The value of nutritional assessment in major abdominal surgery
Haverkort, E.B.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Chapter 8

General discussion
Since the 1970s, there has been growing awareness that nutrition has a positive impact on surgical patients and consequently on their surgical outcome. More generally, human nutrition is now considered to be so important that a recent publication even suggested that diets could replace or reduce drug treatment.\textsuperscript{1} Although the influence of dietary treatment on the course of disease may not be as large as described in this article, nutrition undeniably plays a role in the treatment of surgical patients. The importance of nutrition in relation to surgery is shown by the number of articles published: in 1960 no papers at all on this topic had been listed in PubMed, while in 1980, 370 articles could be found, and in 2010 this number had increased to more than 2150.

Nowadays, dietetics is largely practice-based. The effectiveness and efficiency of dietary interventions has not been demonstrated for the majority of diseases. To further improve the quality of patient care it is therefore of great importance to improve the scientific credibility of dietetics based on evidence-based nutritional recommendations, methods and techniques.

The primary goal of this thesis was to contribute to evidence-based dietetics, specifically focusing on the value of nutritional assessment in preoperative and postoperative patients undergoing major abdominal surgery.

The studies in this thesis, addressed the lack of knowledge about nutritional assessment and dietary interventions in this group of patients. Working on the various aspects of this thesis also brought to light a number of new uncertainties and misstatements that need further attention and consideration. In this final chapter we will summarize and discuss our main findings. Furthermore, implications for clinical practice will be described and direction for future research will be discussed.

**Prevalence of malnutrition among preoperative surgical patients**

Recent epidemiological data on malnutrition among clinical surgical patients demonstrated a prevalence between 5\% and 55\%.\textsuperscript{2,10} However, prevalence data on malnutrition among preoperative outpatients is still lacking. The results of our studies indicate that malnutrition occurs in 25\% of the patients selected for major abdominal surgery (Chapter 4) and in about 6\% of the general surgical population of outpatients (Chapters 2 and 3). In addition, these studies also showed that the living situation and household composition (e.g. patient cannot rely on voluntary care or is living alone) is related to the risk of malnutrition (Chapter 2). For clinical practice, this means that dieticians should also take these psychosocial risk factors into account, otherwise management of malnutrition in the preoperative and postoperative phases will be suboptimal. Therefore, we argue for a more multidimensional approach with a focus on both physical and psychosocial aspects.

**Definition of malnutrition**

Worldwide there is no consensus on the definition of malnutrition.\textsuperscript{11-15} In this thesis malnutrition was operationalized according to the National Dutch Guideline on Perioperative nutrition (CBO richtlijn Perioperatief voedingsbeleid) by (a) involuntary weight loss of
≥ 5% within one month; and/or (b) involuntary weight loss of ≥ 10% within six months, and/or (c) a body mass index < 18.5. However, this definition includes some elements that are still under discussion; a critical loss of body protein must occur before vital physiological functions are lost (e.g. perceptible reduction of muscle strength and muscle function), and we doubt that a body weight loss of 5% in one month generally results in increased health risk. In addition, it is our opinion that in patients undergoing major abdominal surgery, the definition of malnutrition should be based on low fat-free mass. A low fat-free mass is a potential risk factor for adjuvant chemo-radiation therapy, as well as postoperative complications such as infections, leakage of the anastomoses, abscesses and re-operation.

The current definition of malnutrition also has led to discussion on the lower limit of the body mass index. The National Dutch Guideline on Perioperative Nutrition generally uses a lower limit of 18.5. But in specific diseases (e.g. COPD or cardiac disease) and for patients > 65 years of age, is it already common to use a lower body mass index limit of 20.0. Future research is needed to unravel to what extent a lower body mass index limit increases the health risk.

Prevalence of obesity in patients undergoing major abdominal surgery
In any case, it is clear that we should avoid malnutrition in patients scheduled for major abdominal surgery. However, we must also pay attention to the proportion of the surgical population who presents with overweight (BMI 25.0 –29.9) or even obesity (BMI ≥ 30) as this also entails health risks in the preoperative and postoperative phase. Recent studies have described a prevalence of 10% - 34% obesity in their outpatients. In Chapter 4 we demonstrated a mean BMI of 25.2 kg/m² (± 3.8) in 123 patients undergoing major abdominal surgery and although 25% of them were identified as malnourished, 11% were obese. In the Chapters 6 and 7 we studied 96 preoperative patients scheduled for esophagectomy. Their mean BMI was 26.0 kg/m² (± 3.9), and 14% of this population was identified as obese. More research is needed to study the health risks, and the precise nutritional needs, of overweight and obese patients undergoing major abdominal surgery during the preoperative and postoperative phase.

Need for nutrients in the preoperative and postoperative phase of major abdominal surgery
In various chapters of this thesis the importance of optimal nutrition during illness in the preoperative phase and postoperative phase is discussed. Based on best practice, described in the National Dutch Guideline on Perioperative Nutrition, we recommended 1.5 grams of protein/kg body weight /24 hours. To estimate the energy requirements, we calculated the Harris and Benedict equation (1984) plus 30%. However, the precise protein and energy requirements during illness is uncertain; current recommendations are based on limited data from small studies. We do not know whether these requirements safeguard the preservation of the fat-
free mass, especially in surgical oncology patients scheduled for major abdominal surgery. With regard to micronutrients (vitamins, minerals and trace elements), the Dutch recommendations for the healthy adult population are used, even though little research has been conducted on these nutrients during illness. Given the importance of an appropriate advice with regard to energy, macronutrients and micronutrients, future studies should clarify whether and how long the need for nutrients in patients undergoing major abdominal surgery must be modified and whether subgroups should be determined with respect to BMI, ethnicity, sex, age, illness, surgical procedure and/or additional treatment.

**Self-report of anthropometric data**

It is frequently assumed that self-report of weight and height generates inaccurate information. This will probably be the case for certain patient groups (e.g. obese patients and patients who suffer from an eating disorder), but our study in a general population of pre-operative outpatients showed that the use of self-reported anthropometric data is a reliable and valid method to screen for malnutrition (Chapter 2). A high level of agreement was found between self-reports and clinical assessments for height, weights, calculated BMI and classification of nutritional status. Moreover, when we compared the self-reported data with the frequently used screening tools Short Nutritional Assessment Questionnaire (SNAQ), Malnutrition Universal Screening Tool (MUST), and Mini Nutritional Assessment (MNA), the diagnostic accuracy of self-reports proved to be better.\[17,36-39\]

As self-reported data provide in an efficient way to screen for malnutrition in a general population of preoperative outpatients, we advise the use of self-reported data instead of conventional screenings tools in preoperative outpatients.

The results of this study have been used to prepare a form to screen all patients for malnutrition at the outpatient clinic of GIOCA (Gastro-Intestinal Oncology Center Amsterdam) at the Academic Medical Center.

**Handgrip strength measured with a dynamometer**

Currently handgrip strength measurement is a frequently used standard method to identify patients at risk of malnutrition, but it is unclear which reference values should be used. In Chapter 3 we investigated whether handgrip strength, measured with a dynamometer, can be used as a method for screening for malnutrition in adult preoperative outpatients by applying the algorithms of Álvares-da-Silva, Klidjian, Matos, and Webb.\[17,40-42\] However, none of the four algorithms derived from handgrip strength measurements was found to have sufficient diagnostic accuracy to introduce this method as a systematic institutional screening tool to detect malnutrition in individual adult preoperative elective outpatients.

A plausible explanation for this poor accuracy may be the reference values that are used. When using reference values in a specific target population, the characteristics of the target population in relation to the base population in which the values were established are often disregarded.\[17,40-44\] In recent years, hand grip strength values of healthy native Dutch were collected by the University Medical Center Maastricht with the purpose
of drafting normal hand grip strength values for the Dutch population. In the future, it is therefore recommended to use these normal values when performing hand grip strength measurements in the Netherlands.

Interestingly, the normal handgrip strength values as defined by Mathiowetz, which are based on cut-off points, are often used to identify patients at risk of malnutrition or postoperative complications. However, these reference values were originally not defined to assess these risks, but were intended to determine the need of hand strengthening. According to Mathiowetz, it is therefore incorrect and undesirable to apply these normal values for determining malnutrition or predicting postoperative complications (personal communication).

The measurement of handgrip strength itself is another issue that needs further attention. To compare studies that use handgrip strength, a strict procedure should be followed as described by Mathiowetz. In addition, the posture and motivation of the patient affects the outcome and should also be taken into account.

Finally, as it is unclear when and how sudden changes of handgrip strength are measurable during intervention or between preoperative and postoperative observations. More research is needed to determine the optimal time frame (days or weeks) needed to observe clinical relevant changes in handgrip strength.

**Bioelectrical impedance analysis measurement**

Besides handgrip strength, bioelectrical impedance analysis (BIA) measurements are often performed in clinical practice. BIA is alleged to be a simple, easy and non-invasive method to estimate body compartments such as fat-free mass and fat mass during illness, recovery and treatment. Frequently used BIA devices are single-frequency bioelectrical impedance analysis (SF-BIA), multi-frequency bioelectrical impedance analysis (MF-BIA), and bioimpedance spectroscopy (BIS).

In Chapter 4 we evaluated the measurement concurrence between SF-BIA and BIS. Although the results showed good intraclass correlation coefficients between SF-BIA and BIS, the devices are not interchangeable. Compared to SF-BIA, BIS classified a larger proportion of the patients as suffering from a body composition outside the normal range in terms of low fat-free mass and high fat mass. Consequently, health care professionals should be aware that such devices may differ in their measurements of body composition, and could therefore affect clinical decision making in terms of starting physical therapy, dietary therapy or postponing a surgical procedure.

Our systematic review in Chapter 5 indicated that the validity of BIA devices among surgical and oncological (surgical) patients can be questioned; the differences between body compartments measured by both a reference method (regarded as the gold standard) and a BIA device turned out to be considerable. The review also demonstrated that the estimations made by a MF-BIA device or BIS device are not more accurate than those made by a SF-BIA device.

We advise health care professionals to continue measuring body composition with BIA
in surgical and oncological patients (also those treated with surgery), but under strict conditions. The measurements should be performed with the same device, using the same equation and under the same circumstances. Single measurements providing a set of absolute data on body composition are not useful because of the deviations relative to the reference methods. Multiple measurements under the same conditions, however, can provide useful clinical information on changes in body composition for individual patients.

To overcome the present lack of clarity about the equations used in BIA measurements, more knowledge is needed about using raw bioimpedance data (including resistance, reactance, impedance and the phase angle) and/or vector analysis. 59-69

**Nutrition-related symptoms after major abdominal surgery**

Dieticians should be aware of the physiological impact and consequences of major abdominal surgical procedures on the human body and must have sufficient knowledge and expertise to safeguard optimal nutritional care. Much research has been done on the best surgical methods and techniques, but these studies do not always address dietary aspects. Current expert-based dietary recommendations do not always lead to optimal and efficient patient care, and more nutrition-related research on the postoperative effects of major abdominal surgery is urgently needed. For this reason we performed a study on nutrition after esophagectomy with gastric tube reconstruction (esophagectomy).

In Chapter 6, we investigated patients’ experience nutrition-related complaints during the first year after esophagectomy and studied the changes in these symptoms. In addition, we evaluated the necessity of nutrition-related adjustments as well as the patients’ nutritional status in terms of body weight.

The results show that patients suffer from a number of persistent, nutrition-related complaints during the entire first postoperative year. Early satiety, postprandial dumping, inhibited passage due to high viscosity, reflux of food and/or fluids, and the absence of hunger were the most frequently reported nutrition-related complaints. We demonstrated that the number of nutrition-related complaints was stable over time and could not be explained by a range of patient or surgery-related characteristics. One year postoperatively, the large majority of patients still needed to eat smaller meals with a relatively high frequency, had an altered stool frequency and still experienced the negative influence of their changed food intake on their social life. A reduction of body weight occurred directly after the surgical procedure, and the majority of patients were unable to return to their preoperative body weight within one year after surgery. The weight reduction was not associated with the nutrition-related complaints.

In Chapter 7 we reported on our study – in the same cohort of patients – on the extent to which the intake of energy, proteins, and micronutrients 6 and 12 months after esophagectomy meets the recommendations as defined by the Health Council of the Netherlands. 70-73 In addition, we evaluated which nutrients are most frequently suboptimal in the diet and studied if nutrition-related complaints could explain a serious suboptimal intake of nutrients. The results showed that the majority of esophagectomy patients did not reach
the minimum recommended dietary allowances (RDA) for most micronutrients at 6 and 12 months postoperative and were therefore at risk for micronutrient deficiency. The micronutrients with the most frequently reported suboptimal intake were folic acid, vitamin D, copper, calcium and vitamin B1. The number of nutrition-related complaints was not an independent risk factor for the presence of a suboptimal intake of nutrients.

Based on this study we wrote an adapted AMC-nutritional support protocol to guide optimal intake of energy and proteins. To achieve these goals, tube-feeding and sip-feeding must be continued, for a longer period of time if necessary, until sufficient oral intake of energy and proteins is assured. In addition, we recommended evaluating not only the intake of energy and protein, but also the intake of micronutrients. This should be done at least every 3 months until 12 months postoperative, and if necessary, specific nutrients should be supplemented. The results of this study, described in Chapters 6 and 7, formed the basis of the uniform, national guideline ‘Nutritional advice after esophagectomy with gastric tube reconstruction’ by the ‘Chirurgisch Overleg Dietisten Academische Ziekenhuizen (CHIODAZ)’ and can be downloaded from the website of the Dutch Association of Dieticians (www.dietist.nl).

Implications for clinical practice and future research
In this final section we summarise our main findings, describe the implications of the results and discuss direction for future research.

Implications
Self-reported patient anthropometric data was shown to be a reliable method to screen for malnutrition (Chapter 2). These self-reports have high diagnostic accuracy, so we recommend introducing self-reporting of anthropometric data in the general surgical outpatient population as an efficient method to screen for malnutrition.

In contrast, handgrip strength measured with a dynamometer demonstrated low accuracy when used to screen for malnutrition in the general surgical outpatient population, irrespective the equation used (Chapter 3). We therefore advise against using this method for screening purposes; handgrip strength measurement should only be used in longitudinal studies to evaluate changes in strength during disease or treatment. As handgrip strength is greatly influenced by the behavioural, mental and physical state of the patient, the measurement should be carried out according to a strict procedure as described by Mathiowetz.46 For a proper evaluation of the results, the characteristics of the base population and the target population must be comparable, and it is advisable to use national reference values for Dutch studies.

Based on the results of Chapter 4, we now understand that various BIA devices do not generate the same results. Dieticians and other caregivers should be aware of this variation, which may influence their clinical decision making. The results of our systematic review (Chapter 5) also indicate that BIA measurements in surgical and oncological patients are less valid than expected according to the statements of the manufacturers. At
the AMC, we routinely performed BIA estimations in patients scheduled for major abdominal surgery preceding and following therapeutic interventions. Based on the results of the systematic review, we no longer consider a single BIA measurement to be useful. We now use BIA measurements only longitudinally, i.e. to evaluate changes in body composition using the same device and same equation under the same circumstances.

To optimize nutritional care during the first year after esophagectomy, our adapted AMC nutritional support protocol should be followed by dieticians (Chapters 6 and 7). This includes a more intensive monitoring of nutritional goals in terms of proteins, energy, and micronutrients with special attention for folic acid, vitamin D, copper, calcium and vitamin B1. In addition, the national guideline for patients after esophagectomy (‘Nutritional advice after esophagectomy with gastric tube reconstruction’, endorsed by CHIODAZ should be used to inform the patients.

Future research
The current economic crisis has compelled all health care disciplines to work with smaller budgets and fewer resources. In this time of scarce funding, nutrition-related research is often regarded as a costly item that can be easily cut. However, it should be realized that saving money on the development of evidence-based dietary advices stands in the way of optimal patient care and in the long term will result in additional costs due to unnecessary, improper or excessive interventions and methods.

In the future, dieticians and medical doctors must continue to pay attention to screening and treatment of malnutrition, but must also be aware that a substantial number of patients undergoing major abdominal surgery are classified as obese. More research is needed to evaluate the influence of increased BMI on the side-effects of adjuvant chemoradiation therapy and on the occurrence of postoperative complications. To provide optimal nutritional and dietary advice before and after surgery in patients undergoing major abdominal surgery, dieticians must rely on evidence concerning the need for energy, macronutrients (proteins, fats and carbohydrates), micronutrients (vitamins, minerals, trace elements) and fluids. More research is needed to evaluate the optimal need for nutrients during adjuvant treatments, especially in patients with an abnormal body composition in terms of malnutrition and obesity.

Nutritional advice should focus on patients’ fat-free mass rather than total body weight; the preservation of fat-free mass during treatment has a large influence on recovery, prevention of side effects, and postoperative complications in patients undergoing major abdominal surgery. Future research should demonstrate whether the fat-free mass values measured in large groups of healthy adults by the research group of Kyle can be used as normal reference values.  

Regarding handgrip strength measurements by dynamometer, a study should be performed to evaluate the added value of these measurements when used longitudinally in patients undergoing major abdominal surgery. If it appears that the continuation of handgrip strength measurements in this group of patient has added value, efforts should be
made to collect more reference values of healthy subjects in the Netherlands. In addition, a study should be conducted to determine the time frame in which changes with regard to handgrip strength measurements by dynamometer are observable during disease and treatment in patients undergoing major abdominal surgery.

Considering the results of our systematic review, it is desirable to obtain more knowledge about the application of the raw bioimpedance data (e.g. resistance, reactance, impedance and the phase angle at one or more frequencies) and/or vector analysis. Direct use of these values obtained by BIS measurements will probably overcome the lack of clarity with regard to the various equations used in BIA estimations.

In our two studies evaluating the nutritional complaints and nutrient intake after esophagectomy, we followed patients during the first postoperative year. However, it is also necessary to obtain more knowledge about the long-term complaints and intake, for at least 5 years after esophagectomy.

Finally, to further improve patient care after major abdominal surgery, an inventory of complaints and nutrients intake is also necessary in patients who have undergone a stomach resection, pylorus preserving pancreaticoduodenectomy or partial liver resection.

References

14. Soeters PB, Reijvjen PL, van Bokhorst-de van der Schueren MA, Schols JM, Halfens RJ, Meijers JM, van Gemert
131

36. Kruizenga HM, Seidell JC, de Vet HC, Wiersma NJ, van Bokhorst-de van der Schueren MA. Development and validation of a hospital screening tool for malnutrition: the short nutritional assessment questionnaire...