Energy and protein intake at the Department of Cardiothoracic surgery, Landspítali – The National University Hospital of Iceland

Monitoring the implementation of a validated simple screening tool for malnutrition in hospitalized patients

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Thesis for the degree of Master of Science in Human Nutrition Faculty of Food Science and Nutrition, School of Health Sciences University of Iceland
2013

HÁSKÓLI ÍSLANDS

Orku og próteinneysla sjúklinga á hjarta- og lungnaskurðdeild Landspítala

Eftirfylgni með innleiðingu á gildismentu eyðublaði til að skima fyrir vannæringu sjúklinga

Dagný Ösp Vilhjálmsdóttir

Leiðbeinandi: Ingibjörg Gunnarsdóttir

Meistaraprófsverkefni í næringarfræði unnið á Rannsóknarstofu í næringarfræði
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Faculty of Food Science and Nutrition

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ÁGRIP

Bakgrunnur og markmið: Niðurstöður íslenskra rannsókna benda til þess að tíðni vannæringar sé 20-60% á Landspítala, mismunandi eftir sjúklingahópum. Vannæring meðal sjúklinga er talin tengjast aukinni tíðni fylgikvilla. Markmið verkefnisins var þríþætt: 1) Að fylgja eftir innleiðingu á skimun fyrir vannæringu á Landspítala, 2) að meta orku- og próteinneyslu sjúklinga á hjarta- og lungnaskurðdeild Landspítala og bera saman við áætlaða orku- og próteinþörf og 3) að meta jöfnur sem mælt er með að nota til þess að áætla orku- og próteinþörf sjúklinga í klínískum leiðbeiningum um næringu sjúklinga á Landspítala.

Efniviður og aðferðir: Fjöldi skimaðra sjúklinga á LSH var metinn í hverjum mánuði á tímabilinu desember 2011 til nóvember 2012. Næringarástand (líkur á vannæringu) var metið með gildismetnu 7 spurninga skimunareyðublaði þar sem 0-2 stig gefa til kynna litlar líkur á vannæringu, 3-4 stig ákveðnar líkur á vannæringu og ≥5 stig sterkar líkur á vannæringu. Eftirlit var haft með innleiðingu skimunar á hjarta- og lungnaskurðdeild. Þátttakendur í þeim hluta verkefnisins sem snéri að markmiði tvö voru sjúklingar sem lögðust inn á hjarta- og lungnaskurðdeild. Orku- og próteininnihald 5 aðalmáltíða sem framreiddar eru frá eldhúsi LSH er þekkt. Þegar liðnar voru að minnsta kosti 48 klukkustundir frá aðgerð voru allir matarafgangar, ásamt millibitum, vigtaðir og skráðir í þrjá daga samfellt. Orku- og próteinþörf var áætluð út frá neðri mörkum gilda í klínískum leiðbeiningum um næringu sjúklinga (25-30 hitaeiningar/kg líkamsþyngdar/sólarhring og 1,2-1,5 grömm/kg líkamsþyngdar/sólarhring, miðað við kjörþyngd). Gildi jafna sem notaðar eru til að meta orku- og próteinneyslu sjúklinga var kannað með skoðun vísindagreina (markmið 3).

Niðurstöður: Fjöldi skimaðra skjúklinga á LSH jókst úr 17 (1%) í 288 (12%) á tímabilinu desember 2011 til nóvember 2012. Skimun var algengari á þeim deildum þar sem eftirlit var öflugast. Niðurstöður um orku- og próteinneyslu sjúklinga á hjarta- og lungnaskurðdeild LSH eru birtar fyrir 61 sjúkling. Orkuneysla var að jafnaði 19±5,8 hitaeiningar/kg líkamsþyngdar/sólarhring. Meðalpróteinneysla reyndist vera 0,9±0,3 grömm/kg líkamsþyngdar/sólarhring. Þorri þátttakenda (>80%) náði ekki lágmarksviðmiðum fyrir orkuneyslu annars vegar og próteinneyslu hins vegar og átti það við um alla skráningardagana þrjá. Við mat á næringarástandi reyndust 14 sjúklingar (23%) annaðhvort vera vannærðir (≥5 stig) eða í hættu á vannæringu (3-4 stig). Orku- og próteinneysla þeirra var að jafnaði nær áætlaðri orku- og próteinþörf en neysla þeirra sjúklinga sem voru vel nærðir (0-2 stig), sem að hluta til mátti rekja til almennari notkunar næringardrykkja. Ekki fundust upplýsingar um að önnur jafna kæmi betur út heldur en sú sem er mælt með í klínískum leiðbeiningum um

næringu sjúklinga á LSH fyrir skurðsjúklinga. Ef mögulegt er væri æskilegast að meta orkuþörf sjúklinga með efnaskiptamæli (indirect calorimetry).

Ályktanir: Niðurstöðurnar benda til þess að innleiðing á skimun fyrir vannæringu á LSH sé skammt á veg komin. Eftirlit með skimun fyrir vannæringu gæti aukið árangur innleiðingar. Niðurstöður rannsóknarinnar benda jafnframt til þess að áætlaðri orku- og próteinþörf sjúklinga á hjarta- og lungnaskurðdeild sé ekki fullnægt, jafnvel ekki á 5. degi eftir aðgerð, ef fylgja á klínískum leiðbeiningum um næringu sjúklinga á LSH. Huga þarf betur að næringu inniliggjandi sjúklinga, allt frá vönduðu mati á næringarástandi til viðeigandi næringarmeðferðar.

ABSTRACT

Background and Objective: Icelandic studies suggest that prevalence of malnutrition at Landspitali – The National University Hospital (LSH) is 20-60%, depending on patient groups. Malnutrition among patients is considered to increase risk of complications. The objectives of this thesis were: 1) To monitor the implementation of a validated simple screening tool for malnutrition (SSM) at LSH by assessing the number of patients screened in each month from December 2011 to November 2012, 2) To estimate energy and protein intake of patients at the Department of Cardiothoracic surgery, LSH and compare with estimated energy and protein requirements, and 3) To evaluate the method recommended for estimating energy and protein requirements in the Clinical Guidelines on Nutrition for Hospitalized patients at LSH.

Methods: Number of screened patients was estimated each month from December 2011 to November 2012. Nutritional status was estimated using a simple screening tool for malnutrition (SSM), the patients who scored 0-2 points were categorized as well-nourished, those who scored 3-4 points were categorized as at risk of malnutrition and those who scored ≥5 points were categorized as malnourished. The screening was monitored at the Department of Cardiothoracic surgery, LSH. Subjects in the project related to aim two were patients admitted to the Department of Cardiothoracic surgery, LSH. The energy and protein content of meals served by the hospital‘s kitchen is known. Starting at least 48 hours after surgery, all leftover food and drinks were weighed and recorded for three consecutive days. Energy and protein requirements were estimated according to Clinical Guidelines on Nutrition for Hospitalized patients at LSH (25-30 kcal/kg/day and 1.2-1.5 g/kg/day, respectively). The accuracy of energy expenditure equations was estimated by viewing other studies (aim 3).

Results: From December 2011 to November 2012 the number of screened patients per month was 17 and increased to being 288 per month. Number of screened patients was higher at the wards that had an active encouragement. Results are presented for 61 patients. The average energy intake was 19±5.8 kcal/kg/day. Protein intake was on average 0.9±0.3 g/kg/day. Most patients (>80%) had an energy and protein intake below the lower limit of estimated energy and protein needs, even on the 5th day after surgery. According to the nutritional assessment 14 patients (23%) were defined as either malnourished or at risk for malnutrition. This group was closer than the well-nourished group to meeting their estimated energy and protein requirements. The use of nutrition drinks was more common among malnourished patients and those at risk of malnutrition than the well-nourished patients. According to the literature

search conducted as part of this thesis work there is no new evidence supporting that other equations should be used for surgical patients than the ones currently recommended in the Clinical Guidelines on Nutrition for Hospitalized patients at LSH. Ideally, energy expenditure should be measured using IC whenever possible.

Conclusion: The results suggest that screening for malnutrition is not far advanced. By monitoring the screening might increase the success. The results also suggest that the energy and protein intake of patients is below estimated requirements, even on the 5th day after surgery. Attention must be paid to malnutrition and nutrition in general in the hospital wards.

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TABLE OF CONTENTS

ÁGRIP I

ABSTRACT III

ACKNOWLEGMENTS V

LIST OF FIGURES VIII

LIST OF TABLES VIII

1. INTRODUCTION 1

2. REVIEW OF LITURETURE 3

2.1 Implementation of screening for malnutrition at LSH 3

2.1.1 Malnutrition in hospitalized patients 3

2.1.2 Screening for malnutrition 3

2.2 Estimation of energy and protein requirements for hospitalized patients 6

2.2.1 Energy requirements 7

2.2.2 Indirect calorimetry 7

2.2.3 Equations used to estimate energy expenditure 8

2.2.3.1 Accuracy of energy expenditure equations 9

2.2.4 Protein requirements 13

2.2.5 Protein requirements of hospitalized patients 13

2.2.5.1 Surgical patients – protein requirements 14

3. METHODS 15

3.1 Implementation of simple screening tool for malnutrition 15

3.1.1 Implementation of screening for malnutrition at surgical wards 15

3.1.2 Implementation of screening for malnutrition at the Department of Cardiology 15

3.2 Estimation for energy and protein requirements 16

3.3 Author‘s contribution 16

4. MANUSCRIPT 17

5. RESTULTS AND DISCUSSION 23

5.1 Screening for malnutrition at LSH 23

5.1.1 Prevalence of screened and weighed patients at surgical wards 24
5.1.2 Prevalence of screened patients at the Department of Cardiology.....25
5.2 Estimated energy requirements using different equations.....25
6. FUTURE PERSPECTIVES.....28
7. REFERENCES.....29
APPENDIX.....34
Appendix I – Screening tools recommended by ESPEN.....34

LIST OF FIGURES

Figure 1 Simple screening tool for malnutrition (SSM).....5

Figure 2 Flow chart showing how to apply nutritional care depending on nutritional status....6

Figure 3 Nutritional status of all screened patients.....23

Figure 4 Percentage of screened patients each month at 12E, 12G and 13G.....24

Figure 5 Percentage of weighed patients each month at 12E, 12G and 13G.....24

LIST OF TABLES

Table 1 Screening tools recommended in ESPEN guidelines.....4

Table 2 Screening tools sensitivity and specificity among various patient groups.....4

Table 3 Predicting equations for estimating resting energy expenditure.....8

Table 4 Accuracy of ACCP equation (1997).....10

Table 5 Accuracy of H-B equation (1918).....11

Table 6 Accuracy of Mifflin St. Jeor equation (1990).....12

Table 7 Number of patients screened for malnutrition in all wards at LSH and their score, from December 2011 to November 2012.....23

Table 8 Energy expenditure estimated with various predicting energy expenditure equations.....26

1. INTRODUCTION

Malnutrition is a broad term that can be used to describe any imbalance in nutrition; from over-nutrition often seen in the developed world, to under-nutrition seen in many developing countries, but also in hospitals and residential care facilities in developed nations.[1,2] Icelandic studies suggest that prevalence of malnutrition at Landspitali – The National University Hospital (LSH) is 20-60%, depending on patient groups.[3-7] Malnutrition among patients increases the risk of complications.[8-13] Furthermore, the average length of hospital stay is longer among those who are malnourished at admission than those who are well nourished.[11,14-16] Complications and longer length of hospital stay are associated with increased cost.[17]

Early identification of malnutrition in hospitals is important in order to be able to provide appropriate nutritional care. Screening for malnutrition is recommended in clinical guidelines of The European Society for Clinical Nutrition and Metabolism (ESPEN) and American Society for Parenteral and Enteral Nutrition (ASPEN).[17,18] Clinical Guidelines on Nutrition for Hospitalized patients at LSH were published in March 2011, where Screening at admission is recommended for all patients.[19] Early screening targeting malnourished patients can be cost-effective, provided that the malnutrition is treated,[8] otherwise it is of limited value. Worsening nutritional status during the hospital stay has been seen in some studies.[20-22]

Only a few studies have been conducted previously estimating energy and protein intake among Icelandic patients and never especially among inpatients in surgical wards. Earlier studies suggest that nutrition care at LSH can be considerably improved. Energy and protein intake among patients with chronic obstructive pulmonary disease (COPD) was not high enough to improve nutrition status[4] and another study, conducted at the Intensive Care Unit at LSH indicated that the patients only received 67% of their recommended energy requirements.[23] Furthermore, protein provided was less than the estimated protein need according to clinical guidelines.[23,24]

This thesis covers different aspects related to the implementation of clinical guidelines on nutrition for hospitalized patients at LSH, that were published in March 2011. Specific aims where the following:

1) To monitor the implementation of a validated simple screening tool for malnutrition (SSM) at LSH by assessing the number of patients screened in each month from December 2011 to November 2012.

2) To estimate energy and protein intake of patients at the Department of Cardiothoracic surgery, LSH and compare with estimated energy and protein requirements.

3) To evaluate the equation recommended for estimating energy and protein requirements in the clinical guidelines on nutrition for hospitalized patients at LSH.

The thesis is based on a review of the literature with respect to the aims of the thesis, with focus on surgical patients, and a paper published in the Icelandic Medical Journal in February 2013:

Dagný Ösp Vilhjálmsdóttir, Harpa Hrund Hinriksdóttir, Fríða Rún Þórðardóttir, Inga Þórsdóttir, Ingibjörg Gunnarsdóttir. Orku- og próteinneysla sjúklinga á hjarta- og lungnaskurðdeild Landspítala. Læknablaðið 2013; 99: 71-75.

2. REVIEW OF LITURETURE

2.1 Implementation of screening for malnutrition at LSH

2.1.1 Malnutrition in hospitalized patients

Malnutrition is prevalent among hospitalized patients and considered a major health problem.[10,25] In Europe the prevalence of malnutrition in hospitalized patients is estimated to be 21-37% and Icelandic studies have shown similar prevalence, from 20 to 60%, depending on patient groups.[3-7,25] The prevalence is highest among the elderly but it is also a well-know problem for surgical patients.[25]

Anorexia and low energy intake are probable the two major factors that cause malnutrition.[26] Malnutrition in hospitalized patients is associated with increased risk of complications,[10] increased morbidity and mortality, higher rate of infections, delayed healing, longer hospital stay and lower quality of life.[27,28]

Worsening nutritional status during the hospital stay has been seen in some studies,[20-22] which can result in longer hospital stay.[15,20] Furthermore, malnourished patients are more likely to be discharged to nursing homes instead of returning home, compared to the patients who are well-nourished.[10] The hospital cost for malnourished patients is higher than for well-nourished patients, because of increased cost due to longer hospital stay, medications and tests.[29]

2.1.2 Screening for malnutrition

The definition for screening tools is described in ESPEN guidelines „Screening tools are designed to detect protein and energy undernutrition, and/or to predict whether undernutrition is likely to develop/worsen under the present and future conditions of the patient/client".[17]

Hospitals in Europe have been working on implementing nutritional screening on admission.[10,30] ESPEN guidelines recommend either the use of Malnutrition Universal Screening Tool (MUST) or Nutritional Risk Screening (NRS 2002) for adults and Initial Screening in Mini Nutritional Assessment (MNA©) for the elderly (see appendix 1) (Table 1). All these tools have been validated.[17]

Table 1 Screening tools recommended in ESPEN guidelines.

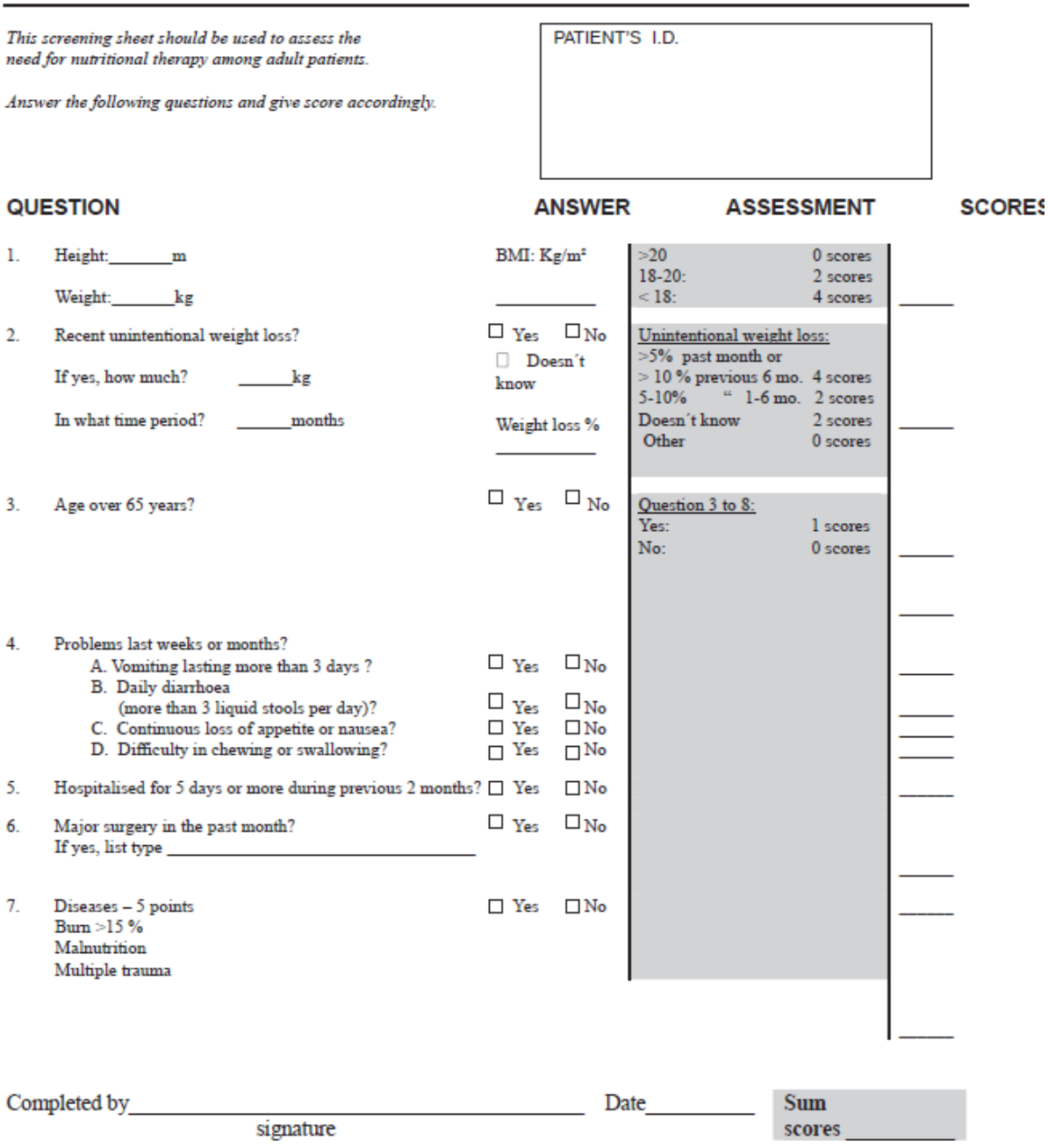
Screening tool	Purpose	Questions
MAST	To detect malnutrition and its association to impaired nutritional status and impaired function. It was originally developed and validated in healthy people. Recently it was validated for clinical settings.	It includes three questions; body mass index, weight loss in 3-6 months and acute disease effect
NRS 2002	To detect malnutrition and the risk of developing malnutrition in the hospital settings.	It contains four questions; body mass index, weight loss last 3 months, reduced dietary intake and if patient is severely ill
MNA	To detect malnutrition among the elderly.	It contains 6 questions; decreased food intake, weight loss last months, mobility, physical stress/acute disease past three months, neuropsychological problem and body mass index

All the screening tools seem to be similar prognostic ability to estimate nutrition status among hospitalized patients. The most important thing is that the screening tool selected in each setting is validated.[31]

The screening tool that is recommended in Clinical Guidelines on Nutrition for Hospitalized patients at LSH is Simple Screening tool for Malnutrition (SSM). It includes questions on body mass index and weight loss in the past months as well as questions related to physical stress and/or decreased food intake (Figure 1).[19] Overall it is quite similar to those recommended in ESPEN guidelines[17] and has been validated in several different patient groups.[3-6] Sensitivity and specificity of the SSM in different patient groups can be seen in Table 2. The screening tool is quick and simple in use, weight and height are the only measurements and it only takes around 5 minutes to screen a patient.

Table 2 Sensitivity and specificity of SSM in different patient groups.

Patient group	Sensitivity	Specificity
Surgical and medical patients[3]	0.56	0.88
Surgical and medical patients[3]	0.69	0.91
Chronic obstructive pulmonary disease[4]	0.69	0.90
Elderly patients (>65 years)[5]	0.89	0.60
Cancer patients in chemotherapy[6]	0.83	0.96



This screening sheet should be used to assess the need for nutritional therapy among adult patients.

Answer the following questions and give score accordingly.

PATIENT'S I.D.

QUESTION	ANSWER	ASSESSMENT	SCORES
1. Height:_____m Weight:_____kg	BMI: Kg/m² _____	>20 0 scores 18-20: 2 scores < 18: 4 scores	_____
2. Recent unintentional weight loss? If yes, how much? _____kg In what time period? _____months	☐ Yes ☐ No ☐ Doesn´t know Weight loss % _____	Unintentional weight loss: >5% past month or > 10 % previous 6 mo. 4 scores 5-10% " 1-6 mo. 2 scores Doesn´t know 2 scores Other 0 scores	_____
3. Age over 65 years?	☐ Yes ☐ No	Question 3 to 8: Yes: 1 scores No: 0 scores	_____
4. Problems last weeks or months? A. Vomiting lasting more than 3 days ? B. Daily diarrhoea (more than 3 liquid stools per day)? C. Continuous loss of appetite or nausea? D. Difficulty in chewing or swallowing?	☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No		_____ _____ _____
5. Hospitalised for 5 days or more during previous 2 months?	☐ Yes ☐ No		_____
6. Major surgery in the past month? If yes, list type _____	☐ Yes ☐ No		_____
7. Diseases – 5 points Burn >15 % Malnutrition Multiple trauma	☐ Yes ☐ No		_____

Completed by_____ Date_____ Sum scores _____

signature

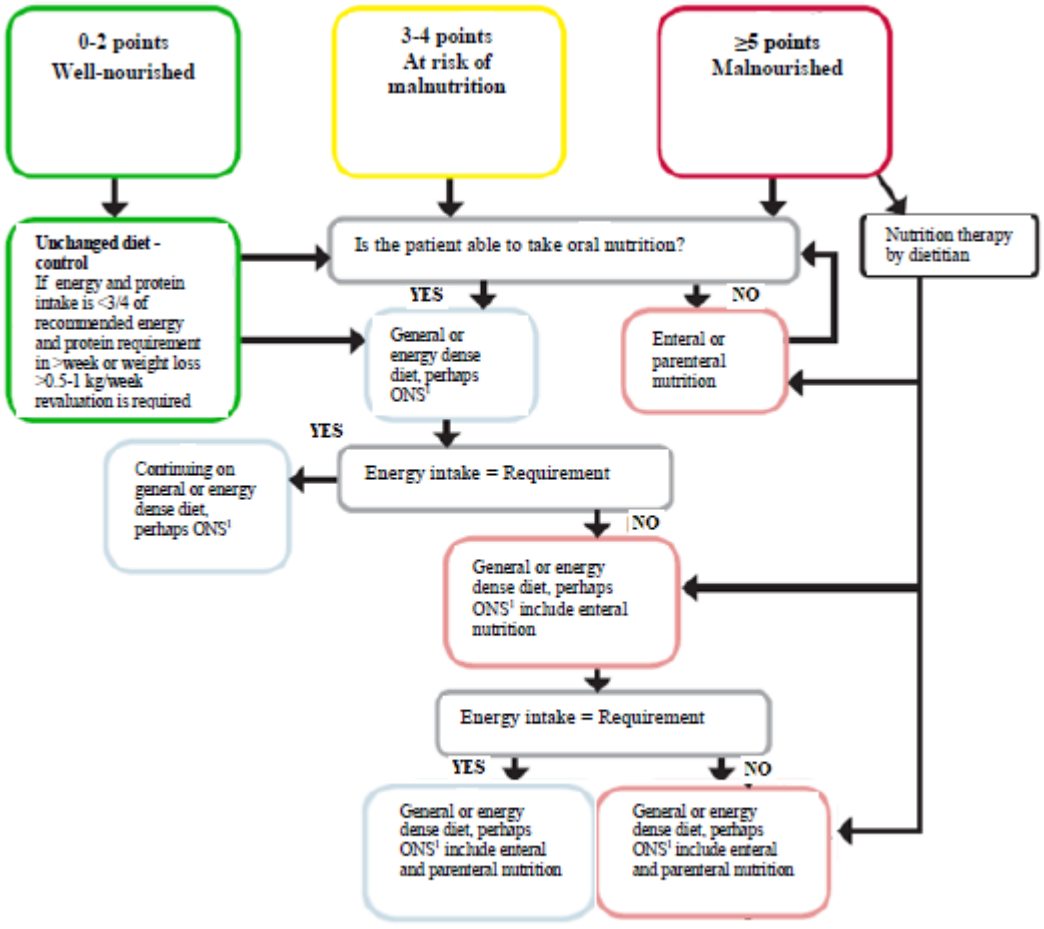
If a patient gets 5 or more scores, a referral should be sent to the department of clinical nutrition.
For cancerpatients and patients with pulmonary diseases use 4 or more scores.

Figure 1 Simple screening tool for malnutrition (SSM).[6]

In December 2011 the SSM was implemented to the patients' medical record (SAGA).[19] One of the aims of the present thesis was to monitor the implementation of the SSM in SAGA by assessing the number of patients screened in each month from December 2011 to November 2012. The results are presented in section 5.1 in this thesis.

2.2 Estimation of energy and protein requirements for hospitalized patients

Figure 2 shows a flow chart presented in the Clinical Guidelines on Nutrition for Hospitalized patients at LSH, how to apply nutritional care depending on results from the nutritional screening. It is recommended that energy and protein intake is measured and compared with estimated energy and protein requirements (Figure 2). Different methods are used to estimate energy requirements. The method currently used at LSH is based on the ESPEN guidelines.[32] An overview of different methods used to estimate energy requirements is given in the following section.



[1]Oral Nutritional Supplements

Figure 2 Flow chart showing how to apply nutritional care depending on nutritional status.[19]

2.2.1 Energy requirements

In a healthy population energy requirements are defined as the amount of energy that individual needs to keep body weight and body composition in balance to maintain good health.[26] Total energy expenditure involves three main factors; resting energy expenditure (REE), physical activity and thermal effect from the diet.[33]

Individual is considered in steady state if the energy intake compensates the total energy expenditure, without disturbing metabolic, physiological or behavioral processes.[26] Variables that have been found to affect REE are thermic effect of food, weight, height, age, gender, body temperature, minute ventilation, and hypermetabolism.[34-38] In hospitalized patients stress factor is sometimes applied to energy requirement predicting equations for hospitalized patients, because most of them were originally developed to estimate resting energy requirement in healthy individuals.[39] An average stress factor is 1.25 in hospitalized patients, for both men and women, different stress factors have been found within different types of diseases.[34,39] The highest stress factor seems to be among patients with burns, infections, or surgical complications. For patients who recently have had surgery stress factors of 1.2 to 1.4 should apply.[34] Higher stress factors have been found in patients with an elevated body temperature, on mechanical ventilation and in those who were restless while being measured.[34]

In healthy population physical activity is an important determinant of total energy expenditure and when estimating total energy expenditure in healthy individuals the REE is multiplied by the physical activity level (PAL). However, as physical activity is relatively low in hospitalized patients it is not applied for the critically ill and replaced by the stress factor.[40]

In order to provide patients with appropriate amount of energy during hospital stay it is important either to measure or predict REE to estimate dietary requirement for patients. The most accurate methods include measurements by indirect calorimetry (IC) or doubly labeled water, but in the clinical setting energy expenditure is most often predicted by equations.[38,41] IC is discussed in the following section, but the use of doubly labeled water is considered too expensive to be used in routine care in the hospital setting.[42]

2.2.2 Indirect calorimetry

IC is the "golden standard" method in hospitals to measure energy expenditure.[43,44] IC measures the body catabolism over 24 hours by measuring the consumption of oxygen and carbon dioxide production.[45]

IC is used to measure REE in patients, it includes the contributions of height, weight, age and gender but it does not include thermal effect of food or physical activity on REE.[37] A few things must be considered to avoid errors while measuring for example thermal effect, fasting, exercise, room temperature, air leak, individual steady-state and V_{O_2} and V_{CO_2} variations.[46] Other factors can influence the measurement of IC, for example elevated body temperature (>37.8°C) and also restlessness during the measurement increases the measured energy expenditure.[34,46] Measuring REE in patients by IC has to be done by trained staff.[41]

Because how accurate IC is the method is often used in studies to develop or study the accuracy of predicting energy expenditure equations.[41,44,47]

2.2.3 Equations used to estimate energy expenditure

Many studies have compared different resting energy equations to IC in patients, especially in critically ill patients. An overview of all the equation and their ability to predict energy expenditure in different patient groups is given in the follow section (Table 3-6).[41,44,47]

Table 3 Predicting equations for estimating resting energy expenditure.

Equation	Sex	Equations for resting energy exenditure (kcal/day)
ACCP, 1997.[56]	Men and women	25 × Wt
Harris-Benedict, 1918.[48]	Men	66.5 + (13.8 × Wt) (5 × Ht) - (6.8 × A)
	Women	655 + (9.6 × Wt) + (1.8 × Ht) - (4.7 × A)
Harris-Benedict, 1984.[49]	Men	88.362 + (13.397 × Wt) + (4.799 × Ht) - (5.677 × A)
	Women	447.593 + (9.247 × Wt) + (3.098 × Ht) - (4.330 × A)
Mifflin St. Jeor, 1990.[52]	Men	(9.99 × Wt) + (6.25 × Ht) - (4.92 × A) + 5
	Women	(9.99 × Wt) + (6.25 × Ht) - (4.92 × A) - 161
WHO/FAO/UNU, 1985.[26]	Men	18-30 y: (15.3 × Wt) + 679
		31-60 y: (11.6 × Wt) + 879
		>60 y: (13.5 × Wt) + 487
	Women	18-30 y: (14.7 × Wt) + 496
		31-60 y: (8.7 × Wt) + 829
		>60 y: (10.5 × Wt) + 596
Owen, 1987.[50,51]	Men	879 + (10.2 × Wt)
	Women	795 + (7.18 × Wt)

A=age
Ht=height (cm)
Wt=weight (kg)
y=years

2.2.3.1 Accuracy of energy expenditure equations

Different equations have been developed to estimate energy expenditure of healthy and non-hospitalized individuals.[48-52] An overview of equations commonly used for hospitalized patients is given in Table 3. Predicting energy expenditure based on equations can be done in many ways. Most of the equations consider body weight and take gender into account, while others also include height and age. The energy expenditure equations do not include thermic effect of food or physical activity.[34,37]

Body weight is one of the major factors in predicting REE. Using adjusted weight has been shown to improve accuracy of the equations when applied for overweight or obese individuals.[37] If actual body weight is used to estimate REE of an overweight individual it tends to overestimate the requirements. The most common way of adjusting the body weight of overweight and obese individuals is to use ideal body weight in the equations, i.e. to include the weight corresponding to a body mass index of 25 kg/m^2 instead of the actual body weight.[19,35,39]

However, some studies have shown that the use of ideal body weight in overweight or obese patients might introduce some underestimation of the resting energy requirements.[53-55] Unfortunately many different methods are currently used in the literature to adjust body weight of overweight and obese individuals that makes interpretation of results challenging.[35,39]

Frankenfield *et al*. (2012) assessed the use of ideal body weight in predicting energy requirements of underweight critically ill patients, where the equations tended to overestimate the energy requirement and have low accuracy.[55]

American College of Chest Physicians equation (ACCP) was developed for patients at Intensive Care Unit so there is no need to multiple it with a stress factor. The equation is very simple and it only contains one factor, body weight (Table 3).[56] The equation is frequently used in a clinical setting because of how simple it is, and thus not time consuming. When compared with measured energy requirement the accuracy tend to be relatively low (Table 4)[35,39,47] with quite large proportion of patients outside ±10% of REE measured by IC. However, the variation between different studies is large. This difference is most likely due to heterogeneity of the patient groups included in the different studies. Another possible explanation is that different methodology is being used in how ideal body weight is determined or how body weight is adjusted. The method was not always presented in the published papers.

Table 4 Accuracy of ACCP equation (1997). The percentage of subjects falling within ±10% of the measured resting energy expenditure (IC) when the equations are applied.

Equation description	n	Group	Measured EE[1]	Accuracy ±10% (%)	Country	References
ActBW	55	Morbidly obese critically ill patients	IC	0	United States	55
ActBW	56	Underweight critically ill patients	IC	43	United States	55
ActBW	395	Patients with an ordered nutrition assessment	IC	28	United States	44
ActBW	27	Criticalli ill patients, ICU	IC	65[2]	United Kingdom	39
ActBW, adjusted for obese	55	Criticalli ill patients, ICU	IC	42	Canada	35
AdjBW for underweight and obese	27	Criticalli ill patients, ICU	IC	64[2]	United Kingdom	39
IBW	272	Preobese, criticalli ill patients, ICU	IC	11	United States	47
IBW	55	Morbidly obese critically ill patients	IC	27	United States	55
IBW	56	Underweight critically ill patients	IC	23	United States	55

[1]Energy expenditure
[2]Accuracy within 80% and 110% of measured REE

Table 5 Accuracy of H-B equation (1918). The percentage of subjects falling within ±10% of the measured resting energy expenditure (IC) when the equations are applied.

Equation description	n	Group	Measured EE[1]	Accuracy ±10% (%)	Country	References
ActBW	55	Morbidly obese critically ill patients, ICU	IC	60	United States	55
ActBW	56	Underweight critically ill patients	IC	25	United States	55
ActBW	395	Patients with an ordered nutrition assessment	IC	43	United States	44
ActBW, stress factor 1.25	55	Morbidly obese critically ill patients, ICU	IC	13	United States	55
ActBW, stress factor 1.25	56	Underweight critically ill patients	IC	52	United States	55
ActBW, stress factor 1.10	395	Patients with an ordered nutrition assessment	IC	61	United States	44
ActBW, stress factor 1.3	27	Criticalli ill patients, ICU	IC	66[2]	United Kingdom	39
AdjBW	272	Preobese, criticalli ill patients, ICU	IC	35	United States	47
AdjBW, stress factor 1.3, adj for underweight and obese	27	Criticalli ill patients, ICU	IC	60[2]	United Kingdom	39
CBW	51	Patients with an ordered nutrition assessment	IC	62	United States	44

[1]Energy expenditure
[2]Accuracy within 80% and 110% of measured REE

Harris Benedict (H-B equation) was developed for healthy individuals but is often used for hospitalized patients, multiplied with a stress factor. The equation involves covariates factors such as gender, body weight and height (Table 3). It has a separate equation for each gender.[48,49] There are two versions of H-B equations, the original one from 1918 and another

from 1984. The latter one is suggested to be more accurate.[49] Still the H-B equation from 1918 is more often used both for healthy individuals and in clinical settings.[33,44,47,57] In healthy individuals H-B equation (1918) seems to overestimate energy requirements for certain individuals.[33,57] Accuracy of the H-B equation for hospitalized patients has been compared to IC (Table 5).[44,47]

Table 6 Accuracy of Mifflin St. Jeor equation (1990). The percentage of subjects falling within ±10% of the measured resting energy expenditure (IC) when the equations are applied.

Equation description	n	Group	Measured EE[1]	Accuracy ±10% (%)	Country	References
ActBW	55	Morbidly obese critically ill patients	IC	55	United States	55
ActBW	56	Underweight critically ill patients	IC	19	United States	55
ActBW	272	Preobese, criticalli ill patients, ICU	IC	15	United States	47
ActBW	395	Patients with an ordered nutrition assessment	IC	25	United States	44
ActBW and stress factor 1.10	395	Patients with an ordered nutrition assessment	IC	32	United States	44
ActBW and stress factor 1.25	55	Morbidly obese critically ill patients	IC	25	United States	55
ActBW and stress factor 1.25	56	Underweight critically ill patients	IC	58	United States	55

[1]Energy expenditure

The Mifflin-St Jeor equation is often used for hospitalized patients, multiplied with a stress factor. The equation involves covariates factors such as gender, body weight, height and age (Table 3). The equation was developed for healthy individuals of normal weight and obese including both genders and a wide age range.[52] This equation seems to be a fair predictor of REE in the overweight and obese BMI groups for healthy individuals.[57] The accuracy for hospitalized patients is often low, variable between the methods of body weight adjustments (Table 6).

Many other equations have been developed, for example WHO/FAO equation and Owen equation. They were developed for healthy population but not used as often in clinical studies as the others (Table 3).[26,50,51] Few studies investigated their accuracy for hospitalized patients which was low in all cases (Table 4-6).[41,47] There are several equations that have been composed for critically ill patients, for example Swinamer equation, Ireton-Jones (ventilator-dependent) and Penn-State. Those equations involve factors including respiratorion and are therefore more complicated.[55,58,59] Those equations can be more accurate in patients than the equations which have been developed for healthy individuals but still not as accurate as IC.[55] Ireton-Jones and Penn State have found to be more accurate in critically ill patients with obesity than in normal weight individuals.[60]

A systematic review from year 2007 showed that the overall the accuracy for predicting energy expenditure equations seems to be low.[60] Table 4 to 6 show commonly used predicting energy expenditure equations used in clinical studies and their ability to predict measured energy expenditure within ±10% accuracy. Overall the ACCP (25 kcal/kg/day) equation, recommended in the Clinical Guidelines on Nutrition of Hospitalised patients at LSH showed low accuracy. Although it is difficult to interpret from the studies included in table 4 to 6, it seems like the accuracy of the H-B equation might be better than the ACCP equation, but more comparable studies are needed. However, the complexity of the H-B equation compared with the ACCP must be taken into consideration when evaluating the best method to be used in the clinical setting.

2.2.4 Protein requirement

Proteins have variety of roles in the body, for example in the structures of muscles and organs and being involved in a wide range of different functions in the body. Proteins are continuously in turnover process where proteins are synthesized and catabolised.[61]

In the healthy population the protein requirement should be fulfilled to satisfy metabolic demand and achieve nitrogen balance. Protein requirements in healthy individuals are often based on nitrogen balance studies where young healthy individuals get protein with high biological value and digestibility. The estimated average requirement is 0.66 g/kg body weight. To cover the requirements of most healthy individuals a protein intake of 0.83 g/kg body weight per day is recommended, irrespective to gender or age.[61]

2.2.5 Protein requirement of hospitalized patients

Although the recommended intake for healthy individuals might be enough for some patient groups, most clinical guidelines recommend a protein intake of 1.2 to 1.5 g protein/kg and

even 2.0 to 2.5 g/kg of ideal body weight or adjusted body weight per day in some cases.[19,27,28,62,63]

A summary of studies estimating protein requirements for adult hospital patients was recently published. The systematic review included studies published from 1950 to October 2011. The estimated protein requirements tended to be different between different patients groups, but harmonized with the ranges presented in current in clinical guidelines.[27,64] High protein requirement was seen for some surgical patients, trauma, burn and critically ill patients but lower for some renal illnesses.[64] Another systematic review estimated the appropriate amount of protein or amino acids in critical illness. All the studies indicated that higher protein or amino acid intake was associated with improvement in nitrogen balance, protein turnover, or better clinical outcome. The highest amount provided in these studies was 2.5 g protein/kg per day.[65]

A recent study among critically ill and trauma patients suggested that nitrogen balance increased with incremental protein intake and significantly more patients achieved nitrogen balance with protein intake ≥2 g/kg per day than 1.5 to 1.99 g/kg per day.[66]

2.2.5.1 Surgical patients – protein requirements

Specific guidelines on protein requirements of surgical patients have been developed by ESPEN where 1.5 g protein/kg ideal body weight or adjusted body weight in stressed condition to limit nitrogen losses in perioperative period is recommended.[27] In the French guidelines specific recommendations are set for elderly surgical patients, 1.2 to 1.5 g protein/kg per day.[28]

The nitrogen loss can be high for some surgical patients.[64,67] In the systematic review by Ferrie *et al*. (2013) protein requirements for surgical patients was variable; recommendations for general surgery was set to 1.5 g protein/kg per day, gastrointestinal surgery >1.7 g protein/kg per day and intestinal failure 1.5 to 2.0 g protein/kg per day.[64]

3. METHODS

The procedure associated with the implementation of screening for malnutrition at LSH (aim 1) is described in chapter 2.1. The methods used to estimate energy and protein intake of surgical patients (aim 2) are described in detail in the paper published in the Icelandic Medical Journal 2013, Energy and protein intake of patients at the Department of Cardiothoracic surgery, LSH (Chapter 4). Methods related to aim 3 are presented in chapter 2.2.

3.1 Implementation of simple screening tool for malnutrition

The simple screening tool for malnutrition (SSM) implemented at LSH has previously been validated in different patient groups.[3-6] As previously described (Chapter 4) screening for malnutrition was made possible in SAGA in December 2011.

Information about the number of patients screened for malnutrition at LSH (the whole hospital) along with information about the number of admitted patients where gathered each month for one year (December 2011 to November 2012).

3.1.1 Implementation of screening for malnutrition at the surgical wards

The implementation was organized by the departments' managers. A special emphasis was made in order to increase the number of screened patients from February until November 2012, in collaboration with the staff at each ward; Department of Cardiothoracic Surgery (12E), Department of General Surgeries (12G, 13G) and at the Admission Office. According to the protocol all surgical patients were supposed to be screened when admitted through the Admission Office. If the patient had not been screened upon admission the nurses or the nurses' aid screened the patients when they were admitted to the wards. Records on the number of screened patients were kept especially for the three surgical wards (12E, 12G and 13G). Two wards, 12E and 12G, were merged in the summer time, from 20th of June to 20th of August. Data on the number of patients screened was collected from SAGA twice each month from March to September 2012 and data on the number of patients that had been weighed (or at least had the body weight recorded) during hospitalisation was collected from June to September 2012. Processing of the data was done in Microsoft Office Excel 2007.

3.1.2 Implementation of screening for malnutrition at the Department of Cardiology (14EG)

The implementation at the Department of Cardiology was organized in collaboration with the dietician at the ward and the department managers. Data was collected for one month, November 2012. The staff at the ward changed the screening sheet into pocket size and

covered the sheet with plastic, so the sheet was reusable. The nurses' aides screened all patients on admission to the ward. If a patient scored ≥5 points the staff contacted the dietician. Further processing of the data was done in Microsoft Office Excel 2007.

3.2 Estimation for energy and protein requirements

As presented in chapter 2.2 different equations are used to estimate energy requirements. Energy expenditure was estimated for the same patients group (see the published paper, chapter 4) using different equations. Body weight was adjusted for patients with BMI >25 kg/m^2, and the weight corresponding to BMI 25 kg/m^2 used in the equations instead of actual body weight. All equations were multiplied with a stress factor 1.2, except for the ACCP equation which was developed for hospitalized patients. Processing of the data was done in SPSS (IBM, Statistical Package for the Social Sciences, edition 20).

3.3 Author's contribution

I started my work in this study in September 2011. Two BSc students previously started the data collection in June to August 2011. From September to December 2011 I collected data at 12E, where my task was to weight all leftovers from patient's plate after evening meal and to prepare the evening snack for weighing. All the food was weighed on a digital scale (Philips Essence HR 2393). The data collection was part of a validation study,[68] conducted by my colleague Rannveig Björnsdóttir. We shared the data management (data entry etc.) and in the end two data sets where made ready for statistical analysis.

I was involved in further data collection related with the implementation of screening for malnutrition from February until November 2012. I visited one surgical ward (12E) and the Admission Office regularly and recorded how many were screened. I also collected data from the three wards (12E, 12G and 13G). From June to September 2012 I also kept records about the number of patients with recorded body weight in the surgical wards. I was involved in instruction for the staff, visits and data collection.

In November 2012 I helped with the implementation of screening for malnutrition at 14EG where I was involved in the active encouragement and data collection.

4. MANUSCRIPT

Published in the Icelandic Medical Journal in February 2013

Energy and protein intake of patients at the Department of Cardiothoracic surgery, Landspítali - The National University Hospital of Iceland

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Key words: patients, hospital food service, energy intake, protein intake, malnutrition.

Orku- og próteinneysla sjúklinga á hjarta- og lungnaskurðdeild Landspítala

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ÁGRIP

Tilgangur: Að meta orku- og próteinneyslu sjúklinga á hjarta- og lungnaskurðdeild Landspítala og bera saman við áætlaða orku- og próteinþörf. Markmiðið var einnig að meta næringarástand sama sjúklingahóps.
Efniviður og aðferðir: Þátttakendur voru sjúklingar sem lögðust inn á hjarta- og lungnaskurðdeild. Orku- og próteininnihald 5 aðalmáltíða sem framreiddar eru frá eldhúsi Landspítala er þekkt. Þegar liðnar voru að minnsta kosti 48 klukkustundir frá aðgerð voru allir matarafgangar, ásamt millibitum, vigtaðir og skráðir í þrjá daga samfellt. Orku- og próteinþörf var áætluð út frá neðri mörkum gilda í klínískum leiðbeiningum um næringu sjúklinga (25-30 hitaeiningar/kg líkamsþyngdar/sólarhring og 1,2-1,5 grömm/kg líkamsþyngdar/sólarhring, miðað við kjörþyngd). Næringarástand (líkur á vannæringu) var metið með gildismetnu 7 spurninga skimunareyðublaði þar sem 0-2 stig gefa til kynna litlar líkur á vannæringu, 3-4 stig ákveðnar líkur á vannæringu og ≥5 stig miklar líkur á vannæringu.
Niðurstöður: Niðurstöður eru birtar fyrir 61 sjúkling. Orkuneysla var að jafnaði 19±5,8 hitaeiningar/kg líkamsþyngdar/sólarhring. Meðalpróteinneysla reyndist vera 0,9±0,3 grömm/kg líkamsþyngdar/sólarhring. Þorri þátttakenda (>80%) náði ekki lágmarksviðmiðum fyrir orkuneyslu annars vegar og próteinneyslu hins vegar og átti það við um alla skráningardagana þrjá. Við mat á næringarástandi reyndust 14 sjúklingar (23%) annaðhvort vera vannærðir (≥5 stig) eða í hættu á vannæringu (3-4 stig). Orku- og próteinneysla þeirra var að jafnaði nær áætlaðri orku- og próteinþörf en neysla þeirra sjúklinga sem voru vel nærðir (0-2 stig), sem að hluta til mátti rekja til almennari notkunar næringardrykkja.
Ályktanir: Niðurstöður rannsóknarinnar benda til þess að áætlaðri orku- og próteinþörf sjúklinga á hjarta- og lungnaskurðdeild sé ekki fullnægt, jafnvel ekki á 5. degi eftir aðgerð, ef fylgja á klínískum leiðbeiningum um næringu sjúklinga á Landspítala. Huga þarf betur að næringu inniliggjandi sjúklinga, allt frá vönduðu mati á næringarástandi til viðeigandi næringarmeðferðar.

Inngangur

[1]Rannsóknastofu í næringarfræði við Háskóla Íslands og Landspítala, [2]eldhúsi og matsal Landspítala.

Niðurstöður íslenskra rannsókna benda til þess að tíðni vannæringar sé 20-60% á Landspítala, mismunandi eftir sjúklingahópum.[1-5] Vannæring meðal sjúklinga er talin tengjast aukinni tíðni fylgikvilla,[6-12] auk þess sem legutími sjúklinga sem eru vannærðir við innlögn er lengri en þeirra sem betur eru nærðir.[9,10,13,14] Fylgikvillum og lengri legutíma fylgir mikill kostnaður.[15]

Í klínískum leiðbeiningum The European Society for Clinical Nutrition and Metabolism (ESPEN) og American Society for Parenteral and Enteral Nutrition (ASPEN) er mælt með skipulagðri skimun fyrir vannæringu.[15,17] Í mars árið 2011 voru gefnar út klínískar leiðbeiningar um næringu sjúklinga á Landspítala þar sem mælt er með að skimað sé fyrir vannæringu við innlögn allra sjúklinga.[19]

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Ein og sér hefur skimun fyrir vannæringu takmarkað gildi og mælt er með því að fylgst sé með því að orku- og próteinþörf inniliggjandi sjúklinga sé mætt.[18-20] Það er mikilvægt til að unnt sé að grípa til viðeigandi ráðstafana og koma í veg fyrir að næringarástand versni í sjúkrahúsvistinni. Fáar rannsóknir hafa verið gerðar á orku- og próteinneyslu sjúklinga á Íslandi og aldrei sérstaklega meðal inniliggjandi sjúklinga á skurðdeildum. Fyrri rannsóknir benda þó til þess að næringarmeðferð sé oft á tíðum ekki nægilega markviss. Til að mynda var orku- og próteinneysla lungnasjúklinga á Landspítala ekki fullnægjandi til þess að leiðrétta slæmt næringarástand[2] og rannsókn sem gerð var á gjörgæsludeild Landspítala benti til þess að sjúklingar fengju aðeins 67% af áætlaðri orkuþörf sinni.[21] Próteingjöf var einnig minni en æskilegt getur talist samkvæmt klínískum leiðbeiningum um næringu gjörgæslusjúklinga.[21,22]

Æskilegt er að skurðsjúklingar séu byrjaðir að borða almennt fæði einum til þremur dögum eftir aðgerð og stefna ætti að orku- og próteinjafnvægi á þriðja til 5. degi eftir aðgerð.[19,20] Markmið rannsóknarinnar var að meta orku- og próteinneyslu inniliggjandi sjúklinga á hjarta- og lungnaskurðdeild á Landspítala og bera saman við áætlaða orku- og próteinþörf. Markmiðið var einnig að meta næringarástand sama sjúklingahóps.

Greinin barst 29. október 2012, samþykkt til birtingar 19. janúar 2013.

Engin hagsmunatengsl gefin upp.

Efniviður og aðferðir

Þátttakendur

Þátttakendur voru allir sjúklingar sem lögðust inn á hjarta- og lungnaskurðdeild Landspítala á tímabilinu júní-desember 2011. Þar sem markmið rannsóknarinnar var að meta orku- og próteinneyslu þátttakenda á þriðja til 5. degi eftir skurðaðgerð var skilyrði að áætluð innlögn væri að minnsta kosti 5 dagar. Eins var skilyrði að áætlað væri að sjúklingar gætu nærst að minnsta kosti að hluta til um munn meðan á innlögn stæði. Deildarstjórar á hjarta- og lungnaskurðdeild Landspítala aðstoðuðu rannsakendur við val á þátttakendum. Leitað var eftir upplýstu samþykki sjúklinga fyrir þátttöku í rannsókninni. Alls hóf 81 sjúklingur þátttöku í rannsókninni, 54 hjartaskurðsjúklingar, 15 lungnaskurðsjúklingar, auk 12 sjúklinga sem lögðust inn á deildina

Tafla I. *Einkenni þátttakenda í rannsókninni (meðaltöl og staðalfrávik).*

	Allir n=61	Karlar n=41	Konur n=20
Aldur (ár)	61,9 ± 17,8	60,1 ± 19,1	64,5 ± 14,7
Þyngd (kg)	80,5 ± 18,0	83,1 ± 18,3	75,3 ± 16,6
Hæð (m)	1,72 ± 0,09	1,76 ± 0,07	1,65 ± 0,09
Líkamsþyngdarstuðull (kg/m^2)	27,3 ± 5,3	27,0 ± 5,5	27,7 ± 4,9

vegna rifbrota eða annarra brjóstholsáverka. Upplýsingar um kyn, aldur, þyngd, hæð og ástæðu innlagnar voru fengnar úr sjúkraskrám sjúklinga.

Rannsóknaráætlun hlaut samþykki siðanefndar Landspítala (erindi 29/2011), lækningaforstjóra Landspítala (tilv. 16, 04.05.2011) og tilkynning vegna vinnslunnar var send til Persónuverndar (tilvísunarnúmer: S5264).

Orku- og próteinneysla

Næringargildi, þar með talið orku- og próteininnihald, allra máltíða sem framreiddar eru frá eldhúsi Landspítala hefur verið áætlað með aðstoð íslenska gagnagrunnsins um efnainnihald matvæla.[23] Daglegar máltíðir eru 5 talsins; morgunverður, hádegisverður, síðdegishressing, kvöldverður og kvöldhressing. Þannig var hægt að áætla orku- og próteininnihald hverrar máltíðar fyrir sig sem borin var fram fyrir þátttakendur í rannsókninni. Við lok hverrar máltíðar voru matarbakkar þátttakenda færðir inn í býtibúr þar sem rannsóknaraðilar vigtuðu (Philips Essence HR 2393) allan mat og drykk sem skilinn var eftir á bakkanum. Vigtun og skráning fór fram í þrjá daga samfellt fyrir hvern þátttakanda. Neysla matar og drykkjar sem ekki tilheyrðu aðalmáltíðum dagsins (millibitar) var skráð sérstaklega, þar með talið neysla næringardrykkja. Skráning á neyslu millibita var fyrst og fremst í höndum starfsfólks deildarinnar, en eins fóru rannsakendur yfir skráninguna með þátttakendum til að ganga úr skugga um að ekkert hefði gleymst. Rannsakendur voru á deildinni þegar meginmáltíðir dagsins voru bornar fram og voru þar af leiðandi í góðum tengslum við þátttakendur í rannsókninni. Fæðisskráning hófst með skráningu morgunverðar þegar liðnar voru að minnsta kosti 48 klukkustundir frá aðgerð. Neyslan endurspeglar því orku- og próteinneyslu á þriðja til 5. degi eftir aðgerð. Niðurstöður fæðuskráningar voru færðar inn í næringarútreikningaforritið Kostplan (AIVO AB, Stockholm, 1996, útgáfa 1,0) sem geymir næringarefnainnihald allra máltíða sem bornar eru fram á Landspítala. Næringarefnainnihald uppskrifta byggir á íslenska gagnagrunninum um næringarefnainnihald matvæla.[23]

Áætluð orku- og próteinþörf

Upplýsingar um hæð og þyngd þátttakenda voru fengnar úr sjúkraskrá. Ef margar mælingar höfðu verið gerðar á líkamsþyngd þátttakanda á mismunandi tímum var miðað við þyngd við innskrift, fyrir aðgerð. Orku- og próteinþörf var áætluð samkvæmt klínískum leiðbeiningum um næringu sjúklinga á Landspítala.[19] Í klínísku leiðbeiningunum er áætlað að orkuþörf sé á bilinu 25-30 hitaeiningar á hvert kíló líkamsþyngdar á sólarhring og próteinþörf 1,2-1,5 grömm á hvert kíló líkamsþyngdar á sólarhring. Útreikningar í þessari grein miðast við neðri mörk áætlaðrar orku- (25 hitaeiningar/kg/sólarhring) og próteinþarfar (1,2 g/kg). Þar sem viðmiðin eiga einungis við ef viðkomandi sjúklingur er í kjörþyngd, var þyngd sjúklinga með líkamsþyngdarstuðul >25 kg/m^2 leiðrétt áður en jöfnunni var beitt. Þetta þýðir að í stað raunverulegrar líkamsþyngdar í kílóum var sú líkamsþyngd sem samsvaraði líkamsþyngdarstuðli 25 kg/m^2 notuð við áætlun orku- og próteinþarfar.

Mat á næringarástandi

Næringarástand sjúklinga var metið með 7 spurninga gildismetnu eyðublaði sem mælt er með að notað sé við mat á næringarástandi sjúklinga.[1,2,19] Eyðublaðið inniheldur spurningar um líkamsþyngdarstuðul, ósjálfrátt þyngdartap, lystarleysi, skurðaðgerð og aðra þætti sem tengjast næringarástandi. Stig eru gefin eftir svörun spurninga og fyrir þann sjúklingahóp sem rannsóknin náði til gefa 0-2 stig til kynna litlar líkur á vannæringu (skilgreindir sem „vel nærðir" í niðurstöðum þessarar greinar), 3-4 stig bera vott um ákveðnar líkur á vannæringu (skilgreindir sem „í hættu á vannæringu" í niðurstöðum) og ≥5 stig gefur til kynna sterkar líkur á vannæringu (skilgreindir sem „vannærðir" í niðurstöðum).[1]

Úrvinnsla

Skráning gagna var gerð í Excel (Microsoft Office Excel, útgáfa 2007) en við tölfræðilegar greiningar var stuðst við tölfræðiforritið SPSS (IBM, Statistical Package for the Social Sciences, útgáfa 20). Orku- og próteinjafnvægi vel og vannærðra sjúklinga var borið saman með t-prófi. Tölfræðileg marktækni var sett við $p<0,05$.

Niðurstöður

Helsta ástæða fyrir brottfalli var ófullkomin skráning mataræðis, annaðhvort vegna þess að skráning einstakra máltíða hafði misfarist, eða að sjúklingur útskrifaðist fyrr en áætlað var. Einn hætti þátttöku áður en rannsókn lauk og upplýsingar um hæð eða þyngd vantaði fyrir þrjá einstaklinga. Tafla I sýnir aldur, þyngd og hæð þeirra þátttakenda sem greiningarnar byggja á (n=61) auk líkamsþyngdarstuðuls. Rannsóknin luku alls 39 hjartaskurðsjúklingar og 12 lungnaskurðsjúklingar, auk 10 sjúklinga sem lagðir voru inn af ýmsum ástæðum. Ekki var marktækur munur á áætlaðri orku- og próteinþörf þátttakenda né metinni orku- og próteinneyslu eftir sjúklingahópum og því var ákveðið að birta niðurstöðurnar fyrir allan hópinn saman.

Neysla 84% þátttakenda í rannsókninni var minni en sem svarar 25 hitaeiningum á hvert kíló líkamsþyngdar á dag (miðað við kjörþyngd) sem eru neðri mörk áætlaðrar orkuþarfar inniliggjandi sjúklinga (tafla II). Neysla 89% þátttakenda var minni en 1,2 grömm af próteinum á hvert kíló líkamsþyngdar á dag, sem eru neðri mörk æskilegrar próteinneyslu samkvæmt klínískum leiðbeiningum.[19] Hvorki reyndist marktækur munur á orkuneyslu né próteinneyslu þátttakenda á þriðja og 5. skráningardegi. Á 5. degi eftir aðgerð náðu einungis 18% þátttakenda að fullnægja áætlaðri orkuþörf ef miðað er við neðri mörk (25 hitaeiningar/kg/dag) áætlaðrar orkuþarfar inniliggjandi sjúklinga. Enginn þeirra sjúklinga sem tóku þátt í rannsókninni fékk næringu í æð eða gegnum sondu.

Meðalorkuinnihald máltíðanna 5 sem framreiddar voru til þátttakenda í rannsókninni frá eldhúsi Landspítala var 1747 hitaeiningar á dag og veittu þær að jafnaði 79 grömm af próteinum á dag. Eins og sjá má í töflu II var heildarorkuneysla dagsins 1370

Tafla II. *Áætluð orku- og próteinþörf þátttakenda og metin orku- og próteinneysla (meðaltöl og staðalfrávik).*

	Allir	Karlar	Konur
Orka	n=61	n=41	n=20
Áætluð þörf (hitaeiningar/dag)[1]	1782 ± 212	1848 ± 183	1646 ± 205
Meðalneysla (hitaeiningar/dag)	1370 ± 422	1384 ± 438	1342 ± 395
Meðalneysla (hitaeiningar/kg/dag)	19 ± 5,8	19 ± 5,7	20 ± 6,2
Prótein			
Áætluð þörf (grömm/dag)[2]	86 ± 10	89 ± 8,8	79 ± 9,8
Meðalneysla (grömm/dag)	61 ± 20	62 ± 21	57 ± 17
Meðalneysla (grömm/kg/dag)	0,9 ± 0,3	0,8 ± 0,3	0,9 ± 0,3

[1]Miðað við lágmarks orkuþörf, 25 hitaeiningar/kg/sólarhring, samkvæmt klínískum leiðbeiningum um næringu sjúklinga á Landspítala.[19]
[2]Miðað við lágmarks próteinþörf, 1,2 g/kg/sólarhring, samkvæmt klínískum leiðbeiningum um næringu sjúklinga á Landspítala.[19]

Tafla III. *Samanburður á orku- og próteinneyslu vel nærðra sjúklinga (litlar líkur á vannæringu samkvæmt mati á næringarástandi) og þeirra sem annaðhvort reyndust vannærðir eða í hættu á vannæringu (meðaltöl, staðalfrávik og %).*

	Litlar líkur á vannæringu n=47	Ákveðnar eða sterkar líkur á vannæringu n=14	P-gildi
Orkuneysla (hitaeiningar/dag)	1343 ± 427	1519 ± 396	0,028*
Orkuneysla (hitaeiningar/kg/dag)	18 ± 5,3	22 ± 6,8	0,001*
Hlutfall af orkuþörf[1]	72,0	88,0	
Próteinneysla (grömm/dag)	60 ± 19	66 ± 18	0,069
Próteinneysla (grömm/kg/dag)	0,8 ± 0,2	1,0 ± 0,3	0,009*
Hlutfall af próteinþörf[2]	66,7	83,3	

[1]Miðað við lágmarks orkuþörf, 25 hitaeiningar/kg/sólarhring, samkvæmt klínískum leiðbeiningum um næringu sjúklinga á Landspítala.[19]
[2]Miðað við lágmarks próteinþörf, 1,2 g/kg/sólarhring, samkvæmt klínískum leiðbeiningum um næringu sjúklinga á Landspítala.[19]

hitaeiningar á dag. Þar af veittu aukabitar, það er annar matur heldur en sá sem kom frá eldhúsi, að jafnaði um 300 hitaeiningar á dag. Af þeim 1747 hitaeiningum sem máltíðir eldhússins gáfu, var um það bil 1070 hitaeininga neytt og rúmlega 700 hitaeiningum hent í ruslið. Þetta þýðir að einungis 60% hitaeininga og próteina í máltíðunum 5 nýttist sjúklingunum.

Við mat á næringarástandi reyndust 14 sjúklingar (23%) annaðhvort vera vannærðir ≥5 stig (n=7) eða í hættu á vannæringu 3-4 stig (n=7). Orku- og próteinneyslu þátttakenda eftir næringarástandi má sjá í töflu III. Orku- og próteinneysla þeirra sem voru vannærðir eða í hættu á vannæringu var að jafnaði nær áætlaðri orku- og próteinþörf en orku- og próteinneysla vel nærðra sjúklinga (0-2 stig), sem að hluta til má rekja til almennari notkunar næringardrykkja.

Umræður

Niðurstöður rannsóknarinnar benda til þess að sjúklingar á hjarta- og lungnaskurðdeild fullnægi ekki áætlaðri orku- og próteinþörf sinni samkvæmt klínískum leiðbeiningum Landspítala, jafnvel ekki á 5. degi eftir aðgerð. Niðurstöðurnar eru í samræmi við erlendar rannsóknir.[18] Einnig er sláandi hversu stór hluti þess fæðis sem framreitt er endar í ruslinu. Þrátt fyrir að fáar innlendar rannsóknir hafi áður verið gerðar á orku- og próteinneyslu inniliggjandi sjúklinga hafa þær allar bent í sömu átt, það er að næringarmeðferð innan spítalans sé ábótavant.[1,21,24] Huga þarf betur að næringu inniliggjandi sjúklinga, allt frá mati á næringarástandi til viðeigandi næringarmeðferðar.

Vannæring hefur lengi verið þekkt vandamál meðal skurðsjúklinga, bæði erlendis og hérlendis.[1, 25,26] Frá því í ársbyrjun 2012 hefur verið mögulegt að skima fyrir vannæringu í Sögukerfinu, rafrænni sjúkraskrá sem notuð er á Landspítala og víðar. Innleiðing skimunar fyrir vannæringu er þó enn sem komið er skammt á veg komin á Landspítala. Vannæring meðal sjúklinga getur haft áhrif á líkamlega virkni, minnkað batalíkur og aukið tíðni fylgikvilla, en við það eykst sjúkdómsbyrði og dánartíðni.[9,26,27] Vannæring veikir einnig ónæmiskerfið[28] og getur truflað starfsemi meltingarvegar.[29] Skert næringarástand inniliggjandi sjúklinga hefur auk þess verið tengt veikingu og rýrnun vöðva, sérstaklega öndunarvöðva.[30,31] Hjá eldra fólki getur skert næringarástand haft áhrif á lífsgæði.[32] Viss vitundarvakning um mikilvægi skimunar fyrir vannæringu og markvissrar næringarmeðferðar virðist hafa orðið síðastliðin ár. Hins vegar benda niðurstöður rannsókna, bæði þeirrar sem hér er kynnt og eldri innlendra og erlendra rannsókna, til þess að orku- og próteinþörf inniliggjandi sjúklinga sé almennt ekki fullnægt.[1,18,21,24] Aukinni tíðni fylgikvilla og lengri legutíma fylgir mikill kostnaður[15] og bætt næringarmeðferð innan sjúkrastofnana tengist því bæði gæðum þjónustunnar og hagrænum áhrifum.

Í klínískum leiðbeiningum um næringu sjúklinga er áætlað að orkuþörf inniliggjandi sjúklinga (annarra en gjörgæslusjúklinga) sé á bilinu 25-30 hitaeiningar á hvert kílógramm líkamsþyngdar á sólarhring. Próteinþörfin er áætluð 1,2-1,5 grömm á hvert kíló líkamsþyngdar á sólarhring. Þrátt fyrir að miðað hafi verið við neðri mörk áætlaðrar orku- og próteinþarfar í þessari rannsókn, var orku- og próteinneyslan skilgreind ófullnægjandi hjá allflestum þátttakendum (allt að 90%), jafnvel á 5. degi eftir aðgerð. Lítil orku- og próteinneysla skurðsjúklinga hefur einnig sést í erlendum rannsóknum.[33] Einungis um 60% af þeim hitaeiningum sem 5 aðalmáltíðir dagsins gáfu nýttust sjúklingunum. Benda niðurstöðurnar til þess að eftirlit og viðbrögð við því að sjúklingar klári ekki þann mat sem borinn er fram séu ekki eins og best verður á kosið. Niðurstöður þessarar rannsóknar sýna þó hærri orku- og próteinneyslu sjúklinga sem voru greindir vannærðir eða í hættu á vannæringu en meðal vel nærðra sjúklinga og fengu þeir einnig oftar næringarríka millibita á borð við næringardrykki. Þetta bendir til þess að starfsfólk geri sér að hluta til grein fyrir vandanum. Niðurstöður rannsóknarinnar sem hér er kynnt benda þó til þess að næring sem í boði var fyrir sjúklingana hafi fullnægt bæði orku- og próteinþörf þátttakenda hefði hennar verið neytt. Áskorun framtíðar snýr fyrst og fremst að því að meta hvers vegna svo stór hluti fæðunnar endar í ruslinu. Ástæðu þessa er ekki hægt að greina út frá þeim gögnum sem aflað var í þeirri rannsókn sem hér er kynnt. Af hugsanlegum skýringum má til dæmis nefna viðhorf til sjúkrahúsmáltíða, skort á mannafla á deildum til að aðstoða sjúklinga við að borða og lystarleysi í kjölfar aðgerðar eða lyfjagjafa. Þess ber að geta að verið er að endurskoða matseðla sjúklinga á Landspítala þar sem hugað er sérstaklega að auknu framboði á orkuþéttara fæði og hagstæðari skammtastærðum.

Ein af skýringum þess að eftirlit með næringu sjúklinga hefur til þessa verið ábótavant er skortur hefur verið á einföldum gildismetnum leiðum til að meta orku- og próteinneyslu sjúklinga. Unnið hefur verið að því undanfarin misseri að þróa og gildismeta einfalt skráningarblað til áætlunar á orku- og próteinneyslu sjúklinga. Af praktískum ástæðum og vegna mikils kostnaðar er ekki unnt að vigta allan mat sem sjúklingar neyta og því þarf að vera til einfaldari og ódýrari leið. Gildismat eyðublaðsins leiddi í ljós að það er talið fullnægjandi til að áætla neyslu sjúklinga, sérstaklega þeirra sem borða lítið.[32,34] Eyðublaðið má einnig nýta við gæðastjórnun, til dæmis við að meta orku- og próteinneyslu sjúklinga á ákveðnum deildum og bera saman við áætlaða orku- og próteinþörf. Eins er hægt að nýta eyðublaðið til áætlunar á hlutfalli matar sem fer í ruslið og til að aðlaga skammtastærðir samkvæmt því svo að draga megi úr sóun.

Nauðsynlegt er að nefna að þeir mælikvarðar sem notaðir voru í þessari rannsókn hafa sínar takmarkanir. Við áætlun á orkuþörf var stuðst við mjög einfaldan mælikvarða samkvæmt klínískum leiðbeiningum um næringu sjúklinga.[19] Hann þykir henta mjög vel í klínísku starfi, þar sem tiltölulega auðvelt er að áætla orkuþörf sjúklinga. Flóknari jöfnur eru til[35,36] sem bæði taka tillit til hæðar og kyns, auk líkamsþyngdar. Notkun annarra jafna við áætlun á orkuþörf þátttakenda í þessari rannsókn breytti ekki meginniðurstöðu hennar um að orkuneysla væri vel innan við áætlaða orkuþörf. Af öðrum annmörkum má nefna að ákveðin ónákvæmni felst í því að einungis matar- og drykkjarafgangar voru vigtaðir en ekki sá skammtur sem borin var á borð fyrir sjúklinginn. Hins vegar er ólíklegt að sú skekkja sé það stór að hún hafi áhrif á þær ályktanir sem dregnar eru af niðurstöðum þessarar rannsóknar.[34]

Í ljósi alvarlegra afleiðinga vannæringar sjúklinga og kostnaðar sem af henni getur hlotist fyrir heilbrigðiskerfið, er nauðsynlegt að heilbrigðisstarfsmenn sameinist um að finna leiðir til að vinna bug á vandamálinu. Skimun fyrir vannæringu mun ein og sér þó ekki leysa þetta vandamál heldur er teymisvinna næringarfræðinga eða næringarráðgjafa, hjúkrunarfræðinga, lækna, lyfjafræðinga og annarra er koma að umönnun sjúklinga gríðarlega mikilvæg. Þar er samvinna, eftirlit og markviss eftirfylgni lykillinn að góðum árangri. Frekari rannsóknir á næringarástandi ýmissa sjúklingahópa eru einnig mjög aðkallandi.

Þakkir

Höfundar þakka Rannveigu Björnsdóttur, Ernu Sif Óskarsdóttur og Dagnýju Rut Pétursdóttur fyrir aðstoð við gagnasöfnun og úrvinnslu. Lilju Ásgeirsdóttur, Kolbrúnu Gísladóttur og öðru starfsfólki á hjarta- og lungnaskurðdeild Landspítala fyrir velvilja og aðstoð við rannsóknina. Verkefnið var kostað af styrkjum til Ingibjargar Gunnarsdóttur frá Vísindasjóði Landspítala.

ENGLISH SUMMARY

Energy and protein intake of patients at the Department of Cardiothoracic surgery, Landspítali - The National University Hospital of Iceland

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Objective: The aim was to estimate energy and protein intake of patients at the Department of Cardiothoracic surgery, Landspítali the National University Hospital of Iceland. Another aim was also to assess their nutritional status.
Methods: The energy and protein content of meals served by the hospital's kitchen is known. Starting at least 48 hours after surgery, all leftover food and drinks were weighed and recorded for three consecutive days. Energy and protein requirements were estimated according to clinical guidelines for hospital nutrition at Landspítali (25-30 kcal/kg/day and 1.2-1.5 g/kg/day, respectively). Nutritional status was estimated using a validated seven question screening sheet.
Results: Results are presented for 61 patients. The average energy intake was 19±5.8 kcal/kg/day. Protein intake was on average 0.9±0.3 g/kg/day. Most patients (>80%) had an energy and protein intake below the lower limit of estimated energy and protein needs, even on the fifth day after sugery. According to the nutritional assessment 14 patients (23%) were defined as either malnourished or at risk for malnutrition. This group was closer than the well-nourished group to meeting their estimated energy- and protein needs. The use of nutrition drinks was more common among malnourished patients and those at risk of malnutrition than the well-nourished patients.
Conclusion: The results suggest that the energy and protein intake of patients is below estimated requirements, even on the fifth day after surgery. Attention must be paid to malnutrition and nutrition in general in the hospital wards.

Key words: *patients, hospital food service, energy intake, protein intake, malnutrition.*

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5. RESTULTS AND DISCUSSION

Main results of this thesis are presented in the paper published in the Icelandic Medical Journal in January 2013 (chapter 4). Results from other parts are presented in the following chapters.

5.1 Screening for malnutrition at LSH

From the time December 2011 to November 2012 26,872 patients were admitted to the hospital. Thereof 1,373 (5%) patients were screened for malnutrition (Table 7). Most of the patients (75%) scored 0-2 points and were categorized as well-nourished, 13% were at risk of malnutrition (3-4 points) and 12% were malnourished ≥5 points) (Figure 3). The majority of patients that were screened (n=471) scored one point. The three highest scores seen were 12, 15 and 16 points, one patient with each score. It would have been useful for further investigation to have the information about how many patients were screened at each ward, but unfortunately the information was not available.

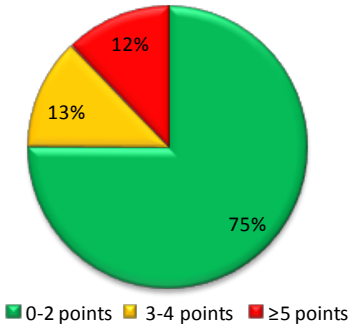

Figure 3 Nutritional status of all screened patients. Ratio of well-nourished patients (green), patients at risk of malnutrition (yellow) and malnourished patients (red).

Table 7 Number of patients screened for malnutrition in all wards at LSH and their score, from December 2011 to November 2012 (number).

	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	All
Admissions	2,158	2,371	2,280	2,398	2,287	2,328	1,999	1,898	2,042	2,287	2,511	2,313	26,872
0-2 points	**7**	**10**	**70**	**105**	**85**	**93**	**87**	**45**	**74**	**100**	**130**	**225**	**1031**
3-4 points	**3**	**4**	**23**	**19**	**7**	**16**	**16**	**5**	**13**	**15**	**25**	**28**	**174**
≥5 points	**7**	**11**	**16**	**14**	**14**	**8**	**11**	**3**	**4**	**12**	**33**	**35**	**168**
Screened (%)	17 (1)	25 (1)	109 (5)	138 (6)	106 (5)	117 (5)	114 (6)	53 (3)	91 (4)	127 (6)	188 (7)	288 (12)	1373 (5)

Twelve percent of all screened patients were malnourished, which is less than the 20-60% indicated by previous studies that have investigated the prevalence of malnourishment in patients at LSH.[3-7] As we don't have information on the wards included in table 7 it is difficult to compare the figure to the previous studies. However, as active implementation was conducted through the admission office and the surgical wards it is likely that the majority of patients included in table 7 are surgical patients. The lowest prevalence of malnutrition was seen in mixed group of surgical and medical patients in the previous Icelandic studies.[3] Last

years the discussion about malnutrition among hospitalized patients has increased, the staff at the hospital might be more conscious about the subject than before.

Even though the number of screened patients during this first year of implementation is low the success must be considered great. At the beginning the number of screened patients per month was 17 and increased to being 288 patients. Number of screened patients rose critically when the active encouragement started in February (Table 7). LSH has around 50 wards and nearly 800 beds. The implementation was only active at three wards and one of them had an active encouragement by the researchers. Further implementation is needed.

5.1.1 Prevalence of screened and weighed patients at surgical wards

In the departments where active implementation of screening was initiated, a higher percentage of patients were screened than shown in table 7, which gives an overview of the whole hospital. From all the wards (12E, 12G, 13G) 12E was the only ward that had an active encouragement. At 12E the ratio for the screened patients at the first month was only 11%. The highest ratio (43%) of screened patients was seen in June (Figure 4). Average ratio in 12E was 22% and for both 12G and 13G it was 12%. The average percentage of screened patients was higher in 12E than in 12G and 13G. Which might indicate that personnel responsible for the nutritional screening might be needed in each ward. Overall the number of screened patients seems to be very random which might indicate that the screening is not yet a routine process. Implementation of screening has to including well organized plan from the beginning that all the staff is aware of, a good active encouragement and how to maintain the screening.

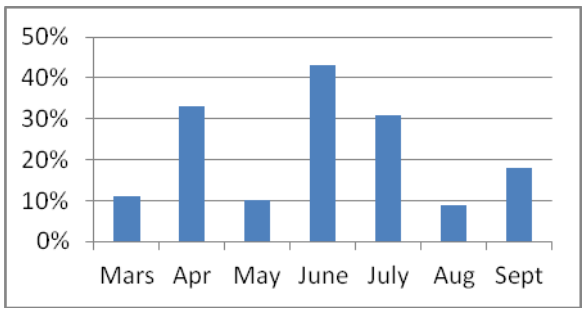

Figure 4 Percentage of screened patients each month at 12E

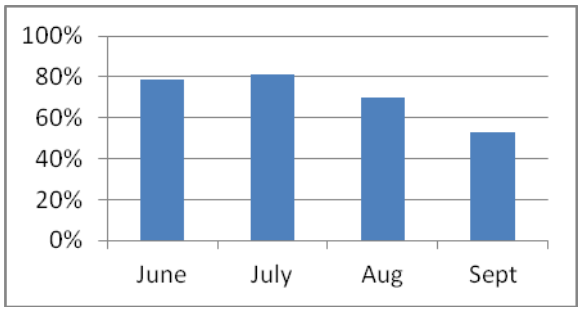

Figure 5 Percentage of weighed patients each month at 12E

The data collection about body weight measuring was recorded at the same wards as the screening (12E, 12G, 13G), the only ward that had an active encouragement during the time was 12E (Figure 5). The initial ratio at 12E was 79% and the last month it had decreased down to 53% even though the ward had an active encouragement. Overall the highest ratio (81%) was in July at merged wards 12E and 12G, the lowest ratio (29%) was in August at

13G. The main reason why the ratio of weighed patients did not increase is most likely because the main emphasis in the visits at the ward was to reminding on the screening and the summer vacations may also have had an impact.

5.1.2 Prevalence of screened patients at Department of Cardiology (14EG)

In the one month period 141 patients were admitted, total screened patients were 88% (n=124). The rest of the patients were not screened because they were discharged or were too sick. Most of the patients 81% (n=101) scored 0-2 points, and where therefore defined as being well nourished. The patients who scored ≥5 points were 7% of screened patients.

The reason for the success is probable the well planned routine work and the intensive active encouragement; visits every workday and the monitoring. They made the screening into pocket size, therefore, handier in use. Studies have shown that implementation of nutritional screening can be successful but more studies are needed to show how to maintain it.[10,30]

Malnutrition is common, under recognised and under-treated health problem,[69] screening for malnutrition helps to detect the malnourished patients. It is recommended that patients who score 5 points or more should get nutrition therapy from dietician, as patients at risk for malnutrition often need nutritional support to improve clinical outcome.[10] The flow chart in figure 2 helps the staff to make a decision based on the score from the screening tool. Recently Rannveig Björnsdóttir *et al*. 2012 validated a plate diagram at LSH, which is cheap and simple way to estimate patient's energy and protein intake. The plate diagram can be helpful in the nutrition support at the wards, for example if a patient is at risk for malnutrition.

A recent systematic review investigated barriers and facilitators of nutritional screening of patients. The main barrier was found to be a lack of initial and ongoing training regarding screening and a lack of education regarding the nutritional care process. The screening must be considered to be integral part of nursing assessment to take place.[70] Still there is a lot of work left regarding to the implementation and one thing is for sure, the active encouragement and education must be continued.

5.2 Estimated energy requirements using different equations

Six different predicting equations were used to estimate energy expenditure for patients (n=61) at the Department of Cardiothoracic surgery. The results are shown in Table 8 presenting the average estimated energy requirements in the group, using different equations.

The difference in estimated energy requirements depending on which equation was used was minimal, or around 100 kcal/d for both men and women when using adjusted body weight in the equations (Table 8). All of the men fell within the range of 25-30 kcal/kg/d but

the women were at the lower limit or just below. Among men, the highest energy requirements were estimated by using the Owen equation while the lowest energy requirements were observed when using the H-B equation (1918). In women the highest energy requirements where estimated by the ACCP equation and Mifflin St. Jeor equation, and as for the men, the lowest values where estimated by the H-B equation (1918). More studies are needed to develop and investigate equations in various groups of patients.

Table 8 Energy expenditure estimated with various predicting energy expenditure equations (mean ± standard deviation).

	Men n=41				Women n=20			
	Adjusted[1]	Actual[2]	Adjusted[1]	Actual[2]	Adjusted[1]	Actual[2]	Adjusted[1]	Actual[2]
Equation	kcal/day		kcal/kg/day		kcal/day		kcal/kg/day	
ACCP	1848 ± 183	2077 ± 457	25 ± 0.0	25 ± 0.0	1646 ± 205	1884 ± 415	25 ± 0.0	25 ± 0.0
Harris Benedict, 1918[3]	1862 ± 204	2013 ± 321	23 ± 4.5	25 ± 3.1	1545 ± 161	1655 ± 237	21 ± 3.5	22 ± 2.4
Harris Benedict, 1984[3]	1892 ± 185	2039 ± 307	26 ± 2.4	25 ± 2.9	1545 ± 165	1651 ± 237	24 ± 1.5	22 ± 2.3
Mifflin St. Jeor, 1990[3]	1846 ± 168	1955 ± 248	25 ± 2.4	24 ± 3.2	1620 ± 210	1734 ± 282	25 ± 1.5	23 ± 2.3
WHO/FAO, 1985[3]	1895 ± 189	2041 ± 298	26 ± 2.7	25 ± 3.1	1577 ± 126	1692 ± 206	24 ± 1.9	23 ± 2.7
Owen, 1987[3]	1960 ± 90	2071 ± 224	27 ± 1.4	25 ± 2.4	1523 ± 71	1605 ± 143	23 ± 2.1	22 ± 3.0
Mean	1884 ± 170	2033 ± 309	25 ± 2.2	25 ± 2.5	1576 ± 156	1704 ± 253	24 ± 1.8	23 ± 2.1
Minimum	1846	1955	23	24	1523	1605	21	22
Maximum	1960	2077	27	25	1646	1884	25	25

[1] Body weight was adjusted for patients with BMI >25 kg/m^2, the weight was used which corresponds to BMI 25 kg/m^2 instead of actual body weight.
[2] Actual body weight.
[3] Equation multiplied with stress factor 1.2.

The difference between those 6 equations is not very high and even though the accuracy is low there is not a prerequisite to change the recommended equation into another.[44,47] Studies suggest that H-B equation is more accurate than ACCP equation.[55] ACCP is more simple, therefore, more feasible to use in clinical settings. In ESPEN and ASPEN clinical guidelines the use of the ACCP equation of 25 kcal/kg ideal body weights is recommended, but for severe stressed patients 30 kcal/kg ideal body weight is used to estimate energy requirements.[32,63] A similar approach is recommended in the Clinical Guidelines on Nutrition for Hospitalized patients at LSH where the energy requirement for hospitalized patients (others than the patients at ICU) is estimated to be 25 to 30 kcal/kg ideal body weight per day

but lower energy intake is recommended for patients at the ICU, or 20 to 25 kcal/kg ideal body weights per day.[63]

Specific guidelines for surgical patients have been developed for example by ESPEN.[27] Those recommendations harmonize with other guidelines.[32,63] Ideally, surgical patients should be able to consume normal food within 1 to 3 days in line with estimated energy requirements. Overfeeding should though be avoided as it has been suggested to result in oedema, postoperative ileus and delayed gastric emptying.[27] In the study (see the published paper, chapter 4) the consumption was compared to 25 kcal/kg ideal body weight, the lower limit recommended in Clinical Guidelines on Nutrition for hospitalized patients at LSH. In the study only 16% of the patients consumed 25 kcal/kg ideal body weight, or more. The nutrition status for those surgical patients who are severe stressed might, therefore, be even worse than concluded in the paper.

According to the literature search conducted as part of this thesis work there is no new evidence supporting that other equations should be used for surgical patients than the ones currently recommended in the Clinical Guidelines on Nutrition for Hospitalized patients at LSH. Ideally, energy expenditure should be measured using IC whenever possible.[19] IC has found to be the "golden standard" to measure energy expenditure in hospitalized patients and also hardly feasible in clinical settings.[41,44] In recent study IC measurement among critically ill patients was found to be feasible, useful, and not extremely time consuming at ICU.[71]

In ESPEN guidelines, protein recommendation for surgical patients is 1.5 g protein/kg/d.[27] In the study (see the published paper, chapter 4) the consumption was compared to 1.2 g protein/kg/d, the lower limit recommended in Clinical Guidelines on Nutrition for Hospitalized patients at LSH. In the study only 11% of the patients consumed 1.2 g protein/kg/d, or more. The nutrition status for those surgical patients might, therefore, be even worse than concluded in the paper.

The results show that much greater effort is needed to ensure enough energy and protein intake in malnourished hospitalized patients at LSH.

6. FUTURE PERSPECTIVES

It is generally accepted that using the SSM at hospitals can be important part in clinical care of hospitalized patients, in order to find malnourished patients and ensure appropriate nutritional care. The results presented in this thesis show that it is important to find a methods to implement nutritional screening as well as finding ways to maintain it. It might be suggested that a responsible person is needed at each ward. Estimating energy and protein intake is important part of the nutritional care, in order to estimate the patients need for additional nutrition, such as oral nutrition supplements or energy- or protein rich in-between meals.

Most of the studies concerning clinical nutrition include patients groups receiving either enteral or parenteral nutrition which is not the scope of the present thesis. There are also many studies about ready-to-use supplemental drinks which have demonstrated that nutrition drinks and supplements in addition to hospital food improves total intake.[72,73] Only few studies have been done concerning changes in the hospital menu and how it can reduce malnutrition in hospitalized patients[74-76] and when patients are able to choose from selected dishes their nutrition status has found to improve.[76]

A new study is now in process by Áróra Rós Ingadóttir where energy and protein intake will be estimated with the validated plate diagram and a questioner will be posed for the patients about their views to the hospital menu.

Addition of oral nutritional supplements to hospital meals has shown improvement in malnourished patients' recovery.[77] Interesting is if similar improvements can be reached by regular food (energy- and protein dense in-between-meals or snack), more studies are needed about the subject.

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APPENDIX

Appendix I – Screening tools recommended by ESPEN

ESPEN guidelines recommend either the use Malnutrition Universal Screening Tool (MUST) or Nutritional Risk Screening (NRS 2002) for adults and Initial Screening in Mini Nutritional Assessment (MNA©) for the elderly.[1]

Malnutrition Universal Screening Tool (MUST) for adults

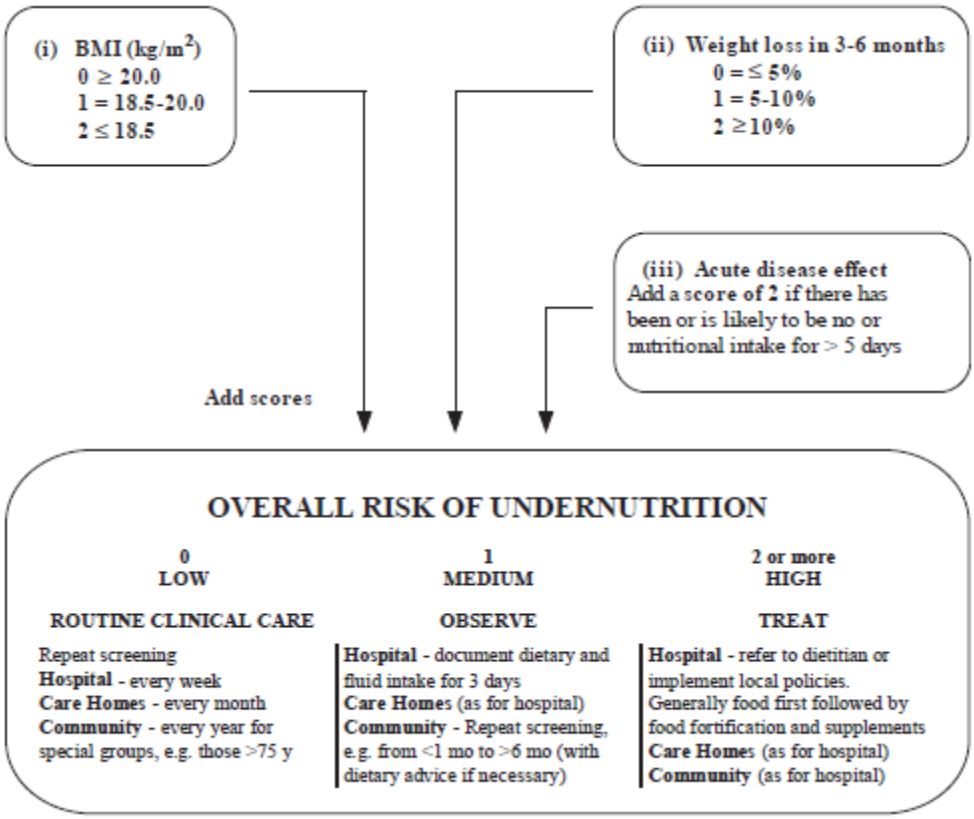

Figure 1 Malnutrition Universal Screening Tool (MUST) for adults.[1]

Nutritional Risk Screening (NRS 2002) screening tool

Table 1 Initial screening.[1]

		Yes	No
1	Is BMI <20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed. **No**: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 2 Final screening.[1]

Impaired nutritional status		**Severity of disease (≈ increase in requirements)**	
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. *Chronic hemodialysis, diabetes, oncology*
Moderate **Score 2**	Wt loss >5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* *Severe pneumonia, hematologic malignancy*
Severe **Score 3**	Wt loss >5% in 1 mth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* *Intensive care patients (APACHE>10).*
Score:	+	**Score:**	**=Total score**
Age	if ≥70 years: add 1 to total score above	**=age-adjusted total score**	
Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated **Score <3**: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

NRS-2002 is based on an interpre-tation of available randomized clinical trials.
*indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in *italics* are based on the prototypes given below.
Nutritional risk is defined by the present **nutritional status** and risk of impairment of present status, due to **increased requirements** caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are

(1) severely undernourished (score = 3), or (2) severely ill (score = 3), or (3) moderately undernourished + mildly ill (score 2 + 1), or (4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease
Score = 1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.

Score = 2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.

Score = 3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

Mini Nutritional Assessment (MNA©) for the elderly

Table 1 Initial Screening.[1]

A	**Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?** 0 = severe loss of appetite 1 = moderate loss of appetite 2 = no loss of appetite	
B	**Weight loss during last months?** 0 = weight loss greater than 3 kg 1 = does not know 2 = weight loss between 1 and 3 kg 3 = no weight loss	
C	**Mobility?** 0 = bed or chair bound 1 = able to get out of bed/chair but does not go out 2 = goes out	
D	**Has suffered physical stress or acute disease in the past 3 months?** 0 = yes 2 = no	
E	**Neuropsychological problems?** 0 = severe dementia or depression 1 = mild dementia 2 = no psychological problems	
F	**Body Mass Index (BMI) [weight in kg]/[height in m]2** 0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater	
Screening score (total max. 14 points)		
12 11	points or greater points or below	Normal—not at risk → no need to complement assessment Possible malnutrition → continue assessment

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