



## Clinical nutrition in the hepatogastroenterology curriculum

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### Abstract

Gastroenterology (GE) used to be considered a subspecialty of internal medicine. Today, GE is generally recognized as a wide-ranging specialty incorporating capacities, such as hepatology, oncology and interventional endoscopy, necessitating GE-expert differentiation. Although the European Board of Gastroenterology and Hepatology has defined specific expertise areas in Advanced endoscopy, hepatology, digestive oncology and clinical nutrition, training for the latter topic is lacking in the current hepatogastroenterology (HGE) curriculum. Given its relevance for HGE practice, and being at the core of gastrointestinal functioning, there is an obvious need for training in nutrition and related issues including the treatment of disease-related malnutrition and obesity and its associated metabolic derangements. This document aims to be a starting point for the integration of nutritional expertise in the HGE curriculum, allowing a central role in the management of malnutrition and obesity. We suggest minimum endpoints for nutritional knowledge and expertise in the standard curriculum and recommend a focus period of training in nutrition issues in order to produce well-trained HGE specialists. This article provides a road map for the organization of such a training program. We would highly welcome the World Gastroenterology Organisation, the European Board of Gastroenterology and Hepatology, the American Gastroenterology Association and other (inter)national

Gastroenterology societies support the necessary certifications for this item in the HGE-curriculum.

**Key words:** Gastroenterology; Training; Clinical Nutrition; Malnutrition; Metabolism; Curriculum; Targeted therapy; Enteral feeding; Parenteral feeding; Obesity

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**Core tip:** There is a need for training in nutrition and nutrition related issues because it lies at the core of gastrointestinal functioning and is very relevant to hepatogastroenterology (HGE) practice. At the moment there is no defined standardised nutrition curriculum this document aims to be a starting point for the integration of nutritional expertise in the HGE curriculum.

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## INTRODUCTION

Until the 1980's gastroenterology (GE) was considered a subspecialty of Internal Medicine. Since then GE has developed into a specialty incorporating hepatology, gastrointestinal oncology, neuromotility and intervention endoscopy. It is a challenge to develop a training program that produces hepatogastroenterologists (HGE specialists) with adequate training, education and expertise competent in all aspects of HGE by the end of their program<sup>[1,2]</sup>.

Although the European Board of Gastroenterology and Hepatology (EUBOGH) curriculum is competence-based the duration of HGE training meets the European minimum of four years of full-time subspecialty training (EU-directive 2005/36/EC). In 2002, the Dutch Board for Hepatogastroenterology extended GE training to 4 years, with a Common Internal Medicine Trunk of 2 years<sup>[1,3]</sup>. In the final year, a fellow may expand their knowledge in an expert field (advanced endoscopy, neuromotility, hepatology, digestive oncology). EUBOGH defined subspecialties in advanced endoscopy, hepatology, digestive oncology, and clinical nutrition. Only training in hepatology and digestive oncology have been well defined; an adequate curriculum for nutrition training is lacking (<http://www.eubog.org>)<sup>[4,5]</sup>. The European Society for Paediatric Gastroenterology Hepatology and Nutrition published their program for Subspecialty training<sup>[6]</sup>. Many HGE-fellows have no formal nutrition training included in their curricula<sup>[7,8]</sup>. Critical reviews on a lack of experienced trainers in this field have been published<sup>[9]</sup>. We suggest nutrition education as part of HGE training programs<sup>[10]</sup>. The

World Gastroenterology Organisation (WGO) formulated standards for HGE training<sup>[5]</sup>. Nutrition has not been defined; therefore such a training program needs to be developed and subjected to regular revision. This document aims to serve as a starting point for such a curriculum.

## NUTRITION AND NUTRITION-RELATED PROBLEMS

Diseases that impair digestion, absorption or delivery of nutrients to the body result in malnutrition, catabolism and vitamin and mineral deficiencies. In recent years, the impact of disease-related malnutrition on outcome is coming into the limelight. The risk of developing malnutrition is increased during states of injury, inflammation or infection<sup>[11]</sup>. Stress metabolism impacts nutrition status and may result in the need for alternative feeding enteral or parenteral. It is important for the HGE-specialist to understand metabolism under different conditions and to be able to provide nutrition when oral feeding is thwarted or inadequate. Patients with diarrhoea, malabsorption, pseudo-obstruction, short bowel syndrome, intestinal inflammation, liver or pancreatic insufficiency and small bowel fistulae require nutritional management. At the other end of the spectrum HGE (pediatric) specialists are increasingly confronted with obesity and its related problems during (chronic) illness and following bariatric surgery<sup>[12,13]</sup>.

Data from The Netherlands show that malnutrition remains present in every one out of four to five admitted patients in hospitals<sup>[11,14,15]</sup>. The relevance of this topic is underlined to assess the prevalence of malnutrition, in the form of the so-called Nutrition Day, by the European Society for Clinical Nutrition and Metabolism (ESPEN), supported by the European Community. Notably, these data confirm that the problem remains despite validated screening tools, such as the Malnutrition Universal Screening Tool (MUST) and the Short Nutritional Assessment Questionnaire (SNAQ). The treatment of malnutrition should be initiated by physicians, in cooperation with trained (clinical) dieticians in any high-risk patient<sup>[16]</sup>. The lack in awareness of nutritional issues probably results from the absence of this topic in the HGE curriculum; ignorance may therefore play a key role here<sup>[17]</sup>.

In our opinion, this situation offers an opportunity for the HGE-fellows for several reasons: (1) Digestion and absorption are key functions of the gastrointestinal tract and HGE-specialists should know the (patho)physiological consequences of dysfunction; (2) Compared to other care providers, the HGE-specialist has the advantage of being trained to recognize the patient's nutritional status. This enables endoscopical visualization that allows the measures and procedures to manage this disbalance; (3) Nutritional problems are associated with gastrointestinal motility disorders,

**Table 1 Requirements for basic nutrition training**

Pathophysiology of the gastrointestinal tract and its motility regulation
Metabolism in health and disease
Diagnosis of nutritional status and GI function
General understanding of dietary requirements in health and disease
Understanding of disease-related digestive and metabolic dysfunction, diagnosis and treatment of intestinal failure
Diagnosis and treatment of obesity
The ability to perform and understand the limitations of more complex nutrition treatments and metabolic derangements in healthy subjects and diseased ones, including enteral and parenteral nutrition strategies
Expertise in multidisciplinary care
Ability to collaborate in (translational) research

such as postoperative or drug-induced dysmotility; (4) HGE specialists play a central role in the care of surgical and medical specialties who deal with metabolic and nutritional derangements. HGE-specialists appear to be the ideal axis in care around the malnourished patient, as the coordinator of a nutrition support team or of intestinal failure units; (5) Another reason is the role of the HGE-specialist in procedures to manage malnutrition, including placement of feeding tubes, percutaneous endoscopic gastrostomies (PEG), jejunostomies (PEG-J and PEJ); (6) The HGE specialist is trained to manage intestinal failure, the indication for parenteral nutrition that can subsequently be initiated in case enteral nutrition and pharmacotherapy fail; (7) The dedicated HGE specialist in nutrition should be trained to tackle complications associated with nutritional interventions and metabolic derangements, including the refeeding syndrome; and (8) Comprehensive training also requires exposure to research, either basic and translational research, but also clinical trials. This will prepare the fellow to explore nutritional and metabolic issues<sup>[18]</sup>.

## **ESPEN: THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM**

ESPEN, founded in 1979 (<http://www.espen.com>) as the European Society for Parenteral and Enteral Nutrition, is dedicated to nutrition and has a collaborative relationship with the American Society for Parenteral and Enteral Nutrition (ASPEN). ESPEN promotes research, education and consensus statements about clinical care<sup>[17]</sup>. The aim of ESPEN is to encourage the knowledge in clinical nutrition and metabolism. As part of their activities, ESPEN offers the Life Long Learning (LLL) programme in Clinical Nutrition and Metabolism.

So far, few training centres offer fellowships in advanced nutrition and essential requirements for this have not been characterized, although educational merits of this type of benchmarking have been shown in recent courses, such as in Denmark. Requirements for the HGE specialist with a focus in nutrition have been defined (Table 1).

The goal of advanced training in nutrition is to improve the knowledge and skills beyond the expertise

that is obtained during the regular HGE program. This fellowship should contain twelve months of clinical exposure during the HGE training.

We suggest membership of ESPEN to be encouraged for European HGE-specialists in nutrition, in particular for those who dedicate their professional activity to this field, those who are board certified by EUBOGH or the respective equivalent in their country of origin, and those who have additional experience in the field of nutrition following formal HGE training.

### ***The training program: structure***

The program in nutrition should provide structured education at such a level to ensure that trainees in their focus year acquire the knowledge and skills necessary to gain expertise beyond that acquired in the standard HGE residency<sup>[1]</sup>. This type of training is additional to the more limited form of training in nutrition, provided to all HGE-fellows at a basic level. Access to patient care and multidisciplinary team discussions with hospital dietitians, surgeons and intensivists with expertise in nutrition are required. Programs must provide structured opportunities to develop skills in nutrition-related endoscopic procedures, such as the placement of feeding tubes, gastrostomies and jejunostomies. Fellows in this program should be involved in a predefined number of such procedures.

If science laboratory training is offered, the facilities must be available under the supervision of a trainer who has obtained at least national reputation in research, as evidenced by publications in peer-reviewed journals, and membership of a nutrition society.

As a benchmark of (Dutch) HGE-approved fellowships in formal HGE training, the following section describes a curriculum for nutrition. Topics for the theoretical basis are included in Table 2.

### ***Nutrition in the Dutch training: Radboud University Nijmegen***

The HGE Department of the Radboud University in Nijmegen is the only academic centre in The Netherlands that currently offers the opportunity to focus on nutrition and intestinal failure during four-months. During this period the HGE-fellow responsible for the care of the patients admitted to the Intestinal Failure Unit. The Intestinal Failure Unit harbours around 175-200 outpatients suffering from intestinal failure necessitating treatment with (par)enteral nutrition and/or fluids. These patients are admitted initially as part of the 1-2 wk patient training to become self-supporting in parenteral nutrition. Thereafter, patients are admitted because of complications related to the underlying disease (Short bowel syndrome, motility disorders) but most often as a consequence related to the presence of a venous access device, or metabolic derangements due to increased stoma or fistula output. The fellow chairs the weekly grand round under daily supervision by a staff member

**Table 2 Elements of the suggested modular teaching program on clinical nutrition for hepatogastroenterology specialists**

Knowledge of key issues in nutrition
GI physiology
Anatomy
Digestion
Absorption
Motility
GI endocrinology/hormones
Physiology and metabolism of body composition, energy homeostasis
In health
Satiety/needs, calculations, measurements, techniques
Concerning:
Fat
Carbohydrates
Protein
Energy
Micro elements/vitamins
Starvation: Differential diagnostics and clinical management
Obesity: see below
Interventions
Artificial nutrition
Tube feeding/Enteral/PEG tube insertion
Parenteral nutrition
Administration:
access techniques and complications
Complications and safety
Risk-benefit analysis
Enteral nutrition
Parenteral nutrition
Normal (per oral) feeding
Feeding and artificial orificia
Use of nutrition with stress metabolism
Pathophysiology of digestion
Diseases of digestion and absorption
Diseases of impaired nutrient delivery
Protein-losing enteropathies
Pathophysiology of metabolism
Stress metabolism
Metabolism in Critical Illness
Nitrogen wasting
Genetic Metabolic disorders (e.g., OTC)
Special Diets
Nutrition and psychology
Role of psychological issues
Specific clinical situations
Kidney and liver disease
Catabolism/malnutrition
Cancer
Inflammation
Use of PN
Indications
Designing a formula
Monitoring for complications
Techniques
Feeding tubes: nasogastric/nasojejunal
PEG/PEJ/PRG
PEG-J
Jejunostomy [surgically created (Witzel's) fistula or needle jejunostomy]
Central venous access: (tunnelled) catheters
Peripherally inserted central catheters (PICC)
Subcutaneous ports/arteriovenous fistulae (shunts)

responsible for the nutrition care. The fellow runs a weekly multidisciplinary outpatient clinic where new and control patients are seen. Patients are referred by HGE-specialists and surgeons on a nationwide basis. Additionally, patients with an indication for

the placement of feeding tubes, gastrostomies or jejunostomies are seen from other local disciplines. The fellow is involved in the endoscopic procedures and aftercare (e.g., wound care, changing of clogged or dislocated tubes). Parenteral nutrition prescriptions and lab results are discussed on a weekly basis with nurses, dietician and a hospital pharmacist. Finally, all in-hospital nutrition consultations are conducted by the fellow. The fellow provides lectures on metabolic/nutrition-related topics for the other HGE-trainees and HGE-staff. In general, the topics covered in Table 2 provide the theoretical background for this training.

### ***Nutrition in the Danish training: Rigshospitalet, Copenhagen***

The HGE Department at Rigshospitalet is one of three academic centres in Denmark offering HGE-training with focus on nutrition. The fellow opting to join the Intestinal Failure Unit will spend 8 mo taking care of patients with intestinal failure. Eighty percent of the 30 beds in the HGE-ward are continuously occupied with patients with intestinal failure. Currently, around 250 IF patients are followed in the outpatient clinic. The number of HPN patients has now exceeded 450 patients in the Danish population (5.6 million people). In the training the fellows are also given an understanding of the large inter-patient heterogeneity and introduced to the affiliated research of the unit. In addition to the practical skills outlined by the Nijmegen group, the trainees are also introduced to the methodology and outcome results which often illustrate the "effect-heterogeneity" within the patient population and the need for "individualised medicine".

### ***Nutrition in the United States training: The University of Chicago***

The Curriculum for HGE training is a joint document by the American Gastroenterological Association (AGA) Institute, American College of Gastroenterology (ACG), American Society for Gastrointestinal Endoscopy (ASGE) and American Association for the Study of Liver Disease (AASLD). Basic nutrition (Level 1) training for HGE fellows includes the basic principles of nutrient assimilation, nutrition status, metabolic response to starvation and stress, nutrition support, management of nutrition therapy, management of obesity, and ethical issues in nutrition. The training process includes lectures, conferences, readings and experience to include nutrition assessment, risk/benefit assessment of nutrition support, tube placement, and order writing for enteral/parenteral formulas. Clinical experience can be obtained in a variety of ways: (1) on an inpatient HGE-unit headed by a faculty member in nutrition; (2) on a nutrition support team; or (3) by management of nutrition outpatients. Learning can be at the home institution or at an affiliated nutrition unit. Advanced nutrition (Level 2) HGE training requires training at a unit with a trainer who has expertise in clinical nutrition and research, and has an established clinical nutrition

**Table 3 Diagnostic matrix nutritional status**

Medical factors	Functional factors
Age, sex	Hand grip strength
Medical diagnosis, disease stage/ characteristics	Walking speed
Hospital admission/surgery/treatment	Activities
Laboratory results	Exercise/sports
Gastro-intestinal complications	(I)?ADL dependency
Appetite	
Difficulties in chewing and swallowing	
Anthropometry (body weight and height, weight loss/gain)	
BMI	
Body composition (fat free mass/fat free mass index)	
Energy expenditure (resting energy expenditure and total energy expenditure)	
Nutritional intake	
Medication	
Mental factors	Socio-economic factors
Motivation/stage of behaviour change	Financial status
Depression/mental disorder	Work
Cognitive disorder/dementia	Educational level
Mental stress	Activities/interests
Loss response	Degree of participation in society
Disease insight	Living and family situation
	Social network
	Children
	Availability family care givers
	Transportation options
	Loneliness

service. Twelve months of training are required.

There are few HGE-specialists in the United States who have adequate expertise in nutrition to train HGE fellows in the Nutrition Curriculum. HGE fellows at the University of Chicago receive basic nutrition training for 4 mo during rotations on the Nutrition Unit, a Nutrition Support Team headed by a HGE-specialist with expertise in nutrition and small bowel diseases. The nutrition curriculum is taught in the in- and outpatient setting. Advanced nutrition training is offered as a 1-2 year fellowship with intensified training in the nutrition curriculum including leading a nutrition support team, research and management of diarrhoea/malabsorption, the short bowel syndrome, intestinal failure and manage (par)-enteral nutrition.

**TOOLS AND METHODS FOR CLINICAL DIETICIANS; VUMC AMSTERDAM**

The diagnosis is the basis for all nutritional interventions. This "Pocket Guide Dietetics" provides a practical and complete guide to dietetic diagnostic tools and methods.

The nutritional status is a result of nutritional intake, nutritional requirements and influencing factors from four underlying domains (medical, functional, mental and socio-economic factors), which, together with the needs of the patient form the basis to the

**Table 4 Weight class an obesity score**

Weight class	BMI
Under weight	< 18.5
Normal weight	18.5 - 25.0
Over weight	25.0 - 30.0
Obesity	
Class I	> 30
Class II	> 35
Class III: Extremely obese	> 40
Class IV: Super obese	> 50

dietetic diagnosis (Table 3). The diagnosis, in turn, gives direction to treatment, interventions and the effectiveness, of which again needs to be evaluated.

The assessment of the nutritional status resembles the comprehensive geriatric assessment (CGA). In daily practice, the diagnostic matrix (Table 3) to assess a patient's nutritional status has proven to be useful to collect, organize and review the available information and to identify missing information. The matrix can be used in hospital, care homes and in the community and in children and adults.

The Pocket Guide Dietetics was developed by the Department of Nutrition and Dietetics of the VU University in Amsterdam and endorsed by the Dutch Dietetic Association and NESPEN with the objective to standardize dietetics<sup>[19]</sup>.

In The Netherlands it has become an important tool to help dieticians with nutrition management in the overall medical diagnosis and treatment.

**Obesity and its treatment**

Stratification of obesity by means of body mass index is shown in Table 4. Differences in normal ranges are made between ethnic groups. With the growing pandemic of obesity better knowledge is essential for HGE specialists (Table 5).

Energy imbalance is the key problem. Genetic and/ or environmental factors are linked to obesity. Neural, hormonal and metabolic signals are involved in regulation of the balance of nutrient intake in relation to energy expenditure. Differences in these mechanisms may lead to obesity. Intestinal microbiota is thought to play a major role. The nutrition specialist understands the pathophysiology of obesity. The therapy is based on three pillars: diet, behavioural therapy and physical exercise. A realistic treatment schedule should be discussed with the patient. The nutrition specialist joins the outpatient clinic of dietician and psychotherapist in designing treatment plans. Pharmacological therapy may be added. The nutrition specialist knows of (contra)indications and side-effects of pharmacological therapy in obesity. In case conservative strategies do not lead to substantial weight loss bariatric surgery might be indicated. Only with a BMI ≥ 40 kg/m<sup>2</sup> or a BMI of ≥ 35 kg/m<sup>2</sup> with related comorbidities bariatric surgery might be considered. Endoscopic bariatric procedures are not

**Table 5 Training for obesity**

Knowledge about the risks and dietary, pharmacological and surgical techniques to control this
Modular Training for Obesity
Physiology of weight regulation
Hormones
Neurotransmitters
Feedback loops
Pathophysiology of Obesity
Behavioural
Hormonal
Genetic
Intestinal microbiome
Obesity managements
In Health
Diet
Lifestyle
Medications
Surgery
Feeding in disease
Hypocaloric feeding
Nitrogen balance
Bariatric surgery management strategies
Restrictive Surgery (Roux-Y gastric Bypass, Gastric band/sleeve)
Diet, vitamin and mineral supplements
Expected weight loss
Monitoring
Complications (dumping syndrome, vomiting, gastro-gastric fistula)
Malabsorptive surgery (Duodenal switch, pancreatico-biliary diversion)
Diet, vitamin and mineral supplements
Expected weight loss
Monitoring
Complications (dumping/rapid transit, dysbiosis, hypoproteinaemia)
Endoscopic Management
Leaks
Strictures
Bleeding
Biliary

commonly performed and are not approved by the FDA.

### **Follow-up after bariatric surgery**

Given the nature of bariatric surgery attention has to be paid to malabsorption and intestinal insufficiency in the bariatric patient. Malabsorptive consequences of surgery are vitamin and micronutrient deficiencies, therefore lifelong supplementation and follow-up is mandatory.

Bariatric surgery changes the normal anatomy and the HGE-specialist should know the new "normal" anatomy in order to correctly interpret potential abnormalities. The HGE-specialist should know signs, symptoms and complications after bariatric surgery. Endoscopic treatment of choledocholithiasis is challenging. If the limb length of the biliodigestive limb and the gastrojejunal limb is approximately more than 150 cm a laparoscopy-assisted ERCP through gastrostomy in the remnant stomach is preferred<sup>[21]</sup>.

## **DISCUSSION**

The goal of the WGO, AGA, or EUBOGH-fellowship

program remains to produce well-trained nutrition HGE specialists who will be coordinators in the clinical nutrition field. They should be qualified to promote improvements in national care to reduce the incidence, morbidity and mortality of malnutrition and obesity and to improve quality of life. Despite a recognized need for structured Nutrition training, there is a lack of standardized fellowship programs for subspecialty qualification. The opportunities for training in Clinical Nutrition are extremely variable all over the world, and non-existent in many countries. It is important to determine the level of nutritional knowledge of HGE-specialists and improve upon it. Nutritional abnormalities associated with malabsorption, the provision of nutritional knowledge and the high prevalence of obesity amongst HGE-patients are reasons to advise nutritional training. Recent studies from Canada and Iran showed a lack in nutrition knowledge among HGE-specialists<sup>[7,8]</sup>.

Our curriculum proposal paves the way for further discussion and developments to improve nutrition training and improve nutrition education.

By working in nutritional support teams, HGE-fellows have an opportunity to participate in the development of multidisciplinary management in patients, as well as participating in research including clinical trials. The in- and outpatient nutritional support teams should provide HGE-fellows with an education in the diagnosis and management of nutritional problems in a diverse population of patients. The fellow will be taught methods to obtain safe access to the GI-tract for enteral feeding. Education in the diagnosis and management of malnutrition, malabsorption and diarrheal diseases is provided in the outpatient setting. Clinical nutrition training is provided to all fellows at a basic level and for those wishing to specialize in nutrition at an advanced level.

At the other end of the spectrum, obesity causes unique problems with regard to nutritional consequences which also require advanced training. Hospitals with bypass-surgery recognize the need for obesity medicine specialists. Obesity is a nutritional disorder, at the same time it is a disease. The treatment is built on diet, exercise, and lifestyle change. Treatment requires overlap between endocrinology and hepatogastroenterology<sup>[21]</sup>. The endocrinologist is the subspecialist who should be consulted in case of comorbidities such as type 2 diabetes mellitus and metabolic dysfunction causing hyperlipidaemia and other endocrine complication.

## **CONCLUSION**

With today's society becoming increasingly health-conscious, more people are seeking help to manage their eating habits and lifestyles. So far, we didn't include training in Clinical Nutrition in our curricula.

Diet has been central to the study of hepatogastroenterology. However, nutrition specialists are few.

They have generally been relegated to nutrition support in the hospitalized patient, short bowel syndrome, malabsorption and malnutrition. The controversies regarding diet for weight loss, weight maintenance and malnutrition should be the purview of a nutrition specialist. A competent subspecialist for nutrition must have knowledge to manage a myriad of nutritional disorders. The European and American Boards of Medical Specialties have never been able to officially classify nutrition as a medical specialty. We suggest such a subspecialty for hepatogastroenterology.

Our recommendation for Clinical nutrition expert competence is to define Clinical Nutrition Medicine as a specialized capacity. This slightly deviates from the nutrition/obesity medicine specialist suggested by the more theoretically educated endocrinologists<sup>[22]</sup>. Paediatric obesity and malnutrition related management issues require coordination of care and nutrition specialists in paediatrics<sup>[12]</sup>. We should use the fellowship programs in nutrition to train HGE-specialists, and in an adapted way, intensivists and endocrinologists to become certified clinical nutrition specialists.

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