there is an inflamed and sensitive oesophagus, ordinary food, especially products that are hard, spicy, hot or sour can be too painful to use. The patient will therefore avoid these products and eat less. It may also be too exhausting to prepare food or there might be a lack of energy to eat well.

Increased requirements
An increased nutritional requirement is present during wound healing, fever and recovery treatments that have caused tissue damage. An increased requirement also emerges in the case of large losses of nutrients due to unstable diabetes, prolonged diarrhoea, fistulas, steatorroe and stomas with high output. As a result, less energy and nutrients are available for preservation or restoration of the nutritional status. The usual diet is insufficient to cover the increased requirement, or to compensate the deficit resulting from large losses.

Daily rhythm, (self) care and eating with help
The daily nutrition requires effort and organization. Grocery shopping and preparation of meals need to be done. There is usually a certain rhythm, especially in older people. Rhythm and organization can be so disturbed in cancer that the patient is unable to find the time to eat. Examinations, treatments and controls require travel and waiting time, are tiring and often take up a large part of the day. The daily radiotherapy over a number of weeks can entail considerable travel time, causing meals to be skipped. A patient can be so tired that he no longer has the energy to eat. Definitely for the older, often single patient, it is not easy to find the energy to prepare food or to eat. It may also be too exhausting to prepare food or there might be a lack of energy to eat well.

Psychosocial stress
Cancer brings forth a lot of emotions. With stress, anxiety, uncertainty, pain or fatigue, the patient may eat worse and sometimes literally cannot swallow a single bite. In depression insufficient intake is one of the criteria for diagnosis. Diet itself can be a source of emotions and stress because food is seen as a contribution to life, health and recovery. Stress affects not only the patient when eating, but also the carer who takes care of the diet. Stress during eating negatively influences the ability of the patient to eat enough and to enjoy eating.

Inflammation and metabolic dysregulation
This form of malnutrition arises as a result of the disease process itself and can occur despite sufficient intake of nutrition. Inflammation is a collective name for inflammatory processes in response to stimuli such as trauma, tumour growth, micro-organisms and stimuli of a chemical nature. Cancer in a number of types and stages can be regarded as a chronic inflammatory process with changed levels of certain acute phase proteins and cytokines. Acute phase proteins are proteins whose concentration in the blood increases
(positive acute phase proteins) or decreases (negative acute phase proteins) in an early stage of inflammation. The tumour itself and/or the patient's immune response to tumour growth form cytokines that are released into the blood. The liver responds to these cytokines by making acute phase proteins. C-reactive protein (CRP) and lipopolysaccharide binding protein (LBP) are positive acute-phase proteins that increase in inflammation. Albumin is a negative acute phase protein that decreases in inflammation. Cytokines are proteins playing a role in immunity. There are cytokines that stimulate the inflammation (pro-inflammatory cytokines such as tumour necrosis factor-alpha (TNF-α) and IL-1 beta interleukins, IL-6, IL-8, IL-12) and cytokines that limit the inflammation (anti-inflammatory cytokines such as IL-4, IL-10 and IL-13). Inflammation and inflammatory processes are accompanied by metabolic disturbances in the carbohydrate, protein and fat metabolism. Increased levels of pro-inflammatory cytokines seem to play a prominent role in this. Cytokines also have a negative impact on appetite.

<table>
<thead>
<tr>
<th>Metabolism</th>
<th>Disorder</th>
<th>Explanatory Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate metabolism</td>
<td>Glucose turnover† Gluconeogenesis† Cori cycle † Glucose tolerance ↓</td>
<td>There is an increased production of lactate in tumours and muscle tissue that is converted into glucose in the liver. This leads to an increased Cori cycle, which costs a lot of energy. With higher insulin resistance, glucose is less available and the gluconeogenesis (glucose from fat and protein) increases in order to cover the energy requirements.</td>
</tr>
<tr>
<td>Protein metabolism</td>
<td>Protein turnover † Break down muscle protein† Muscle protein synthesis ↓ Degradation liver protein ↓ Synthesis liver protein↑</td>
<td>The breakdown of protein is increased and the synthesis of protein is decreased in muscle tissue. The synthesis of protein in the liver is increased to serve as fuel and for the formation of glucose resulting in loss of lean body mass (muscle mass).</td>
</tr>
<tr>
<td>Fat metabolism</td>
<td>Plasma triglyceride↑ Glycerol-turnover↑ Lipoprotein lipase activity↑</td>
<td>The breakdown of fat is increased and is not limited by glucose, as in healthy people. As a result there is a loss of fat mass.</td>
</tr>
</tbody>
</table>

**Anorexia-cachexia syndrome**

The **anorexia-cachexia syndrome** can be defined as a multifactorial syndrome due to illness, which is characterized by an increased loss of skeletal muscle mass (with or without loss of fat mass) that cannot be fully treated by conventional nutritional intervention and leads to progressive functional decline. The anorexia-cachexia syndrome is considered a complex combination of reduced nutritional intake due to various causes, and metabolic changes due to illness with a disturbed carbohydrate, fat and protein metabolism as a result. The metabolic dysregulations also cause poor appetite (anorexia) and early satiety, causing the dietary intake to worsen. The anorexia-cachexia syndrome can shift to cachexia. Not all malnourished patients are cachectic, but cachectic patients are always malnourished.

**Sarcopenia/sarcopenic obesity**

<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| Sarcopenia        | A form of malnutrition characterized by loss of muscle mass and muscle strength with constant or increased body fat, causing no or virtually no weight loss. | • low muscle mass  
 • reduced muscle strength and functionality |
| Sarcopenic obesity| A form of malnutrition characterized by loss of muscle mass and muscle strength that is accompanied by a high fat mass and (serious) weight gain. | • criteria as in sarcopenia  
 • overweight: BMI 25-30 kg/m², obesity 30-40 kg/m², morbid |
Sarcopenia can be divided into the following categories.

- Primary sarcopenia. This form occurs as a result of the normal aging process: *sarcopenia of ageing*. The exact cause is still unclear, but there are indications that genetic and hormonal factors play a role. Muscle loss of 10-25% from the age of 50 to 70 years normally occurs. At the age of 80 there is, on average, a 30-50% muscle loss. This process is not reversible or treatable: loss of muscle mass as a result of old age alone cannot be recovered.

- Secondary sarcopenia. This form occurs as a result of:
  - insufficient physical activity with little movement and an inactive, sedentary lifestyle.
  - Immobility, such as being bedridden, increases muscle loss.
  - disease which is accompanied by inflammation, metabolic dysregulations and protein breakdown, such as anorexia-cachexia syndrome in cancer, cancer treatments, organ failure and endocrine disorders such as insulin resistance;
  - malnutrition, due to inadequate intake of especially protein, malabsorption with disorders in the digestion and resorption of protein, gastro-intestinal problems or side effects of treatments such as nausea and vomiting.

Sarcopenic obesity is a form of secondary sarcopenia which is characterized by a high fat mass and (serious) weight gain that is accompanied by loss of muscle mass and muscle strength and that cannot be traced back to a higher intake of energy and nutrients. Sarcopenic obesity occurs in cancer such as breast cancer, prostate cancer, colon cancer and sometimes with some forms of chemotherapy. An existing high BMI and weight gain at the diagnosis of cancer increases the risk of early recurrence, a second tumour and a limited survival. In addition, being overweight and gaining weight have adverse effects on the quality of life and health. There is a higher risk of complications during surgery, lymph oedema, diabetes mellitus, cardiovascular diseases and hypertension.

Sarcopenia and sarcopenic obesity cannot easily be determined on the basis of weight alone. The criteria that apply are: a low muscle mass and decreased muscle strength or functionality. To determine changes in muscle mass, various *measurements* are available. Muscle strength or functionality can be estimated with various walking tests.

In cancer sometimes loss of weight (lean body mass and fat mass) occurs first, followed by weight gain. Studies suggest that weight gain is especially an increase in fat mass and that the lean body mass remains at a low level. But also in a stable weight situation lean body mass is lost. This loss of muscle mass and muscle strength during and after cancer treatment can be one of the causes of the prolonged fatigue which even after a successful treatment is seen as a bothersome side effect. Sarcopenia influences the prognosis unfavourably.

**Tumour growth**

Sometimes the question arises whether or not nutrition stimulates malignant tumour growth. Nutrition undeniably stimulates cell development. Tumour cells, like other cells, need nutrition for growth. Differences in tumour growth by supplying very little or a lot of nutrition have been demonstrated in animal research. Accelerated tumour growth has been seen in animals that were well fed and received extra nutrition compared to animals which were already malnourished and given less food. Relatively few studies of good quality have been performed in humans. The effect of nutrition on tumour growth in animal research cannot be extrapolated to humans due to the fact that the growth of human tumour cells is different than in animals. Studies on the effect of nutritional therapy in cancer patients with liquid feeding, tube feeding and parenteral feeding, enriched with specific nutrients such as arginine, glutamine and omega 3-fatty acids show conflicting results.

A good nutritional status in itself does not result in faster tumour growth. There is no evidence available that an adequate intake of nutrition in cancer patients leads to excessive tumour growth. Adequate nutrition is a diet that is tailored to the actual nutritional needs of the patient and to the prevention of malnutrition. Hyper alimentation or overfeeding leads to complications such as an increased fat mass and hyperglycaemia. When giving an overdose of vitamins undesirable effects on tumour growth in addition to toxic effects have also been shown. Therefore it is considered risky and hyper alimentation and overdose of vitamins are both discouraged. There is, however, no reason not to aim for adequate feeding of patients with cancer. The benefits of improving nutritional status (if feasible) outweigh the possible effect on tumour growth. Fear of
disease progression as a result of nutritional interventions may therefore not be the argument to refrain from nutritional support.
Screening and assessment

This chapter is divided into the following parts.

- Screening
- Nutritional assessment
- Considerations
- Dietary diagnosis

Screening

The purpose of screening for malnutrition is a timely identification of patients with, or at risk for, malnutrition. Malnutrition screening should be performed by a nurse, doctor, nurse practitioner or other health care professional potentially resulting in referral to a dietician. A number of malnutrition screening tools have been developed which are both quick and easy to use. These screening tools lead to a quick result through a simple scoring system or decision tree.

Screening tools contain indicators of acute malnutrition and frequently also indicators of chronic malnutrition are included. Unintentional weight loss is one of the most frequently used indicators of acute malnutrition in screening tools. Unintentional weight loss of >10% (or >6 kilograms) in six months or >5% (or >3 kilograms) in one month is classified as malnutrition. Body Mass Index (BMI) is a frequently used indicator of chronic malnutrition. A BMI of <18.5 is the most commonly used cut-off point for malnutrition. Due to the decrease of body height with age, a BMI of <20 is maintained as cut-off point in people over 65 years. Arm circumference is a possible alternative when BMI cannot be determined or is not reliable (for instance with oedema). An arm circumference of <23.5 cm is equal to a BMI <20.

On admission, oncology patients suffer more frequently from acute than chronic malnutrition. In oncology patients the use of a screening tool containing at least the indicator weight loss is advised. A screening tool with BMI as a second indicator will also identify chronic malnutrition in oncology patients.

The most frequently used screening tools in the Netherlands are the SNAQ (Short Nutritional Assessment Questionnaire) and the MUST (Malnutrition Universal Screening Tool). The MNA-sf (Mini Nutritional Assessment-short form) was developed as a screening tool in elderly patients.

The greatest drawback of the screening tools currently available is that they frequently do not recognize an unfavourable body composition (loss of muscle mass) in cancer patients. Loss of muscle mass with a steady or increased body weight, such as in sarcopenia or sarcopenic obesity, is not currently identified. However, in order to maintain consistency in the Dutch health care system it is still advised to screen oncology patients with the MUST, the various versions of the SNAQ or the MNA-sf, depending on the patient category, as these instruments are currently in use as quality performance indicators and have been implemented in various health care divisions over the past few years. It is important however, to keep in mind the limitations of these screening tools in oncology patients.

The Patient-Generated Subjective Global Assessment (PG-SGA) is a tool that can also be used for screening purposes but is mainly useful for diagnosing malnutrition. The PGA-SGA was specifically developed for use in cancer patients. The amount of time needed to complete the PG-SGA is relatively high compared to the screening tools SNAQ and MUST and its use requires trained dietitians.

Malnutrition can develop at every stage in the diagnosis and treatment of cancer. Screening for malnutrition in cancer patients should therefore be repeated and should preferably take place:

- in the period prior to treatment: during visits to a general practitioner and/or during the first appointment with a specialist;
- during treatment: on hospital admission, during outpatient visits and during visits to a radiation therapy institute;
- in the period after treatment: during a follow-up appointment with a doctor, during an intake with a home care professional or district nurse or on admission to a nursing home.

There is no added benefit in screening for malnutrition in patients with end-stage disease and a short life expectancy. However, it remains important to assess a patient's wishes, questions and complaints.

Treatment based on screening result versus treatment according to protocol
When a screening tool yields a positive result, a patient is referred to a dietician. The effect of a nutritional intervention implemented after screening is not immediate. It is often easier to prevent malnutrition than to treat it once it has been established. Therefore a proactive nutritional policy is indicated in several forms of cancer and a number of cancer treatments especially in those with a high risk of developing malnutrition. A proactive nutritional policy entails a multidisciplinary approach which anticipates the occurrence of common nutritional problems. An example of a proactive nutritional policy can be found in the Dutch Perioperative Nutritional Policy Guideline in which the procedures surrounding preoperative feeding, the nil per os policy and the postoperative resuming of nutrition are outlined.

Another example is the treatment protocol for patients undergoing (chemo)radiation therapy for head, neck or oesophageal cancer. The proactive and systematic use of nutritional advice to cover nutritional needs before, during and after (chemo)radiation therapy yields a greater positive effect on weight maintenance and weight improvement than nutritional advice provided after a patient presents with symptoms.

Whether nutritional intervention should be implemented based on screening results or through referral to a dietician according to protocol should be assessed individually for each category of patient.

For more information see the website of the Dutch Malnutrition Steering Group.

**Nutritional assessment**

Nutritional assessment is a method of determining the nutritional status and the nature and severity of malnutrition by a dietician. This usually takes place after a positive screening result. Over the course of the illness the data yielded by a nutritional assessment can also be used to evaluate the effect of a nutritional intervention. Reference and cut-off values can be found on the website of the Maastricht University Medical Centre Department of Dietetics. Instead of solely evaluating the absolute values generated by an assessment it is better to take into account the course of an individual patient values. Repeated measurements give a good indication of changes in body composition.

A nutritional assessment includes a combination of data with the following elements:

**a. Body composition**

- Weight, weight change, height, BMI; see also [Malnutrition/cachexia](#)
- Lean body mass and fat mass:
  - Mid-arm muscle circumference calculated using the measured values of the triceps skin fold thickness and the mid upper arm circumference Bioelectric impedance analysis or bioelectric spectroscopy (BIA or BIS). These measurements are based on the body's electrical resistance. Tissues rich in water and electrolytes, such as blood and muscle, have a very low electrical resistance. Lean body mass and fat mass can be determined based on the measured electrical resistances using prediction formulas.
  - Dual-energy X-ray absorptiometry (DEXA) is a method in which the lean body mass and fat mass of the torso and extremities is determined using X-ray. The lean mass of the extremities is used to determine the appendicular skeletal muscle index (ASMI).
  - Lumbar skeletal muscle index, determined using CT or MRI-scanning techniques.
  - Measurement of hand grip strength, which gives an impression of the peripheral muscle strength. Studies have shown that hand grip strength is directly related to the total body muscle mass. Hand grip strength is also related to other factors such as inflammation. Changes in hand muscle function can be measured before changes in muscle mass occur making hand grip strength measurement an indicator for catabolism and anabolism. Dutch reference values were developed for hand grip strength measurement in 2011.

NB. Measurements provide additional information on the maintenance or loss of lean body mass, fat mass and muscle strength. There is a lack of consensus regarding reference and cut-off values, however it is agreed that muscle mass depletion occurs when muscle mass and/or muscle strength drop below the fifth percentile of the healthy population. The fifth percentile entails that in a normal, healthy, well-nourished population 95% of that population has a higher muscle mass and 5% has a lower muscle mass. There are no reference values for muscle mass available for the Dutch population.
b. Food intake and nutritional needs

- Nutritional history:
  - dietary history: usual intake;
  - 24 hour recall: current intake;
- History of symptoms and complaints;
- Loss of nutrients;
- Determination of nutritional needs.

c. Medication and biochemical measurements

- Medication
- Biochemical measurements. An elevated C-reactive protein (CRP) or a decreased serum albumin indicate metabolic dysregulation, however these measurements are not specific for malnutrition in cancer. Furthermore, there is an ongoing discussion of which cut-off values to use. Biochemical measurements can provide additional information on whether the malnutrition is mainly caused by metabolic dysregulation.

Considerations

Feeding is not a goal in itself. Before commencing nutritional treatment it is important to consider the following points.

a. Medical considerations

- **Diagnosis**
  - Does the location of the tumour and/or metastases necessitate nutritional adjustments?
  - Does the treatment necessitate nutritional adjustments?
  - Do the symptoms and complaints necessitate nutritional adjustments?
- **Prognosis**
  - Do the nutritional adjustments suit the curative or palliative goal of the treatment?
  - Do the nutritional adjustments suit the remaining life expectancy?

b. Social considerations

- **The patient's views**
  - Are the nutritional adjustments compatible with the patient's views and wishes?
- **Quality of life**
  - Do the nutritional adjustments benefit the patient's wellbeing?
  - Do the potential advantages of nutritional adjustments outweigh their potential disadvantages?
- **Discrimination**
  - Is age a factor considered in the nutritional adjustments?
  - Are social status, ethnicity and lifestyle factors considered in the nutritional measures?

c. Considerations related to care

- Does the care of the clinical patient or nursing home resident necessitate nutritional measures?
- Does the patient's level of invalidity necessitate nutritional measures?

Dietary diagnosis

The dietary diagnosis is formed based on

- Data from the nutritional assessment;
The patient's view of his or her illness;
Medical factors (among which the prognosis);
Social factors (housing, living and working conditions);
Personal factors (nutritional and exercise habits, language proficiency, motivation, insight into illness).

The dietary diagnosis is the basis on which treatment goals are determined and a nutritional treatment plan is developed. It is important that a multidisciplinary approach is taken and both doctors, nurses and paramedics are involved in developing the goal and specifics of the nutritional treatment plan. The patient remains in charge throughout. This entails that the patient is free to make his or her own decisions, even at moments where guidance and counselling are necessary. In the Netherlands, the patient can make an appointment with a dietician without discussing this with a doctor; there is no need for an official referral.
Nutritional requirements

Nutritional requirements include the need for energy, the need for macronutrients such as protein, fat, carbohydrates, fibre and fluid and the need for micronutrients such as vitamins, minerals and trace elements. Energy and nutrient requirements vary between individuals depending on their sex, age, body composition, activity level, illness and medication use. Specific requirements are also determined such as the need for an adjusted texture or consistency of food, or nutrition administered through a feeding tube or intravenously. The dietician then converts these results into a nutritional advice that is tailored to the individual patient.

Energy

The total energy requirement covered by nutrition consists of the resting energy expenditure (REE) together with the energy expenditure through physical activity. In oncology patients total energy requirements tend to be lower than in healthy individuals due to a reduction in physical activity. However, extra energy can be required due to increased expenditure during illness and to combat weight loss in malnutrition. Nutritional advice on energy-intake is corrected for weight development in order to optimally meet energy requirements.

Resting energy expenditure

Studies have mainly been focused on resting energy expenditure (REE). Cancer and its treatment can affect resting energy expenditure, however this effect is not consistent. Resting energy expenditure can be unchanged, increased or reduced. Resting energy expenditure can be either measured or estimated. Measurement is performed using indirect calorimetry. In this method a hood is placed over the patients head. REE can then be calculated by measuring the amount of air that flows through the hood and the O₂ and CO₂ concentrations of the in- and outgoing air. Measuring the REE is the most accurate method of determining the individual resting energy requirement. However, in daily clinical or primary practice it is not feasible to measure each patient's REE. The measurement of REE is labour-intensive and therefore costly. Furthermore, not all hospitals and primary practices have REE measurement equipment at their disposal. REE can also be estimated using certain formulas. At a group level, REE can be measured with reasonable accuracy, however at an individual level the differences between estimated REE and actual REE are substantial. Whether the actual REE is higher or lower than the estimated REE and the degree of variation between the measured and estimated REE cannot be predicted for the individual patient.

Harris-Benedict equation

A valid starting point when estimating the individual energy requirement is the Harris-Benedict equation, which is commonly used in the Netherlands. In over 50% of patients, the difference between estimated and measured energy requirement remains within the acceptable boundaries of +10 or -10% when using this equation. Harris and Benedict's original equation from 1919 was revised by Rosa and Shizgal in 1984. Activity, metabolic stress factors and weight loss are used to determine the total energy requirement.

<table>
<thead>
<tr>
<th>Harris- Benedict equation (1984)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men (kcal)</td>
<td>88.362 + (13.397 x Wt) + (4.799 x Ht) - (5.677 x Age)</td>
</tr>
<tr>
<td>Women (kcal)</td>
<td>447.593 + (9.247 x Wt) + (3.098 x Ht) - (4.33 x Age)</td>
</tr>
<tr>
<td>Wt = weight in kg</td>
<td></td>
</tr>
<tr>
<td>Ht = height in cm</td>
<td></td>
</tr>
<tr>
<td>Age = age in years</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>+10%</td>
</tr>
<tr>
<td>bedridden</td>
<td>+20%</td>
</tr>
<tr>
<td>ambulant</td>
<td>+30%</td>
</tr>
<tr>
<td>light activity</td>
<td></td>
</tr>
</tbody>
</table>
2. Metabolic stress

| Metabolic stress                                      | Kcal/kg bodyweight per day for 
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No metabolic stress</td>
<td>REE</td>
</tr>
<tr>
<td>Light metabolic stress and/or +10 C fever</td>
<td>20</td>
</tr>
<tr>
<td>Moderate metabolic stress and/or +20 C fever</td>
<td>25-30</td>
</tr>
<tr>
<td>Heavy metabolic stress and/or +30 C fever</td>
<td>30-40</td>
</tr>
</tbody>
</table>

3. Extra addition

- When weight gain is desired, up to +30%

Kcal/kg-ratio method

Another method for estimating patients' energy requirements which is used in the Netherlands is the kcal/kg ratio method. This method is based on the equation 20 kcal/kg bodyweight per day for REE, 25-30 kcal/kg bodyweight per day for patients who are not severely ill and 30-40 kcal/kg bodyweight per day for severely ill patients. This equation underestimates energy requirements in underweight patients and overestimates them in overweight patients. Therefore, energy requirements in overweight patients are recalculated to a BMI of 27. However, the kcal/kg ratio gives a rough estimation which doesn't take individual features into account. The Harris-Benedict equation is preferred over the kcal/kg ratio as it corrects for sex, height and age. These are important characteristics in the oncology patient population in which 40% is over the age of 70.

Activity

After measuring or estimating resting energy expenditure, an addition needs to be estimated for exercise and physical activity. This can be done using the Harris-Benedict equation or by taking into account the physical activity level (PAL). The total daily energy requirement is calculated by multiplying the resting energy expenditure by the PAL-value. The PAL-value varies from 1.2 in (extremely) inactive people to 2.4 in (extremely) active people.

<table>
<thead>
<tr>
<th>Lifestyle</th>
<th>PAL-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting or lying down for entire day</td>
<td>1.2</td>
</tr>
<tr>
<td>Sedentary work and little activity in leisure time</td>
<td>1.4-1.5</td>
</tr>
<tr>
<td>Sedentary work with walking around and little activity in leisure time</td>
<td>1.6-1.7</td>
</tr>
<tr>
<td>Standing work</td>
<td>1.8-1.9</td>
</tr>
<tr>
<td>Large amount of physical activity in work and leisure time</td>
<td>2.0-2.4</td>
</tr>
<tr>
<td>Extremely active (highest PAL-value measured)</td>
<td>± 5.0</td>
</tr>
</tbody>
</table>

Source: Guidelines for a healthy diet 2006

Protein

There are no well-founded recommendations on protein requirement in cancer available in the literature. Therefore one might consider using the same recommendations as in other illnesses which are accompanied by inflammation and metabolic stress. There is little to be found in the literature concerning protein requirement in illness. There are no studies available on protein requirement in illness with little to moderate inflammation.

The Dutch Perioperative Nutritional Policy Guideline states that the recommended daily intake 0.8 g of protein/kg bodyweight in the healthy population is insufficient to maintain lean body mass in patients who have undergone surgery. There are indications that in order to maintain lean body mass in (severely) ill patients a daily intake of at least 1.2-1.5 g of protein/kg bodyweight is necessary. It is important to note that in both healthy and severely ill patients the maximum daily amount of protein that the body can digest is 1.5-1.7 g of protein/kg. Protein intake would be overestimated in overweight patients (BMI ≥ 27) when using current bodyweight, since there is increased fat mass in these patients with reduced metabolic activity. Therefore, in overweight patients bodyweight is recalculated to correspond with a BMI of 27.

Protein intake cannot be separated from energy intake. For maintenance or improvement of nutritional status both sufficient protein and energy in healthy proportions are needed. A sufficient energy supply is necessary to prevent that part of the available protein is used as fuel instead of for the building of lean body.
mass. A reduced protein intake with a sufficient energy intake leads to an increase in fat mass. This causes an increased body weight without improving muscle mass, resulting in an unfavourable body composition. In order to maintain or increase muscle mass, physical activity and muscle training are essential besides a sufficient protein intake.

**Fat and carbohydrates**

These macronutrients are mainly used as sources of energy. During the treatment of cancer and the palliative phase, the fat-carbohydrates ratio and the type of fats and carbohydrates used are of minor importance. A minimal amount of essential fatty acids (linolenic and linoleic acid) must be available. After successful completion of treatment and in order to prevent illnesses such as overweight, metabolic syndrome, diabetes, vascular disease, cancer recurrence or a second tumour it is advised to follow the recommendations on fat and carbohydrates as formulated in Guidelines for a healthy diet 2006.

**Dietary fibre**

The recommended dietary fibre intake is 30-40 g/day, unless there is a contra-indication. Dietary fibre ideally consists of a mix of soluble, insoluble, coarse and fine fibres.

**Vitamins, minerals and antioxidants**

It is currently assumed that oncology patients require the same amount of micronutrients such as vitamins, minerals and trace elements, as healthy people: 100% of the recommended daily intake of vitamins, minerals and trace elements. This standard however was not developed specifically for ill patients and the literature lacks reliable studies on the requirements during illness. Vitamins and minerals can be ingested in their natural form through regular nutrition and in their synthetic form through enriched nutrition or supplements. The actions of the various forms differ and it is not clear whether the effects are greater when using the natural or synthetic form. Patients often use several forms at once, increasing the risk of an overdose.

In the Netherlands many people use vitamin and mineral supplements. The 2003 Dutch Food Consumption Survey showed that over one fifth of men and almost one third of women used nutritional supplements. According to data from the Dutch Vitamin Information Bureau 40% of people in the Netherlands use supplements; 26% of these supplements are combined multivitamin and mineral supplements. The use of supplements could potentially be even higher among (ex-)oncology patients, however there is no Dutch data available on this specific group. American studies have shown that 81% of oncology patients use a single vitamin or mineral supplement at any given time and 26-77% use combined multivitamin and mineral supplements. The most frequently used supplements are selenium, vitamin A, vitamin C, beta-carotene and ubiquinone-10. These supplements are available without a prescription and are commonly valued as ‘beneficial’, ‘healthy’ or ‘natural’ by the general public. Frequently cited motives for supplement use during treatment are: natural sources and therefore harmless, more effective than traditional treatment, detoxifies, restores equilibrium, strengthens the effect of traditional treatments and the ability to personally contribute to the treatment. Vitamins and minerals are generally used after being recommended by a friend, family member or advertisement. Their use is rarely advised by doctors, dieticians or nurses.

Both the positive and negative effects of the use of vitamin and mineral supplements in cancer remain unclear. Besides having a positive effect on health and disease, vitamin and mineral supplements could also potentially stimulate tumour development and tumour growth and cause negative interactions with treatment. The studies on the effect of vitamin and mineral supplements leave much to be desired. In vitamin and mineral studies there have only been a few phase 1 (safety studies) and phase 2 (dose-response and effect studies) studies. Most studies were performed without first establishing what dose should be effective and why. High dosages of vitamins appear to lead to unwanted and sometimes even toxic side effects. Moreover, most studies are of poor methodological quality. Therefore, more research of better quality is needed before definitive conclusions can be drawn.
Vitamins

This chapter is divided into the following parts.

- Vitamin A
- Beta-carotene
- Vitamin B1
- Vitamin B6
- Folic acid
- Vitamin B12
- Vitamin C
- Vitamin D
- Vitamin E

Vitamin A

Despite frequently being compared to an antioxidant, vitamin A does not react with free radicals in the way that antioxidants do. It plays a role in the control of certain biological functions, such as cell growth, differentiation and apoptosis. Vitamin A can either stimulate or inhibit cell growth by binding to the retinoid receptor, depending on the type of cell and vitamin A derivate. This characteristic is responsible for vitamin A’s actions against tumour cells.

There are only two studies available on the effect of vitamin A during chemotherapy, namely in chronic myeloid leukaemia (CML) and in metastasised breast cancer. Both studies demonstrated a positive effect on response to treatment and survival and a decrease in tumour recurrence. However, due to the limited size of the study groups, these results must be interpreted with care. One study also investigated toxicity, which proved to be significantly higher in the antioxidant group, corresponding to the high dosage that was used.

Beta-carotene

The best known carotenoid is beta-carotene. Beta-carotene has a structure similar to vitamin A and is therefore also referred to as provitamin A. An important role in the prevention of cancer is attributed to beta-carotene due to its improvement of interaction between cells and its anti-oxidative effects. Regular cells are in constant contact with their environment, as opposed to tumour cells that frequently have little interaction with their surroundings. A good interaction with the environment is important for the growth and development of cells. When carcinogenic elements impede communication between cells, beta-carotene can counteract and prevent this. The anti-oxidative function is important since beta-carotene is one of the most potent inactivators of a certain type of free radical. However, under specific circumstances beta-carotene can also have a pro-oxidative effect, such as for example due to an elevated intracellular oxygen concentration.

The effect of beta-carotene has primarily been studied in animal studies. These studies suggest that administration of beta-carotene can potentially reduce DNA damage in healthy cells. However, these results have not been adequately verified by clinical studies. Most clinical studies have examined beta-carotene in combination with other antioxidants. Even larger studies have not been able to provide evidence that beta-carotene prevents cancer. Two studies demonstrated an elevated risk of lung cancer in (ex-) smokers and an increased risk of death in the beta-carotene supplement group.

Vitamin B1

In head and neck tumours, vitamin B1 (thiamine) deficiency is usually present when combined with prolonged excessive alcohol intake. There is evidence that vitamin B1 deficiency is common after a stomach resection. The ability to absorb vitamin B1 remains intact but the body’s thiamine levels are limited so that insufficient nutritional intake easily results in systemically reduced thiamine levels.

Vitamin B1 is an essential co-enzyme in the carbohydrate metabolism. Therefore, when administering nutrition (mainly carbohydrates) after a period of fasting or reduced intake, the body requires an increased amount of vitamin B1.
Vitamin B6

It has been described that vitamin B6 (pyridoxine) could prevent hand-foot syndrome. It has also been reported to cure hand-foot syndrome, however the various studies are contradictory on this point. Hand-foot syndrome (erythema, tenderness and peeling of the skin on hands and feet) is an adverse side-effect that can occur after use of certain cytostatic drugs such as capecitabine, 5 fluorouracil (5-FU) and doxorubicin. The effect of vitamin B6 on chemotherapy response and survival has not been studied systematically and is therefore unknown.

Folic acid

Most studies concerning folic acid have focussed on colorectal cancer. Folic acid has never been shown to reduce tumour recurrence in colorectal cancer. In contrast, a high folic acid intake has been linked to an increased risk of several other forms of cancer, most notably lung cancer. Folic acid does play a role in the treatment of cancer since it is a necessary element in rapidly dividing cells such as tumour cells. Methotrexate is a commonly used cytostatic drug with anti-folic acid properties. The intensity of its side effects can be reduced by adding folinic acid (Leucovorin®), which is not the same as folic acid. Theoretically, folic acid supplements could reduce the side effects of cytostatic drugs, but could at the same time reduce the effects of cytostatic drugs with anti-folic acid effects.

Vitamin B12

Vitamin B12 (cobalamin) has been reported to reduce the toxicity of the cytostatic drug vinblastine. 25% of all Dutch seniors have a vitamin B12-deficiency. One of the causes is atrophic gastritis which reduces the secretion of gastric acid in the stomach. A vitamin B12-deficiency can occur after the resection of oesophageal or stomach cancer, partly due to inadequate nutritional intake, but mainly due to inadequate absorption following a (partial) stomach resection. The absorption of vitamin B12 is no longer possible following a total stomach resection due to the absence of gastric fluids containing intrinsic factor, a glycoprotein necessary to bind vitamin B12 so that it can be absorbed in the terminal ileum. A subtotal stomach resection results in insufficient intrinsic factor to absorb vitamin B12, especially when combined with prolonged use of medication (proton pump inhibitors or metformin), pancreas insufficiency, bacterial overgrowth or following vagotomy. Vitamin B12-deficiency occurs following the resection of urothelial cancer in approximately 15-25% of patients. Since vitamin B12 is absorbed in the terminal ileum, its absorption can be reduced when part of the ileum is used to construct a new bladder.

Vitamin C

Vitamin C is a well-known antioxidant. Due to its anti-oxidative properties, vitamin C reacts with water-soluble radicals, preventing damage to lipids and DNA. The effects of vitamin C and vitamin E are synergistic, as vitamin C has a protective effect in water on the lipids of the cell membrane and vitamin E protects the lipids themselves. Vitamin C also has a regenerative effect on vitamin E, so that the same vitamin E is able to neutralize free radicals several times. Vitamin C becomes pro-oxidative when it is administered in very high doses. The potential anti-carcinogenic effect of vitamin C has been extensively studied. In 1976 it was first published that intravenous administration of vitamin C followed by oral supplementation could improve survival in cancer patients. The results of the large number of studies that followed, including a number of placebo controlled randomised trials, are contradictory. Therefore, no recommendations can be made concerning optimal therapeutic vitamin C plasma levels which could reduce tumour size. It also remains unknown which dose is needed to obtain these therapeutic plasma levels. Finally, it is unknown which tumours are sensitive to high levels of vitamin C. There have been a small amount of clinical studies on the effects of vitamin C use in combination with chemotherapy (in metastasised breast cancer) or radiotherapy (in prostate cancer and gynaecological cancers). However, the studies were too small to allow for definitive conclusions. Most clinical studies have evaluated the effect of vitamin C supplements in combination with other antioxidants.
Vitamin D

Vitamin D is the only vitamin for which there is evidence that it could improve survival in cancer patients, when administered in higher doses than the standard dose. There are studies indicating that vitamin D has anti-carcinogenic properties. Vitamin D could influence cell differentiation, cell proliferation, angiogenesis and metastasation.

Both epidemiological studies and animals studies indicate a relationship between vitamin D deficiency and tumour development. Whether vitamin D deficiency leads to tumour development or vice versa remains unclear. In order to investigate this intervention studies are needed. A number of prospective clinical intervention studies are currently being carried out. The primary results in breast cancer survivors indicate a positive effect of vitamin D supplementation on the prognosis. It is too early for well-founded recommendations. Since vitamin D deficiency is common, it is advised to maintain optimal vitamin D serum levels. These are 30-50 nmol/l of 25-hydroxyvitamine D 25(OH)D, the most commonly used indicator of serum vitamin D, in young adults and >50 nmol/l in women over the age of 50 and men over the age of 70. Hormonal therapy increases the risk of reduced bone mineral density. The Dutch Guideline Osteoporosis and fracture prevention 2011 recommends optimizing patients' vitamin D status during hormonal therapy for breast and prostate cancer. Furthermore, an optimal vitamin D level has a beneficial effect on the prevention of osteoporosis, falls and fractures, depression and fatigue. Besides nutrition, sunlight is an important source of vitamin D.

Vitamin E

The term vitamin E refers to eight different substances. The most important one is alpha-tocopherol. Vitamin E protects cells against oxidative damage, especially against oxidation of lipids. This enables cancer cells to keep rapidly proliferating, which is essential for an adequate effect of cytostatic treatment, and protects healthy cells against harmful influences. There is evidence that vitamin E and chemo- and radiotherapy have a synergistic effect in cancer cells. There are five clinical studies available of limited size (all under fifty patients) and mediocre quality on the effect of vitamin E supplementation on toxicity. Four of these studies were performed in chemotherapy patients, one in radiotherapy patients. Vitamin E supplementation during chemotherapy for a number of solid tumours resulted in a significant reduction of neurotoxicity and oral mucositis. No effect was found on other adverse chemotherapy side effects. One of the studies also took into account the complete or partial response to treatment. The response to treatment in the placebo group was better than in the supplement group. These results were not significant. A study on vitamin E supplementation during radiotherapy showed a similar result. Vitamin E supplementation through mouthwash during radiotherapy for head and neck cancer was associated with a 36% reduction in symptomatic mucositis. However, the two-year survival of patients in the supplement group was worse (32%) than in the placebo group (63%). The difference was not significant and may be due to bias as more patients in the supplement group had a tumour in a higher stage (T3 or T4). There is only one high quality double blind, randomised, placebo controlled trial available. The effect of vitamin E and beta-carotene was studied in 540 patients with stage I or II head and neck cancer. Primary end points included the occurrence of a second (primary) tumour, toxicity and survival. The intervention group was given a combination of vitamin E and beta-carotene; the control group received a placebo. After the inclusion of 156 patients, beta-carotene supplementation was stopped following the results of another study which demonstrated an elevated risk of lung cancer in beta-carotene supplement users. For ethical reasons the study was continued using only vitamin E in the intervention group versus placebo in the control group. The results show a significant reduction of radiation damage in the intervention group, however patients receiving vitamin E also had a significantly reduced survival rate after 52 months. Furthermore, the occurrence of a second tumour was higher in the intervention group. Survival in both groups was equal after eight years. Since the other clinical studies were small and of poor quality, the evidence for the positive effect of vitamin E on toxicity is limited. Moreover, the trend towards a negative effect on survival is very disquieting. Therefore, the use of high doses of vitamin E in patients with head and neck cancer is not recommended.

Minerals

This chapter is divided into the following parts.

- Calcium
• Magnesium  
• Zinc  
• Selenium

**Calcium**

Intracellular calcium is essential for the proper functioning of cells and tissue. High intracellular calcium levels are associated with an increase in apoptosis (cell death). The administration of cisplatin leads to an increase in intracellular calcium which theoretically can lead to increased apoptosis. Studies on whether the use of calcium supplements could augment cisplatin’s anti-tumour effect are still in a preliminary stage.

Peripheral neuropathy (neurological pain in the hands and feet) is frequently described side effect of the use of cytostatic drugs containing platinum, cytarabine, taxane or thalidomide. Intravenous calcium and magnesium infusion during treatment with oxaliplatin has been shown to protect against peripheral neuropathy; studies seem to indicate a reduction of both acute and chronic neurological side effects.

**Magnesium**

Antitumor treatment can result in systemically reduced magnesium levels. Furthermore, treatment with cisplatin can potentially lead to kidney damage, resulting in an increased loss of magnesium. Treatment with cetuximab leads to increased renal excretion of magnesium which can lead to reduced systemic magnesium levels. It is therefore advised to regularly check magnesium levels during treatment with cisplatin or cetuximab and to supplement magnesium if necessary.

Magnesium supplementation is usually administered intravenously, together with cytostatic drugs. It has been suggested that low serum magnesium levels could benefit the therapeutic effect of anti-tumour treatment. Hypomagnesaemia could potentially inhibit tumour growth and angiogenesis. In contrast, studies in mice demonstrated an increased number of metastases during hypomagnesaemia. Research on magnesium metabolism in oncology patients is still in a relatively early phase. It is not yet known how a tumour influences magnesium metabolism.

**Zinc**

Zinc is known to play a potential role in the development and progression of prostate cancer. Epidemiological studies suggest that low doses of zinc increase the risk of developing prostate cancer. Since many (older) men have a zinc deficiency, supplementation up to the recommended level is advised. However, higher doses (>25 mg/day) could promote the development of prostate cancer and should therefore be avoided. Additional research on the subject is needed.

**Selenium**

The trace element selenium is not an antioxidant per se. Intracellular selenium does play a role in an anti-oxidative enzyme system. The most important enzyme in this system is glutathione peroxidase, which converts hydrogen peroxide into water thus preventing damage to the cell wall and genetic material.

The effect of selenium on treatment response has not been studied. A limited number of clinical studies have evaluated the effect of selenium on toxicity during treatment with chemotherapy. In women with ovarian cancer, the supplement group demonstrated a significant reduction of toxicity with reduced hair loss, muscle weakness and myelosuppression. A significant reduction in muscle weakness was found in patients with an intestinal tumour.

A limited number of studies have been performed on the effect of selenium supplementation in patients undergoing radiotherapy. A small randomised study found a significant reduction in loss of taste and difficulty swallowing in patients with head and neck cancer undergoing radiotherapy. Supplementation of selenium in order to restore normal serum levels in women with ovarian or endometrial cancer who had reduced serum selenium concentrations on initiation of postoperative radiotherapy, lead to a significant reduction in the number of episodes of diarrhoea due to radiation damage. Since the available studies are small and of limited quality, the evidence for the positive effect of selenium supplementation on toxicity remains weak. Furthermore, the margin between a therapeutic and a toxic dose is very small so that supplement use can potentially be harmful.
Antioxidants

Antioxidants protect the body from so called free radicals and other harmful elements through oxidation reactions. A free radical is a molecule with one or more unpaired electrons. Free radicals are highly chemically reactive and can therefore easily cause damage to, for example, DNA leading to dysregulation of cell division and potentially cancer. Antioxidants can react with free radicals and neutralise them. The main antioxidants are vitamin A, vitamin C, vitamin E, beta-carotene and selenium.

Interaction with chemotherapy or radiotherapy

There are three, partly conflicting theories on the role of antioxidants in chemo- and radiotherapy. The theories assume there is an interaction between the anti-oxidative system and chemo- or radiotherapy through the reaction between free radicals and antioxidants.

The first theory states that antioxidants limit the effect of the treatment. Free radicals that are formed during radiotherapy and a number of chemotherapies are necessary to destroy the cancer cell. The use of anti-oxidative vitamin supplements could protect the tumour cell against cell death, reducing the effectiveness of the treatment.

According to the second theory, antioxidants enhance the effect of chemo- and radiotherapy. High doses of antioxidants during radiotherapy not only neutralise radicals, but also have a positive effect on other mechanisms that stimulate apoptosis. This theory also states that antioxidants improve the effect of chemotherapy, since they stimulate the cell cycle thereby enhancing the anti-tumour effects of cytostatic drugs. A properly functioning cell cycle is essential for the toxic effect of cytostatic drugs, since these drugs are only effective in a specific part of the cell cycle.

The third theory states that antioxidants are selective in their function. They protect healthy cells from DNA-damage by free radicals without protecting cancer cells. Therefore, antioxidants limit the damage caused by free radicals without compromising the effectiveness of chemo- and radiotherapy.

Combinations

More research is needed on the use of combined vitamin, mineral and antioxidant supplements in the treatment of cancer. Due to a variety of interactions, both synergistic and antagonistic, the effect of a combination of antioxidants is not necessarily equal to the sum of its parts.

The use of multivitamin and mineral supplements has mainly been studied in prostate cancer. The course of prostate cancer can be relatively mild with patients surviving for years following the diagnosis. There is evidence that (excessive) use of vitamins and minerals through supplements (in doses greatly exceeding the recommended daily amount) could have a negative effect on the prognosis of prostate cancer, especially in patients with an advanced form of cancer.

The effect of a combination of antioxidants during chemotherapy has been studied in two randomized controlled trials. One study evaluated the effect of a combination of vitamin C, vitamin E and beta-carotene in non-small cell lung cancer stage III and IV. The second trial studied the effect of a combination of vitamin E and selenium in a number of tumour types. Both studies found no difference in toxicity, such as hair loss, myelosuppression, diarrhoea, neuropathy, renal toxicity and ototoxicity between the supplement group and the control group. Furthermore, no difference was found in response to treatment or survival between the groups.

The various studies have only demonstrated weak evidence for a positive effect of vitamin, mineral and antioxidant supplements on toxicity during treatment. The studies are of limited quality and size and results are often contradictory. Moreover, a number of studies demonstrated a reduction in response to treatment and/or survival in the group of patients using supplements. This is an important reason to advise against the use of over the counter vitamin and mineral supplements in cancer patients.

Recommendations

Insufficient nutritional intake is the only reason to advise the use of vitamin and mineral supplements. Adult oncology patients undergoing chemo- and/or radiotherapy often have a reduced intake of nutrients, including vitamins, minerals and antioxidants, due to symptoms related to tumour location, side effects of treatment, psychosocial problems and metabolic dysregulation due to the tumour. Patient groups at risk for deficiencies are mainly elderly patients, smokers, patients using certain types of medication (antibiotics, laxatives, sedatives, painkillers, diuretics) and people with a limited diet. The lack of vitamins and minerals in dietary intake can be compensated using enriched nutrition or supplements containing no more than the recommended daily amount (see table). In patients using large amounts of nutrition enriched with vitamins and minerals or high doses of vitamin and mineral supplements, it is important to reduce these amounts. It
is advised to reduce the maximum dose of vitamin, mineral and antioxidant supplements to 100% of the recommended daily amount, in addition to a normal nutritional intake. This dosage is considered safe for use during cancer treatment. The ‘Warenwetbesluit Toevoeging microvoedingsstoffen aan levensmiddelen’ (Dutch statutory regulation Addition of micronutrients to food) (1996) determined that the total amount of vitamins and/or minerals in the regular daily ingested amount of enriched nutrition should be at least 15% and at most 100% of the recommended daily amount. This means that the intake of vitamins, minerals and/or antioxidants through the use of enriched nutrition can easily exceed the maximum daily amount. When this amount is exceeded, patients should be advised to stop the use of vitamins and mineral supplements. The maximum daily amount is easily exceeded when using liquid nutrition and/or tube feeding and when the nutritional intake is sufficient with or without the use of enriched nutrition.

It is primarily the role of the treating physician to enquire after supplement use. The doctor is aware of the mechanisms of the cytostatic drugs being used and knows whether their function is dependent on the depletion of certain substances and therefore whether supplements are required or not. The treating physician is the expert on the potentially harmful or beneficial interactions with the administered therapy and can use supplements as part of the therapy. In this case, the pharmacological properties of a supplement are taken into account and the supplement used is prescribed by the physician. When a dietician is involved in the treatment it is the dietician’s task to consistently inquire whether supplements or enriched nutrition are being used. In the case of excess intake, the patient should be informed of the potential risks and complications of use. It is important that a dietician reports his or her findings to the doctor in charge of treatment and if necessary consults other health care professionals to prevent potentially harmful interactions with the designated treatment.

**Recommended daily intake (RDI) vitamins and minerals in nutrition**

**Fluid intake**

The recommended adult daily fluid intake is 1500 ml of drinking fluid. With good kidney function this amount is sufficient to remove waste products from cell death during chemo- and radiotherapy. In the elderly 1700 ml of drinking fluid is advised due to a more vulnerable kidney function and an increased permeability of the skin. Fluid requirements increase during chemo-radiotherapy, use of nephrotoxic cytostatic drugs (cysplatin and carboplatin), fever and bladder and kidney function disorders. The recommended daily intake to ensure protection of the kidneys is at least 2000 ml of fluid daily. Fluid requirements can also increase due to heightened losses such as drains, fistulas, an ileostomy, vomiting or diarrhoea.

**Disease specific formulas**

Disease specific formulas are specifically developed for patients with certain diseases or for patients undergoing certain forms of treatment.

**EPA-enriched formulas**

Eicosapentaenoic acid (EPA) is an essential omega 3 fatty acid derived from oily fish and fish oil. It is naturally present in herring, salmon, mackerel and sardines in limited amounts. There is evidence that EPA is beneficial to the immune system. It has an anti-inflammatory effect, inhibiting pro-inflammatory cytokines produced by the tumour (such as TNF-alpha, IL-1, IL-6) which are responsible for the inflammatory process and metabolic deregulation in anorexia-cachexia syndrome. However, the systematic reviews on this subject conclude that there is no definitive evidence that EPA is effective in the treatment of anorexia and weight loss.

**Immunonutrition**

Immunonutrition are formulas which consists a combination of basic nutrients supplemented with substances such as glutamine, arginine, nucleotides and omega 3 fatty acids.

Glutamine is a semi-essential amino acid which, under normal circumstances, the body can produce itself. Under severe metabolic stress, when the required amount is higher, production is insufficient and glutamine becomes an essential amino acid. Glutamine plays a role in protein synthesis and in host
defence against infection. It is an important source of nitrogen and protein in rapidly replicating cells such as intestinal cells (enterocytes) and immune system cells (among which lymphocytes and fibroblasts). Glutamine appears to have a beneficial effect on maintaining bowel integrity, immunological host defence, postoperative mortality and duration of hospital admission. There is evidence that glutamine requirements during cancer exceed normal production levels. Glutamine could potentially decrease the severity and the duration of stomatitis after chemo- and radiotherapy. Positive effects of parenteral vitamin supplements have been described in patients with cancer of the blood, bone marrow or lymph nodes; however these results vary and are inconsistent. Positive effects of glutamine supplements have mainly been demonstrated in severely ill patients using parenteral nutrition and multi-trauma and burn patients using tube feeding. Adding glutamine to tube feeding or liquid nutrition appears to be less effective than parenteral glutamine administration. Oral administration of 18-30 grams of glutamine appears to be a safe dose. Extra glutamine has not been shown to stimulate tumour growth.

**Arginine** is also a semi-essential amino acid which can be used to produce glutamine using citrulline and is essential in catabolic situations. Furthermore, arginine plays an important role in protein synthesis and maintenance of the immune system and is necessary for cell growth and wound healing. Supplementation of arginine could reduce the incidence of postoperative infections however there is evidence that arginine increases mortality in severely ill patients, therefore its use is not recommended in septic patients. **Nucleotides** are the basic components of DNA and RNA and are essential for cell division and immunological host defence.

There is a large body of literature available on the benefits of immunonutrition. There is no consensus on the value of immunonutrition in specific patient groups or various types of cancer (colorectal cancer, head and neck cancer or cancer of the blood, bone marrow or lymph nodes) and cancer treatments (surgery, chemo- or radiotherapy). Therefore the routine use of immunonutrition in the nutritional treatment of oncology patients is not currently advised.

### Health products and alternative diets

Approximately 30% of all oncology patients undergo alternative treatments besides their regular treatment program. Alternative treatments include all treatments which are not taught in the official medical and paramedical curriculum and for which no professional standards have been developed. Examples include homeopathy, acupuncture, hypnotherapy, aromatherapy, orthomolecular medicine, non-toxic tumour therapy and paranormal healing. Dietary advice is frequently a part of alternative treatments. Examples include nutritional supplements, Moerman diet, Houtsmuller diet, salt treatment, sodium bicarbonate and health products. Books advertising '(anti-)cancer diets' are also increasingly popular.

Mainly young, educated and female patients undergo alternative treatments and make individual dietary adjustments. Nutritional supplements and health products retain their popularity whereas the Moerman and Houtsmuller diets are hardly used anymore. Research shows that patients undergoing alternative treatments believe that only regular treatments will cure their cancer. The main reason given by patients for the use of alternative treatments is to strengthen the immune system and occasionally to prevent the occurrence of metastases. Another important consideration is the desire to actively contribute to their treatment and cope with their disease, besides all of the treatments that patients are passively submitted to by others.

Cancer is a life-threatening disease which approximately 50% of patients will not survive. Fear of illness and death are important factors in a patient's choices. Alternative treatments offering a sense of hope can have a powerful attraction on people in this situation. Patients are in need of clarity and certainties in the extremely uncertain situation that their disease has put them in. Whether or not a treatment's mechanism of action is founded on any scientific proof is not seen as an important reason to undergo or forfeit a treatment. Whether or not a potential effect appeals to a patient and matches his or her lifestyle and coping mechanisms is of much greater importance.

Alternative diets, health products and supplements are viewed as harmless. Frequently, nutritional aspects of alternative treatments are encompassed into nutritional advice. However this is not always the case. High dosages of vitamins, minerals and antioxidants can cause adverse side effects on tumour growth and anti-tumour treatment. An excess use of health products during increased nutritional requirements, such as large amounts of fruit, unrefined and lean products and no animal fat, sugar or alcohol could lead to an insufficient intake of energy and nutrients. Furthermore, alternative (nutritional) treatments can be expensive and are frequently not covered by health insurance.

**Health products**

Health products such as ginseng, garlic, mistletoe, açai berries, pomegranate, soy, fish oil, organic
products and additive free products claim to have a beneficial effect on many diseases including cancer. Beneficial health effects are ascribed to combinations of certain products.

**Dietary supplements**
Dietary supplements include vitamin, mineral and antioxidant supplements. Alternative treatments often advise the use of high doses of these products in order to strengthen the immune system or reduce supposed deficiencies. Practitioners such as orthomolecular dieticians and doctors, homeopathic doctors and acupuncturists administer these treatments and work according to the principles of natural medicine and non-toxic tumour therapy. Furthermore, patients frequently use nutritional supplements at their own initiative.

**Moerman diet**
The Moerman diet sees cancer as a metabolic disorder caused by a deficiency in iodine, vitamins A, B, D, E, iron and sulphur which should therefore be consumed in large amounts. The Moerman diet advises the use of large amounts of vegetables (especially beets and carrots) and citrus fruit, green peas and whole grains, a limited intake of dairy products and no meat, fish, poultry, sugar, coffee or tea.

**Houtsmuller diet**
The Houtsmuller diet is a variation on the Moerman diet. Besides large amounts of fruit and vegetables, pulses, oily fish and limited amounts of meat, high doses of vitamins, minerals and trace elements are advised. Furthermore the Houtsmuller diet advises the use of products that it deems to be anti-carcinogenic such as genistein (from soy) and shark cartilage. Finally, mental support is seen as an important factor in fighting cancer.

**Salt treatment**
Salt treatment consists of the additional use of 7-8 g of salt per day in the form of salt tablets. The theory behind this is that tumour cells require a larger amount of fluid than healthy cells. The ingestion of extra salt extracts fluid from the tumour cell, causing dehydration and limiting cell growth.

**Sodium bicarbonate**
The use of sodium bicarbonate is based on the theory that cancer is caused by a fungus. Bringing the tumour into contact with sodium bicarbonate would cause it to disappear.
Nutritional interventions

This chapter is divided into the following parts.

- Dietary features
  - Healthy eating
  - Adequate diet
  - Protein-energy enriched diet
  - Protein enriched diet
  - Palliative nutritional support
  - Nutritional counselling and physical activity
- Treatment

Dietary features

After determining the required amount of energy, protein and other nutrients, a dietary advice is formed. In oncology patients there are several forms of nutrition available with specific features: healthy, adequate, protein-energy enriched and protein enriched nutrition and palliative nutritional support. Dietary advice should always include an exercise recommendation.

Healthy eating

Healthy eating should ultimately benefit long term health and maintain current health. The main goal of healthy eating is to prevent overweight and thereby reduce the risk of developing diabetes, vascular disease and certain forms of cancer. The Health Council of the Netherlands (Gezondheidsraad) has developed the Guidelines for a healthy diet 2006. Although these guidelines were developed for (seemingly) healthy adults, they are also suitable for oncology patients with a normal and stable weight who are in good physical condition and are undergoing, or have undergone anon-invasive form of treatment. Followingsuccessful completion of treatment, healthy eating can contribute to reducing the risk of tumour recurrence or the development of a second tumour.

The Guidelines for a healthy diet 2006 include several key points, recommended daily amounts and general recommendations to achieve a healthy diet.

Key points

- Energy: a good energy balance is required in order to maintain or achieve a healthy body weight (BMI 18,5-24,9) and prevent an energy excess causing or maintaining overweight.
- Protein, fat and carbohydrates in energy percentages of daily energy requirements:
  - Protein: a daily intake of 0,8 g of protein per kg of body weight is sufficient for healthy people, provided the quality of the protein is high;
  - Fat: besides the total amount of fat, the nature of ingested fat and fatty acids is also important;
  - Carbohydrates: no differentiation between mono-, di- and polysaccharides and minimal use of products containing added sugar.
  - In practice, alcohol will often serve as an energy source.
- Dietary fibre, vitamins, minerals and fluid as described under dietary requirements.

Recommended amounts

Recommendations for a healthy diet

- Ensure a varied diet.
- Take adequate daily physical activity.
- Eat plenty of fruit, vegetables and whole-grain cereal products every day.
- Regularly eat (oily) fish.
Generally avoid products with a high level of saturated fatty acids and mono trans unsaturated fatty acids.

Avoid frequent consumption of foods or beverages that contain easily fermentable sugars and drinks that are high in alimentary acids.

Limit intake of salt.

If alcohol is used, do so in moderation.

### Adequate diet

An adequate diet supplies enough energy and nutrients to maintain nutritional status and is sufficient for daily functioning. This nutritional advice suffices when body weight is stable, treatment is mild and there are no complications. The goal of an adequate diet is to cover current energy and nutrient requirements, not to have a beneficial effect on health in the long term. The preventive advice in the Guidelines for a healthy diet on a favourable fatty acid composition and the limited use of mono- and disaccharides in order to prevent vascular disease and diabetes are of limited importance in this situation and do not have priority.

**Key points**

- **Energy**: measurement of the resting energy expenditure or estimation using the [Harris-Benedict equation](#) with additions for physical activity. When using the kcal/kg ratio, 25-30 kcal/kg of current body weight is a reasonable starting point.
- **Protein**: 1.0-1.2 grams of protein /kg of current body weight /day. In case of a BMI ≥ 27, recalculate to a BMI of 27.
- **Nutrients** such as dietary fibre, vitamins, minerals, trace elements and fluid should be ingested in the amounts described under nutritional requirements.

### Protein-energy enriched diet

A protein-energy enriched diet provides an increased amount of protein and energy to improve nutritional status or maintain nutritional status when energy and nutritional requirements are elevated. A protein-energy enriched diet can be advised in the case of:

- recent weight loss due to reduced intake,
- great losses (multiple days of (fatty) diarrhoea, fever, large ulcers, drains, colostomy or fistula with output),
- invasive treatments (major surgery, intensive chemotherapy, chemoradiotherapy) and complications such as fever.

**Key points**

- **Energy**: measurement of resting energy expenditure or estimation using the [Harris-Benedict equation](#) with 30-50% additions for physical activity, metabolic stress and/or weight gain. When using the kcal/kg ratio, 30-35 kcal per kg current body weight is a reasonable starting point.
- **Protein**: 1.2-1.5 grams of protein /kg current body weight /day (in case of a BMI ≥ 27, recalculate to a BMI of 27). Note: in severe illness and following major surgery at least 1.5 grams of protein per kg of body weight are thought to be needed to maintain lean body mass. It should be noted that 1.5-1.7 grams of protein per kg of current body weight is the maximum amount of protein that the body can process.
- **Other nutrients** such as carbohydrates, fat, dietary fibre, vitamins, minerals, trace elements and fluid: according to the general recommendations on nutritional requirements.
Protein enriched diet

A protein enriched diet provides an increased amount of protein to maintain or improve lean (muscle) mass and to correct an unfavourable body composition through increased muscle mass with stable or decreasing fat mass. This advice is frequently given during mild treatments or during the recovery period that follows treatment.

Key points

- **Protein:**
  - 1.2-1.5 grams of protein/kg current body weight/day (in case of a BMI ≥ 27, recalculate to a BMI of 27);
  - spread protein intake over all daily meals.
- **Energy:**
  - adequate energy intake: measurement of resting energy expenditure or estimation using the Harris-Benedict equation with additions for physical activity;
  - limited energy intake to a maximum of 500 kcal below the calculated requirements, when aiming for weight loss, provided the diet remains sufficient.
- **Other nutrients such as carbohydrates, fat, dietary fibre, vitamins, minerals, trace elements and fluid:** according to the general recommendations on nutritional requirements.

Palliative nutritional support

The aim of palliative nutritional support is to maximise wellbeing and comfort and to, if possible, alleviate symptoms and/or help to cope with them. Maintaining nutritional status and providing sufficient energy and nutrients are also potential goals but do not have priority in this situation. The patient is allowed to eat what he can and wants and omit foods that he cannot or does not want to eat. When intake abilities are limited, fluid is more important than energy and nutrients. Palliative nutritional support is aimed at the current situation and short-term effects.

In the setting of progressive disease, the change from an adequate diet to palliative nutritional support is not a clear turning point, but usually a gradual development.

In clinical practice it is frequently the case that the choice between an adequate diet and palliative nutritional support is not clearly delineated. When specific treatments such as chemotherapy are initiated, oral nutritional supplements or tube feeding can be used to guarantee an adequate intake but are not necessary when treatment is suspended. When a patient with a poor prognosis still wishes to eat, the choice can be made to use energy dense meals, snacks or occasionally oral nutritional supplements, as opposed to tube feeding. This does not guarantee that needs are sufficiently covered. This is however not the primary goal and this approach does optimize patient intake under the given circumstances.
Nutritional counselling and physical activity

In order to maintain muscle mass, both physical activity and diet are essential. Muscle mass always declines during inactivity and immobility, even when there is a generous protein intake. Muscle mass is needed to maintain and improve both muscle strength and a patient's physical level of functioning. Exercise and training lead to more muscle being developed or maintained from dietary intake than without exercise or training. Furthermore, exercise and training have a beneficial effect on fitness level, fatigue and pain. Many oncology patients have a limited level of physical activity. There is sufficient evidence proving the value of exercise and intensive training programs in order to maintain muscle or aid recovery after treatment. A combination of strength training and endurance training increases muscle mass, stimulates recovery of function and improves endurance. Strength or resistance training includes exercise using weights, press-ups and sit-ups. Aerobic and endurance training includes brisk walking, running, cycling, swimming, steps, trampoline jumping and dancing. Strength or resistance training is aimed towards building muscle mass, aerobic and endurance training towards improving endurance levels. Ideally, patients should exercise on a daily basis or for at least thirty minutes three times a week. The Guideline Cancer Rehabilitation 2011 recommend that rehabilitation should take place during all stages of the disease: during and following treatment and both in the curative and in the palliative stage.

Diet and physical activity

It is not yet clear which types of diet optimize exercise results. A protein enriched diet appears to be essential for building or maintaining muscle mass. There is little data available on the exact nutritional requirements for physical activity and training in cancer. Research indicates that, especially in elderly patients, an even distribution of protein intake (for example 20-30 grams of protein per meal) has a greater effect on the building of muscle mass than one large intake of protein per day, for example during the main meal. Research shows that although protein metabolism in the elderly functions normally, the synthesis of muscular protein is sensitive to an evenly distributed supply of protein. It has been suggested that in strength or resistance training the use of small amounts of protein (approximately 10 grams) shortly before and after exercise improves the building of muscle. Depending on the body weight target (weight gain, stable weight or weight loss), nutrition should be energy dense, isocaloric or contain limited energy. Besides this, nutrition should provide sufficient vitamins, minerals and fluid. Both during and after cancer treatment, nutritional counselling should specifically include exercise and activity recommendations.

Treatment

This chapter is divided into the following parts.

- Malnutrition
- Sarcopenia/sarcopenic obesity
- Patient queries
- Perioperative nutritional support

Malnutrition

In order for a treatment to be as effective as possible it is important to know the cause of the malnutrition. If the tumour has not (yet) been removed, malnutrition can be caused by insufficient intake or by inflammation and metabolic dysregulation. Usually, there is a combination of both forms of malnutrition. Malnutrition due to insufficient intake can be corrected by using sufficient or extra energy and nutrients. Malnutrition due to inflammation and metabolic dysregulation cannot be corrected by diet alone. Even with sufficient nutritional intake or the use of extra energy and nutrients, the breaking down of both fat and lean body mass will persist until the underlying mechanisms causing the metabolic dysregulation are addressed. Removing the tumour is the most effective way to treat cancer related malnutrition as it corrects the metabolic dysregulation responsible for malnutrition. Following the removal of the tumour, a patient's nutritional status can be improved by sufficient dietary intake. Occasionally, problems with nutritional intake persist after tumour removal due to treatment side effects; this can lead to malnutrition persisting due to insufficient intake, without the presence of metabolic dysregulation. Examples are the continuing difficulties with chewing and swallowing following surgery and/or radiotherapy for head and neck tumours.
When tumour removal is not an option, metabolic dysregulation will remain a problem. Nutritional intervention can nonetheless be used as an important adjunctive therapy to limit the further deterioration of nutritional status due to insufficient intake. No or insufficient intake of nutrition inevitably leads to extra problems or even death. Administering nutrition provides additional time to perform planned treatments under optimal nutritional conditions in order to cure a patient or provide maximum palliative support.

The dietician takes a nutritional case history: the eating habits using a dietary history and the current intake using a 24-hour recall technique. The protein and energy requirements of the malnourished patient are calculated or estimated together with the current nutritional intake, followed by the formulating of a nutritional treatment plan by a multidisciplinary team. Sufficient physical activity is essential for optimal results after nutritional interventions as physical activity stimulates the development of muscle tissue. Prevention of physical inactivity is the main priority. Exercise recommendations should therefore be aimed at staying active in daily life for example by walking, cycling and climbing stairs.

The dietician consults with the patient and/or his family and caregivers and discusses the relationship between malnutrition and cancer. Furthermore, the dietician determines whether adaptation of the patient’s regular diet will be sufficient to meet protein and energy requirements. Verbal information is supported using written or audiovisual tools. As soon as possible, the patient is provided with diet that is as attractive as possible, is adjusted to potential symptoms and provides sufficient energy, protein, fluid and other nutrients. The nutritional treatment plan in malnutrition contains the following key points:

• When 100% of the nutritional needs are met, protein-energy enriched diet is continued.
• When 75-100% of nutritional needs are met, the treatment plan consists of protein- and energy dense nutrition in the form of enriched main meals, snacks and if necessary oral nutritional supplements. The treatment plan is re-evaluated within 7-10 days and adjusted if necessary.
• When 50%-75% of nutritional needs are met, oral nutritional supplements and/or tube feeding is advised besides protein- and energy dense nutrition. The treatment plan is re-evaluated after 4-7 days and adjusted is necessary.
• When intake drops below 50% of nutritional needs, complete tube feeding is advised, supplemented by whatever can be ingested orally. The treatment plan is re-evaluated after 2-4 days and adjusted if necessary.

The use of these guidelines in clinical practice is always tailored to the individual patient. The patient’s wishes and the short and long term prognosis play an important role in determining the nutritional treatment plan. Furthermore, insight into the estimated length of poor dietary intake is necessary. If dietary intake is poor for a few days but is expected to recover soon thereafter, it is not recommended to start invasive treatments such as tube feeding. In cancer, changes in the situation occur frequently. Therefore, nutritional status and prognosis should be re-evaluated regularly and adjusted if necessary.

Sarcopenia/sarcopenic obesity

It is important to establish the cause of sarcopenic obesity, as this determines whether it can be treated, thus restoring the lost muscle mass and muscle power. Secondary sarcopenia is mainly the case in younger cancer patients: in this patient group, increases in muscle mass and muscle strength are possible after treatment when the focus lies specifically on nutrition and exercise. In elderly patients a combination of primary and secondary sarcopenia determines the final result. In old age, when illness, loss of muscle and malnutrition occurs simultaneously and reinforce each other, recovery following disease can be difficult as the possibilities for increasing muscle mass are limited at a higher age. Exercise and nutrition still have a beneficial effect, but the possibilities to engage in them are often limited. What is lost can frequently not completely be restored (‘use it, or lose it’). This leads to increased loss of function and a decreased level of independence in elderly patients. Sarcopenic obesity with extreme weight gain can result in limited physical activity, thereby increasing loss of function and limiting independence.

The dietician takes a nutritional case history: eating habits using a dietary history and current intake using a 24-hour recall technique. Protein and energy requirements are calculated, followed by determination of the nutritional treatment plan by a multidisciplinary team. Since exercise and training are essential to build and maintain muscle mass, it is necessary to consult a doctor, sports physician or physical therapist in order to determine the degree to which exercise and training are possible and effective and at which intensity. The main goal of physical activity is maintenance of muscle mass; exercise (especially strength training) is used
to build muscle mass. The dietician consults with the patient and/or his family and caregivers, discusses protein enriched diet, the connection between muscle mass, weight, overweight and cancer and determines whether the calculated protein and energy requirements and optional energy limitations can be met by altering the regular diet. Together with the patient, the necessary amount of support and guidance is determined to reach and maintain a healthy ratio of muscle and fat mass. Verbal information is supplemented by written and audiovisual tools.

**Patient queries**

Besides malnutrition and an unfavourable body composition, a patient's questions regarding nutrition, diets, supplements and health products are important reasons to refer a patient to a dietician. However, this does not always occur. A poll in a panel of cancer patients showed that over half the participants (patients, former patients, partners, family members) felt they missed information on nutrition. Almost all participants agreed that information on nutrition and nutritional support should always be available, especially when there are questions or symptoms and complaints. Nutritional information should also suit a patient's needs, abilities, expectations and personal opinions. The common advice from health care professionals that patients should eat 'normally' is not enough and does not sufficiently meet the patient's queries. Nutrition is often a topic of conversation between patients, fellow cancer victims, family and friends. Increasingly, the internet is becoming a source of information and nutritional advice can be found and shared on internet forums. Alternative diets in the Netherlands such as the Moerman diet or Houtsmuller diet are no longer in common use; however supplements, vitamins, minerals and other products with health claims remain popular. Not because people believe these products will cure their disease, but to strengthen their immune system, limit potential disease progression and most importantly to actively contribute to their health and recovery. A scientifically based method does not appear to be a condition for patients to engage in alternative treatments. Whether or not a treatment and its potential mechanism of action appeal to a patient and match his or her ideas, lifestyle and coping mechanisms is of much greater importance. Fear of illness and death are important incentives in cancer patients to look for additional methods besides their regular treatment.

Studies show that health care professionals regularly underestimate a patient's need for nutritional information. Patients expect that during their illness they will be given information by their general practitioner or specialist on nutrition, the link between nutrition and cancer, weight loss, supplements, health claims and potentially harmful substances in nutrition; however they do not explicitly ask for this information. Especially younger patients require more information on health, fitness level and nutrition. Even when there are no nutritional complaints, patients still value information on nutrition. With all the insecurities that cancer inflicts, patients appreciate the clarification of nutritional facts and fiction. Information on healthy eating can also give a patient that already follows a healthy diet and his caregivers the confirmation that they are doing well in that area. When health care professionals do not provide sufficient information, patients search for information themselves, including through unreliable sources. Regular nutritional science does not always have a fitting and scientifically based answer to the many claims of a positive effect on the disease process made by health products and others which are sometimes also adopted by the patient. Furthermore, a scientifically based answer does not always meet the patient's expectations. Sometimes a patient is mainly looking for confirmation of his own choices and views. It is important that alternative treatments can be discussed and approached with an open attitude and understanding for the patient's motives and considerations. Patients that feel rejected will not be as open to their health care professional's opinion.

**Perioperative nutritional support**

Surgical procedures in cancer vary between small superficial procedures that hardly affect the patient to major surgical interventions with a high risk of morbidity and mortality. Malnutrition is an independent risk factor for the development of postoperative complications. During the recovery period that follows surgery, there is an increased need for nutrients. Malnourished patients have insufficient reserves. Muscle mass and muscle strength decrease, leading to reduced heart and lung function and physical condition, a weakened immune system and slower wound healing. This results in an increased risk of postoperative complications and mortality, leading to higher expenses and longer hospital admissions.

**Preoperative nutritional policy**

In the case of a good nutritional status, the routine use of clinical nutrition before an operation is not indicated as it doesn't reduce postoperative morbidity and mortality. Malnourished patients (MUST-score ≥
2 or SNAQ-score ≥ 3) should receive extra nutrition during seven to ten days preoperatively in order to optimize nutritional status, even if this leads to postponement of surgery. When screening leads to the discovery of malnutrition, oral nutritional supplements or tube feeding should be initiated immediately, since nutritional advice alone yields few results in the short term. Tube feeding is favoured over parenteral feeding. Sometimes, combinations of oral, tube and parenteral feeding are necessary to cover nutritional requirements. The malnourished preoperative patient requires protein-energy enriched nutrition.

Nil by mouth policy
Prolonged fasting (over 12 hours) or a strict diet are not necessary in preparation for surgery. A brief preoperative preparation suffices and does not lead to an elevated risk of aspiration, nausea, regurgitation or other postoperative complications compared to the standard policy in which no food or drink is allowed after midnight on the day before surgery. An exception to this are patients with an elevated risk of aspiration such as morbidly obese patients, elderly patients and patients with delayed gastric emptying such as diabetics with gastroparesis.

Solid food can be used up to six hours before surgery including oral nutritional supplements and tube feeding. Clear liquids with no protein or fat can be used up to two hours before surgery, such as water, fruit juice without pulp, uncarbonated soft drinks, tea and coffee (without milk). A carbohydrate-rich drink (50 grams of carbohydrates is ideal) administered orally, through a feeding tube or intravenously could reduce postoperative insulin resistance, hunger, thirst and agitation and lead to a more rapid recovery.

Postoperative nutritional policy
Direct postoperative feeding (within six hours) reduces morbidity. Direct postoperative feeding doesn't lead to an increase in postoperative nausea, vomiting or the occurrence of ileus compared to the slower and more gradual initiation of feeding according to a fixed step by step schedule that was previously standard practice. A rapid initiation of nutrition has a positive effect on the immune system, the nitrogen balance, the maintenance of bowel integrity and wound healing and advances recovery. When oral nutrition is impossible (for example after head, neck or oesophageal surgery) or doesn't succeed within 3-5 days following surgery, clinical nutrition is indicated. Tube feeding is favoured over parenteral feeding.

In the case of insulin resistance, nutrition becomes less effective, leading to an increased risk of infection. If necessary, insulin can be administered guided by glucose levels. The postoperative patient needs protein-energy enriched nutrition. Accurate body weight measurement can be impeded by fluid retention following surgery. In that case, the last known body weight with a normal fluid balance can be used.

In ICU-patients, the administration of large amounts of protein does not lead to a positive nitrogen balance. Based on the available literature, the protein requirements of ICU-patients are approximately 1.2g/kg/day, calculated using the body weight prior to ICU-admission.
Symptoms and advice

Cancer patients often have multiple nutritional symptoms simultaneously. These symptoms derive from each other and reinforce each other. Dysphagia is often accompanied by constipation, mucositis often leads to unintended weight loss and fatigue is often present following unintended weight gain. Symptoms contribute to distress. This is mainly to do with the fact that eating sufficient, flavoursome and healthy food is seen as an important condition for life, health and recovery from disease. Nutritional symptoms caused by cancer make the disease evident and can be very confrontational. This ensures that the patient and the caregiver, who prepares the meals, are often very fixated on nutrition and wish to contribute to their potential recovery through food. When healthy eating is not possible this can lead to uncertainty, tension, irritation and distress for both parties. Moreover, food is not only an important source of nutrients but also has an important social function: people enjoy eating and drinking with company. When it is no longer possible to enjoy food together in the usual manner because a patient is forced to use special products, ground or liquid nutrition or is fed through a feeding tube, this affects the family and social contacts. Finally, good food and drinks are an important contribution to a person's quality of life.

For practical implementations of specific nutritional advice in the Netherlands see the current patient information folders by the KWF Kankerbestrijding (Dutch Cancer Society). These contain general advice. A registered dietician forms an individually tailored advice based on general recommendations and helps a patient choose from the large amount of products, nutrition and cooking methods.

Weight loss

Malnutrition in cancer is caused by insufficient nutritional intake, inflammation and metabolic dysregulation or a combination of the two (see Nutritional status). In 15 to 40% of cancer patients, weight loss occurs in an early stage of the disease. This increases up to 85% shortly before death. Weight loss in cancer patients should be determined using the patient's average weight prior to the disease and not the patient's ideal weight. An overweight patient who until recently was much heavier could have a worse nutritional status than a thin patient with a stable body weight. Unintended weight loss can sometimes be seen as a pleasant side effect by overweight patients. However, weight loss in cancer patients can be a negative sign as it indicates not only loss of fat mass but also of muscle mass. Malnutrition due to insufficient intake can be corrected and restored through the use of sufficient or additional energy and nutrients. Malnutrition due to inflammation and metabolic dysregulation cannot be restored through nutrition alone. Even with enough nutrition or extra intake of energy and nutrients, the breakdown of fat and lean body mass will continue until the underlying mechanisms responsible for the metabolic dysregulation are addressed. Medication is of limited use in the treatment of metabolic disorders which lead to poor appetite and weight loss.

Intervention goals

The decision to treat weight loss or not depends on the goal of the nutritional intervention. In curative or palliative care aimed at substantially increasing life expectancy, the goal is maintenance or improvement of nutritional status. In the setting of progressive disease where life expectancy is short, the goal is to accept weight loss, improve wellbeing and not attempt to improve nutritional status.

Treatment policy

- Attempt to determine the possible causes of the unintended weight loss. What is the main problem: decreased intake or metabolic dysregulation?
- Consult with a doctor or nurse on whether the possible causes of decreased intake can be treated.
- Inform the patient on weight loss in cancer and explain that this symptom can be difficult to treat when its cause (the disease) cannot be eliminated.
- Discuss the goals of the nutritional treatment with the patient and his caregivers: improving body weight, maintenance of body weight, the prevention of unnecessary deterioration of body weight or refraining from weight preservation.
- Assess the nutritional status and if possible the body composition.
- Determine the required amount of energy, protein, fluid and other nutrients.
- Take a nutritional history with emphasis on the period in which weight loss occurred, the extent of the weight loss, intake of energy and nutrients, symptoms, 24-hour rhythm and fluid intake.
Nutritional advice

- **Protein-energy enriched diet** to improve or maintain current nutritional status.
- **Palliative nutritional support** when life expectancy is limited.
- Small, attractive meals and snacks within easy reach.
- Meals at times the patient may not be used to; bringing something to eat on hospital visits.
- Meals and products that are protein and energy dense.
- No meals or products with a high satiety index or containing little energy; no light or diet products.
- Sufficient fluid intake (at least 1.5 litres).
- Use clinical nutrition to combat insufficient intake: food fortification, oral nutritional supplements or tube feeding.

Anorexia and early satiety

Anorexia is disease related loss of appetite due to inflammation and metabolic dysregulation. Together with the sense of feeling full due to early satiety, this leads to a reduced intake and weight loss. See Nutritional status. Poor appetite also occurs due to problems in the digestive system such as oral problems, delayed gastric emptying, obstruction, nausea, diarrhoea, constipation and ascites. General symptoms such as pain, fever, being bedridden or inactive, fatigue, dyspnoea, anxiety and depression can also reduce appetite.

Not being able to eat and/or to enjoy eating can have a negative influence on the wellbeing of patients and their caregivers. The inability to consume sufficient amounts of food or to enjoy the taste of food can cause feelings of guilt and powerlessness in patients and their caregivers leading to conflicts. Caregivers constantly expressing concern about and insisting on food intake can have the opposite effect in patients with an already poor appetite.

Intervention goals

- To make the loss of appetite and satiety less troublesome.

Treatment policy

- Take a nutritional history focused on the duration and features of the poor appetite, the intake of energy and nutrients, 24-hour rhythm, fluid intake and other symptoms.
- Consult with a doctor or nurse on possible treatments for the causes of poor appetite.
- Explain that poor appetite and early satiety are caused by the disease and can be difficult to treat when the cause (the tumour) cannot be eliminated (yet).
- Discuss feelings of guilt and powerlessness due to not being able to eat with the patient and his caregivers.
- Consider exercise and physical activity, such as a short walk to improve appetite.
- Consult with the treating physician on medication to combat symptoms leading to poor appetite.

Nutritional advice

- Small, frequent, attractive meals in a relaxed atmosphere and surroundings.
- Snacks with high nutrient density, evenly distributed throughout the day.
- Sufficient fluid intake (at least 1.5 litres).
- Eating together with other people.
Appetite-stimulating foods, such as cup of broth or a small glass of alcohol before a meal.

- No compact or dense dishes or greasy and gaseous products.
- Liquid energy dense nutrition. Liquid food can be easier to eat than solid food and does not satiate as easily. Because liquid food is naturally low in energy, energy dense substances should be added.
- Remove meals and products that are not immediately consumed out of the patient's reach.
- Use clinical nutrition to combat insufficient intake: food fortification, oral nutritional supplements or tube feeding.

**Alterations in taste and smell**

Changes in taste and smell occur in 55-75% of oncology patients, eliminating the sensation of a pleasant taste or smell and reducing the enjoyment of food. These changes can be temporary but can also persist or become permanent.

Changes in taste that occur during cancer are:

- Ageusia: the inability to recognize flavours and the complete loss of taste.
- Hypogeusia: a reduced ability to taste.
- Dysgeusia: an altered sense of taste, the sensation of a bad taste in the mouth with flavours that are usually enjoyed.

Perceiving taste is partly a function of the tasting organs in the taste buds of the tongue. The taste buds can discern four basic tastes (sweet, sour, salty, and bitter) and are renewed every seven to ten days. Taste is however mainly determined by the sense of smell and the olfactory system enables us to taste a large variety of flavours.

The four basic tastes can be recognized by taste buds on the entire surface of the tongue. Depending on the location on the tongue, some taste buds are more sensitive to a certain taste and less sensitive to others. Besides these four basic tastes there is a fifth taste which is sensitive to glutamate (an amino acid): umami. Umami increases the production of saliva and provides a savoury and sweet taste. It is naturally present in meat, peas, mature cheese and seaweed. Glutamate is also used as a taste enhancer in monosodium glutamate (MSG) which is a commonly used food additive in many ready-made meals, savoury snacks and stock cubes.

Changes in taste and smell and an aversion towards certain types of food can develop due to

- inflammation and metabolic dysregulation
- chemotherapy (especially cisplatin, carboplatin, cyclophosphamide, methotrexate, 5 FU and doxorubicin)
- radiotherapy in the head and neck area
- fever
- oral problems, infections of the oral cavity
- dehydration
- medication

Alterations of taste and smell can cause daily meals to be frustrating and disappointing experiences. The sense of taste changes because the taste threshold for sweet, sour, salty and bitter can be higher or lower than normal. This can completely change the taste of food (dysgeusia) or lead to food not having any taste at all. Even water can taste bad. Patients that previously preferred savoury products and disliked sweets can develop a preference for sweet food and a dislike for savoury and salty foods due to their illness or treatment. The reverse is also possible. In chemotherapy, patients often experience a metallic or cardboard-like taste, a bitter taste or no taste at all.

When a patient with a taste and smell disorder is asked what type of food he likes, he will not be able to provide an adequate answer since his memory of taste (that which the patient expects to taste based on his experience) no longer corresponds to his actual taste sensation. That which the patient previously enjoyed, is now disappointing. This can be difficult for the patient, but also for his caregivers. The reverse can also occur. Things that the patient didn't eat prior to his illness, he now enjoys. Therefore, it is recommended to not always inquire after the patients preferences but to offer (small) meals with a large variety of products.
An aversion to certain types of food is seen in many forms of cancer. Products with strong or distinct tastes are often disliked, such as coffee, broth, grilled meat, gravy, (deep-)fried food, the main (warm) meal in general, hot food, chocolate, herbs, spices and alcoholic drinks. Flowers with a strong scent, scented cosmetics and the smell of tobacco or cleaning products are also frequently disliked. Products with a fresh or less pronounced taste such as dairy products, fruit, salads, wheat products and cold dishes are often found less objectionable.

Radiotherapy in the head and neck area can lead to temporary or permanent hypogeusia or even ageusia. When the mucosa have recovered following radiotherapy, products with a strong or distinct taste can be a good way to provide a pleasant taste sensation.

Zinc plays an important role in the perception of taste. Zinc is involved in the development of taste buds. A zinc deficit is found in malnourished patients and can disturb the sense of taste. A number of studies have linked a zinc deficit to changes in taste during cancer. In the case of a zinc deficit, administration of 25 mg of zinc sulphate 4 times a day could improve taste but can also cause gastro-intestinal symptoms (diarrhoea). There is an ongoing discussion on whether the use of a zinc sulphate supplement could improve impaired taste due to chemo- or radiotherapy. The results of several studies show no, or conflicting results.

**Intervention goals**

- To make the aversion to food and changes in taste and smell less troublesome.
- To combat a bad taste in the mouth.

**Treatment policy**

- Take a nutritional history that is focused on the nature of the aversion to certain products and cooking methods, the type of changes in taste and smell and the bad taste.
- Explain that aversion and changes in taste and smell can be caused by the disease and/or treatments and can be difficult to treat when the cause cannot be eliminated.
- Discuss feelings of guilt and powerlessness regarding the aversion to certain foods with the patient and his caregivers.
- Explain that the sensation of taste no longer corresponds to the memory of taste.
- Explain that the patient can no longer reliably indicate what types of food he enjoys and that this can vary each time. For example, a caregiver can prepare a meal at the patient's request, which the patient then instantly dislikes after having tasted it.
- Do not give false hope and recommend that the patient eat 'sensibly' ('Food is necessary to stay alive, it can't always be enjoyable'), or that he views the use of oral feeds as medication. Persistently hoping for something to taste good usually leads to disappointment.
- Try new products that the patient is not used to.
- Explain that these problems can persist for some time after the treatment has ended, can vary greatly and can sometimes be permanent.
- Emphasize the importance of good oral hygiene and refer to a dentist or dental hygienist.

**Nutritional advice**

- Chew well, chewing can somewhat improve taste.
- Avoid strong scented foods (grilled meat, fish or a warm meal) that evoke dislike.
- Nutrition can be adjusted to the new taste preferences.
- Eat cold dishes. Their smell is less strong than that of heated products.
- Give advice on substitutions.
- Combine meat dishes with something fresh and sweet such as cranberries, apples or peaches.
- Use products with a mild or bland taste such as boiled or mashed potatoes, (white) bread, crackers, porridge, mild (cream) cheese and plain biscuits.
- Use plastic cutlery when experiencing metallic taste in the mouth.
- Don't exclude any products and keep trying different combinations and products that the patient doesn't normally eat.
- Drink sufficient amounts of fluid (1,5 litres). Insufficient fluid intake can worsen the sensation of a bad taste in the mouth.
- Use mints, sweets or (sugar free) chewing gum to mask a bad taste in the mouth.
- Provided that the oral mucosa are not sensitive or damaged, encourage the use of extra salt, herbs, spices, seasonings such as ginger, soy sauce and wasabi, marinades, gravy and sauces.
Avoid cooking smells, cleaning products, the smell of tobacco and perfume. Have others prepare the meals, stay out of the kitchen when people are cooking and ventilate the room well. Cold meals and microwave meals produce less smell.

In the case of a severe aversion to or distortion of food odours, a nose clip worn during cooking and/or eating can help.

**Nausea and vomiting**

Nausea and vomiting can occur separately but are also strongly connected. Nausea occurs in 31% of patients with advanced cancer and vomiting in 20%.

Nausea and vomiting are not always related to eating or stomach contents. In 25% of cases there are multiple causes of nausea and vomiting that occur simultaneously and amplify each other. The moment when vomiting occurs and the amount and consistency of the vomit can indicate the underlying cause.

- Regurgitation of undigested, non-acidic food directly after swallowing indicates an obstruction of the oesophagus.
- Vomiting several hours after eating indicates delayed gastric emptying.
- Vomiting small amounts with a varying degree of nausea and a distended fluid filled stomach indicate a gastroparesis.
- Vomiting combined with abdominal distention and shortness of breath indicates ascites.
- Vomiting (in the morning), often without the presence of nausea, or explosive vomiting combined with headaches and/or neurological symptoms indicate increased intracranial pressure.
- Position-dependant nausea and vomiting can be caused by fluid stasis in the stomach and infiltration of the mesenterium or peritoneum.
- Vomiting combined with thirst, polyuria, constipation, drowsiness, and/or confusion may indicate an electrolyte imbalance.

The emetogenicity of cytostatic drugs varies from strongly emetogenic to hardly emetogenic. There are various types of anti-emetics available that affect the vomiting mechanism in different ways. Usually, a combination of these drugs if the most effective in alleviating symptoms. Anti-emetics are also used as a prophylactic measure, for example during chemotherapy. See [http://www.oncoline.nl/nausea-and-vomiting](http://www.oncoline.nl/nausea-and-vomiting)

**Intervention goals**

- To reduce or stabilise nausea and vomiting due to nutrition.
- To prevent fluid and electrolyte imbalances.

**Treatment policy**

- Determine whether the patient can use oral nutrition. Determine whether the patient is able and willing to discuss nutrition. With severe vomiting, fasting and gastric drainage, in which gastric juices are suctioned through a nasal tube, are applied. An intravenous line is placed to guarantee the fluid and electrolyte balance.
- Confer with the treating physician on the use of medication such as anti-emetics, laxatives and prokinetics.
- Give information on the cause of nausea and/or vomiting and explain that it is not always related to food.
- Take a nutritional history focused on potential causes and the pattern of nausea and vomiting. Discuss the consequences such as reduced nutritional intake and dehydration.
- Emphasize the importance of a good body position such as sitting upright during and after meals and advise against immediately lying down or other rapid changes in position.
- Monitor the fluid balance.
- Verify whether the prescribed medication can be used and is being used in the correct manner.
- Emphasize the importance of good oral hygiene, especially in the case of repeated vomiting.
- Provide fresh air and good ventilation.

**Nutritional advice**
• Do not force nutrition.
• Drink sufficient fluid (at least 1.5 litres), but do not put pressure on this and reassure the patient that an intravenous line can be placed to administer fluid or electrolytes if necessary.
• Small, frequent meals.
• Use food at the times of day or the moments that the patient is the least nauseous, or in between courses of chemotherapy.
• Implement a nutrition break with severe nausea.
• Do not impose food and remove unused food and drink.
• Avoid an empty stomach by frequent small snacks such as crackers.
• Attempt to 'eat away' the nausea through small regular meals.
• Suck on an ice cube, chewing gum, ice lolly or soft pieces of fruit.
• Try if carbonated drinks alleviate symptoms.
• Use oral nutritional supplements or tube feeding, or in the case of severe vomiting: parenteral nutrition. However, oral feeds can quickly lead to aversion and worsen the sense of nausea. In severe vomiting, a post-pyloric feeding tube should be placed.

Dry mouth (xerostomia)

A dry mouth (xerostomia) is caused by a lack of saliva. This usually concerns a lack of thin serous saliva. A dry mouth can impair the patient's ability to speak, chew, swallow and taste, since many flavours can only be discerned in a dissolved state.

Saliva is a natural form of protection against dental caries, dental erosion and infections. The salivary buffer effect contributes to the neutralization of acids from food and drinks in the mouth, such as apple juice, wine, coke and fruit. Furthermore, saliva contains a number of electrolytes, enzymes and proteins that play a role in the prevention of dental caries and erosion, the maintenance of the microbial balance of the oral cavity and the repair of early decalcification of teeth.

Saliva is produced by various salivary glands. There are three major salivary glands: the parotid, submandibular and sublingual glands. Furthermore there are hundreds of minor salivary glands located throughout the oral cavity. Some salivary glands mainly secrete serous saliva, such as the parotid gland, whereas others mainly secrete mucous saliva, such as the sublingual gland, or a combination of the two, such as the submandibular gland. Normally, salivary glands produce 500-600 ml of saliva per day, however values of up to 1.500 ml per day are no exception. In xerostomia, the production of saliva is reduced to less than 150 ml per day.

A dry mouth can be caused by radiotherapy of the head and neck, certain types of chemotherapy, auto-immune diseases (Sjögren's syndrome), dehydration, not eating or drinking, medication, poorly controlled diabetes, graft-versus-host disease and smoking. Many elderly patients suffer from a dry mouth due to the production of thicker, more viscous saliva which is usually caused by the amount of medications used by this patient group. Dry mouth due to radiotherapy, depending on the radiation dose, is frequently permanent.

Artificial saliva (Xialine®), mouth spray (Glandosane®, Saliva Orthana®, BioXtra®)or gel (Oral Balance®, BioXtra®) or a mouth wash (Caphosol®, BioXtra®) can alleviate symptoms of a dry mouth, but their effects are short-lived (up to two hours). Pilocarbine (Salagen®) is a drug that stimulates the production of saliva. It can be prescribed by a doctor or dentist. These forms of medication are usually covered by health insurance on request.

Intervention goals

• To reduce or prevent worsening of xerostomia due to nutrition.
• To ensure that food can easily be swallowed.
• To prevent or limit dental caries and erosion.

Treatment policy

• Take a nutritional history focused on the symptoms and limitations, fluid intake and food intake.
• Rule out dehydration. In dehydration, administration of fluid in the mouth will (temporarily) reduce dryness.
• Explain the cause of a dry mouth and discuss that drinking large amounts of fluid usually doesn't solve the problem.
Guideline: General Nutrition and Dietary treatment (2.0)

- Emphasize the importance of good oral hygiene, recommend regular check-ups by a dental hygienist due to the increased risk of tooth decay and recommend the use of a mild toothpaste.
- Discuss the use of saliva stimulating medication or other methods of symptom relief with a doctor or dental hygienist.
- A pocket-sized spray that can be refilled can be used to regularly moisten the mouth using tap water or saline solution. Due to its low mineral content, tap water is less suitable than a physiological saline solution since it leaches the oral mucosa.
- Recommend keeping the moisture level in the air high by placing water-filled containers on radiators or using a humidifier.

Nutritional advice

- Frequently rinse or spray the mouth.
- Sour or tart tasting foods can increase the production of serous saliva, such as pineapple, gherkin, cucumber, pickled onion, apple, tomato, lemon, orange and vitamin C tablets. However, in the case of mucosal damage in the mouth, sour foods are too painful.
- Drink something with every bite of solid food and mix the liquid with the food through chewing.
- Chew well, for example on (sugar free) chewing gum, cucumber or carrots or suck on an ice lolly or a mint. Do not switch to liquid nutrition too soon; keep chewing in order to stimulate the production of saliva.
- Dip food in tea, milk or soup.
- Use gravy, sauces, ragout or soup in generous amounts.
- Use butter, cream, crème fraîche or mayonnaise to make food creamier.
- Avoid acidic (sports) drinks, fruit juices or carbonated drinks as much as possible. A lack of saliva removes the protective layer against acidic food, making teeth more vulnerable to decay and erosion.
- Drink acidic drinks through a straw: this limits the contact between the acid and the teeth.

Difficulties in chewing and swallowing

There are many types of difficulties in chewing and swallowing (or high dysphagia). Tumours in the mouth and throat cause different symptoms than difficulty swallowing due to paralysis or radiation damage. What a patient is able to eat varies greatly and is different for each individual patient. Frequently, meat, coarse wholegrain products, hard fruit and raw vegetables cause difficulties. Sometimes it can be enough for food to be creamy and slide down easily, small bits and pieces do not present a problem; sometimes food needs to be completely liquid and smooth. This limits the choice of products. Pureed and liquid nutrition often has less taste and looks less appealing. Due to the difficulties with chewing and swallowing, the duration of a meal is longer and eating is more tiring. This leads to a reduced intake and deterioration in nutritional status. Pureed or liquid food typically has a larger volume but limited energy content, adding to the deterioration of nutritional status. Constipation frequently occurs due to the reduced intake and the fact that soft or liquid nutrition is naturally low in fibre.

Intervention goals

- To adjust nutrition according to the chewing and swallowing abilities.
- To prevent an insufficient intake due to difficulties chewing and swallowing.

Treatment policy

- Take a nutritional history focused on the difficulties and the possibilities with chewing and swallowing and the effect on nutritional intake.
- Explain that omitting certain foods increases the risk of an insufficient diet.
- Take relevant measures against constipation.
- Consider the use of tube feeding in severe swallowing difficulties. When a patient is expected to be tube fed for over six weeks, the placement of a percutaneous endoscopic gastrostomy (PEG) tube is indicated.
- Consider referring the patient to a speech therapist.
Nutritional advice

- Adjust nutrition to the patient's chewing and swallowing abilities.
- Keep chewing if at all possible and do not switch to pureed or liquid nutrition too soon, as chewing has a positive effect on flavour and the production of saliva.
- Choose different foods to prevent deficiencies.
- In case of pureed food, attempt to keep products identifiable by not mixing everything together but serving the various elements separately.
- Chop or puree food very finely and mix to the desired level of thickness and moisture with liquid, cream, gravy or sauce.
- Add a thickening agent to let food slide down more easily and to prevent aspiration with thin liquid nutrition.
- Ensure variation in meals and colour.
- Suggest recipes or recommend specific leaflets or cookbooks.
- In the case of an insufficient intake use clinical nutrition: food fortification, oral nutritional supplements or tube feeding.
- Products with mixed textures, such as thin soup with pieces of meat, pasta or vegetables, often cause problems in patients with a heightened risk of aspiration.

Mucositis

Mucositis is an infection of the mucosa of the gastro-intestinal tract. Mucositis is associated with intense pain during eating and swallowing and can also cause severe diarrhoea. Besides the localized symptoms in the mouth or intestines, damaged mucosa also form a potential porte d'entrée for pathogens which can then enter the bloodstream, causing sepsis.

Oral mucositis

Oral mucositis is an inflammatory reaction of the oral mucosa which manifests itself clinically with oedema, erythema, ulceration and/or pain. The inflammatory reaction is directly caused by the administered therapy and can be aggravated by local factors such as bacteria, trauma and changes in saliva). Oral mucositis can cause severe discomfort, such as a sore mouth and throat (especially in eating hot, sour and heavily seasoned food) and trouble chewing, swallowing and speaking. This greatly affects the patient's quality of life. The more severe the mucositis, the bigger the risk of (life threatening) infections and the more severe the nutritional problems.

WHO-scale for oral mucositis (1997)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>Absence of mucositis</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Soreness, with or without erythema of the mucosa, no ulceration. Eating solids and liquids remains possible.</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Mucosal erythema and ulcers. Eating solids and liquids is painful but possible.</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Large ulcers, extensive erythema. Eating solid food is not possible, pureed or liquid nutrition usually is.</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Oral mucositis with ulcers and bleeding. Alimentation is not possible.</td>
</tr>
</tbody>
</table>

In radiotherapy, all patients in which the mucosa of the oral cavity or throat are situated in the irradiated volume develop oral mucositis to some extent. 85% of patients receiving high doses of radiation for head and neck cancer develop severe mucositis (grade 3 and 4). Severe mucositis of the mouth and gastro-intestinal tract also occurs following the use of certain cytostatic drugs and in 90% of patients undergoing stem cell transplants. Risk factors that contribute to the development, the duration and the severity of mucositis are poor oral hygiene, mucosal irritation due to ill-fitting dentures, poor physical shape and reduced nutritional status. When mucositis is partly due to neutropaenia (leucocytes < 0,5 × 10⁹/l), it can recover rapidly when leucocyte levels improve between chemotherapy courses. This is in contrast to radiotherapy where symptoms are usually prolonged.

Good protocolled dental care is necessary to limit the extent and severity of oral mucositis. Patients being...
treated with radiotherapy in the head and neck area and patients undergoing a stem cell transplant should be examined at least two weeks prior to the start of treatment in order to remove or treat potential infections that could cause complications during or following therapy, and dental plaque or tartar which could damage mucosa.

**Intervention goals**

- To reduce or prevent an increase of pain due to nutrition.
- To prevent insufficient nutritional intake due to mucositis.

**Treatment policy**

- Take a nutritional history focused on the patient’s abilities and limitations due to mucositis and its effect on intake.
- Explain the relationship between nutritional problems and mucositis and discuss the impact of the choice of nutrition.
- Discuss analgesic medication with the treating physician, discuss good oral hygiene with the dental hygienist and nurse.
- Adhere to dental hygiene protocols in patients being treated with chemotherapy or radiotherapy in the head and neck area in order to limit severe oral mucositis.
- Emphasize the importance of good oral hygiene. Recommend the brushing of teeth after every meal, preferably two to four times per day with a soft toothbrush and a mild toothpaste containing fluoride (menthol-free is necessary).
- Advise against the use of dentures at night, recommend that dentures be stored in clean water and advise against the use of dentures altogether in oral mucositis.
- Recommend the rinsing of the mouth several (4-10) times per day with physiological saline solution (NaCl 0.9%) or with 1 teaspoon of salt and one teaspoon of sodium carbonate (or two teaspoons of salt) dissolved in 1 litre of water.
- Recommend keeping the lips clean and greased with some wet gauze and sterile vaseline from a tube.

**Nutritional advice**

- Use ice chips or ice water, unless this worsens the pain.
- Use soft, moist, creamy or liquid nutrition.
- Do not eat food with a pH level of < 6*.
- Do not eat spicy food (pepper, chilli) or overly salted products (smoked meat or fish, stock, crisps, salty snacks or peanuts), carbonated drinks or alcohol.
- Do not eat hard food that could damage the mucosa such as nuts, hard fruit, crusts or hard-baked dishes.
- Do not eat heated food and preferably consume drinks at room temperature. Sometimes ice-cold food and drink can be pleasant, sometimes it is not.
- Use a short straw. Sucking is easier this way and the contact between food and mucosa is limited.
- In insufficient intake during neutropaenia: Protein-energy enriched diet when neutropaenia has ended.
- In the case of insufficient intake use clinical nutrition: oral nutritional supplements or tube feeding.
- In severe mucositis grade 4: nil by mouth and switch to tube feeding. Sometimes parenteral nutrition can be necessary (with simultaneous intestinal mucositis).

*pH-level - products*

<table>
<thead>
<tr>
<th>pH-level</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8</td>
<td>Tea, sweet dairy products: whole and semi-skimmed milk, custard, (whipped) cream</td>
</tr>
<tr>
<td>4-6</td>
<td>Coffee, sparkling water, (alcohol free) beer, acidic dairy products: buttermilk, yoghurt, cream yoghurt (with or without fruit), yoghurt drinks, fromage frais.</td>
</tr>
<tr>
<td>2-4</td>
<td>Isotonic (sports)drinks, soft drinks (diet/regular coke, orange, lemon/lime drinks, ice tea, energy drinks), wine, (citrus) fruit, fruit juice (apple, grape, orange, grapefruit), dressing, vinegar.</td>
</tr>
</tbody>
</table>
**Intestinal mucositis**

Local intestinal mucositis, such as enteritis or proctitis, can occur following radiotherapy in which the gastrointestinal absorptive area are in the irradiated volume, for example in urological, colorectal and gynaecological tumours and lymphomas. Local signs of inflammation are seen in over 70% of patients. This can lead to symptoms such as a constant urge to defecate and increased frequency of stool, which can be thin and watery or contain blood and mucus. Large fluid losses are uncommon in radiotherapy. The symptoms occur around the second and third week of treatment and generally diminish several weeks after the treatment has finished. Sometimes radiation symptoms persist such as a constant urge to defecate, increased frequency and faecal incontinence. In a small number of patients, late radiation damage can occur with severe complications such as intestinal obstruction, fistulas and bleeding. Thanks to improved radiation techniques in which the bowels are either no longer in the irradiated volume or a smaller segment of the bowels is subject to radiation, these complications are becoming less severe and less common. The use of certain cytostatic drugs can lead to mucositis affecting the entire gastro-intestinal tract. Evaluation of the level of mucosal damage in the oral cavity indicates the degree of damage to the mucosa of the stomach and bowels. Damage to the intestines can limit the bowels' ability to reabsorb. In severe mucositis (grade 3 and 4) due to chemotherapy, there are limited possibilities for oral and enteral nutrition and parenteral nutrition is indicated. In haematological malignancies, 90% of patients undergoing stem cell transplants develop a severe form of oral or intestinal mucositis. For treatment policy and nutritional advice see: [Diarrhoea](#).

**Excess mucus**

Excess mucus is thick viscous salvia that is difficult to swallow and gives the sensation of an occlusive ‘web’ in the throat. Thick viscous salvia in the mouth is a common symptom following radiotherapy of the head and neck. This mucus is difficult to swallow or cough up and can also be a problem in oesophageal cancer or lung cancer. Excess mucus is difficult to treat. Sometimes the only option is to remove the thick viscous salvia from the mouth with a tissue. The idea that milk is largely responsible for viscous salvia is widespread. Although the mouth can feel sticky after drinking milk because milk doesn't stimulate the salivary glands to form serous saliva as much as other products, milk is not the cause of excess mucus.

**Intervention goals**

- To not increase excess mucus due to nutrition.

**Treatment policy**

- Take a nutritional history focused on a patient's experiences with mucus and certain foods and on the consequences of mucus for nutritional intake.
- Explain that excess mucus is mainly caused by the disease or treatment itself and is (usually) not due to nutrition.

**Nutritional advice**

- Eat sour or tart products and chew well to stimulate the production of serous saliva. NB: In the case of sensitive mucosa, these products can be too sharp.
- Drinking sparkling water or rinsing the mouth with dark beer (alcohol content 1.5%) can sometimes dissolve mucus to a certain extent. This advice is not suitable for patients with a history of alcohol addiction.
- Rinse the mouth with water, tea or coffee after drinking milk. Acidic dairy products such as butter milk or yoghurt (drink) give a less sticky sensation in the mouth. Sometimes soymilk is preferred over cow’s milk.
Obstructive symptoms

This chapter is divided into the following parts.

- Dysphagia
- Intestinal obstructions

Dysphagia

Besides oesophageal and stomach cancer, pancreatic and lung cancer can also cause low dysphagia due to ingrowth into or pressure on the oesophagus, stomach or duodenum. Dysphagia usually manifests itself gradually. At first, meat, raw and hard pieces of fruit and vegetables, crusts of bread and hurried eating cause difficulties. Increasingly, patients feel that their food will not go down. Further tumour growth will progressively limit the passage of food and fluid until eventually, even saliva can no longer be swallowed. Eating soft and liquid nutrition requires large amounts of time and energy and is therefore very tiring.

<table>
<thead>
<tr>
<th>Passage score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score 0</td>
<td>No dysphagia: able to eat normal diet.</td>
</tr>
<tr>
<td>Score 1</td>
<td>Moderate passage: able to eat some solid foods</td>
</tr>
<tr>
<td>Score 2</td>
<td>Poor passage: able to eat semi-solid foods.</td>
</tr>
<tr>
<td>Score 3</td>
<td>Very poor passage: able to swallow liquids only.</td>
</tr>
<tr>
<td>Score 4</td>
<td>No passage, unable to swallow anything</td>
</tr>
</tbody>
</table>

Interventions goals for low dysphagia

- To adjust nutrition to the degree of obstruction.
- To prevent insufficient intake due to dysphagia.

Treatment policy

- Explain the cause of the symptoms.
- Take a nutritional history focused on the time period and severity of the dysphagia and which texture of food can still be passed. Inquire specifically after which foods cause complaints.
- Adjust the texture of food: chewed, chopped, pureed or liquid.
- Suggest certain positions: if possible eat meals sitting upright and avoid lying down directly after eating.
- Explain that eating takes time and it can be tiring to manage to eat enough food.

Nutritional advice

- Eat slowly and concentrate on eating.
- Eat small frequent meals.
- Cut food up, chew well and soak food in drinks or use extra gravy or sauce; sometimes oily products that are easily swallowed such as smoked salmon, trout and mackerel do not pose a problem.
- Use pureed or liquid nutrition.
- Avoid products that aggravate symptoms.
- In the case of insufficient intake use clinical nutrition: food fortification, oral nutritional supplements or tube feeding.
Intestinal obstructions

Obstructive symptoms of the intestines occur when the bowels are partially or completely obstructed due to a mechanical obstruction or a lack of intestinal peristalsis, leading to the development of an ileus. In the case of a complete occlusion or the total absence of peristalsis, the passage of food or stool is no longer possible and complete abstinence of food (nil by mouth) is vital. Fluid and electrolytes can be supplemented parenterally if necessary.

In the case of a partial bowel obstruction, there is ongoing debate on which diet should be advised for which degree of obstruction. A partially obstructed bowel would allow for the passage of food that doesn't contain coarse indigestible elements and coarse dietary fibre. Coarse dietary fibre would also stimulate peristalsis, which would be undesirable in this case. Therefore, a diet is required without coarse dietary fibre or coarse indigestible elements. The nutrient's level of coarseness is important. For example, smooth peanut butter can be ingested but peanuts cannot. A suitable diet includes viscous nutrition that is smooth, slides down easily and contains fine, chewed or pureed dietary fibre. Soluble fibre carries a smaller risk of obstruction than insoluble fibre. However since most nutrition contains both soluble and insoluble fibre, all food should be chewed or ground. Nutrition that cannot be chewed or pureed should be avoided.

Foods containing coarse dietary fibre or indigestible elements:
- Hard or raw vegetables, fibrous stringy vegetables: asparagus, celery, bamboo shoots, salsify, cabbage, rhubarb (rhubarb puree is allowed), bean sprouts, string beans, green beans, peas, corn, mushrooms, pulses.
- Unpeeled fruit with stones, slices or wedges of citrus fruit, pineapple, berries, grapes, kiwi, coconut, dried figs, raisins, dates and prunes.
- Tough and stringy meat containing bones, sinews and tendons and fish with bones.
- Coarse wholegrain products such as brown rice, rye bread, muesli, coarse whole-wheat bread, whole-wheat crackers and bread with raisins, nuts and seeds.

Foods containing fine dietary fibre:
- Flour, oatmeal, semolina, custard, cornstarch and porridge.
- Brown bread, fine whole-wheat bread, crackers, croissants, cake, biscuits, Cornflakes®.
- Potatoes, pasta, noodles or rice.
- Chopped vegetables, vegetable soup with finely chopped vegetables or pureed pulses.
- Peeled and stoned fruit, sieved fruit juice, fruit puree or Stimulance fruit drink®.
- Oral nutritional supplements and tube feeding with added fibre.

Foods containing little to no indigestible elements:
- Sugar, butter, refined grains.
- Milk and dairy products.

Intervention goals in intestinal obstruction

- Prevention of occlusion due to nutrition.
- Prevention of insufficient nutritional intake due to obstructive symptoms.

Treatment policy

- Discuss treatment policy and the enteral nutrition options with the treating physician.
- Discuss resuming (tube) feeding when the obstruction is reduced or removed.
- Emphasize the importance of adequate chewing, attentive eating, avoidance of risk enhancing products such as coarse nutrients and adjustment of food texture (pureed or liquid).
- Discuss the options for oral and dental care when oral nutrition is no longer possible.

Nutritional advice in obstruction of the small intestine

- Pending an active form of treatment: nil by mouth; fluid and electrolytes intravenously.
In gastric drainage in which fluid and nutrition are drained through a nasal or PEG tube: drinking small amounts to rinse the mouth en limit dry mouth if the patient enjoys the taste. Sufficient intravenous fluid prevents the patient from becoming thirsty.

- Start parenteral nutrition when feeding is beneficial and oral nutrition will be resumed within several days.
- When resuming oral nutrition: clear liquid nutrition, followed by liquid nutrition.
- At least 1,5-2 litres of drinking fluid daily.
- Expand diet to include (very) finely ground nutrition which is viscous and slides well.
- Chew well or grind if chewing is not possible.
- Avoid nutrients with coarse fibre and indigestible elements.
- In insufficient intake: food fortification, oral nutritional supplements or tube feeding.

**Nutritional advice in obstruction of the colon**

- In the case of complete obstruction:
  - Nil by mouth.
- In the case of severe stenosis which cannot be passed by an endoscope:
  - Full liquid nutrition supplemented by liquid feeds;
  - A fluid intake of at least 2 litres per day.
- In the case of a stenosis that can be passed by an endoscope:
  - At least 1,5-2 litres of drinking fluid per day;
  - Chew food well or use finely pureed food;
  - Do not use nutrients containing coarse dietary fibre and indigestible elements.
  - Avoid gaseous nutrients such as cabbage, Brussels sprouts, leeks, peppers, onion, garlic, pulses and carbonated drinks.

**Endoscopic stenting**

In the case of obstruction of the oesophagus, pylorus or duodenum in the palliative stage, endoscopic stenting can be used to improve the passage of food. Growth of the tumour into the stent can lead to renewed obstructive complaints which can warrant adjustment of the texture of nutrition. A new stent can also be placed inside the previous stent.

**Intervention goals**

- To prevent obstruction due to nutrition.

**Treatment policy**

- Discuss the nutritional status aims, depending on the life expectancy: to avoid unnecessary deterioration of nutritional status or to refrain from active maintenance of nutritional status.

**Nutritional advice**

- Sit upright during meals
- Eat slowly and attentively; chew, cut or mash well.
- Drink large amounts with each meal
- Ingest sufficient fluid (at least 1,5 litres)
- Use generous amounts of gravy, sauce, cream and butter.
- Drink something one hour after meals to rinse the stent.
- Remove stones, peel, skin and bones.
- Take care with nutrients that could obstruct the stent:
  - Steak, stringy beef or cold meats;
  - Meat on the bone or fish containing bones;
  - Large hard pieces of fruit or vegetables such as crudités, carrot, apple, pieces of orange or tangerine;
  - Tough and stringy vegetables such as celery, rhubarb, asparagus, cabbage, bean sprouts and mushrooms;
• Dry bread or bread containing nuts and seeds;
• Sweets, liquorice, popcorn, toffee;
• Nuts;
• ‘Sticky’ food such as freshly baked white bread or white rolls.

Gastro-oesophageal reflux

Gastro-oesophageal reflux is a burning sensation that can rise up into the throat and is usually felt in the stomach region and behind the sternum. Other symptoms include regurgitation, a sore throat, coughing and the sensation of a lump in the throat. Gastro-oesophageal reflux is not continuously present. It usually occurs episodically and lasts between several seconds and several minutes. Gastro-oesophageal reflux is seen in stomach and oesophageal cancer, ascites, overweight, diaphragmatic hernias and gastric emptying disorders. It is also seen in lung cancer patients as coughing opens the lower oesophageal sphincter.

Intervention goals

• To prevent an increase of gastro-oesophageal reflux due to nutrition.

Treatment policy

• Take a nutritional history focused on the times when gastro-oesophageal reflux occurs, the pattern of meals and the patient's self-imposed limitations.
• Discuss the possibilities of medication for gastro-oesophageal reflux (drugs that bind gastric acid, inhibit the production of gastric acid or protect the gastric mucosa).
• Explain the relationship between gastro-oesophageal reflux and meal pattern to the patient.
• Advise the patient to stop smoking.
• Give suggestions to prevent or reduce overweight.
• Suggest certain body positions such as not lying down directly after meals and sleeping on the left side, elevating the head.
• Advise the patient not to wear tight clothing, to bend the knees when stooping over and not lift heavy objects.
• Focus on good defecation and prevent constipation.

Nutritional advice

• Frequent small meals.
• Avoid large (high-fat) meals; the size of a meal is more important than the amount of fat it contains.
• No more large meals for two hours prior to going to bed.
• Avoid alcohol, chocolate, peppermint, coffee and carbonated drinks.
• Avoid the swallowing of air due to the use of chewing gum and hasty eating.

Constipation

Constipation is a disruption of the regular defecation pattern in which the frequency of defecation is reduced, hard and painful stools are produced and the patient suffers from bloating and/or abdominal pain. 10% of the healthy population suffers from constipation. It is more frequent in women and the elderly. In the palliative stage 37% of patients suffer from constipation.

Frequently, multiple factors play a role in the development of constipation, which influences the choice of laxatives. For a summary of laxatives see: http://www.oncoline.nl/constipation

Dietary fibre

Dietary fibre is of great importance in the treatment of intestinal problems. In constipation dietary fibre can regulate the defecation pattern, provided that fluid intake is sufficient. Dietary fibre shortens bowel transit time and increases the volume of stools. In diarrhoea fibre can thicken stool and have a regulatory effect. An obstructed bowel can be a contra-indication for the use of dietary fibre.
Dietary fibre can withstand human digestive enzymes and is not absorbed in the small intestine. The majority of ingested dietary fibre is degraded by bacteria in the colon. During this process short-chain fatty acids such as formic acid, butyric acid and propionic acid are formed, which have a beneficial effect on the bowel contents and intestinal mucosa. Fibre is divided into soluble and insoluble fibre.

Types of fibre:

<table>
<thead>
<tr>
<th>Type of fibre</th>
<th>Name</th>
<th>Mainly present in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soluble fibre</td>
<td>Pectin</td>
<td>Apple, citrus fruit, fruit</td>
</tr>
<tr>
<td></td>
<td>Vegetable gum</td>
<td>Beans, pulses, oats, barley, guar gum, isphalga, seaweed, algae</td>
</tr>
<tr>
<td></td>
<td>Mucilaginous fibre</td>
<td>Psyllium, linseed</td>
</tr>
<tr>
<td></td>
<td>Algal polysaccharides</td>
<td>Agar, seaweed, algae</td>
</tr>
<tr>
<td></td>
<td>Oligosaccharides</td>
<td>Leeks, onions, soybeans</td>
</tr>
<tr>
<td></td>
<td>Resistant starch</td>
<td>Lentils, beans, bananas, stale bread, pasta, cooled cooked potatoes, cornflakes</td>
</tr>
<tr>
<td>Insoluble fibre</td>
<td>Cellulose</td>
<td>Apple, beans, carrot, cabbage, bran, wheat flour, peas.</td>
</tr>
<tr>
<td></td>
<td>Hemicellulose</td>
<td>Wheat products, bran, vegetables</td>
</tr>
<tr>
<td></td>
<td>Lignin</td>
<td>Wheat, vegetables</td>
</tr>
</tbody>
</table>

Insoluble dietary fibre absorbs water from the gastro-intestinal tract. It is not fermented but ensures good smooth stool due to its bulk forming abilities. Soluble fibre makes the bowel contents viscous, is fermented in the small intestine and improves pain, cramps and bloating, especially in gastrointestinal tumours. Nutrients such as fruit vegetables and cereals contain both soluble and insoluble fibre. Approximately 25% of ingested fibre is soluble and approximately 75% is insoluble. A diet containing only soluble fibre is not possible. The amount of soluble fibre can be increased by using psyllium fibre which is produced from the husks of the plant Plantagepsyllium or Plantagoovato, also known as Ispagul which is available as a dietary supplement.

**Intervention goals**

- Normalising the defecation pattern.

**Treatment policy**

- Determine the possible causes of the constipation and determine whether oral nutrition can be used.
- Take a nutritional history focused on defecation pattern, the duration of the symptoms, the frequency and amount of defecation and the intake of dietary fibre and fluid.
- Explain the relationship between possible causes and changes in defecation pattern.
- Keep in mind that in reduced appetite and a full feeling it is nonetheless important that the patient eats something. Dietary fibre is not as great a priority in this case since it can increase early satiety and bloating.
- Keep in mind that in patients with an insufficient fluid intake, a high content of dietary fibre or the use of fibre supplements should be avoided as they can worsen constipation and increase the risk of occlusion.
- Explain that regular exercise (if possible) can improve bowel function.
- Discuss the use of laxatives with the treating physician. Laxatives should always be prescribed in opiate use.

**Nutritional advice**

- Sufficient dietary fibre (if possible 30-40 grams/day) and sufficient fluids (2 litres).
- A diet with regular intervals throughout the day, preferably with a large breakfast.
- Vary between different types of fibre.
Diarrhoea

Diarrhoea is an increased frequency of thin stools. It is seen in 11% of patients during the palliative phase. Diarrhoea can be acute, chronic or paradoxical. Acute diarrhoea usually resolves without treatment within several days to a week. Chronic diarrhoea continues for over two to three weeks. Paradoxical diarrhoea is overflow diarrhoea in which thin stool leaks past an obstruction caused by impacted stool. The cause and type of diarrhoea determines the choice of policy and medication.

There is no evidence to support the dietary advice provided for diarrhoea due to chemo- and radiotherapy since studies on the influence of nutritional interventions on gastro-intestinal side-effects do not provide definitive conclusions. Both fat restrictions and lactose restrictions are commonly prescribed but yield few results. Probiotics have been suggested to have a beneficial effect on stool frequency, however study results vary. Probiotics can contribute to a rapid recovery of gut flora after the use of antibiotics and can reduce the duration of diarrhoea. Probiotics should be avoided in diarrhoea due to severe mucositis and immunocompromised patients following chemotherapy.

Intervention goals

- To not increase the diarrhoea due to nutrition.
- To prevent dehydration.

Treatment policy

- Determine the cause of the diarrhoea. Recommendations will depend on the aetiology. If the cause cannot be eliminated, nutrition can barely influence diarrhoea. In paradoxical diarrhoea: see recommendations for constipation.
- Take a nutritional history and inquire after the defecation pattern, specifically the frequency, consistency, amount and colour of stool.
- Explain that strict dietary limitations do not improve symptoms since nutrition is (usually) not the cause of the diarrhoea. Diarrhoea can also occur during fasting or parenteral nutrition as stool is formed by the shedding of intestinal mucosa and cells.
- Explain that no form of food will stop diarrhoea. Nutritional interventions can prevent unnecessary aggravation of diarrhoea, such as the avoidance of products containing sorbitol and certain types of fruit such as prunes.
- Discuss medication options with the treating physician.

Nutritional advice

- Large fluid intake (at least 1.5-2 litres of drinking fluid per day).
- A generous salt intake, over 10 grams, unless there are contra-indications such as heart failure or renal insufficiency. If necessary, recommend supplementation using oral rehydration salts or an intravenous saline solution.
- A varied diet without strict limitations.
- No or a limited amount of products that increase peristalsis, gas formation or mucosal irritation: avoid large, high-fat meals, coarse (insoluble) fibre, carbonated drinks and sharp spices or seasonings.
- Limited the use of coffee and alcohol.
- Limited the use of milk (three dairy products evenly distributed over the day) and sugar. Acidic dairy products are usually better tolerated as part of the lactose in these products is converted into lactic acid.
- Avoid products containing the sweetener sorbitol such as sugar-free or diet products.
- Use probiotics for diarrhoea due to antibiotics.
- Do not use probiotics for diarrhoea due to mucositis and in immunocompromised patients.

Weight gain/overweight

Besides unintended weight loss, unintended weight gain can also occur. Overweight that develops during and after the treatment of cancer mainly consists of sarcopenic obesity: loss of muscle mass and muscle
strength and an increase in fat mass and (severe) overweight. The mechanism behind the development of sarcopenic obesity in cancer has not yet been elucidated. Possible causes of sarcopenic obesity in cancer are:

- A change in life style with less physical activity.
- Chemotherapy, with or without hormonal therapy.
- Menopause in women and hormonal therapy in men with prostate cancer.
- An excess energy intake.
- Corticosteroids which can stimulate appetite and increase subcutaneous fat deposition in the torso and face.

NB: Weight gain is also seen in ascites and oedema, however this weight gain is caused by fluid retention. Although an unintended increase in body weight can disturb the balance between energy intake and expenditure leading to more nutrition being consumed than necessary, nutritional intake is not always increased with weight gain. When diet is not the main cause of weight gain, it can be difficult to lose the additional weight using nutritional measures.

**Intervention goals**

- To prevent unintended weight gain or to achieve weight loss.
- To achieve the best possible body composition.

**Treatment policy**

- Rule out that the weight gain is due to fluid retention such as in ascites or oedema.
- Take a nutritional history focused on variation in body weight, energy and nutrient intake, diet and exercise pattern and/or level of physical activity.
- Assess the nutritional status and if possible the body composition.
- Determine the required amounts of energy, protein, fluid and other nutrients.
- Explain the possible causes of weight gain. Discuss that nutrition and physical activity are the only factors that a patient can influence and that lifestyle changes do not always yield the desired results, despite a reduced food intake and increased physical activity.
- Discuss the aim of stabilising body weight or gradually reducing body weight. Discourage extremely low-calorie crash diets because they do not result in sufficient development of muscle mass and a yoyo-effect only increases the problem.
- Encourage physical activity or sports, preferably with professional supervision by a sports physician or sports physiotherapist. The most effective form of physical activity is moderate exercise consisting of strength or resistance training and aerobic or endurance training for at least 30 minutes every day.
- Monitor the course of body weight and if possible body composition.

**Nutritional advice**

- **Healthy eating.**
- **Protein enriched diet** when muscle development is required and when using strength or resistance training.
- When aiming for weight reduction: energy-limited diet up to a maximum of 500 kcal below the calculated requirements, provided that the dietary intake remains adequate.
- Low-calorie filler foods: large amounts of fruit, vegetables, whole-wheat products and low-calorie drinks.

**Fatigue and muscle weakness**

Fatigue in cancer clearly differs from the fatigue that healthy people experience following physical or mental exertion. Fatigue in cancer is more intense, can suddenly manifest itself, is not proportionally related to effort or exercise and is only partially, if at all, affected by rest and sleep. Treating fatigue is complex and, if possible, is aimed at eliminating the cause of the fatigue. Causes resulting in poor nutritional status or the loss of muscle mass and muscle power can sometimes be tackled,
depending on the stage of the disease and the prognosis. There is currently sufficient evidence supporting the positive effects of physical activity and intensive training on combating fatigue. For Causes and Policy see Guideline Cancer Rehabilitation.

A decrease in muscle mass or (intensive) power and resistance training can lead to an elevated protein requirement of up to 1.5 grams of protein per kg of body weight. There are indications that the use of 10 grams of protein shortly before and after training improves the building of muscle mass. Furthermore, there is evidence that, especially in the elderly, even distribution of protein intake over all daily meals stimulates the development of muscle mass more than one peak amount of protein in a meal. In practice this means that protein should be evenly distributed over meals. The main (warm) meal should no longer be the chief supplier of protein, but breakfast and lunch should also contain a substantial amount of protein. To benefit optimally from protein intake, a diet should also contain sufficient amounts of energy and nutrients.

**Intervention goals**

- The use of nutrition with sufficient protein for the development or maintenance of muscle mass.
- To prevent an increase in fatigue due to nutrition and cooking methods.

**Treatment policy**

- Take a nutritional history focused on protein intake, nutrient deficiencies, 24-hour rhythm, organization of the household, exercise and resting patterns and moments in which fatigue occurs.
- Assess the nutritional status and if possible the body composition.
- Explain that fatigue is caused, among other things, by disease and treatments and that sufficient rest is important, however physical activity is also beneficial and is essential for maintenance and development of muscle mass. Discuss that rest alone will not solve the problem but only increase it.
- Determine the required amounts of energy, protein, fluid and other nutrients.
- Explain that regular physical activity benefits endurance levels, digestion, body weight and mood.
- Encourage the patient to remain as active as possible and discuss that illness should not lead to complete cessation of physical activity and training. Suggest cancer rehabilitation programs with professional guidance and consult a doctor or physiotherapist on the permitted level of physical activity.
- Discuss or suggest possibilities for assistance with food preparation or household tasks and encourage the patient to accept help and delegate responsibilities.
- Recommend that the patient accept the fatigue when it occurs and come up with potential solutions together with the patient.

**Nutritional advice**

- Protein enriched diet in power or resistance training; distribute protein over all daily meals.
- Eating at times when the patient is less tired.
- Use a microwave, ready-made meals, products in cans or jars, frozen meals and meal service.
- Only use soft or liquid protein-dense products in the case of extreme fatigue: they are easier to consume.
- In the case of insufficient intake or nutritional deficiencies: food fortification, dietary supplements, oral nutritional supplements or tube feeding.

**Immunocompromised patients**

Specific advice on nutritional hygiene is necessary in:

- Neutropaenia. Due to intensive chemotherapy the amount of white blood cells is reduced. A patient is considered neutropaenic when the amount of neutrophilic granulocytes is below 0.5 × 10⁹/l.
- Increased permeability of the bowels due to intensive chemotherapy and/or radiation or severe intestinal graft-versus-host disease, in which pathogens can enter the bloodstream and cause sepsis.
Immunosuppressive drugs that prevent transplant rejection following an allogeneic stem cell transplantation or due to graft-versus-host disease.

In the immunocompromised patient there is an increased risk of nutrition related infections and for this reason the neutropenic diet based on guidelines for food hygiene and safety has been developed and patients receive an antimicrobial prophylaxis such as selective intestinal decontamination (SID). The precise indications for the use of guidelines for food hygiene and safety vary between hospitals. In practice the neutropenic diet:

- Is initiated at the start of chemotherapy or the start of SID.
- Ends on discharge from the hospital, or discontinuation of SID or immunosuppressive drugs.

There is insufficient evidence available on the degree of strictness, the indications and the duration of the diet. Over the years, there has been a trend towards relaxing measures, partly due to the Hazard Analysis and Critical Control Points (HACCP) Guidelines and the availability of better antibiotics. In 2011 in the Netherlands the Guidelines for food hygiene and safety were re-evaluated by the Dutch Dieticians Haematology and Stem cell transplants Group (Landelijk Overleg Diëtisten Hematologie en Stamceltransplantatie, LODHS) and the precise indications for the use of these guidelines were determined.

<table>
<thead>
<tr>
<th>Medical treatment</th>
<th>Neutropenic diet in case of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive chemotherapy</td>
<td>Antimicrobial prophylaxis: SID = combination of fluconazole, ciprofloxacin or colistin and/or cotrimoxazole.</td>
</tr>
<tr>
<td>Autologous stem cell transplant</td>
<td>Antimicrobial prophylaxis: SID = combination of fluconazole, ciprofloxacin orcolistin and/or cotrimoxazole.</td>
</tr>
<tr>
<td>Allogeneic stem cell transplant</td>
<td>SID and/or immunosuppressive drugs, such as cyclosporine and mycophenolatemofetil, and corticosteroids such as prednisone (from 0.5 mg/kg/day).</td>
</tr>
<tr>
<td>Active intestinal graft-versus-host reaction</td>
<td>Immunosuppressive drugs, such as cyclosporine and mycophenolatemofetil, and corticosteroids such as prednisone (from 0.5 mg/kg/day).</td>
</tr>
</tbody>
</table>

**Intervention goals**

- To prevent infections due to nutrition.

**Treatment policy**

- Inform the patient verbally and/or using written information on the Guidelines for food hygiene and safety.
- Discuss the duration of these guidelines.

**Nutritional advice**

- No raw meat, raw fish, pre-packed smoked fish, soft unpasteurised cheeses, unpasteurised milk, raw of soft-boiled eggs.
- No unpeeled or unheated nuts.
- No products containing probiotics.
- Wash fruit and vegetables well; only use fresh and undamaged products.
- Do not add ground pepper after cooking but add pepper during the cooking process so that it is heated along with the food.
- Wash hands before preparing and eating meals.
- Change towels and dishcloths on a daily basis.
- Use plastic cooking utensils (chopping boards and ladles).
- Keep raw and unprepared products separate from cleaned and cooked products and prevent the transfer of bacteria from raw to cooked products via chopping boards, plates or other kitchen utensils.
- Do not leave dairy products outside the refrigerator for longer than two hours, if this does happen throw the product away.
Guideline: General Nutrition and Dietary treatment (2.0)

- Remove food from the refrigerator temperature zone as little as possible; allow food into the temperature zone of 7-60 °C for as briefly as possible. Rapidly cool meals that are not eaten directly. Only reheat cooked meals once at most. Do not use products that have been kept warm for over an hour.
- Note the best-before date and storage advice on the packaging.
- Check whether food that has been brought by others meets the guidelines for food hygiene and safety.
Clinical nutrition

This chapter is divided into the following parts.

- Clinical nutrition
  - Refeeding syndrome
  - Food fortification
  - Oral nutritional supplements
  - Tube feeding
    - Enteral formulas
    - Tubes and access
    - Administration and advancement
    - Evaluation
    - Complications
    - Transition to oral nutrition
- Parenteral nutrition
  - Composition
  - Access
  - Medication
  - Evaluation
  - Complications
  - At home
  - Stopping

Clinical nutrition

Clinical nutrition is a collective term for industrially prepared nutrition and nutritional supplements that are intended for medical use in both hospitals, health care institutions and at home. Clinical nutrition includes:

- Food fortification: products containing large amounts of one or several nutrients;
- Oral nutritional supplements: a ready-to-use liquid form of oral nutrition with high concentrations of energy, protein and other nutrients;
- Tube feeding: a thin-liquid form of nutrition which is administered into the stomach or intestines through a thin flexible tube;
- Parenteral nutrition: a form of liquid nutrition which is administered directly into the bloodstream through an intravenous (i.v.) line.

Dietary supplements, oral nutritional supplements, tube feeding and parenteral nutrition are usually all covered by health insurance. With a basic Dutch health insurance policy, being at risk for the development of malnutrition, malabsorption, allergies and metabolic disorders are all medical indications to cover these products.

When regular oral nutrition is not (sufficiently) possible, clinical nutrition can be used to meet nutritional requirements and/or improve quality of life. Oral nutritional supplements can easily and noninvasively be implemented into the daily diet. Tube feeding and parenteral nutrition are more demanding and require invasive feeding systems. Oral nutritional supplements, tube feeding and parenteral nutrition can all be used as supplementary or complete forms of nutrition. Combinations of regular oral nutrition, oral nutritional supplements, tube feeding and parenteral nutrition are also possible.

In cancer, the routine administration of nutrition through a feeding tube or i.v. is not justified since there are a number of studies which have not demonstrated an effect on the course of the disease and the length of survival. However, in the case of (near) malnutrition and no or insufficient oral intake, tube feeding and/or parenteral nutrition are indicated to meet daily nutritional requirements and maintain or improve nutritional status in the case of:

- Improvement of moderate or severely poor nutritional status preceding (major) surgery;
- (risk of) no or insufficient oral intake for at least 7-10 days due to:
  - Anorexia due to illness or treatment;
Dysphagia or gastro-intestinal obstruction;
♦ Surgery of the gastro-intestinal tract or the head and neck area;
♦ Aggressive chemo- or radiotherapy or combination treatment.

Tube feeding versus parenteral nutrition

Tube feeding is always preferred over parenteral feeding because:

- Tube feeding into the stomach or intestines bears more physiological resemblance to regular nutrition than nutrition administered directly into the bloodstream;
- Tube feeding prevents bowel atrophy. A small amount of tube feeding (200-500 ml/day) is sufficient to maintain bowel integrity;
- Tube feeding stimulates the intestinal immune system;
- Tube feeding reduces the risk of transporting intestinal bacteria and toxins into the bloodstream, thereby reducing the risk of sepsis and multi-organ failure (MOF);
- Tube feeding stimulates secretion from the gallbladder and pancreas and stimulates the bile cycle, preventing cholestasis and the development of gallstones;
- Parenteral administration of nutrition increases the risk of infection, thrombosis, pneumothorax, liver disorders and metabolic complications;
- Tube feeding is less costly and easier to implement at home;
- Parenteral nutrition cannot be administered in nursing and care homes in the Netherlands.

Parenteral nutrition is preferred when it is not possible to absorb sufficient fluid and nutrients from the gastro-intestinal tract such as in:

- Obstruction or pseudo-obstruction of the lower gastro-intestinal tract or obstruction distally to the feeding tube;
- Mechanical or paralytic ileus;
- Peritonitis;
- Intestinal perforation or leakage;
- Short bowel syndrome
- High-output fistulas (>750-1000 ml/day);
- Severe (recurrent) gastro-intestinal bleeding;
- Bowel ischemia or necrosis;
- Infection or inflammation of the bowel mucosa such as in severe mucositis following bone marrow transplant, severe radiation enteritis or delayed radiation effects (delayed graft-versus-host disease);
- Prolonged vomiting or severe diarrhoea;
- Scleroderma with severely reduced motility and absorption of the gastro-intestinal tract.

Refeeding syndrome

There is a risk of refeeding syndrome following the initiation of clinical nutrition after a 5-10 day period of severely reduced oral intake. The refeeding syndrome is a combination of metabolic, biochemical and functional changes caused by resuming a complete diet in malnourished patients or in patients who have received little or insufficient nutrition over a prolonged period of time. Patients receiving intravenous fluids and glucose (without other nutrients) can also develop this syndrome. Little is known on the incidence because there is no exact definition of refeeding syndrome. The complications that can occur in refeeding syndrome are severe and life-threatening.

Complications of refeeding syndrome

<table>
<thead>
<tr>
<th>Area</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Shock, arrhythmia, hypotension, heart failure and sudden death.</td>
</tr>
<tr>
<td>Renal</td>
<td>Kidney failure, acute tubular necrosis, metabolic acidosis.</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Respiratory failure, dyspnoea, difficulties during the weaning process (with mechanical ventilation), respiratory alkalosis.</td>
</tr>
<tr>
<td>Neurological</td>
<td></td>
</tr>
</tbody>
</table>
Delirium, paraesthesia, paralysis, muscle cramps, muscle weakness, ataxia, Wernicke-Korsakoff syndrome, eye abnormalities.

Haematological
Haemolytic anaemia, thrombocytopenia, leukocyte dysfunction, increased susceptibility for infection, sepsis.

Other
Sepsis, rhabdomyolysis, renal function disorders, metabolic acidosis.

The administration of nutrition (especially carbohydrates) causes an anabolic state in which insulin secretion increases and glucagon secretion diminishes. Serum insulin levels rise, stimulating the uptake of glucose, potassium, magnesium and phosphate from the extracellular space (blood) to the intracellular compartment. These shifts reduce extracellular concentrations of these electrolytes, resulting in hypophosphataemia, hypocalcaemia and hypomagnesaemia. There is an increased need for vitamin B₁ (thiamine) because vitamin B₁ is an essential enzyme in carbohydrate metabolism. Hyperinsulinism and hyperglycaemia result in fluid and salt retention and severe congestive heart failure. The elevated CO₂ production leads to an increase in respiratory frequency, the atrophy of respiratory muscles due to malnutrition results in dyspnea.

Refeeding syndrome can be prevented by gradually increasing the energy supply starting at 10 kcal/kg/day (5 kcal/kg/day in severely malnourished patients), supplementation of vitamin B₁ (100-300 mg orally or intravenously) for at least one week and if necessary the addition of a vitamin-B-complex supplement and a multivitamin supplement. Energy intake should be gradually increased by 10/kcal/kg/day until energy requirements are met. Fluid intake levels should be 20-30 ml of fluid/kg and should be monitored using the fluid balance, body weight or serum electrolyte levels. Serum electrolyte levels should be monitored on a daily basis and deficiencies should be supplemented. Sodium, potassium, magnesium, phosphate, calcium, urea, creatinine and glucose levels should be determined prior to the initiation of nutritional therapy and should be monitored daily until a stable state has been reached. During a hospital admission, it is easy to draw blood and check blood levels. When a patient is at home it is more complicated to arrange who monitors blood levels and who takes action when values are abnormal. If this cannot be arranged at home, nutrition should be increased very gradually starting with 10 kcal/kg/day and adding 5 kcal/kg/day until the required intake levels have been reached.

Recommended daily electrolyte supplementation in refeeding:

<table>
<thead>
<tr>
<th>Electrolytes</th>
<th>Normal range</th>
<th>Supplementation advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate</td>
<td>0,90-1,5 mmol/l</td>
<td>20-50 mmol</td>
</tr>
<tr>
<td>Potassium</td>
<td>3,5-5 mmol/l</td>
<td>40-80 mmol</td>
</tr>
<tr>
<td>Sodium</td>
<td>135-145 mmol/l</td>
<td>80 mmol</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0,7-1,0 mmol/l</td>
<td>8 mmol</td>
</tr>
<tr>
<td>Calcium</td>
<td>2,10-2,55 mmol/l</td>
<td>10 mmol</td>
</tr>
</tbody>
</table>
Food fortification

There are various forms of dietary supplements available for food fortification. They contain high concentrations of one or more nutrients. Certain products supplement regular nutrition, others contain a complete diet. Types of dietary supplements include:

- Powder-based modulars containing protein, carbohydrates, fats or a combination. Some of these products contain additional vitamins and minerals;
- Concentrated liquid modulars that contain protein, carbohydrates, fats or a combination;
- High-calorie/protein supplements in the form of puddings, cream-based products, fruit purees or bars;
- Thickening agents for patients prone to aspiration.

Oral nutritional supplements

Oral nutritional supplements are a ready-to-use form of liquid oral nutrition for use on medical grounds with high energy and nutrient density, supplemented by micronutrients. Some forms of oral nutritional supplements have added dietary fibre or disease-specific elements. Oral nutritional supplements are mainly used as supplemental nutrition in addition to a regular diet. Most feeds contain 200-300 kcal per unit. In general, two to three units per day suffice, depending on the remaining oral intake. When oral nutritional supplements are the only form of nutrition being used, larger amounts are needed to meet the patient's protein and energy requirements.

There are many advantages to oral nutritional supplements: it contains large amounts of nutrients, is user friendly and easy to transport. Research has shown that oral nutritional supplements are more effective in increasing the intake of energy and nutrients in the short term than a regular diet with additional dietary supplements. However, this effect only persists in the long term when oral nutritional supplements can be implemented into the regular diet and a patient is provided with individual advice on how to adjust his regular diet. Intake from regular food can be reduced due to the use of oral nutritional supplements, however this decrease tends to be less than the additional intake provided by oral nutritional supplements.

A disadvantage of oral nutritional supplements is the feeling of early satiety, especially in anorexia. The taste can also be unpleasant for patients with alterations of taste and smell. The large variety in the range of liquid feeds allows for the patient's preferences to be taken into account as much as possible. There are milk-, yoghurt- and juice-based feeds available in various flavours. Furthermore, oral nutritional supplements can be mixed into meals and thinned with milk, dairy products or ice. Cooled feeds taste better because the distinct flavours of the supplements are less pronounced when cold. There are savoury options for patients that dislike sweet flavours. These products (such as soup and coffee drinks) are served warm. When intake volume presents a problem, extra concentrated feeds can be used (400 kcal/unit or 300 kcal/smaller unit). This allows the required intake to be achieved in a smaller volume. The manufacturers of oral nutritional supplements also provide recipes to improve compliance. Companies often offer taste boxes or sample packages, allowing the patient to try various types and flavours.

Due to the high rate of taste alterations in cancer patients, it is sometimes easier for a patient to view oral nutritional supplements as a form of medication instead of a tasty drink. The use of water, coffee, tea or juice after oral nutritional supplements can somewhat combat an unpleasant taste in the mouth but does increase satiety.

In practice, only 50-65% of the prescribed volume of oral nutritional supplements is actually consumed. Oral nutritional supplements and food fortification are more effective when incorporated in the regular daily diet and when the patient is provided with professional nutritional advice. Together with the patient the dietician decides which nutrients should be adjusted or supplemented, which dietary products are the most suitable and how the patient can be reimbursed for these products. Furthermore it is important to keep re-evaluating the provided dietary advice and to make adjustments according to the patient's abilities and wishes if necessary.

Tube feeding

Tube feeding is a thin-liquid form of nutrition which is administered into the stomach or intestines through a thin flexible tube.
Enteral formulas

The selection of an enteral nutrition formula depends on:

- **Digestion and absorption**
  Most oncology patients can be fed using polymeric formulas which consist of intact proteins, fats and carbohydrates. In severe impairment of the digestive system, oligomeric or monomeric formulas are advised. These formulas contain hydrolysed protein (short-chain peptides or amino acids), fats (short- or medium-chain fatty acids) and carbohydrates (mainly maltose-dextrin). The osmolarity of oligomeric and monomeric formulas is higher, increasing the risk of diarrhoea.

- **Protein and energy requirements**
  In order to meet protein and energy requirements there are several options:
  - Regular enteral formula (1 kcal/ml, 30-40 grams of protein/l);
  - Protein enriched (50-70 gram/l) or energy enriched (1.5 - 2 kcal/ml) enteral formula;
  - Enteral formula with a reduced protein (20 gram/l) or energy (0.5 kcal/ml) content.
  - In addition to enteral formula, oral and/or parenteral nutrition can be used to cover part of the nutritional requirements.

- **Fluid requirements**
  Concentrated enteral formula is advised in the case of fluid restriction. In increased fluid requirements, additional fluid can be administered through the feeding tube if necessary.

- **Hypersensitivity to nutrients such as lactose or gluten**
  Most enteral formulas are milk-based but contain no or limited amounts of lactose and are gluten-free. If necessary, soy-based enteral nutrition can be advised.

- **Type and amount of fat, carbohydrates and minerals**
  Some patients require specific adjustments in the type and amount of fats, carbohydrates and minerals (mainly sodium and potassium). An enteral formula with a low fat content can be necessary in the case of severe digestive disorders, lymphatic leakage and pancreatic enzyme deficiency. Enteral formula is naturally low in sodium and is suitable for patients with a sodium restriction. In patients with severe losses such as diarrhoea, vomiting, fistulas and ostomies, the addition of extra salt can be necessary.

- **Contra-indications for dietary fibre**
  There are enteral formulas available containing both soluble and insoluble fibre which each have their own specific effect. Fibre regulates the consistency of stool and can be advised in both diarrhoea and constipation. Negative effects of a overly high fibre intake include bloating, abdominal distension, cramps and flatulence.

- **Dietary adjustments**
  Disease specific enteral formulas have been developed for patients with COPD, pressure ulcers, large wounds, diabetes and cancer.

Tubes and access

**Feeding tubes** can be made from various materials:

- **Polyvinyl chloride (PVC) feeding tube.** This is suitable for a short feeding period (seven to ten days). Gastric acid dissolves the plasticizers in PVC, making the tube rigid and stiff. This can easily lead to damage or perforation of the stomach lining.
- **Polyurethane (PUR) feeding tube.** This smooth and flexible material can remain in place for six to twelve weeks. This feeding tube is usually placed endoscopically or using a guide wire.
- **Silicone feeding tube.** This material is not affected by bodily fluids and can remain in place for prolonged periods of time. Replacement is only necessary following complications such as obstruction or displacement of the tube. This type of feeding tube is very flexible and should therefore be placed using a guide wire.

There are multiple lengths (in cm) and diameters (in Charrière (Ch) or French (Fr)) available.

**Types of access**
Nasoenteric access
Nasogastric feeding tubes are the preferred route of administration. These tubes can be placed relatively easily by a nurse, doctor or by the patient himself. A nasogastric tube is the most physiological form and preserves the stomach functions such as the secretion of gastric acid (bactericidal) and gastrin (regulates secretion of bile and pancreatic enzymes). A nasoduodenum or nasojenunum tube should be considered when feeding through the stomach is not sufficiently possible due to a decreased level of consciousness, a reduced cough or swallowing reflex, gastro-oesophageal reflux, gastric retention, obstruction, fistulas or perforation. A nasogastric tube is also unsuitable for patients with decreased oesophageal or stomach motility which can occur postoperatively, patients with a diabetic gastroparesis and intensive-care patients because the risk of nausea, vomiting and subsequent aspiration is too high. Prokinetics can be prescribed, however if these are not sufficiently effective, it is better to reposition the tube or directly place a feeding tube into the duodenum or jejunum. There is insufficient evidence that post pyloric feeding significantly reduces the risk of aspiration compared to gastric feeding.

Enterostomy
An enterostomy is an artificial opening in the abdominal wall through which a feeding tube can be placed into the stomach or intestine. This access route has several advantages over a nasoenteric tube such as a smaller risk of dislocation, no irritation of the nose and/or throat, a higher level of social acceptance and a better cosmetic effect since the feeding tube is not immediately visible. Because these tubes tend to have a larger diameter, they are easier to administer medication through. An enterostomy is indicated when tube feeding is necessary for a period of over four to six weeks, or when the use of a nasal tube is not an option. Contra-indications for a gastrostomy include untreatable coagulation disorders, abdominal wound infections, sepsis, peritoneal dialysis, abdominal fluid retention (ascites), peritonitis carcinomatosa and hepatomegaly.

An enterostomy can be created:
- Surgically or laparoscopically: During large oncological surgeries of the oesophagus, stomach or pancreas, the creation of a jejunostomy is often standard procedure.
- Endoscopically: the percutaneous endoscopic gastrostomy (PEG) or percutaneous endoscopic jejunostomy (PEJ) in which the feeding tube is placed in the duodenum or jejunum in the case of a contra-indication for gastric feeding.
- Under X-ray screening: the percutaneous radiological gastrostomy (PRG) or jejunostomy (PRJ).

Before initiation of feeding, the position of the feeding tube must be checked. Especially in nasogastric tubes there is a risk of tube dislocation and aspiration of nutrition which can potentially lead to pneumonia with serious consequences. An X-ray is the golden standard test with which to determine tube position but cannot be used too frequently due to radiation exposure. The auscultation method (infusion of air into the feeding tube and listening for crackles with a stethoscope) is not sufficiently reliable since stomach noises can be confused with crackles from the chest. Measuring the stomach contents with a pH test strip is much more accurate. When the measured pH value is below 5.5, it can be assumed that the tube is placed in the stomach. Following placement, the tube’s position can also be monitored. The external segment of the tube is measured, if its length increases it has most likely been dislocated. The tube can be externally repositioned, but the result should always be checked.

Administration and advancement

Administration
The administration of enteral formula can be continuous or intermittent (only during the day or overnight). It can be administered as a bolus, using an enteral feeding pump, or through a gravity-drip. If the patient is mobile and active, bolus administration is the preferred method. This method most closely approximates regular physiology. Bolus administration is also preferred in disoriented patients in whom the risks of tube dislocation and aspiration are high. This method of administration also allows for additional contact time with the patient. In impaired pyloric functioning, gastric retention, impaired intestinal functioning and direct administration into the duodenum or jejunum, the use of an enteral feeding pump is recommended. This can reduce complications such as dumping syndrome, nausea, vomiting, diarrhoea and cramps. In patients who still consume regular nutrition, with some difficulty, it can be useful to administer enteral formula overnight, allowing patients to eat during the day. This can also be a solution for patients with head and neck tumours.
Advancement
There is no consensus on the correct feeding schedule for the initiation of tube feeding. If possible patients are immediately given optimal nutrition, however it can be necessary to start with a smaller amount of nutrition and gradually increase the administered amount. This depends on several factors. Has the patient eaten shortly before the initiation of tube feeding, is there a risk of refeeding, what can the patient tolerate and does the patient have gastric retention?

Following surgery, tube feeding should be initiated within 24 hours. There are no set rules for the gradual increase of tube feeding after surgery. Important criteria are: reflux, vomiting, diarrhoea, abdominal distension and gastric retention. When initiating gastric feeding, retentions should be determined every six hours by extracting the stomach contents using a syringe. If gastric residual volume exceeds 250-300 ml/hour, the increase of nutrition should be postponed and prokinetics (erythromycin) should be initiated. If this does not yield sufficient results, the feeding tube can be placed intestinally.

In general, a feeding pump rate of 40 ml/hour (taking refeeding syndrome into consideration) is a safe starting dose. In complex situations it is better to start with 20 ml/hour and to increase feeds with 20 ml/hour every six hours. If an increase in volume is not tolerated and the daily requirements have not yet been covered, nutrition should be switched to a more concentrated enteral formula. Most patients tolerate a pump rate of 80-100 ml/hour well. A pump rate of over 125-150 ml/hour frequently causes bloating, nausea, cramps and diarrhoea, especially with a post pyloric feeding tube. Bolus feeds into the stomach or through a PEG can be initiated at portions of 100 ml per feed. This can be increased to portions of 250 ml up to as much as 500 ml per feed, provided that nutrition is not infused too quickly (under 15 minutes).

Evaluation
The course of tube feeding should be regularly evaluated by checking and inquiring after:

- gastric retention when using a gastric tube (> 250-300 ml);
- the effectively administered amount of the prescribed amount of enteral formula. A significant amount of patients is not fed according to instructions. The less feeding is interrupted, the greater the chance that the prescribed amount of nutrition is actually ingested.
- symptoms such as irritation of the mouth and throat, reflux, regurgitation, nausea, vomiting, bloating and cramps;
- appetite and oral intake besides tube feeding;
- blood values such as sodium, potassium, glucose, urea, creatinine and when at risk for refeeding: phosphate, magnesium and calcium; if necessary additionally: albumin, liver function and C-reactive protein (CRP).
- the defecation pattern
- fluid intake (colour, frequency and amount of urine) and if necessary fluid balance;
- course of body weight and if possible body composition.

Complications

### Mechanical complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Possible causes</th>
<th>Prevention or treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislocation</td>
<td>• Coughing, vomiting, disoriented or agitated patient</td>
<td>• Check the position of the tube.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fix the tube into place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Place the tube past Treitz's ligament.</td>
</tr>
<tr>
<td>Tube obstruction</td>
<td>• Crushed medications</td>
<td>• Avoid administering medication through the tube</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consult a doctor or nurse on other forms of medication administraion</td>
</tr>
<tr>
<td></td>
<td>• Inadequate</td>
<td>• Flush the tube 2-4 times per day</td>
</tr>
</tbody>
</table>
irrigation. with tepid water.
- Do not flush acidic drinks such as cola or sparkling mineral water.
- In the case of obstruction: flush with a small syringe (2-5 ml) or with Fluimucil® or sodium bicarbonate.
- Replace the tube.

| Irritation of nose and/or throat, bleeding of nose, throat, stomach or oesophagus | • Irritated mucosa. | • Change to small-bore poly-urethane or silicon tube.
• Switch nostrils.
• Consider creating an enterostomy.
• Use the proper fixation material. |
| Leakage or infected skin around enterostomy or perforation | • Inadequate personal hygiene. | • Ensure good personal hygiene. |
• Skin problems. | • Consult with the doctor, ostomy nurse or wound therapist. |

**Gastro-intestinal complications**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Possible causes</th>
<th>Prevention or treatment</th>
</tr>
</thead>
</table>
| Dry mouth, gingivitis or oral mucositis | • Insufficient production of saliva due to not chewing. | • Ensure good oral hygiene.
• Suggest chewing on chewing gum, tart or sour foods. |

| Aspiration, gastro-oesophageal reflux, gastric retention | • Decreased stomach motility. | • Determine gastric retention.
• Administer feeding continuously, not by bolus.
• Consult with the doctor on medication use (prokinetics)
• Place post pyloric feeding tube. |
| The patient is lying down flat. | • Increase angle of the bed (30°). |
| Dislocation of the feeding tube. | • Check tube position and if necessary replace tube. |

| Nausea, vomiting, cramps, bloating | • Rapid formula administration. | • Decrease administration rate and/or increase the concentration. |
| Formula too cold. | • Administer formula at room temperature. |
| Amount of fibre and fat from enteral formula. | • Adjust enteral formula (fibre or fat). |

| Diarrhoea | • Low-fibre enteral formula. | • Switch to high-fibre enteral nutrition. |
| Administration rate too high. | • Reduce the amount of nutrition and/or switch to continuous feeding. |
| Give 300-400 mOsmol/l at most. |
- Osmolarity too high.
  - Too little sodium.
    - Increase the amount of sodium to 3-4 grams of salt per litre.
  - Malabsorption.
    - Adjust the composition of nutrition.
  - Inadequate personal hygiene.
    - Ensure good personal hygiene.
  - Medication such as antibiotics, products containing sorbitol, lactulose and acid-binders with magnesium.
    - Consult with a doctor on possible medication changes.

**Constipation**
- Inadequate fluid intake.
  - Increase free water administration.
- Low-fibre enteral formula.
  - Use high-fibre enteral formula.
- Physical inactivity.
  - Encourage physical activity.
- Medication (such as opioids).
  - Consider laxative use.

### Metabolic complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Possible nutritional causes</th>
<th>Prevention or treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>• Inadequate free water</td>
<td>• Increase free water administration.</td>
</tr>
<tr>
<td></td>
<td>• High fluid output</td>
<td>• Monitor the fluid balance and body weight on a daily basis.</td>
</tr>
<tr>
<td></td>
<td>• Hypertonic feeds</td>
<td>• Adjust the enteral formula's osmolarity.</td>
</tr>
<tr>
<td>Overhydration</td>
<td>• Excess fluid administration.</td>
<td>• Concentrate the enteral formula.</td>
</tr>
<tr>
<td></td>
<td>• Refeeding.</td>
<td>• Gradually increase the amount of nutrition.</td>
</tr>
<tr>
<td>Elevated glucose.</td>
<td>• Insulin resistance.</td>
<td>• Ensure a regular supply of nutrition.</td>
</tr>
<tr>
<td>Normal range: 3,5-5,6 mmol/l</td>
<td>• Metabolic stress.</td>
<td>• Use a feeding pump.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consult with a doctor on the administration of insulin.</td>
</tr>
<tr>
<td>Hyponatraemia.</td>
<td>• Fluid overload.</td>
<td>• Determine the cause. Depending on this administer extra salt or implement fluid restrictions.</td>
</tr>
<tr>
<td>Normal range: 135-145 mmol/l</td>
<td>• Insufficient sodium in feeds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increased</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Symptoms</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hypokalaemia.</td>
<td>Normal range: 3.5-5.0 mmol/l</td>
<td>Increased losses (diarrhoea, vomiting, gastric drainage or renal losses). Provide potassium supplementation.</td>
</tr>
<tr>
<td>Hyperkalaemia.</td>
<td>Normal range: 3.5-5.0 mmol/l</td>
<td>Kidney failure, decreased potassium excretion, potassium sparing diuretics. Consult a doctor on medication.</td>
</tr>
<tr>
<td>Hypomagnesaemia.</td>
<td>Normal range: 0.7-1.0 mmol/l</td>
<td>Increased gastro-intestinal losses. Refeeding. Gradually increase the amount of nutrition.</td>
</tr>
<tr>
<td>Hypophosphataemia.</td>
<td>Normal range: 0.9-1.5 mmol/l</td>
<td>Malnutrition. Refeeding. Medication. Provide phosphate supplementation. Gradually increase the amount of nutrition.</td>
</tr>
<tr>
<td>Hyperphosphataemia.</td>
<td>Normal range: 0.9-1.5 mmol/l</td>
<td>Renal insufficiency. Excess intake. Consider adjusting the amount of protein. Consult with a doctor on the use of phosphate binders.</td>
</tr>
<tr>
<td>Calcium, albumin, CRP.</td>
<td>Normal range calcium: 2.10-2.55 mmol/l. Normal range albumin: 35-55 g/l. Normal range CRP: &lt;</td>
<td>Albumin and CRP are indirect measures for malnutrition and protein status. Albumin and CRP. Provide optimal nutrition and discuss abnormal values with a doctor. Correct calcium for albumin levels, corrected serum-Ca = measured serum-Ca in mmol/l + 0.2 mmol/l</td>
</tr>
</tbody>
</table>
Transition to oral nutrition

When the patient is able and allowed to resume eating and oral nutrition can provide over 50% of dietary requirements, tube feeding can be decreased. The effect of tube feeding on appetite appears to be limited. However a feeding tube can impede swallowing. When gradually decreasing tube feeding, feeds can be administered overnight and the administration rate or the number of bolus feeds can be reduced. Tube feeding can be stopped when oral intake provides approximately 75% of dietary requirements. Oral nutritional supplements and food fortification can be used to complete the diet.

Parenteral nutrition

Parenteral nutrition (usually referred to as total parenteral nutrition or TPN) is nutrition that is administered outside the gastro-intestinal tract, directly into the bloodstream. The nutrients in TPN should be administered in a form that the body can metabolise: protein in the form of individual amino acids, carbohydrates in the form of glucose and fat in the form of emulsions. Micronutrients also merit extra attention. Vitamins, minerals and trace elements should be administered in the amount that the body requires. Overdoses should be avoided: once administered, nutrients are not easily removed from the body. Properly monitoring blood levels is of the utmost importance. Besides TPN, enteral nutrition should always be attempted (even if only in small amounts) to prevent bacterial overgrowth.

Before the start of TPN it is important to determine its goal. In oncology patients with a reasonable life expectancy, parenteral nutrition can be of use until regular oral nutrition is resumed. This allows for adequate maintenance of the nutritional and fluid status. In malnourished patients, preoperative TPN results in less postoperative complications and TPN during treatment results in less treatment interruptions. This should be weighed against the potential complications of TPN which can be life-threatening.

If it is unclear if and when TPN can be stopped, the initiation of this therapy should be properly discussed with the patient. What is the prognosis and how long will the patient remain in the hospital? TPN is not an option in most nursing homes. In the case of a poor prognosis the use of TPN could potentially have more disadvantages than advantages in the short term.

Composition

Since the early nineties, TPN has been produced in all-in-one-feeds: one bag with sub-units containing amino acids, glucose and (optionally) lipid emulsions. These bags are available with or without electrolytes (sodium, potassium, calcium, magnesium, phosphate). By breaking the sealed seams between the sub-units, the different liquids are mixed. When unmixed, these bags can be stored for up to two years; once mixed in clean household surroundings they must be used within 24 hours. When the bags have been mixed in aseptic surroundings (compounding pharmacy), the contents can be stored in a refrigerator for 7-10 days. Over 90% of TPN is administered in these all-in-one bags. In hospitals, the bags are prepared in the pharmacy or on the ward (breaking the seams and adding supplements such as vitamins, minerals and trace elements). Insulin or extra electrolytes can be added on the ward. It is important to adhere to the manufacturers recommendations on what can safely be added. The TPN solution is a delicate balance and too much of one nutrient can make it unstable. If standard solutions do not suffice, a specialized hospital pharmacy can compile TPN from various modular components. This is mainly done for children and patients with strongly divergent electrolyte and protein requirements.

- **Amino acids**
  TPN should have an amino acid composition that allows for maximum availability of amino acids for the development of body protein. This contains a broad range of essential and non-essential amino acids. TPN has amino acid levels varying from 30 to 60 grams per litre. For clinical use, a solution containing approximately 50 grams of protein per litre is sufficient for most patients.

- **Glucose**
  Glucose is the most important energy source in parenteral nutrition. If glucose were the only available energy source, 400 grams of glucose would be needed per day. Many ill patients cannot
process such large amounts due to insulin resistance and develop elevated blood glucose levels. These blood levels should be monitored closely. In the case of elevated blood glucose levels due to TPN, insulin is added to the TPN starting with 1 U of insulin per 4 grams of glucose. Insulin can also be administered separately but adding it to the TPN prevents the development of hypoglycaemia after stopping TPN. When TPN is not administered continuously but cyclically (for example overnight or only during the day), interrupting TPN can lead to hypoglycaemia due to the insulin response to the previously high glucose flow. This can be prevented by halving the administration rate for the last one hour or 30 minutes of feeding. Some patients require a longer time to taper down, sometimes up to 4 hours. The recommended maximum daily amount of glucose is 6 grams per kilo of current body weight.

**Fat**

There are many types of lipid emulsions available. The fat percentage in the solution varies: 10%, 20% and 30%. The fat composition also varies: coconut oil (medium-chain triglycerides, MCT), soy and olive oil (long-chain triglycerides, LCT) and fish oil (very-low-density lipoprotein, VLDL; omega 3- and omega 6-fatty acids). There are mixtures available of MCT (coconut), LCT (soy) and industrially prepared structured lipids. The glycerol molecule in structured lipids is bound to both an LCT and an MCT molecule. The lipid emulsion component in all-in-one feeds is 30-40 grams/litre. The recommended amount is 1 gram per kg of current body weight for MCT/LCT and structured lipids. In the case of pure fish oil the recommendation is 1-2 ml/kg of current body weight. Fish oil is a 10%-solution which is used therapeutically (see Complications). There is ongoing debate on which emulsion is the most suitable. There is over 30 years of experience with soy oil. Long term use does not result in essential fatty acid deficiencies. In children the use of fish oil as a separate modular component has proved effective in aiding liver recovery, however side effects such as delayed coagulation have also been demonstrated. The emulsions that are currently available are all safe, the choice depends on the composition of other nutrients and the cost-effectiveness.

**Electrolytes**

Administering intravenous fluid directly into the bloodstream influences electrolyte concentrations. Therefore, iso-osmolar administration of electrolytes is used. It is important to closely monitor blood electrolyte levels in increased losses such as vomiting, diarrhoea, fistulas or bleeding or expected variations due to dehydration or refeeding, and to adjust the intravenous administration of electrolytes if necessary. Other intravenous administrations besides TPN (NaCl solution and medication) should also be included in the calculation of the total administered amount.

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Amount / litre TPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>50 mmol</td>
</tr>
<tr>
<td>Potassium</td>
<td>30 mmol</td>
</tr>
<tr>
<td>Calcium</td>
<td>3-5 mmol</td>
</tr>
<tr>
<td>Magnesium</td>
<td>2-4 mmol</td>
</tr>
<tr>
<td>Phosphate</td>
<td>5-10 mmol</td>
</tr>
</tbody>
</table>

**Vitamins**

Water and fat soluble vitamins are added to TPN every day. Water (B-complex and C) and fat (A, D, E and sometimes K) soluble vitamins are available separately or combined. The composition is adjusted to the meet the patient's needs. In the case of a deficiency, one dose of vitamin mixture will not be enough to treat this, therefore additional (intravenous or intramuscular) administration is also necessary.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Recommendation adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiamine (B$_1$)</td>
<td>6 mg</td>
</tr>
<tr>
<td>Riboflavin (B$_2$)</td>
<td>3.6 mg</td>
</tr>
<tr>
<td>Niacin (B$_3$)</td>
<td>40 mg</td>
</tr>
<tr>
<td>Pantothenic acid (B$_5$)</td>
<td>15 mg</td>
</tr>
<tr>
<td>Pyridoxine (B$_6$)</td>
<td>6 mg</td>
</tr>
<tr>
<td>Biotin (B$_7$)</td>
<td>60 µg</td>
</tr>
<tr>
<td>Folic acid (B$_9$)</td>
<td>600 µg</td>
</tr>
<tr>
<td>Cobalamin (B$_12$)</td>
<td>5 µg</td>
</tr>
<tr>
<td>Ascorbic acid (C)</td>
<td>200 mg</td>
</tr>
<tr>
<td>Retinol (A)</td>
<td>8,300 IE</td>
</tr>
</tbody>
</table>

Guideline: General Nutrition and Dietary treatment (2.0)
### Ergocalciferol/cholecalciferol (D)

200 IE

### Tocopherol (E)

10 IE

### Phytomenadione (K)

(beware effect on coagulation!)

150 µg

### Trace elements

Mixtures of trace elements can be added to TPN. These contain zinc, copper, iron, chrome, iodine, fluoride, manganese, molybdenum and selenium. Due to the instability of TPN, the amounts used are not the same as the recommended daily amounts. Trace elements should be monitored during prolonged use, especially iron. Most mixtures contain iron, however in the case of a deficiency or large losses (bleeding) this can be insufficient. If the iron status is too low, intravenous administration of an iron supplement can be necessary.

<table>
<thead>
<tr>
<th>Trace element</th>
<th>RDA adults</th>
<th>In mmol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome</td>
<td>10-20 µg</td>
<td>0,05 0 0,10 µmol</td>
</tr>
<tr>
<td>Copper</td>
<td>0,3-1,2 mg</td>
<td>4,7-18,8 µmol</td>
</tr>
<tr>
<td>Iodine</td>
<td>70-140 µg</td>
<td>0,54-1,08 µmol</td>
</tr>
<tr>
<td>Iron</td>
<td>1-1,5 mg</td>
<td>18-28 µmol</td>
</tr>
<tr>
<td>Manganese</td>
<td>0,2-0,8 mg</td>
<td>2,6-14,6 µmol</td>
</tr>
<tr>
<td>Selenium</td>
<td>20-80 µg</td>
<td>0,25-1 µmol</td>
</tr>
<tr>
<td>Zinc</td>
<td>2,5-4 mg</td>
<td>38-61 µmol</td>
</tr>
</tbody>
</table>

### Access

Each form of access to the bloodstream can be used for TPN. If a patient has an intravenous access route in place, it should be determined whether this is suitable for the administration of TPN. If the duration of TPN use is not yet clear, an existing access route can be used to prevent further damage to the blood vessels. Because all nutrients are administered in an elementary form, the nutrition's osmolarity is high: 1.200-1.500 mOsm/l (normally 300-400 mOsm/l). This means that TPN must be administered into a blood vessel with a high flow rate in order to prevent the development of thrombosis. Therefore, most catheters terminate in the right atrium of the heart, ensuring optimal distribution of the nutrients throughout the bloodstream. In prolonged use of parenteral nutrition, especially at home, it is important to determine who will perform procedures involving the access route since these should be safe and not carry the risk of infection. The patient's preference is also taken into account.

<table>
<thead>
<tr>
<th>Access route</th>
<th>Location</th>
<th>Duration of use</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral intravenous line</td>
<td>Arm, leg</td>
<td>&lt;1 week</td>
<td>• Can be inserted bedside</td>
<td>• Oncology patients often have poor peripheral access due to prior history and treatments • Peripheral nutrition can have a maximum osmolarity of 750 mOsm/l, meaning high volume, low</td>
</tr>
<tr>
<td>Catheter Type</td>
<td>Location</td>
<td>Duration</td>
<td>优点</td>
<td>Drawbacks</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Midline catheter: peripherally inserted venous catheter in upper arm vein</td>
<td>Arm</td>
<td>1-3 months</td>
<td>- Can be easily placed in a radiology unit</td>
<td>- Only suitable for peripheral TPN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Easy to secure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Suitable for medication with low osmolarity</td>
<td></td>
</tr>
<tr>
<td>PICC-line: peripherally inserted central venous catheter; tip ends in superior vena cava</td>
<td>Arm</td>
<td>1-3 months (can be longer)</td>
<td>- Can be easily placed in a radiology unit</td>
<td>- Arm is flexible: high risk of dislocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Easy to secure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- No catheter in chest or abdomen</td>
<td>- At home: the patient cannot change his own fixing plaster</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Suitable for all types of TPN</td>
<td></td>
</tr>
<tr>
<td>Non-tunneled central venous catheter, monoluminal</td>
<td>Chest, groin</td>
<td>See above</td>
<td>- Can be easily placed bedside with an ultrasound machine</td>
<td>- Material not suitable for prolonged use</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Is easy to remove</td>
<td>- Higher risk of infection in prolonged use due to short distance to bloodstream</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Suitable for all types of TPN</td>
<td></td>
</tr>
<tr>
<td>Non-tunneled central venous catheter, multiple lumens</td>
<td>Chest, groin</td>
<td>See above</td>
<td>- Multiple liquids can be administered at once</td>
<td>- Multiple lumens increase the risk of infection</td>
</tr>
<tr>
<td>Tunnelled central venous catheter (Hickmann®, Broviac®, Tesio®); monoluminal and biluminal</td>
<td>Chest, groin</td>
<td>Extended (years), until the catheter malfunctions (infection, tear in material)</td>
<td>- Placement in radiology department or operation room</td>
<td>- Insertion is unpleasant. Patients prefer general anaesthesia: depending on the hospital this must take place in the O.R.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Tunnel acts as barrier against infections</td>
<td>- The more lumens, the higher the risk of infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Patient can shower and</td>
<td>- Visible catheter</td>
</tr>
</tbody>
</table>

energy
- Line must switch arm or leg daily
- Not suitable at home
Medication

Medication cannot be added to TPN because of the potential reaction between the nutrition and the medicine. Furthermore, medication cannot be administered simultaneously through a separate lumen in the catheter. When administering medication, the catheter should be rinsed before and after use with 10ml of NaCl or glucose solution. Unstable nutrition with incorrect or large amounts of additions can contain large particles which can cause thrombosis and/or pulmonary embolisms.

Evaluation

Administration of TPN requires proper evaluation. Depending on the underlying illness a patient will need to be monitored regularly.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency of evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Daily in an unstable patient, weekly in others</td>
</tr>
<tr>
<td>Serum:</td>
<td>1-2 times per week, more often in unstable patients, in stable patients the frequency can be gradually reduced.</td>
</tr>
</tbody>
</table>
  - Kidney function (urea, creatinine);
  - Liver function (total bilirubin, ALT, AST, GGT, ALP);
  - Electrolytes (calcium, potassium, sodium, magnesium, phosphate);
  - Bicarbonate;
  - Hb;
  - Albumin;
  - Glucose |
### Complications

Because TPN is administered directly into the bloodstream, the ensuing complications are much more severe and life threatening than in other methods of feeding.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Treatment</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Pneumothorax | • Thorax drainage | • Qualified personnel.  
• Chest X-ray following insertion of catheter |
| Thrombosis | • Anti-coagulation therapy, therapeutic dose | • Anti-coagulation therapy, therapeutic dose with catheter in place and history of thrombosis, PE and/or active cancer or IBD |
| Infection: | | |
| • Catheter or Port-a-cath  
• tunnel in tunnelled catheter | • Antibiotics, potentially remove catheter (depending on infection policy of institution) | • Practice according to protocol |
| **Metabolic** | | |
| Liver function disorders (elevated total bilirubin, AST, ALT, GGT, ALP). Evaluation of other factors: | • Iso-energetic diet  
• If necessary stop lipid emulsion temporarily  
• Fish oil | • Iso-energetic diet  
• Monitor liver function closely  
• Adequate treatment of infections  
• Treatment of gallstones |
| • Gallstones;  
• Medication;  
• Infection | | |
| Electrolyte abnormalities | • Adequate supply of electrolytes | • Adequate evaluation of electrolytes in unstable patient  
• Anticipate in- or decrease of fluid losses |
| Hypoglycaemia or hyperglycaemia | • Hypoglycaemia: prevent sudden stagnation of glucose supply  
• Hyperglycaemia: insulin.  
• Insulin resistance declines due to treatment of infection: monitor glucose levels closely! | • Prevent hyperalimentation  
• Use a taper-up- or taper down-schedule in non-continuous TPN administration  
• Regular evaluation of glucose levels |
Hypertriglyceridaemia
(NB always check whether patient had this before TPN)

| • Halt lipid supply | • Prevent hyperalimentation |

At home

After initiating parenteral nutrition in the hospital, it can safely be continued at home if the patient remains dependant on TPN. In the Netherlands there is a high degree of expertise on this form of home treatment. Patients who require (extended) TPN at home can receive training at the University Medical Centres of Amsterdam and Nijmegen. The goal of these TPN-home teams is patient autonomy. In order to achieve this, the patient is admitted to one of these two training centres to learn the procedures involved in TPN use. This training lasts for seven to fourteen days, depending on the patient's physical condition. When the patient has been adequately trained, the TPN-home teams ensure the home supply of TPN and other necessities (tools, pump, fluid, medication). It is imperative that when a patient experiences problems with TPN at home, help can be provided quickly. Arrangements should be made ensuring that the TPN-team can be reached by telephone 24 hours a day, also on-call doctors and hospital wards should always be available. Follow-up takes place through the outpatient clinic to ensure optimal nutritional therapy and to prevent long term complications of TPN use.

If a patient is not able to perform or learn the actions required for TPN use, or if TPN is only required for under six months, specialized home care nurses can provide support. TPN is supplied by the home or hospital pharmacy, or by a specialized company. Home TPN use is evaluated by the treating physician together with the dietician and the (dietary) nurse. If there is insufficient knowledge or expertise on this form of care, the specialized centres in Nijmegen and Amsterdam can provide assistance and support. Severe problems regarding TPN can be encountered in primary health care institutions. The costs of TPN (€200-250 per day) and specialized nursing care can be a large burden on the budgets of nursing homes, rehabilitation centres or health resorts. If a patient does require treatment in one of these care facilities, outpatient treatment with overnight TPN administration at home can be an option. It is not necessary to provide TPN 24 hours daily at home, as is often the case in hospitals. An administration rate of approximately 200 ml/hour can easily be managed in a patient with good cardiac function. TPN can be administered for ten to twelve hours and then be disconnected. The catheter should be closed off with an antiseptic product (TauroSept®).

Stopping

TPN can be stopped the moment that an adequate supply of nutrients can be guaranteed enterally (orally or through a feeding tube). This can be done directly, TPN does not need to be tapered down. However, it should be noted that TPN is also a means of administering large amounts of fluid. If enteral fluid intake (orally or through a feeding tube) is insufficient, additional fluid can be administered intravenously until the patient is able to ingest and absorb adequate amounts of fluid.
Nutrition Care Process

This chapter is divided into the following parts.

- Nutrition Care Process
- Tasks and responsibilities

Nutrition Care Process

The focus on nutrition in cancer patients should not be seen as a goal in itself but as a form of supportive therapy. Improving nutritional status is one step in the process of improving quality of life and reducing morbidity and mortality. A good nutritional policy for the treatment of cancer includes:

- Selection and treatment of patients with or at risk for a poor or deteriorating nutritional status as soon as possible following diagnosis and throughout the treatment;
- Identification and treatment of nutrition-related complaints that trouble the patient, limit the ability to eat and prevent the patient from enjoying food;
- Identification of the patient and his caregivers' questions regarding diet and their need for information.
- Support optimal recovery of physical endurance level and level of functioning and reduction of (reduce) the risk of tumour recurrence, a second tumour or other health problems;
- Support optimal palliative support and quality of life in the case of a reduced life expectancy.

A good nutrition care process in cancer is multidisciplinary by definition: all available expertise should be combined. Nutritional care is not the unique responsibility of the dietician, but also that of the doctor, nurse, dietary aide and other health care professionals involved. In the nutrition care process these various disciplines have different tasks and responsibilities and information should be aligned so that the message is clear and unambiguous for the patient. This also applies to caregivers and volunteers involved in the patient's care.

To improve the quality of care, so-called care pathways have been developed. A clinical care pathway is a combination of methods and tools with which to provide consistent treatments and task distributions for specific patient populations. It is a means to systematically plan and execute a patient-oriented program. A case manager (usually a specialised nurse or other health care professional) is in charge, ensuring that all activities are coordinated properly and acting as the patient's direct contact.

Tasks and responsibilities

The role of the dietician

As a specialized nutritional expert, the dietician has an important advisory, initiatory and coordinating role in the organization of the nutrition care process.

The dietician determines the dietary diagnosis and focuses on the nutritional status and the medical, psychosocial and personal aspects of the illness. Subsequently the dietician determines the dietary requirements and forms an individual nutritional treatment plan in consultation with the patient. If necessary the dietician organizes the delivery of and reimbursement for clinical nutrition and its attributes, including a potential extension of use. This way, the dietician makes the transition from the goal of the nutritional treatment to a suitable diet for the patient. After this, the effect of the nutritional intervention is evaluated regularly and adjusted if necessary. The dietician provides the information and support that a patient needs to successfully adjust his diet.

Research shows that an individual nutritional advice provided by a registered oncology dietician aimed at improving oral intake before, during and after treatment, has a positive effect on protein and energy intake and body weight maintenance or improvement. It also significantly improves the quality of life. Group education or general (written) advice has additional value but mainly as a supplement to individual advice. The routine prescription of oral nutritional supplements can improve poor nutritional status in the short term, however this effect is lost in the long term if its use is not incorporated into the individual nutritional advice that is tailored to the patient's abilities and limitations at that time.

The dietician's tasks include developing protocols and working arrangements and discussing new
developments with doctors, nurses, carers and other health care professionals. A doctor is consulted on medication, possible new symptoms and laboratory test results. A nurse is consulted on the execution of the nutritional treatment plan and potential problems that could arise. A speech therapist is consulted on problems with swallowing, an occupational therapist on practical aids and a physiotherapist on the intensity and nature of physical activity.

A specialized oncology dietician provides training on nutrition, coordinates the availability of relevant literature on nutrition in oncology patients and plays a role in the range selection of various types of clinical nutrition. This range should be adjusted to the patient groups being treated in the health care institution and this choice should be evidence based.

Besides interdisciplinary collaboration, good teamwork between dieticians in different fields or institutions is also of great importance as cancer patients often receive treatment in a number of different health care disciplines. In order to ensure continuity of care, information should be transferred and data on previous nutritional interventions should be requested. Determining the availability of various colleagues from different fields in the same area can aid this nutrition care process.

The role of the doctor
The doctor's task is to include the nutritional status in the medical diagnosis and treatment, to identify nutritional problems when they arise and if possible to treat their cause. The doctor provides information, refers all malnourished patients to a dietician, informs nurses on the medical policy and consults others when a patient's recovery stagnates. Medical interventions include prescribing medication to improve nutritional symptoms and complaints such as antacids, anti-emetics or laxatives and feeding through invasive delivery systems such as tube feeding and parenteral nutrition whilst monitoring laboratory test results (signs of refeeding and electrolytes). Furthermore, the doctor ensures a good transfer of information within the health care institution and continuity of nutritional care.

The role of the (district) nurse
The (district) nurse is tasked with identifying nutritional problems through systematic screening for malnutrition and the monitoring of body weight, recognizing intake problems and determining the patient's and his caregivers' needs. The nurse focuses on the correct implementation of the nutritional treatment plan in the patient's daily care, provides information and if necessary performs nursing interventions such as assisting the patient with eating, good oral hygiene and the administration of tube feeding or parenteral nutrition.

The role of the dietary aide
The dietary aide or carer provides the patient's meals and snacks in a hospital, nursing home or at home, helps the patient with eating and drinking, stimulates the patient to eat sufficient amounts, pays attention to the mood during meals, registers the actual dietary intake and identifies problems in the execution of the nutritional treatment plan.
This chapter is divided into the following parts.

- Elderly patients
- Frailty
- Malnutrition
  - Functional domain
  - Psychological domain
  - Social domain
  - Physical domain
- Nutritional care process

Elderly patients

40% of all cancer patients are over the age of 70. Three-quarters of all men and two-thirds of all women diagnosed with cancer are over the age of 65. Due to aging and increased life expectancy, the amount of cancer patients will increase further, in particular the amount of elderly cancer patients. In 2000, over 40,000 people older than 65 were diagnosed with cancer, in 2015 this number will have risen to over 58,000. The amount of newly diagnosed cancer patients over the age of 65 will rise by approximately 45% in the next 15 years. Due to better treatment options, cancer patients live longer. As a result the amount of elderly patients living with cancer and its consequences is also increasing. The most common forms of cancer in the elderly are colorectal cancer, lung cancer, breast cancer, prostate cancer, non-Hodgkin's lymphoma and skin cancer (excluding melanoma).

Frailty

The process of aging involves functional, psychological, social and physical changes. These changes can have a negative effect on the course of illness and the effects of treatment. When treating elderly patients, a health care professional should consider a number of things besides the standard protocol before proposing a treatment plan tailored to the individual elderly patient. Age alone is not an appropriate starting point from which to determine treatment policy. The elderly are a very heterogeneous group. Large differences can exist between calendar age and biological age. A 75 year old can be biologically younger than a 65 year old with multiple ailments, functional and social restrictions and decreasing mental and physical resilience.

Screening for frailty can reveal the group's diversity. Frailty is difficult to define. It involves a deterioration of general health. Frail elderly patients often have an advanced age, more than one (chronic) illness, decreased general health and multiple limitations. In oncological care, insight into a patient's degree of frailty can be useful in determining whether an invasive or taxing form of treatment is possible and in choosing the best possible form of treatment. Elderly patients with early signs of dementia for example can still be considered for curative treatment. Elderly patients with severe dementia receive palliative care. The Groningen Frailty Indicator (GFI) is a list of fifteen questions determining the loss of functioning and complications in elderly patients. Furthermore, a Comprehensive Geriatric Assessment (CGA) can be used to detect elderly patients' multiple problems and determine their capacity and required level of care. The nutritional status and potential malnutrition are important elements in the geriatric screening for frailty.

When an elderly patient is considered 'old but fit', the standard cancer treatment can be offered. If screening results show frailty, the degree of frailty should be evaluated. In the case of severe frailty an adjusted and less taxing form of treatment can be offered aimed at reducing symptoms and achieving short term effects. In patients with a limited life expectancy, curative treatment should be refrained from and palliative supportive therapy commenced.

In geriatric oncology there are several additional important factors to be considered:

- **Time-to-benefit**
  The amount of time in which a patient can enjoy the potentially beneficial effects of treatment is often shorter. The average life expectancy of an 80-year old woman in the general population is nine years, however the one year survival rate of an 80-year old woman with two additional
illnesses currently admitted to a clinical department of internal medicine is 50%, meaning that half of patients in a similar situation are still alive after one year.

• **The tolerance for cancer treatments**
  The amount of complications and symptoms due to treatment can be difficult to predict. In taxing treatments such as chemotherapy, the impact of treatment measured using hospital admittance or mortality, is significantly higher in seemingly fit elderly patients than it is in younger adults.

• **The effect of age on a patient's considerations and decisions**
  Elderly patients have been shown to accept fewer side effects for a given amount of health gain. Quality of life during treatment plays an important role; survival is a less important factor in the choice for a full treatment. Elderly patients, especially those at an advanced age, consider different things in their choice of treatment than younger patients. An American study showed that younger adults (<40 years old) accept a taxing treatment with large amounts of side effects with an 8% chance of symptom reduction, 3 months survival gain and a 7% chance of cure. Elderly patients (>60 years old) only accepted this form of treatment at a 50% chance of symptom reduction, twelve months survival gain and a 50% chance of cure.

**Malnutrition**

Malnutrition in elderly patients can be seen as a multifactorial geriatric syndrome; a frequently occurring and complex problem with multiple causes. A risk assessment based on the CGA is useful in determining these causes and covers four domains.

**Functional domain**

The following aspects of the functional domain affect the nutritional status:

• Limitations in mobility and (I)ADL-dependency. Limitations in mobility increase with age: 6% of elderly people between the ages of 55 and 64 have a decreased level of mobility, this is also the case for 10% of elderly people between the ages of 65 and 74 and 28% of people over 75 years old. Common causes for this decreased mobility are physical inactivity, fear of falls, overweight, limited muscle strength, balance disorders, decreased eyesight, pain and cognitive limitations. Fine motor skills can also be affected.

• Hearing and visual impairment have a negative influence on daily activities. For example, a patient can struggle with the preparation of meals, grocery shopping, toilet use and level of independence.

**Psychological domain**

The following aspects of the psychological domain affect the nutritional status:

• Depression symptoms. Approximately 2% of elderly people suffer from clinical depression and 13% of elderly people have mild symptoms of depression. Common causes of depression include: grieving, cognitive disorders, loneliness, medication and residence in a (health) care institution. Besides temporary sadness as a normal reaction to a stressful life event, cancer increases the risk of developing depression to 30-35% in the palliative stage. Symptoms of depression are often poorly recognised in elderly patients. Depression can be a direct result of eating habits and lifestyle: it can be difficult to eat and drink at regular times.

• Cognitive disorders and dementia. Dementia is a progressive and deadly disease in which almost all elderly patients develop behavioural disturbances throughout the course of the illness. One of the behavioural disturbances in dementia that increases the risk of malnutrition is resistance in which food, drinks and medication are refused: a spoon is pushed away, food is kept inside the mouth, food is spit out or the head is averted. These signals indicate that a patient cannot or will not eat, or doesn't understand the actions involved in eating and drinking. If this behaviour cannot be corrected, it is important to adjust the nutritional policy. Unfeasible dietary interventions are recorded in the patient's medical file following multidisciplinary consideration and in consultation with the family.
Social domain

The following aspects of the social domain affect the nutritional status:

- **Limited financial capacity.** The risk of malnutrition is increased in the case of limited financial capacity. Chronic disease can affect financial status due to large additional costs. This can influence the practicability of dietary advice and limit the patient's ability to afford everyday food.
- **Loneliness, social isolation and a lack of carers.** Carers and/or volunteers play an important role in the realization of adequate nutritional care at home. They can provide functional support, groceries and meals and help practically implement nutritional advice. Carers can limit social isolation and stimulate the patient to eat and drink adequately.
- **An increased need for extra care.** Frail elderly patients who require more care are admitted to care institutions more frequently. The past years' Dutch National Prevalence Survey of Care Problems show that malnutrition is more common among inhabitants of care institutions than among those living at home.

Physical domain

The following aspects of the physical domain affect the nutritional status:

- **Physiological changes:**
  - Aging changes the body composition due to the loss of water and the relative increase in fat, which is mainly stored around the waist.
  - Bone mass is reduced (osteoporosis) due to increased resorption and decreased formation of bone. After the age of 60, decreasing bone mass can lead to an average height reduction of 0.5 cm per year.
  - Loss of muscle mass and muscle strength (sarcopenia) is usually a combination of primary sarcopenia due to aging and secondary sarcopenia due to illness, reduced level of physical activity and insufficient intake. Depending on the applied definitions, methods and sex, the prevalence of sarcopenia increases from 10-25% in people aged 50-70 to 30-50% in people over 80. Increasing sarcopenia can limit the degree of independence.
  - Energy requirements decrease due to the changes in body composition and reduced physical activity.
- **Gastro-intestinal changes:**
  - In the mouth, problems with chewing or swallowing can arise due to decreased muscle strength or poor condition of teeth or dentures, ill-fitting dentures and/or decreased production and higher viscosity of saliva. This can cause difficulties with eating.
  - The sensation of thirst decreases while the required amount of fluids increases, leading to a risk of dehydration.
  - The sense of taste and smell decreases. Food is not tasted as strongly. Taste enhancers and extra salt usually have no effect on the decreased sense of taste as the decreased sense of smell plays a more important role in tasting.
  - Atrophic gastritis can lead to decreased secretion of gastric acid. This can influence the availability and metabolism of, among other things, calcium, iron, zinc, folic acid and vitamin B<sub>12</sub>. A vitamin B<sub>12</sub> deficiency can be found in one quarter of elderly people.
  - Hormonal and muscular changes in the stomach cause an earlier feeling of satiety and a decreased appetite (anorexia of ageing).
  - Constipation is three to four times as common as in young adults. This is caused by factors such as chronic illness, immobility, decreased intake of fibre and fluid, neurological and psychiatric disorders, higher fluid losses through thinner skin, decreased sense of thirst and prolonged and extensive use of medication.
- **Chronic and acute illnesses**
- **Polypharmacy.** 39% of 65-74 year olds use more than one form of medication; in the group of elderly people over 75, this percentage is 51%. People can suffer from more side-effects due to impaired renal and liver function, changes in body composition and interaction between medication and nutrition. With age, the risk of memory problems increases, together with the risk of over- and
under-dosage of medication. If medication is ground due to difficulties chewing or swallowing, this can lead to severe and prolonged changes to the sense of taste.

**Nutritional care process**

This chapter is divided into the following parts.

- Screening
- Dietary requirements
- Nutritional intervention

**Screening**

When fat mass is relatively increased and body weight remains stable, malnutrition can easily be missed and screening is necessary. Standard screening tools for malnutrition such as the various versions of the SNAQ (Short Nutritional Assessment Questionnaire) and the MUST (Malnutrition Universal Screening Tool) can also be used to screen elderly oncology patients, since it is practical to use one single screening tool in a health care institution. However, the MUST has not been validated for use in patients over 65. Due to the group's heterogeneity and frailty, specific screening tools have been developed for use in elderly patients. The MNA (Mini Nutritional Assessment) is an extensive screening and diagnostic tool. The MNA-sf (MNA-short form) was deduced from the MNA and can be completed in several minutes. When screening using the MNA-sf indicates that further investigation is needed (≤ 11 points), the full MNA should be completed to diagnose the nutritional status using a scoring system. The MNA requires time and expertise but covers a broader range of points than other screening tools. Besides questions on anthropometry and nutritional intake, the MNA includes questions on the risk of malnutrition that are relevant in elderly patients such as mobility, level of functioning, neuropsychological and social problems and medication use. Furthermore, the MNA can also determine the effect of nutritional treatment. When screening indicates malnutrition, the degree of malnutrition should be established. To do so the decrease in muscle mass and muscle strength is important. In elderly patients the same methods can be used as in young adults such as mid-arm muscle circumference, DEXA-scanning and measurement of hand grip strength. See *Nutritional assessment*. The BMI should be interpreted differently in the elderly. Due to changes in body composition, higher cut-off values are used.

<table>
<thead>
<tr>
<th>BMI (kg/m²) in the elderly</th>
<th>Interpretation</th>
</tr>
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<tbody>
<tr>
<td>&lt; 20</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>20 to 22</td>
<td>Risk of malnutrition</td>
</tr>
<tr>
<td>22 to 28</td>
<td>Healthy weight</td>
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<tr>
<td>&gt; 28</td>
<td>Overweight</td>
</tr>
</tbody>
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In the case of spinal compression fractures or when height is difficult to measure, the length of the lower leg can be used to reliably calculate height (see [http://www.nutritionalassessment.english.azm.nl/](http://www.nutritionalassessment.english.azm.nl/)).

**Dietary requirements**

The required amount of energy, protein and other macro- and micronutrients is no different in elderly cancer patients than it is in young adults (see *Nutritional requirements*), with the exception of fluid and vitamin D.

- **Energy**
  The energy requirements for resting energy expenditure are best estimated using the [Harris-Benedict equation](http://www.nutritionalassessment.english.azm.nl/), since this equation corrects for advanced age. Additional factors such as metabolic stress due to illness, physical activity and desired weight gain or loss are used to calculate the total energy expenditure.
Protein
There are no specific recommendations for elderly patients. Research shows that although protein metabolism functions normally in the elderly, the synthesis of muscle protein is sensitive to an evenly distributed availability of protein. Physical activity is essential for muscle maintenance in the elderly. Studies have not shown definitive results on the protein requirements in sarcopenia, immobility and advanced age such as in frail elderly patients who have difficulty walking, are wheelchair-bound or bedridden. In cancer, a protein intake of 1.2-1.5 g/kg/day is necessary to maintain lean body mass. An elderly patient's individual requirements can differ and be reduced in the case of renal function impairment. A high protein intake of ≥ 1.5 g/kg/day can lead to additional kidney damage.

Vitamins and minerals
In adults, the recommended daily amount (RDA) is sufficient to meet daily requirements. In the case of an insufficient diet additional supplement use can be necessary. Extra attention should be paid to vitamin D. In supplement use there is a fine line between ‘optimal’, ‘too little’ and ‘too much’. A vitamin D level of at least 50 nmol/l (but preferably 65-75 nmol/l) helps prevent falls and fractures. In elderly patients over 70, the synthesis of vitamin D in the skin is insufficient, even if they go outdoors regularly. Without the use of vitamin D supplements or enriched products, the recommended level of vitamin D cannot be achieved through regular diet alone. For optimal maintenance of bone mass an adequate calcium intake is required (1.200 mg Ca/day). A vitamin B12 deficiency can be treated using intramuscular injections or oral supplements.

Fluid
Elderly patients have higher fluid requirements due to deteriorating renal function and increasing permeability of the skin. The minimum required amount is 1.700 ml of drinking fluids daily. Extra attention should be paid to the fluid intake in warmer temperatures. Fluid intake is often limited due to a decreased sense of thirst, the use of diuretics and incontinence or when bathroom visits are viewed as tiring.

Nutritional intervention
Nutritional intervention in elderly oncology patients is not a goal in itself but can support the medical treatment goal as determined by the doctor together with the elderly patient (or carers). In the case of curative therapy, nutritional intervention is aimed at improving or maintaining the nutritional status. With palliative supportive therapy, maintenance of the nutritional status or prevention of unnecessary deterioration of nutritional status can contribute to the quality of life. In the case of disease progression and a limited life expectancy, the nutritional status will inevitably deteriorate and nutrition can no longer have a positive influence on the nutritional status. During nutritional treatment, dilemmas and contradictory views on standard treatment policy can arise.

There may be age discrimination:

- By the patient, who sees his advanced age as a reason to not follow advice;
- By the health care professional, who feels that advanced age is sufficient reason in itself to make concessions in nutritional counselling.

Choosing to not perform certain nutritional interventions can be justified, however the risk of inadequate treatment increases when advanced age is used as the main decisive factor.

Treatment policy
Obtain information

- Involve next of kin or other carers in obtaining information.
- Determine the limitations in the functional domain. Consider limited muscle strength when opening packaging and limited mobility with the preparation of meals.
- Determine the limitations in the psychological domain. Consider apathy in depression that can present itself as an abnormal daily routine or the skipping of meals.
- Determine whether there are signs of resistance in the case of dementia. If necessary, adjust treatment policy in consultation with the treatment team and carers and record this in the patient's file.
Determine limitations in the social domain. Determine whether there are contacts and potential social support for assisting with groceries and household tasks. Determine potential financial limitations.

Determine limitations in the physical domain. Determine which physical changes, symptoms and other illnesses besides cancer affect the nutritional status.

Screen for malnutrition and the need for nutritional care. Be aware of an increased risk of malnutrition when adjusting the texture of food.

Determine the nutritional status and if possible the body composition.

Take a nutritional history focussed on meal pattern, habits, adjusted texture, sense of taste and smell, intake of nutrients, adjustments and practical solutions that the patient has already implemented.

Inquire after problems with chewing and swallowing and potential problems with teeth or dentures.

Inquire after the use of spout cups and straws due to the risk of aspiration.

Determine the average fluid intake. Inquire after the use of porridge, pudding, fruit compote etc. Frequently, elderly patients say they drink enough fluids but when determining the exact amount it proves to be insufficient.

Determine the use of medication that could affect dietary intake and lead to malabsorption. Inquire after taste problems following the use of ground medication.

Screen for malnutrition and the need for nutritional care. Be aware of an increased risk of malnutrition when adjusting the texture of food.

Determine the required amount of energy, protein, fluids and other nutrients.

Consider whether the standard nutritional treatment policy should be adjusted due to frailty. Beware of inadequate treatment solely due to age and discuss the option of breaking with protocol with the patient.

Consultation

Consult with the occupational therapist and the physiotherapist in the case of functional difficulties in order to limit deterioration and use the remaining functional capacity to full effect.

Consult with the treating physician and if necessary the geriatric physician on multimorbidity, medication and the possible treatment of symptoms.

Consult with the psychologist, psychiatrist or social worker on behavioural therapy and/or conduct advice.

Consult with the social worker on financial options, reducing social isolation and increasing supportive care. In the case of depression, ensure daily care to encourage the patient to eat and drink.

In the case of dementia consult with the carers and nurses on the decision to implement or refrain from nutritional interventions. Instruct the carers and nursing staff on:

♦ A low stimulus environment during meals;
♦ Specific points of attention when offering assistance with eating and drinking;
♦ The limited ability of the patient to follow instructions and the need for clear instructions;

Consult with carers and/or nurses on the spread and timing of meals to ensure that a patient is not too tired to eat, for example directly following being washed or another form of activity.

Consult with the dental hygienist and/or dentist in the case of problems with teeth or dentures.

Consult with the speech therapist on difficulty swallowing or communication problems such as aphasia or other speech problems.

Consult with the health care institution’s contacts on the atmosphere during meals, such as a laid table and a multi-course meal. Research has shown that improving the atmosphere during meals reduces the deterioration in quality of life, functional capacity, fine motor skills and body weight.

Ensure adequate transmural dietetic collaboration through planned and structured moments for the transfer of information and feedback.

Discuss

Ensure optimal communication. Remember to speak loudly and clearly in short sentences.

If necessary provide instruction material in a large print or material that is suited to communication difficulties.

Discuss the effect of diet on the nutritional status during cancer and treatment, so that the patient can make an informed decision.

Respect the autonomy of an elderly patient and respect their choice to refrain from treatment. In the case of cognitive disorders, pay attention to (non-) verbal signals that indicate the patient’s
Discuss whether the patient is independently able to cook, operate a microwave, make coffee and thee or get other drinks.

Discuss the options of a meal service when preparation of meals is difficult.

Discuss the importance of enough physical activity with the patient in order to maintain endurance level and functionality.

Encourage the patient to participate in social networks.

Involving carers in the instructions and advice given to elderly patients living independently, who have problems with self care and organizing daily meals. Discuss the practical implementations of dietary advice together. Take into account the potential overburdening of the carer.

If necessary, make the carer aware of the elderly patient's autonomy. Limit persistent encouragement.

Evaluate

- Determine whether the advised nutrition can be used and adjust the advice if necessary.
- Monitor the course of body weight, BMI and if possible body composition.
- Standardize weighing moments in the care institution: always with or without shoes, with or without clothing. Consider using a chair scale if standing is difficult for a patient.

Nutritional advice

Depending on the treatment goal one can choose from:

- **Adequate diet, protein and/or energy enriched diet, palliative nutritional support.**
- Limit (high) protein intake in renal function impairment.
- Supplement vitamins and minerals in the case of dietary deficiencies.
- Supplement vitamin D according to the recommendations by the Health Council of the Netherlands:
  - 10 mg/day for women over the age of 50 or men over the age of 70 who are regularly exposed to sunlight during the summer.
  - 20 mg/day for people with osteoporosis, elderly people in a care or nursing home who do not spend enough time outdoors, women over the age of 50 or men over the age of 70 with dark skin and women over the age of 50 who wear a veil.
- In the case of a vitamin $B_{12}$-deficiency, intramuscular injections or oral supplements (when there is no malabsorption such as with atrophic gastritis) of 600-1,000 mg/day for two to four months appear to be sufficient.
- Drink at least 1,700 ml of fluid daily.
- In the case of limited mobility, place enough food and at least two drinks within reach.
- An even distribution of (basic) nutrition throughout the day, due to rapid satiety in the elderly and maximum use of protein in sarcopenia or the prevention of sarcopenia.
- Tasty meals with sufficient variation.
- Use and if necessary adjust dentures. With ill-fitting dentures their use can be advised against.
- Pureed meals and thickened drinks in the case of difficulties chewing or swallowing.
- Good posture, preferably sitting upright when eating.
- Adjusted cutlery if necessary.
- For slow eaters use a heated plate, serve the meal in two portions or reheat in the microwave.
- Suggest cheaper alternatives in the case of limited financial capacity.
- For symptoms see: Symptoms and advice.
Comorbidity

This chapter is divided into the following parts.

- Comorbidity
- Cardiovascular disease
- Diabetes

Comorbidity

Comorbidity or multimorbidity indicates that the patient has one or more chronic diseases besides cancer. In oncology the term comorbidity is common, even in the case of multiple additional chronic diseases (multimorbidity). An increasing amount of patients already has one or more chronic illnesses at the moment of cancer diagnosis. An additional disease is sometimes discovered during the diagnostics for cancer. A chronic illness can also occur during the treatment or rehabilitation and aftercare period. Of the newly diagnosed cancer patients between 50-64 years old, 48% already have one chronic disease; in patients aged 80 or above this number is 80%. An increasing amount of patients even has two or more chronic diseases at the time of cancer diagnosis: 17% in the age group 50-64, up to 45% in the age group of 80 or older. Cardiovascular disease, hypertension, COPD and diabetes are the most common additional illnesses.

Patients with cancer and comorbidity receive a poorer standard of treatment, both for their cancer and their additional disease. This results in a poorer prognosis for cancer patients with comorbidity than for cancer patients without an additional disease. Furthermore, the disease that was already present when the cancer was diagnosed tends to worsen. This is partly inevitable since both diseases have a negative influence on each other. However, progress can be made by paying attention to both illnesses and treating both diseases adequately. In the nutritional treatment of oncology patients with cardiovascular disease or diabetes there can be conflicting dietary advice or focus points. This is hardly ever the case with COPD and hypertension.

Cardiovascular disease

This chapter is divided into the following parts.

- Background and treatment
- Nutritional status
- Clinical nutrition

Background and treatment

Background

Together with cancer, cardiovascular disease is the most common cause of death in the Netherlands. Both cancer and cardiovascular disease cover a diverse group of illnesses. Many cardiovascular diseases are due to atherosclerosis. Atherosclerosis is a complicated and slowly evolving process in which lipid-like substances are deposited between the various layers of the artery wall. This can lead to arteries becoming constricted or obstructed. Almost all cardiovascular disease can eventually lead to congestive heart failure: insufficient pumping action by the heart. Little is known on the interaction between cardiovascular disease and cancer. Studies show that total cholesterol levels are usually decreased when cancer is established. This is most likely due to the increased cholesterol requirements due to the proliferation of tumour cells. Frequently, the triglyceride level increases slightly at first. This could be due to the metabolic dysregulation in cancer which increases lipolysis, but could also be due to impaired reabsorption of lipids in tissue, leading to elevated serum triglyceride levels. The lipid profile in cancer patients is characterized by low total cholesterol, low
HDL-cholesterol and low LDL-cholesterol. These levels appear to decline further with disease progression and cachexia in which the BMI, serum albumin level and the (initially increased) serum triglyceride level decrease. This can be compared to the acute phase reaction in many acute and chronic illnesses which is caused by the release of pro-inflammatory cytokines.

Treatment
The nutritional treatment of atherosclerosis normally consists of a (saturated) fat-restricted diet which can be combined with an energy-restricted diet, causing the cholesterol level and - in the case of overweight - the body weight to decline. In heart failure, a low sodium diet and in the case of severe heart failure a fluid-restricted diet is indicated.

With curative treatment or treatment aimed at significantly prolonging life expectancy, both diseases should be taken into account. The current nutritional status is given priority for the duration of the anti-tumour treatment. Previously given advice on the prevention of cardiovascular disease in the long term, such as restriction of energy and saturated fat intake, is temporarily adjusted and given less priority. An exception is the low sodium diet in heart failure since stopping or easing this diet could directly lead to negative effects. A peak load in sodium intake can especially lead to congestive heart failure symptoms such as dyspnoea, fatigue and oedema (ankles, liver, lungs) for which hospital admission can be required.

Following curative treatment or in the case of expected long term survival, oncological rehabilitation and aftercare are necessary to ensure optimal recovery and health. The optimization of blood pressure and lipid profile, body weight, body composition and waist circumference (in overweight) are important factors in the prevention of cardiovascular disease. Especially in patients with an additional illness, diet and lifestyle advice focused on exercise and physical activity are of great importance in order to improve health and reduce the risk of tumour recurrence or a second tumour. In the case of a limited life expectancy, the emphasis should be on comfort and the prevention of symptoms. The preventive aspects of diet in cardiovascular disease are no longer relevant and the nutritional policy is based on palliative supportive care. In heart failure, a peak load in sodium intake can directly cause complaints or fluid retention, which affect wellbeing. If necessary a doctor or heart failure nurse can adjust the dose of diuretics.

Nutritional status
An oncology patient with cardiovascular disease can have a good, moderate or poor nutritional status. In the case of a moderate or poor nutritional status, interventions aimed at potential improvement of nutritional status have priority. Besides malnutrition with unwanted weight loss there can also be an unfavourable body composition with a high fat mass and overweight. Overweight can hide poor nutritional status, delaying its detection. The patient usually does not see unwanted weight loss as a problem, especially when weight loss had been previously advised due to cardiac disease.

Intervention goals
- In the case of a moderate or poor nutritional status: improve nutritional status if possible.
- In the case of a good nutritional status: maintain nutritional status and maintain a healthy lifestyle when treatment is intended to be curative.
- In the case of overweight and in treatments that can increase overweight:
  - Stable weight or prevention of an increase in overweight during treatment;
  - Weight reduction and improvement of body composition during non-taxing treatment.
- Combine potentially contradictory advice into an unambiguous dietary advice.

Treatment policy
- Inquire after the patient's medical history.
- Determine priorities in the treatment goals depending on nutritional status, prognosis and medical treatment.
- Determine which cardiovascular medication the patient uses.
- Assess the patient's lipid profile and re-evaluate the need for a fat-restricted diet following a decline in triglycerides and cholesterol. If necessary determine cholesterol levels so that they can be monitored.
- Inquire after which dietary advice the patient has received in the past and which advice he still uses.
- Take a nutritional history focused on:
  - Energy and nutrient intake;
  - Amount and types of fat;
Nutritional advice

- Depending on nutritional status:
  - adequate diet in the case of a good nutritional status;
  - protein-energy enriched diet in the case of a moderate of poor nutritional status;
  - protein enriched nutrition and if necessary an energy-restricted diet in the case of an unfavourable body composition.
- In the case of symptoms see: Symptoms and advice.
- If the lipid profile is abnormal:
  - Where possible substitute unsaturated fat for saturated fat. The main sources of saturated fat in a protein-energy enriched diet are: whole milk products, meat, snacks. Substitutes include: (oily) fish, nuts or other products high in unsaturated fat;
  - Prepare food using unsaturated fat;
  - Eat fish at least twice a week, preferably oily fish.
- In congestive heart failure:
  - Maximum amount of 2,000 mg of sodium (=5 grams of salt) daily when using diuretics. Ensure that energy and protein requirements are covered;
  - Avoid peak sodium load due to extremely sodium-rich products such as crisps, soup, pasties.

Clinical nutrition

Both oral nutritional supplements and enteral formula have a healthy fatty acid composition and are low in sodium. When a fluid- or sodium restriction is necessary, concentrated enteral formula (2 kcal/ml, mineral-restricted) can be an option. See also Clinical nutrition.

Diabetes

This chapter is divided into the following parts.

- Background and treatment
- Nutritional status
- Corticosteroids
- Clinical nutrition
- Nausea and vomiting
- Hyperglycaemia following surgery
Background and treatment

Background
One in ten cancer patients either has or develops diabetes and this is expected to increase to one in five. Diabetes is an abnormal carbohydrate metabolism with an elevated blood glucose level and the excretion of glucose in urine caused by insufficient production and action of insulin. The survival rate of patients with cancer and diabetes is worse than that of cancer patients without diabetes. It is unclear whether cancer patients with diabetes receive different or inadequate treatment for their cancer. Poor glucose regulation has been shown to increase the risk of infection, morbidity and mortality. The diagnosis of cancer can influence the treatment of diabetes: cancer is seen as more life-threatening so that the treatment of diabetes (regulation of blood glucose levels, blood pressure and fat metabolism) appears temporarily less important. The combination of diabetes and cancer can lead to both elevated and decreased serum glucose levels.

Treatment
The (dietary) treatment of diabetes consists of a specific diet and/or the use of oral hypoglycaemic medication and/or insulin therapy.

When cancer treatment is intended to be curative or ensure long term survival, optimal treatment of diabetes remains important in order to prevent complications in the long term. Exercise and physical activity can contribute to a better nutritional status, a more favourable body composition and improved blood glucose levels.

Following curative treatment or in the case of expected long term survival, oncological rehabilitation and aftercare are necessary to ensure optimal recovery and health. Besides optimization of blood glucose levels, optimization of blood pressure, lipid profile, body weight, body composition and waist circumference (in overweight) are important for the prevention of cardiovascular disease or the delaying of diabetes related complications. Especially in patients with an additional illness, dietary and lifestyle advice focused on exercise and physical activity is important for the improvement of health and the reduction of the risk of tumour recurrence and a second tumour.

With a limited life expectancy the prevention of symptoms and short-term complications has priority over the preventive aspects of the diabetic diet (for example to reduce the risk of cardiovascular complications). In diabetes, both hyperglycaemia and hypoglycaemia can reduce a patient's wellbeing. If this is the case, one should try to prevent this. High blood glucose levels without symptoms can be accepted. For the patient this can give rise to many questions. It is the task of the dietician and other health care professionals to discuss these questions with the patient and explain that the cancer progression has changed the goals of the nutritional treatment.

Adjustment of diabetes medication by the dietician
In some situations the dietician is allowed to adjust the diabetes medication. Adjusting insulin and/or other diabetes medication is a patient-related high risk activity necessitating a special arrangement. In the Netherlands this arrangement is based on the 'reserved procedures' rules in the Individual Health care Professions Act. In this case it concerns a patient-related high risk activity in the medical domain. Through an individual declaration of competence which includes a protocol or arrangements, the dietician can become qualified to adjust diabetes medication.

If there is no individual declaration of competence, or if the situation differs from the arrangements agreed upon in the declaration, the dietician must consult a doctor on adjustment of medication.

Nutritional status
An oncology patient with diabetes can have a good, moderate or poor nutritional status. A patient can have an unfavourable body composition with a higher fat mass and overweight. In patients with type 2 diabetes and overweight, poor nutritional status can be hidden by the overweight, delaying the detection of malnutrition. The patient does not see the unintended weight loss as a problem but rather as a benefit, especially when weight reduction has been advised in the past. Weight loss in overweight patients can improve regulation of the diabetes and can even lead to the decrease or cessation of diabetes medication. Besides deterioration of nutritional status due to cancer, poor glucose regulation can lead to a further deterioration of the nutritional status due to hyperglycaemia and glycosuria in which glucose, and with it energy, is lost with the urine. For a patient, the advice given with a poor nutritional status can be the complete opposite of previous dietary advice, such as a healthy diet with diabetes and/or an energy restriction.
Intervention goals: (in a curative treatment setting or with expected long term survival)

- Improve, maintain and prevent unnecessary deterioration of the nutritional status.
- Optimize blood glucose levels (fasting blood glucose levels between 4.0 and 6.1 mmol/l, postprandial glucose levels between 4.0 and 9.0 mmol/l).
- Prevent hyper- and hypoglycaemia.
- Delaying of diabetes related complications.
- Prevention of excretion of glucose with the urine through adequate regulation of blood glucose levels.
- In the case of overweight and with treatments that can increase overweight:
  - Stable weight or the prevention of an increase in overweight during treatment;
  - Weight reduction and improvement of body composition during non-taxing treatment.
- Combine potentially contradictory advice into an unambiguous dietary advice.

Treatment policy (in the case of poor nutritional status)

- Determine and monitor the nutritional status and need for dietary care.
- Determine and monitor blood glucose regulation.
- Inquire after diabetes related symptoms such as hypo- and hyperglycaemia.
- Take a nutritional history focused on energy and protein intake and the distribution of carbohydrates.
- Determine the required amounts of energy, protein, fluids and other nutrients.
- Discuss potentially contradictory advice in the diabetes diet and the nutritional advice for a poor nutritional status.
- Discuss the potential consequences of a diet on blood glucose regulation.
- Discuss additional monitoring of blood glucose levels through for example self-monitoring or consult the general practitioner, treating physician or diabetes nurse on measuring the blood glucose levels.
- Adjust the diabetes medication if necessary.
- Determine whether the advised nutrition can be used and adjust the advice if necessary.

Nutritional advice

- **Protein-energy enriched nutrition** in the case of a moderate or poor nutritional status.
- In the case of symptoms see: Symptoms and advice

N.B. When nutritional status is adequate an existing diabetes diet can be continued or a diabetes diet can be initiated. In the Dutch Diabetes Federation's nutritional guidelines a normal amount of protein is advised due to the risk of nephropathy. The long term effects and safety of an increased protein intake and the development of diabetic nephropathy have been insufficiently studied, however the Dutch Diabetes Federation's guidelines assume that there is a possible connection.

In the case of a taxing treatment the recommendations for protein intake should be followed during the period of treatment and recovery. After this the regular diabetes diet should be continued. In the case of a good nutritional status and a non-taxing treatment there is no indication for the use of additional protein in diabetics.

Corticosteroids

Corticosteroids are used in chemotherapy, brain tumours, cranial radiotherapy, rejection reactions following allogeneic stem cell transplants and palliative care. Blood glucose levels can increase due to the use of corticosteroids and lead to the development of diabetes. In patients with diabetes, corticosteroids can lead to deregulation of the diabetes. In both these situations, nutritional intervention can do little to improve this. Adjustment of the diabetes medication should be considered.

Studies have shown an increased risk of osteoporosis in prolonged use of corticosteroids. The Dutch CBO Osteoporosis and Fracture prevention Guidelines 2011 recommend the use of specific nutritional interventions such as ample calcium intake and supplementation of vitamin D in order to prevent osteoporosis when using corticosteroids for over three months. This is rarely the case in cancer. In graft-versus-host disease following an allogeneic stem cell transplant it can be necessary to use corticosteroids for prolonged periods of time.
Clinical nutrition

The use of oral nutritional supplements or tube feeding can affect blood glucose regulation. Patients can object to the use of oral high-calorie/protein supplements due to these elevated blood glucose levels, or due to the fear of having to switch from oral medication to insulin injection.

In type 1 diabetes there is a direct link between the amount of carbohydrates and required insulin amount. Adjusting the dose and/or the time of insulin administration will usually be necessary when using oral nutritional supplements. In type 2 diabetes the link between the amount of carbohydrates and insulin is less clear. This is due to the fact that there is still some degree of endogenous insulin production. Insulin resistance also plays an important role. The amount of carbohydrates in different brands and types of oral and tube feeds varies; the dietician can take this into account.

There are specific oral and tube feeds available for diabetics. Usually, these feeds contain fewer carbohydrates, less mono- and disaccharides and have a different fat composition. There is insufficient evidence on the added benefit of this special diabetes nutrition.

Intervention goals

- Improving or maintaining nutritional status or preventing unnecessary deterioration of nutritional status.
- Optimization of blood glucose levels.
- Prevention of hyper- and hypoglycaemia.
- Delaying of complications related to diabetes.
- Combine potentially contradictory advice into an unambiguous dietary advice.

Treatment policy

- Assess the nutritional status and the need for nutritional care.
- Determine and monitor blood glucose regulation and adjust diabetes medication if necessary.
- Inquire after diabetes related symptoms such as hypo- and hyperglycaemia.
- Take a nutritional history.
- Monitor the nutritional status and the intake of nutrition and fluid.
- Discuss the potential effects of clinical nutrition on blood glucose regulation.
- Discuss additional monitoring of blood glucose levels through for example self-monitoring or consult the general practitioner, treating physician or diabetes nurse on measuring the blood glucose levels.
- Determine whether the advised nutrition can be used and adjust the advice if necessary.

Nutritional advice

Oral nutritional supplements.

Blood glucose levels can become elevated due to the intake of extra carbohydrates (between meals). It can be possible to limit the increase in blood glucose levels through dietary adjustments (limit or spread carbohydrate intake). Sometimes, changes in medication can be necessary. There is no standard solution to these problems, therefore it is important find an individual solution together with the patient such as:

- Spread the use of oral feeds throughout the day;
- Choose oral feeds with less carbohydrates;
- Adjust diabetes medication;
- Administer an additional dose of (ultra-)short-acting insulin with the oral nutritional supplement;
- Use oral feeds during meals and increase the (ultra-)short-acting insulin dose to avoid an additional injection.

Tube feeding.

The administration of tube feeding mainly requires adjustments to the insulin schedule in patients with type 1 diabetes. (Self-)monitoring and medication adjustments are important:

- With continuous tube feeding, the use of long-acting insulin once to twice daily can be enough. If necessary, blood glucose levels can be corrected using (ultra-)short-acting insulin;
- Overnight tube feeding requires additional medication during the night;
With bolus administration of tube feeding, (ultra-)short-acting insulin can be adapted to the amount of carbohydrates per bolus.

**Nausea and vomiting**

Hypoglycaemia is seen in patients treated with insulin and/or sulphonylurea derivatives and/or meglitinides. Hypoglycaemia can develop due to nausea and vomiting and eating too little, too late or too few carbohydrates without adjusting medication.

**Intervention goal**

- To not worsen nausea and vomiting through diet; to prevent or treat hypoglycaemia.

**Treatment policy**

- Determine (the risk of) the development of hypoglycaemia.
- Adjust diabetes medication if necessary.
- For specific advice on nausea and vomiting see: Nausea and vomiting.

**Nutritional advice**

- A carbohydrate-rich diet, in liquid form (lemonade) if necessary.
- Adequate treatment of hypoglycaemia:
  ♦ 15-20 grams of carbohydrates, preferably glucose. Recommend the use of fat-free products since fat can delay the absorption of glucose;
  ♦ Check the blood glucose level after 15-20 minutes. If it is still too low another 15 to 20 grams of glucose is needed. The glycaemic response of glucose is short, usually two hours at most.
  ♦ If the next meal is scheduled for over two hours after the resolution of hypoglycaemia, advise the use of extra carbohydrates (15 grams) in the form of a snack;
  ♦ The amount of 15-20 grams of carbohydrates is a general recommendation. The exact increase in blood glucose levels with a specific amount of carbohydrates differs for each individual and can be tested by practical experience. When using sulphonylurea derivatives, hypoglycaemia can be prolonged. In that case, a larger, individually determined amount of glucose can be necessary.
  ♦ Hospital admission is required for severe deregulation of blood glucose levels.

**Hyperglycaemia following surgery**

Following a surgical intervention for cancer, insulin resistance and hyperglycaemia can occur postoperatively in both diabetics and patients who had not been previously diagnosed with impaired glycaemic control. It has been shown that intensive regulation of blood glucose levels results in less morbidity and mortality. However, this is based on medical treatment, not dietary treatment. In general patients either receive intensive insulin therapy with regular monitoring of blood glucose or an Actrapid®-pump with regular monitoring.
Aftercare

This chapter is divided into the following parts.

- Aftercare
  - Malnutrition
  - Overweight
  - Health promotion
- Cancer rehabilitation
- Diet and exercise

Aftercare

Due to earlier diagnosis and treatment improvements, the survival rate of various types of cancer is expected to significantly improve over the coming years. The amount of cancer survivors is expected to increase from 370,000 in 2000 to 700,000 in 2015. The Health Council of the Netherlands concludes in its report *Follow-up in oncology* that many patients still suffer from symptoms following curative treatment for their cancer. Cancer survivors often have a worse level of general health and reduced functional capacity compared to before their illness. The primary goal of aftercare is to limit the disease burden by improving quality of life, extending the disease-free period and improving survival. This process is also referred to as follow-up. Aftercare includes guidance and treatment of symptoms that are early or late effects of the disease and its treatment.

*Early effects* are the symptoms that the patient experiences directly or in the first year after treatment. Foreseeable nutrition-related effects that are clearly linked to a specific form of cancer and treatment include difficulties with chewing and swallowing, changes in taste, colostomy and permanent diarrhoea. These symptoms can range from mild to severe. Early effects that are less easy to predict include changes in body weight and/or composition. Furthermore, symptoms such as fatigue, pain, distress, the fear of disease recurrence, low self-esteem due to an altered body image and negative feelings potentially leading to depression frequently occur.

*Late effects* are symptoms that are not yet present, or at least not yet troublesome, at the end of treatment. Prolonged and late nutrition-related effects of treatment include severe fatigue, unintended weight loss and unintended weight gain.

Cancer often has permanent consequences for a patient's job and private life. Cancer is being increasingly viewed as a disease with chronic long term effects. Support and adequate treatment of foreseeable effects can limit disease burden and duration. Good aftercare is anticipation. Good aftercare usually commences during treatment or just after diagnosis. Following the completion of treatment, it is important to provide information on the possibility of late effects and where the patient can find support or treatment for these effects. Information on support groups, recommendation of reliable websites and phone contacts can contribute to the patient's independence when seeking out a new balance.

The *Distress Thermometer* is a validated screening tool used to determine the degree of distress in *(former) cancer patients. The patient completes the Distress Thermometer himself. The patient can indicate the degree of burden experienced on a list of five problem areas: the practical, social, emotional, spiritual and physical domain. Finally, the patient can indicate whether he would like to speak to a professional about his problems. A score of 5 or higher indicates complex problems necessitating discussion in a multidisciplinary team including the responsible physicians and specialized paramedical and psychosocial health care professionals. The Distress Thermometer includes a number of nutrition related subjects such as eating, constipation, diarrhoea, nausea, oral mucosa and changes in taste and weight. The Distress Thermometer is not a screening tool for nutritional status or a replacement for an extensive nutritional history, but can signal the degree of distress that the patient experiences. This valuable information can be used to form individually tailored nutritional guidance.

See also *Guideline Cancer Rehabilitation 2011*
See also *Guideline Screening for Psychosocial Distress 2010*
Malnutrition

Unintended weight loss is seen in over half of all cancer patients during illness and treatment. Even when a nutritional intervention is implemented timely and adequately, recovery of poor nutritional status is not always possible during the treatment period. When the tumour is still present, metabolic dysregulation remains active and the breakdown of muscle and fat tissue continues. During treatment, maintenance of nutritional status and prevention of further deterioration is often the maximum that can be achieved. Improvement of nutritional status is frequently only achieved after successful remission or tumour removal. A final goal or target body weight for the use of energy enriched nutrition can be determined together with the patient. Agreements can be made on whether or not to continue food fortification, oral nutritional supplements and tube feeding. Permanent damage and loss of function of the gastrointestinal system also plays a role in these decisions. Besides the physical aspects of unintended weight loss, the patient's desire and ability to cope with the consequences of cancer and treatment should also be discussed.

For treatment policy and advice see: Weight loss and Fatigue and Muscle weakness.

Overweight

There are indications that out of the patients who have had breast or prostate cancer, approximately 70% is overweight or obese. Overweight is also seen following treatment of colorectal cancer. Overweight is one of the risk factors that contributes to the development of cancer, but also appears to be a negative factor after completion of treatment. Overweight is associated with a higher chance of tumour recurrence or a second tumour. People with overweight have a higher risk of complications and comorbidity such as diabetes and also report a decrease in quality of life.

Overweight following cancer is mainly sarcopenic obesity. The cause of sarcopenic obesity in ‘ex’-cancer patients remains unclear. It is not only due to a higher intake of energy and nutrients but also to decreased physical activity and lifestyle factors. It appears that other - difficult to influence- factors are also important such as chemotherapy, medication and sex-specific hormonal factors such as menopause.

Exercise can improve muscle mass and strength leading to a more favourable body composition, however at first there is little or no weight loss. Besides the physical aspects of unintended overweight, attention should also be paid to its consequences and the patient's desire and ability to cope with them. See: Weight gain/Overweight.

Health promotion

Diet, lifestyle and body weight are factors that can influence the development of cancer. See Prevention. There are strong indications that the same factors that influence the development of a primary tumour can influence tumour recurrence or the development of a second tumour in ex-cancer patients. In 2011 the Guide for nutrition and lifestyle after cancer was published by the World Cancer Research Fund based on the scientific report on cancer prevention.

Recommendations for diet and lifestyle following cancer

- Be as lean as possible within the normal range of body weight.
- Be physically active as part of everyday life.
- Limit consumption of energy-dense foods. Avoid sugary drinks.
- Eat mostly foods of plant origin.
- Limit intake of red meat and avoid processed meat.
- Limit alcoholic drinks.
- Limit consumption of salt.
- Aim to meet nutritional needs through diet alone.

Continuing research will most likely provide further scientific evidence but for now these recommendations are the best there is to offer.

Every treated patient should have:

- Information on the early and late nutritional effects of disease and treatment and the possible consequences for nutritional status;
- Referral options in the case of early and late symptoms;
• Information on aftercare facilities, including at a future point in time;
• Lifestyle advice on physical activity, healthy diet, alcohol use and quitting smoking.

Cancer rehabilitation

Cancer rehabilitation incorporates: the active tailored care for cancer patients and ex-cancer patients aimed at obtaining an optimal quality of life with no or as few as possible symptoms and effects of the disease or its treatment. Cancer rehabilitation includes: physical training, psychosocial support and education, nutritional and dietary advice, coaching on energy distribution in fatigue and reintegration in the work place. Cancer rehabilitation is important throughout the course of the disease and afterwards. Positive effects can also be achieved in the chronic or palliative phase when a cure is no longer possible. Special programs have been developed to learn to cope with the disease and improve physical condition. Physical exercise and intensive training are an important aspect of cancer rehabilitation. A combination of strength and endurance training contributes to the building of muscle and the recovery of function and endurance level. Strength and resistance training to improve muscle strength (weights, push-ups, sit-ups); endurance or aerobic training to improve physical condition and endurance level (cycling, walking or running, swimming, steps, dancing). Besides Recovery & Balance (Herstel & Balans), gyms, rehabilitation centres, physiotherapy practices and other institutions offer training and support.

See: Guideline Cancer Rehabilitation 2011.

Diet and exercise

Exercise and a healthy diet are essential for optimal recovery. Muscle maintenance and muscle building are not possible when the intake of energy, protein and other nutrients is insufficient. An adequate intake is required in order to reach an optimal effect of cancer rehabilitation. Physical activity and exercise ensure that nutrients are used more effectively to sustain and build muscle. Physical activity and exercise lead to more muscle mass and muscle strength being generated from nutrition containing sufficient protein and energy than is generated without physical activity and exercise. Without physical activity and exercise, additional nutrition is mainly converted into extra fat mass.

There is little research available on interventions aimed at improving body composition and weight management in cancer rehabilitation. Studies on the effect of exercise after cancer mostly looked at reduction of fatigue and improvement of quality of life but rarely at the maintenance or achievement of a healthy weight and body composition. The influence of nutritional interventions has mainly been studied in ex-breast cancer patients. The majority of studies looked at interventions aimed at weight loss and provided no information on body composition. Interventions that prevent or treat sarcopenic obesity have mainly been studied in groups, such as elderly people without cancer. More research is needed to reliably determine which nutritional advice is most suited to improving endurance levels and preventing unintended weight gain, sarcopenia and sarcopenic obesity following cancer. Studies have shown that exercise alone is not enough to achieve a favourable body composition and a target weight in sarcopenic obesity. Energy-restricted diets have a positive effect on body weight but their effect on body composition is less clear.

Nutritional requirements

The main starting point is a normal energy and nutrient requirement (see Nutritional requirements). It remains unclear how much protein, energy and nutrients are needed in a cancer rehabilitation program since there is insufficient high quality research on the subject. At the moment it appears to be safe and effective to follow the recommendations for exercise programs in ‘healthy’ people. After completing a curative cancer treatment, the tumour is not expected to further influence metabolism and nutritional requirements. A decrease in muscle mass that can be disguised by a high or increased fat mass should be taken into account. The nutritional requirements during exercise depend on body weight, body composition, the type (strength, endurance or team sports), intensity, length and frequency of training and can differ for each cancer rehabilitation program and each patient.

• Energy requirements can be estimated using the physical activity level (PAL), in which the resting energy expenditure is multiplied by the so-called PAL-factor for activity. An overview of energy expenditure for various types of sport can be found in Nutrition and Sport, a manual for trainers,
coaches and athletes (Voeding en Sport, een handboek voor trainers, begeleiders en (top)sporters) by Van Geel and Hermans.

- Protein requirements can be increased to up to 1.5 grams of protein/kg of body weight, for example during intensive weights training or in the case of decreased muscle mass. Whether protein intake should be increased depends on the patient's current dietary protein intake. The diet in the Netherlands is usually relatively high in protein. There are indications that in weight or strength training, the use of 10 grams of protein shortly before and after exercise promotes the building of muscle. Furthermore, there are indications that spreading a high protein intake over all daily meals stimulates muscle growth more effectively than a peak amount of protein during one single meal, especially in elderly patients where aging is a factor in the loss of muscle mass and strength.
- In order to utilize protein to its full effect, nutrition should contain sufficient energy and nutrients. A strict calorie-restricted diet should therefore be advised against, even when weight loss is required. A slight to moderate energy restriction up to 500 kcal under the calculated requirements can be used under professional supervision.

Nutritional recommendations and advice
At the start of cancer rehabilitation it can be useful to provide general nutritional advice on the combination of diet, physical activity and exercise and if necessary tailored nutritional advice on individual needs. A number of (ex-)cancer patients have difficulty achieving an adequate intake. This is mostly due to symptoms resulting from treatment such as poor appetite, difficulty chewing or swallowing or gastro-intestinal disorders. Furthermore there are patients with a stable body weight who do not appear to have a decreased nutritional status who have sarcopenia: decreased muscle mass and muscle power with a stable or increased fat mass. Finally there are patients whose weight and mainly fat mass increase unintentionally and sometimes dramatically: sarcopenic obesity.

Recommendations
(Ex-) cancer patients should be selected at the start of cancer rehabilitation based on:

- Changes in body weight;
- Loss of muscle mass and low lean body mass;
- Nutritional problems;
- Questions regarding nutrition.

Referral to a dietician for individually tailored advice should take place in the case of:

- Unintended weight loss of 3-6 kg or 5% in one month or 10% in six months;
- Unintended weight gain of 3 kg or ≥ 5%, an steadily increasing BMI of ≥ 27;
- Low muscle mass, increased waist circumference;
- Nutritional symptoms that restrict dietary intake;
- Questions regarding nutrition.
Palliative care

This chapter is divided into the following parts.

- Palliative care
- Nutrition

Palliative care

Each year over 40,000 people die of cancer in the Netherlands. The care for these patients in the final phase of life is called palliative care. The World Health Organization (WHO) provided a definition for palliative care in 2002:

"Palliative care is an approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual." For more information see: Guidelines for palliative care.

Aspects of palliative care include: quality of life, management of symptoms, a proactive approach to symptoms, patient autonomy, focus on psychosocial, emotional and spiritual aspects and care for the patient's family and carers. Nutritional care is one of the focus point within these aspects.

Quality of life

Quality of life is the functioning of people in physical, psychological and social sense and the way patients experience this. Objective aspects involve actual limitations and subjective aspects involve a person's views on these limitations. The patient and his family are forced to continuously adapt their values and their views on quality of life to the changing situation. Besides professional knowledge, palliative care requires the correct attitude by the health care professional toward the patient and his family. Besides the physical aspects, attention should be paid to coping with the disease, disease perception and its meaning. Health care professionals should monitor the ratio of disease and treatment burden versus coping by the patient and his family. With each step in the disease process, options are lost. Therefore, the patient continuously receives bad news.

This is no different in nutritional care. An good nutritional status contributes to the quality of life and the length of survival. A well-nourished patient is undoubtedly more able to organize or undertake things in the final phase of life, is socially more capable and is less dependent. In order to achieve this, an invasive nutritional intervention such as tube feeding or parenteral nutrition can be used. When a well-informed patient views the treatment as more taxing than the deterioration in nutritional status it can be better to refrain from these interventions.

Symptom management

"A symptom is a symptom when the patient says it is a symptom and it is as bad as the patient says it is". Nutrition related symptoms.

Out of all patients in the palliative phase, 70% has four or more symptoms. Symptoms enhance each other and result in new symptoms. Treatment of one symptom can cause the next symptom. Therefore palliative care is highly complex. Pain can cause decreased appetite. Pain management can cause constipation, which also has a negative effect on appetite.

Symptom management requires an interdisciplinary approach. An interdisciplinary approach involves a number of professionals from different backgrounds consulting each other and reaching an agreement by contributing to each other's views whilst respecting the opinion and professionalism of the other fields present. A comprehensive, uniform and consistent form of communication provides patients and their families with a sense of security.

Symptom management starts with taking an extensive history of the content and severity of the symptoms, possible causes, the burden the patient experiences and his views on possible advice and measures. A numerical rating scale (NRS) can be used to quantify the intensity of a symptom: a scale of 0 (not bothered by symptom) to 10 (worst intensity of symptom imaginable). A score of 4-5 or above necessitates treatment of the symptom in order to improve the patient's quality of life. A visual analogue scale (VAS) is very similar, except that it is not based on points but rather on a straight line with two opposite statements on either end. For nutritional interventions see: Symptoms and advice.
Proactive, anticipatory treatment
Good care often involves anticipation. Certain symptoms can be predicted to a certain degree with specific types of tumours. Frequently, preventive and proactive actions can be undertaken by prescribing medication, for example when nausea and vomiting or constipation are expected. In the case of a reasonable life expectancy (at least 1-2 months), dietary and exercise advice can be relevant in order to prevent unnecessary deterioration of nutritional status, provided that the patient is willing and able to follow this advice. Maintaining physical condition and nutritional status is easier and more effective than restoring poor physical condition and nutritional status following a period of inactivity.

Patient autonomy
Autonomy can be described as the right to self-determination. This is a general right in health care but it is given a specific meaning in the final phase of life. The patient makes his own decisions, preferably after having been extensively informed on the available options, and chooses how he wishes to cope with his abilities and limitations, including those related to nutrition.

Focus on psychosocial, emotional and spiritual aspects
A symptom can be approached in several equally important ways. Take for example a patient with cachexia (severe weight loss and loss of muscle mass). This leads to weight loss and weakness (physical aspect). Physical changes that are visible to everyone and can cause shame (psychological aspect). Due to weakness the patient limits his activities and his social contacts are reduced. Furthermore, he no longer enjoys eating and dislikes eating with company (social aspect). Thoughts on being insufficiently able to eat, resulting in loss of strength lead to fear and the realization of the impending end of life (spiritual aspect). An approach that is purely nutritional - how much energy and protein is required and how to adequately provide this? - insufficiently cover the patient's total need for care.

Care for the family
By assisting with nutrition, the family can fulfil their desire to contribute and support the patient. This is pleasant and often necessary for an optimal nutritional status. Especially the secluded, elderly, ill patient is frequently not able to provide meals and snacks for himself. At the same time, nutritional care by the family can also lead to severe stress and feelings of frustration when the patient deteriorates despite their best efforts or when the patient does not eat the food he had previously specifically requested.

Focus on the family, understanding of their desire to care for the patient and if possible practical advice can reduce the pressure and stress related to food. Discussing the changing role of nutrition with the patient and his family can be helpful. Explaining that the lack of appetite is due to the disease and not the patient's intentions or the family's efforts can reduce feelings of guilt.
Furthermore, the diet of the family members themselves can become a point of attention if it is affected by the intensive level of care they provide.

Nutrition
This chapter is divided into the following parts.

- Weight loss and anorexia
- Clinical nutrition
- Intestinal obstruction and ileus
- Ascites
- Dehydration
- Stopping

Weight loss and anorexia
The nutritional status in the palliative phase varies and depends on the stage of disease the patient is in. Patients with a poor prognosis can be well-fed for a prolonged period of time but as the disease progresses their nutritional status inevitably deteriorates. This is usually due to the anorexia-cachexia syndrome, a combination of decreased intake and metabolic dysregulation leading to cachexia. Untreatable refractory cachexia develops in 85% of cancer patients in the period shortly before death. Symptoms almost always have a negative effect on the patient's ability to eat. Due to the cachexia the patient is more susceptible to pressure ulcers and infection.
When choosing a nutritional intervention the expected length of survival is important. This is difficult to estimate. With an expected survival of several months, maintaining nutritional status can be seen as a feasible or useful goal. This is also the case when treatments such as chemo- and radiotherapy are being considered, aimed at significantly extending survival (disease targeted palliation). In the case of a life expectancy of a number of weeks, when symptom targeted palliation for specific symptom relief is being considered, the deterioration in nutritional status is accepted. This is not a sudden transition but a gradual one. This attitude provides some support and is also used in guidelines. The maintaining or improving of the nutritional status or the prevention of unnecessary deterioration is not a goal in itself. It can have a positive effect on the quality of life, but can also prolong suffering. Eventually, the well-informed patient's wishes and the interdisciplinary consensus determine the policy. It is difficult but valuable and often clarifying to specifically point out the limited options for maintenance or improvement of nutritional status. Avoid discussions on nutrition but encourage the patient and his family to voice their expectations. The following examples can be useful in conversation:

- ‘Feeling better due to nutrition is only possible when the disease allows it. If the disease is this active, the body cannot improve through a healthy diet.’
- ‘The disease is starting to take charge and predominate; a healthy diet cannot change that.’
- ‘The increase in symptoms that the patient is experiencing [anorexia, aversion, fatigue] is not a result of you or your care, nor is it the patient’s fault; it is an expression of the disease and its active progression.’
- ‘Your body is so busy with the disease that additional nutrition or supplements would only form a larger burden instead of a benefit. Therefore, you would most likely not tolerate them.’

**Intervention goal**

- Maintaining or improving quality of life.

**Treatment policy**

- Obtain information from the health care professionals involved.
  - Consult the doctor and nurse on the prognosis and short and long term treatment options, comorbidity and medication.
  - Consult with the doctor on treatment of symptoms that limit nutritional intake.
  - Consult with the doctor on the possibility of appetite enhancing medication.
- Obtain information from the patient.
  - Inquire after symptoms that affect the appetite such as trismus, dental problems, dry or painful mouth, difficulty swallowing, dysphagia, nausea and vomiting, abdominal pain, constipation, diarrhoea, pain, dyspnoea, fever and stress.
  - Take a nutritional history focused on the degree of anorexia and early satiety, the severity and duration of weight loss, meal pattern, use of snacks, aversions, alterations in taste and smell, prescribed or self-inflicted dietary restrictions, the use of oral high-calorie/protein supplements, vitamin and mineral supplements (including during earlier phases of the disease).
  - Inquire after the amount and type of physical activity, muscle strength, functional capacity and fatigue.
  - Inquire after the patient and his family's expectations, their views on the role of nutrition, how they deal with nutrition and how they value it.
  - Inquire after the need for and options for assistance with eating, grocery shopping and meal preparation.
- Inform the patient and family.
  - Discuss the relationship between the disease, appetite and weight loss. Explain that decreased appetite and body weight are normal phenomena during the course of the disease. Explain that improving intake only results in improved physical condition if the disease is not actively progressing. Explain that deterioration of the nutritional status is caused by the disease and is not a result of the degree of effort made by the patient and his family.
  - Consider that weighing and measuring is only useful when improvement or maintenance of nutritional status is the goal.
  - Discuss existing dietary restrictions and if possible remove them.
  - Discuss the options for physical activity and exercise. Even when cure is no longer an
option, physical activity can contribute to physical condition and improve the quality of life. Consult the physiotherapist on therapeutic options and the type and intensity of the exercise.

♦ Pay attention to the family’s diet if this is affected by the care for the patient. Discuss the importance of maintaining one’s meals when eating together is not always possible.
♦ Discuss tips with which to provide healthy food with little effort such as ready-made meals, meal services or convenience products.

Nutritional advice

- Adequate diet or protein-energy enriched diet with a life expectancy of several months.
- Palliative nutritional support with a life expectancy of several weeks.
- In the case of symptoms that affect intake see: Symptoms and advice.

Clinical nutrition

Clinical nutrition (oral nutritional supplements, tube feeding and parenteral nutrition) can contribute to the diet meeting the nutritional requirements and ensure that the patient receives enough nutrition when oral intake is insufficient. This way, the nutritional status can be maintained or, if the disease process allows, improved. Initiation of clinical nutrition can provide time during rapid progression of the disease, especially when it seems that the patient will die of malnutrition before succumbing to the disease. Time is important to give the patient and his family the opportunity to adapt to the idea of the impending end of life and if necessary to organize a number of things.

Oral nutritional supplements can be advised when the regular diet is not sufficient, even after individual adjustments. One of the benefits of oral feeds is that it is easy to dose and ingest. A drawback is the rapid satiety and aversion that occurs in patients with anorexia. When oral feeds are spread evenly throughout the day and used between meals they do not interfere with regular nutrition. Practical tips can improve the use of oral feeds. Oral nutritional supplements can fulfill an important symbolic function of adequate care and peacefulness. When this fails, it can be helpful to discuss that oral feeds can be omitted.

Tube feeding or parenteral nutrition can be more taxing because it requires invasive techniques. One of the conditions for the use of tube feeding or parenteral nutrition in the palliative phase is a life expectancy of at least 1-2 months and a reasonable physical condition for which a Karnofsky-performance status of 50 is usually seen as the minimum. The cause of weight loss is an important factor in this decision. In the case of high dysphagia in the throat or oesophagus, tube feeding can be of use when a patient's intake is insufficient despite individual dietary adjustments. Weight loss caused by metabolic dysregulation cannot be reversed using tube feeding. It can seem appealing to health care professionals, the patient and his carers to act and to reduce the pressure of having to eat, but it is important to realize that it hardly improves the nutritional status. Tube feeding can also be used at home and in nursing homes, if necessary with help from home care professionals. When tube feeding is continued following discharge from the hospital, the date of discharge must be determined preferably 48 hours in advance to ensure that everything is taken care of at home or in the hospice and the general practitioner has been informed. To guarantee continuity of care, the patient and his carers must have a designated contact person for questions regarding nutrition and methods of administration. Parenteral nutrition is hardly ever used in the palliative phase. It is only an option when the gastro-intestinal tract is not functioning for a limited period of time, such as with a transient ileus. Parenteral nutrition is also possible at home but requires a lot of medical and nursing support. This can be taxing in a phase in which the focus should be on the impending end of life. When initiating clinical nutrition it should be considered that in the case of progressive disease it will have to be terminated at some point. The decision to initiate tube feeding or parenteral nutrition, especially in the hospital, is much easier than the decision to terminate it. Withholding nutrition is seen as an act with severe consequences for the state of the patient and can be viewed as an act that leads to a more rapid death. The terminating of oral nutrition or oral nutritional supplements is a natural process. When the terminal phase is entered, the patient gradually stops eating and drinking. Oral feeds also gradually stops. The terminating of tube feeding or parenteral nutrition is much more abrupt. When it is initiated, the conditions under which it is to be stopped should be determined. Nutrition can not only be initiated and increased over the course of several days, it can also be reduced gradually. Subsequently, the decision to withhold fluid can be made. By stopping tube feeding at home, the patient can die peacefully with less pressure on and care by his family.

The decisions concerning nutritional interventions in these situations are influenced by the wishes, views
whether correct or not) and emotions of the patient, his family and the health care professionals involved. Determining these views and obtaining adequate information on feasible and unfeasible goals is of major importance in the decision-making process. Tube feeding and parenteral nutrition are seen as medical interventions. A patient's wish to undergo these interventions is essential for starting them, but will only be granted if treatment is viewed as medically useful, in which the expected effect on the quality of life is the primary consideration.

For types of nutrition and access routes see: Clinical nutrition.

**Intestinal obstruction and ileus**

A bowel obstruction or ileus is seen in 3-15% of all patients with advanced cancer, especially in ovarian and colorectal cancer. Peritonitis carcinomatosa can severely decrease intestinal peristalsis and lead to the development of a paralytic ileus (no audible bowel sounds) with decreased motility of an intestinal segment. Ingrowth of tumour can lead to narrowing of the intestinal lumen in multiple areas resulting in mechanical bowel obstruction (tinkly bowel sounds) with a partial or total obstruction in multiple locations within the small intestine and colon. In the palliative phase these two forms can alternate and be difficult to distinguish between. Although their cause is different, both forms result in the accumulation of faeces. Symptoms include: abdominal pain, nausea and vomiting (sometimes faecal), constipation or sometimes paradoxical diarrhoea.

In the palliative phase, an ileus or bowel obstruction can occur gradually and symptoms can vary over time. Management of symptoms and nil by mouth are the main cornerstones of treatment. Sometimes active treatment is an option (laxatives, surgery, stent placement), sometimes it isn't. Depending on the severity of the obstruction, placement of a colostomy, naso-gastric suction or a draining PEG tube can be considered. The patient's prognosis, the estimated length of survival and the patient's wishes determine whether or not to employ a nutritional intervention such as intravenous fluid administration, tube feeding or parenteral nutrition. Frequently, the patient can ingest small amounts of liquid food or drink.

**Intervention goal**

- To prevent the increase of symptoms due to nutrition.

**Treatment policy**

- Consult with the doctor on the treatment policy and options for enteral nutrition.
- Discuss the deliberations and decisions on nutritional intervention with the patient in view of the impending end of life.

**Nutritional advice**

- Whilst awaiting active treatment: nil by mouth, intravenous fluid administration if necessary.
- In the case of naso-gastric suction, drink small amounts to combat dry mouth and when the patient enjoys the taste. Fluid and nutrition can be suctioned out through a naso-gastric or PEG tube or spat out. Sufficient intravenous fluid prevents the patient getting thirsty.
- Following reduction of the obstruction:
  - Liquid or smooth pureed nutrition;
  - No coarse fibres, coarse indigestible elements and gaseous products (see: Intestinal obstructions);
  - Drink at least 1,5 litres of fluid daily.

**Ascites**

Ascites in cancer is the pathological accumulation of fluid in the abdominal cavity. It is mainly caused by peritonitis carcinomatosa (metastases to the peritoneum) and liver metastases. Ascites can develop due to increased supply and reduced removal of fluid from the abdominal cavity and is also seen in progressive liver disease such as cirrhosis. It leads to the development of elevated intra-abdominal pressure which can result in impaired function of the gastro-intestinal tract and nutritional symptoms such as anorexia and rapid
satiety, dyspnoea, nausea and gastro-oesophageal reflux. The development of oedema in the legs and abdomen can lead to significant weight gain. Ascites in cancer usually indicates metastatic disease. The average survival of a patient with ascites is twenty weeks. If symptomatic, ascites fluid can be drained through paracentesis, resulting in symptom relief lasting one to two weeks. Paracentesis can be repeated regularly or a permanent drain can be placed. Ascites fluid can be high in protein (exudate) or low in protein (transudate). The frequent drainage of protein-rich ascites fluid results in the loss of large amounts of protein and minerals, leading to a decrease in serum albumin. However, there is no consensus on the use of a protein-enriched diet since dietary protein does not directly influence serum albumin. In the case of a limited life expectancy, protein synthesis is impaired further due to progressive metabolic dysregulation. A fluid and salt restriction as advised in cirrhosis is not beneficial in cancer.

Intervention goal

- Preventing the increase of dyspnoea, satiety, nausea and gastro-oesophageal reflux due to nutrition.

Treatment policy

- Take a nutritional history focused on the duration and severity of symptoms such as anorexia, early satiety, nausea and gastro-oesophageal reflux.
- Discuss the link between the symptoms and the ascites with the patient.
- Discuss whether eating while sitting in an upright position reduces early satiety.
- Make sure the advised nutrition can be used.

Nutritional advice

- Protein-enriched diet should only be used when followed by treatment aimed at tumour remission.
- No fluid or salt restriction.
- In the case of anorexia, early satiety, nausea and gastro-oesophageal reflux, see: Symptoms and advice.

Dehydration

Dehydration is divided into dehydration in general and terminal dehydration. Dehydration in general is a lack of body water due to a disturbance of the equilibrium between intake and excretion of water resulting from a reduced fluid intake, an increased loss of fluid or a combination of the two. A decreased sodium level can lead to hypotonic dehydration, elevated sodium levels result in hypertonic dehydration. In isotonic dehydration the fluid and sodium levels are balanced. Terminal dehydration is the dehydration in the dying who are no longer able to drink sufficient amounts. It is the final phase before death. Dehydration occurs due to increased losses from vomiting, diarrhoea, impaired renal function and losses through the skin. Dehydration can also occur due to fluid accumulation such as ascites, oedema and bleeding. Symptoms of dehydration include: decreased urinary output, dry skin and mucosa, weight changes - ascites leads to weight gain - decreased skin turgor, constipation, altered mental state, apathy and a reduced level of consciousness. Pain is not a symptom of dehydration; in fact dehydration can be an analgesic. To the patient's carers, thirst is often the most worrying symptom requiring treatment. Thirst is often confused with a dry mouth.

Dehydration is diagnosed using history and symptoms. Laboratory tests have limited additional value. When dehydration has been determined, the decision whether to rehydrate using intravenous fluid, a feeding tube or hypodermoclysis should be made.

Stopping

The treatment policy in the terminal phase of life is aimed at quality of death. Reducing or terminating the ingestion of food and fluid are a natural part of dying. Usually, a patient eats and drinks progressively less and stops altogether 1-2 weeks prior to death. A patient who has ceased to drink will die several days later. Withholding nutrition and fluid shortly before death seems like a logical and simple step but can give rise to discussion, questions and emotions in which the patient, carers and health care professionals need to determine their positions.
The patient's position

Usually the patient is less troubled by no longer eating and drinking than his carers. He eats and drinks whatever he wants and doesn't drink when he doesn't want to. Gradually, the patient loses interest in food and eventually in drink. Sensations of hunger and thirst disappear. The pattern can vary. A patient who has hardly eaten for several days can suddenly start eating small amounts and some of the food being offered to him.

Voluntary terminal dehydration is the refusal of food and fluid with the intention of no longer postponing death. In voluntary terminal dehydration the emphasis is on the patient's decision.

The carers' position

The patient's family and carers play an important part in the final stages of life. In the case of an altered mental state or reduced level of consciousness, the patient is no longer able to make choices and his family's assistance is needed. For carers, no longer eating and drinking is a clear sign of disease progression. Food and fluid have a strongly symbolic function and are seen as a sign of life and care. Especially when carers cannot accept that a patient is going to die, they can urge the patient to ingest food, food fortification and oral nutritional supplements and insist on the administration of nutrition and fluid: ‘The patient must eat, otherwise he will die’. Giving up eating can worsen feelings of helplessness. Nutritional interventions can provide a sense of hope. Carers can feel that the use of food and especially fluid can prevent an unpleasant death. Emotions can run high around a deathbed. Good communication and information can help. Relieving the pressure of having to eat or care for food can be liberating. Sometimes it can help to specifically point out that: ‘The patient is not going to die because he can no longer eat or drink, he can no longer eat or drink because he is going to die’.

Carers want to help their loved one and feel that they did everything they could. Besides care at the end of life, this presumably contributes to feeling better following the death. Caring for food and drink is viewed as contributing to care and a sign of attention. It can help when carers are given the opportunity to assist the patient in another way.

The health care professional's position

Out of all deaths, 31% occur at home, 28% in a hospital, 25% in a nursing home, 10% in a care institution and 6% elsewhere (including in a hospice). Many health care professionals view the administration of food and fluid as a sign of care. In hospitals especially, the goal is to treat the disease. Professionals want to actively contribute to patient care. It can be challenging to ‘do nothing’. After all, there is always a possibility to offer food and drink or administer fluid. Health care professionals at home, in nursing homes or hospices are more reserved in taking measures to administer food or fluid. Routine weighing should be ceased. In this phase a dietician will most likely play an advisory role and not be directly involved.
Communication

A conversation on nutrition and nutritional problems in cancer requires a certain degree of communicative skill by the health care professional. Different situations require different types of conversations and conversational techniques. A conversation on nutrition frequently involves advice and adjustments to a new situation and the patient's abilities. Knowledge of the various steps involved in a conversation on nutritional advice increases the effect. The delivering of bad news regarding nutrition is also one of the skills of a specialized dietician. A conversation can be aimed at achieving behavioural changes in the patient in order to improve nutritional status or general health in the long term. A specialized dietician should be able to select the preferable conversational technique for each situation.

There are large amounts of written material and brochures available to supplement and aid the conversation. Furthermore there are audio-visual tools available to support oral communication. See also Guideline Screening for psychosocial distress.

Conversations with the patient

When diagnosed with cancer, a patient has to deal with a lot of things in a short period of time. This can also involve many nutritional changes; information on this should reach the patient quickly.

A patient has a right to answers to questions he may have regarding the use of fortified nutrition, potentially harmful elements or products, health claims by products, (vitamin) supplements and oral high-calorie/protein feeds.

Some forms of treatment require customized nutrition. This can involve nutritional interventions that need to be directly implemented to prevent or combat malnutrition and complications due to malnutrition. This can involve measures and dietary advice that a patient with symptoms expects. It can also be information on nutritional interventions that patients are not normally familiar with such as tube feeding or parenteral nutrition, guidelines for food hygiene and safety for immunocompromised patients or specific diets such as the MCT-diet for chylous leakage, an iodine-restricted diet or a protein-restricted diet.

Throughout the disease a patient can be consumed by physical, emotional or psychological problems and not be able to adequately process and store nutritional information. Dietary advice should not be given too quickly since the patient will most likely not remember it. It is more effective to note and voice the problems the patient is consumed by, even if they are not related to nutrition. The patient can be open to nutritional information only after these problems have been dealt with.

Coping strategies

To reduce or manage stress due to cancer, patients and their carers develop various coping strategies to deal with problems or new situations. In a conversation on nutrition it is important to discuss the coping strategies that a patient uses to deal with cancer and its consequences.

- **Denial, avoidance.** The patient cannot or will not think of his disease and therefore sees no indication for nutritional advice.
- **Looking for information.** The patient surfs the internet looking for information on supplements.
- **Searching for explanations.** The patient is convinced that there is a link between harmful elements in nutrition and cancer.
- **Looking for support.** The patient enjoys improving his physical condition in a cancer rehabilitation course.
- **Expressing aggression and emotion.** The patient responds angrily to the person prescribing him badly tasting oral nutritional supplements or presenting him with oral feeds.
- **Taking everything into account.** The patient wants to know the exact duration of the dependence on tube feeding before making a decision.
- **Closing off, being depressed.** The patient closes himself off from nutritional advice.
- **Passive submission.** The patient leaves the choice of nutrition to the dietician, lies in bed and doesn't undertake anything.
- **Acceptance.** The patient makes the decisions regarding nutritional advice.

Steps in the conversation with the patient and his carers

- Pay attention to verbal and non-verbal signals.
- Regularly summarize the conversation.
- Specifically point out the observed physical, practical, social, emotional and spiritual problems.
• Only discuss the nutritional advice after completing the previous point (or postpone until a later date).
• Determine whether the goal and contents of the advice meet the patient's expectations.
• Provide room for the expression of reactions such as relief, frustration, anger and sadness.
• A nutritional advice can generate emotions when the contents are better or worse than the patient expected. Specifically point out the reactions to the nutritional advice and discuss them.
• After this go through the conversational steps again.

Delivering bad news

A conversation on nutrition can include having to deliver bad news. This can occur in the palliative-terminal phase when the disease predominates and the nutritional status inevitably decreases. The patient will have to be informed that nutrition will not be able to change this. This is the opposite of the idea of health promotion that is normally associated with healthy eating. Another example of having to deliver bad news is when a tumour or treatment involving the mouth and throat makes it impossible to eat normally, making a patient temporarily or permanently dependant on tube feeding. Participating in a regular meal with others is no longer possible or acquires a different meaning.

Whilst delivering bad news there are three goals, namely that the patient and his carers:

• hear the bad news: patients are informed of the bad news and, depending on the reaction by the patient and his carers, treatment options are discussed;
• understand the bad news: patients realize what the news entails; ambiguities are cleared up and misconceptions corrected;
• assess the bad news: patients understand the consequences for themselves and their family.

A number of steps in the structuring of the delivery of bad news

• Step 1: prepare the conversation and the message you wish to deliver well. Know all the facts, treatment options and information the patient has already received. Make sure that you can speak to the patient without being disturbed. Ensure, if possible, that there is also a family member present.
• Step 2: deliver the bad news quickly, clearly, concisely and understandably. Do not leave room for the patient to have to guess the news or express it in their own words. Try not to play down the bad news.
• Step 3: provide room for the expression of thoughts and emotions. Listen and allow the patient to express his feelings. Do not immediately fill silences by providing more information. Try to express and summarize the patient's feelings. Show empathy, interest, understanding and concern. Do not worry if the patient rejects this.
• Step 4: summarize. Ask if anything is unclear. Plan a follow-up appointment and wrap up the conversation. Advise the patient to write down any questions that might arise for the next conversation.

Behavioural changes

Behavioural changes are often required to improve the nutritional status or body composition over a prolonged period of time: a patient needs to eat or drink more, less or differently than he is used to. Especially after completion of treatment, a number of patients are confronted with an unfavourable body composition or unintended weight gain necessitating a change of diet and lifestyle in order to improve health and reduce the risk of tumour recurrence or a second tumour. Advice on healthy dietary choices, weight loss, increased physical activity or quitting smoking or drinking can meet with resistance. On the one hand the patient or ex-patient is extremely motivated to get better and healthier. On the other hand it can be difficult to give up certain habits.

Motivational interviewing is a style of counselling that can help patients study and solve their ambivalent feelings regarding behavioural changes. The method involves collaboration between the patient and the counsellor. It builds trust, discusses and if possible removes resistance. A central aspect of motivational
interviewing is that the motivation to change behaviour should come from within the patient and not be imposed by someone else. Therefore it is not a good strategy to attempt to reduce someone's resistance by trying to convince them as an expert using large amounts of information. The relationship between patient and dietician is a partnership of equals. One of which has professional expertise, the other is the expert on his life, abilities, impossibilities and wishes.
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