



Opinion paper

Suggestions for terminology in clinical nutrition



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SUMMARY

Purpose: The nomenclature in clinical nutrition differs locally, among (para)medical disciplines, and both nationally and internationally. The inconsistencies hamper public, professional and scientific discussions. A working group of the German Society of Nutritional Medicine (DGEM) was established to work out definitions for the relevant terms used in nutritional support within Germany.

Methods: Terms were searched in (inter)national hard print technical literature (medical dictionaries, text books, (inter)national guidelines and online (PubMed, Embase, CINAHL, Google Scholar, general internet). (Inter)nationally agreed definitions published by Clinical Nutrition Societies were preferred to other reports.

Results: The terms were organised into four categories totaling 53 definitions: 1. *Fields and structure:* medical nutrition, clinical nutrition, nutrition steering committee, nutritional care, care catering, dietetics (dietary advice), obesity as part of clinical nutrition (obesity team), nutritional support (nutrition support team, malnutrition screening, nutritional support therapy), functional nutrition, nutritional assessment, nutrition therapy plan, nutritional therapy, 2. *Nutritional conditions:* disease-related malnutrition (starvation induced malnutrition, chronic disease-related malnutrition, acute disease-related malnutrition), cachexia, sarcopenia, specific nutrient deficiencies, refeeding syndrome, 3. *Forms of nutrition:* diet (regular diet, therapeutic diet, fortified food), artificial nutritional support (oral nutritional supplementation, enteral nutrition, parenteral nutrition) 4. *Products:* oral nutritional supplements and enteral formulas (whole protein formula, peptide-based formula, free amino acid formula, standard formula), parenteral solutions (total nutrient admixtures, multi-chamber systems, multiple bottle systems).

Conclusion: A comprehensive list of definitions for terms in nutritional support has been established for the first time and is made available to the international community for further development and discussions.

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Introduction

As a naturally growing area, professionals in clinical nutrition have developed individual terminologies depending on their geographical region, professional background, medical discipline and speciality of clinical nutrition. These inconsistencies

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complicate discussion and exchange among specialists on a national and international level.

This paper is the effort of a working group of the German Society of Nutritional Medicine (DGEM) to define terms imperative to nutritional support. The main incentive was to ensure consistent wording among all chapters of the 2010–2013 DGEM guideline update “Clinical Nutrition”.¹ The primary aim was to develop a national consensus.² With this English report, the DGEM working group decided to make its efforts available for international discussion. The ultimate objective is to stimulate the future development of European or even world-wide consensus definitions under the patronage of international nutrition societies. This would be especially helpful to harmonise international scientific communication and will be necessary to improve the awareness of clinical nutrition in the overall medical community. Consistent criteria for definition of nutrition-related medical problems are needed to address these for diagnosis and treatment, as well as for applying for health care resources.

The newly developed nomenclature contains working definitions, implying that the definitions will be subject to change through publication, international discussion and newly emerging scientific evidence. In medicine, working definitions should reflect current scientific knowledge and be clinically useful, specific, and easy to understand. To comply with requirements, the definitions are provided in a short, glossary-style description. This is followed by a more detailed explanation in the form of specifying definitions, when deemed necessary. Specifying definitions are definitions that extend the lexical definition of a term by including additional criteria that narrow down the set of possibilities meeting the definition. This approach was chosen to make sure that clear information is being supplied to the reader, in particular, because some of the introduced concepts can be subject to different interpretation in clinical practice.

Methods

The definitions were developed by the members of the DGEM working group, who are also the authors of this report.

The search and development strategy consisted of three steps. 1) *Nomenclature and lexicography*: First, we identified names for the fields, structure, conditions or products to be defined. Each term was searched in printed media (medical dictionaries, text books for clinical nutrition, national and international guidelines) followed by online research (PubMed, Embase, CINAHL, Google Scholar and internet in general) to create a list of synonym terms. Obvious rare terms were omitted. Terms used in national and international guidelines or MeSH headings (PubMed) were preferred. The decision to use a word as main term was based on 1) the frequency of use in practise and science (checked by hits in google and PubMed) and its non-interchangeability with other terms. 2) *Definitions*: For each term definitions that already existed were collected and discussed for their consistency and completeness. Further online research was performed using MeSH headings and keywords in combination with “definition” or “terminology”. Gaps in definitions were identified and suggestions for amendments were developed to reflect the state-of-art of each defined term. Where applicable, existing definitions published by international PEN societies were used, e.g. of the European Society for Clinical Nutrition and Metabolism (ESPEN), the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.), the British Society for Enteral and Parenteral Nutrition (BAPEN) and the guidelines “Nutritional Support in Adults” of the National Institutes for Health and Clinical Excellence (NICE). Definitions and information published by the DGEM and the Austrian Society of Clinical Nutrition (AKE) were also considered. 3) *Taxonomy*: In a third step the interdependence of terms was

visualized graphically and the chapters of the present report were structured accordingly.

Suggestions for nomenclature and definitions were discussed electronically in multiple Delphi rounds within the working group and complemented by three in person meetings. Draft versions were sent on three occasions to all 95 members of the DGEM task force for guideline development for comments. The comments of the DGEM task force were integrated into the Delphi rounds of the working group. Disagreements within the working group were discussed until a simple majority (more than 50% of the author group) agreed to a solution.

With each definition, information was referenced to its source. Synonyms in English are quoted as other terms used in the

Table 1

Overview on defined terms.

1. Fields and structure

- 1.1. Medical nutrition
- 1.2. Clinical nutrition
- 1.3. Nutrition steering committee (NSC)
- 1.4. Nutritional care
- 1.5. Care Catering
- 1.6. Dietetics
 - 1.6.1. Dietary advice
- 1.7. Obesity (as part of clinical nutrition)
 - 1.7.1. Obesity team
- 1.8. Nutritional support
 - 1.8.1. Nutrition support team (NST)
 - 1.8.2. Malnutrition screening
 - 1.8.3. Artificial nutritional support therapy
- 1.9. Functional nutrition
- 1.10. Nutritional assessment
- 1.11. Nutritional therapy plan
- 1.12. Nutritional therapy

2. Nutritional conditions with relevance to nutritional support

- 2.1 Disease-related malnutrition
 - 2.1.1 Starvation-related malnutrition (S-DRM)
 - 2.1.2 Chronic disease-related malnutrition (C-DRM)
 - 2.1.3 Acute disease- or injury-related malnutrition (A-DRM)
- 2.2 Cachexia
- 2.3 Sarcopenia
- 2.4 Specific nutrient deficiencies
- 2.5 Refeeding syndrome

3. Forms of nutrition with relevance to nutritional support

- 3.1 Diet
 - 3.1.1 Regular diet
 - 3.1.2 Therapeutic diet
 - 3.1.3. Fortified food
- 3.2 Artificial nutritional support
 - 3.2.1 Oral nutritional supplementation (ONS)
 - 3.2.2 Enteral nutrition (EN) = tube feeding
 - 3.2.3 Parenteral nutrition (PN)
 - 3.2.3.1 Total parenteral nutrition (TPN)
 - 3.2.3.2 Partial parenteral nutrition (PPN)
 - 3.2.3.3. Subcutaneous nutrition

4. Products for artificial nutritional support

- 4.1. Oral nutritional supplements (ONS) and enteral (EN) formulas
 - 4.1.1 Whole protein formula
 - 4.1.2 Peptide-based formula
 - 4.1.3 Free amino acid formula
 - 4.1.4 Standard formula
 - 4.1.4.1 Normocaloric standard formula
 - 4.1.4.2 High energy standard formula
 - 4.1.4.3 High protein standard formula
 - 4.1.5. Disease-specific formula
 - 4.1.6 Nutritionally complete formula
 - 4.1.7 Nutritionally incomplete formula
 - 4.1.8. Summary of suggested nomenclature for ONS and EN formulas

4.2 Parenteral solutions

- 4.2.1 Total nutrient admixture (TNA)
- 4.2.2 Multi-chamber bags
- 4.2.3 Multiple bottle systems

literature, if not indicated otherwise. The German translation for each term is consistent with the consensus nomenclature employed in the 2013 DGEM guidelines update.² Terms defined somewhere else in this document are printed in italic letters in the text body of a definition.

Results

The complete list of defined terms is provided in Table 1.

1. FIELDS AND STRUCTURE

Fig. 1 depicts the taxonomy of terms defined in this chapter.

1.1. Medical nutrition (nutritional medicine)

GER: **Ernährungsmedizin**

Source: own development based on the subject area covered by trainings and textbooks for medical nutrition.

Medical nutrition is the subject area that encompasses *clinical nutrition* and additionally the research, practice and theory of *nutritional care* provided by clinicians (doctors, dietitians, nurses) also including particular groups of healthy people who are under medical or nursing supervision. Examples of this healthy group include pregnant women and athletes.¹

1.2. Clinical nutrition

GER: **Klinische Ernährung**

Source: own development based on the general consensus that clinical nutrition is aiming at ill humans.

Clinical nutrition is the subject area that embraces all research, practice and theory of *nutritional care* provided by clinicians (doctors, dietitians, nurses) to inpatients, outpatients or nursing home residents.

Clinical nutrition includes nutritional research, *care catering*, *dietetics*, *obesity management*, *nutritional support* and *functional nutrition* for acutely or chronically ill humans of any age, who are either receiving continuous care in health care institutions (hospitals, nursing homes, other long-term care facilities) or those who receive care periodically as outpatients in medical practices, clinics, or other ambulant health care facilities. As such clinical nutrition covers therapeutic and also preventive approaches.

1.3. Nutritional Steering Committee (NSC)

Syn: *Nutrition care committee (rare)*

GER: **Ernährungskommission**

Source: DGEM,^{3,4} BAPEN,^{5,6} NICE 2006.⁷

The nutritional steering committee (NSC) is a board in hospitals or nursing homes consisting of managers and directors, who together with delegates from all areas of *clinical nutrition*, draw up mandatory, hospital-wide standards for the management of *clinical nutrition*.

The objective of the NSC is to develop consistent and agreed standards for both the structures and the procedures in *clinical nutrition*.

¹ The practice and science of nutrition in healthy individuals belongs, above all, to nutritional sciences and to public health nutrition, and therefore is not exclusive to medical nutrition.

1.4. Nutritional care

Syn: *nutritional management*

GER: **Ernährungsversorgung**, Ernährungsmanagement

Source: Free medical dictionary,⁸ not in line with A.S.P.E.N.,⁹ where it is synonym to nutrition intervention.

Nutritional care is an umbrella term that encompasses every activity that addresses nutrition in institutionalised patients and nursing home residents.

1.5. Care catering

Syn: *Hospital diet*

GER: **Care Catering**, Gemeinschaftsverpflegung in Einrichtungen des Gesundheitswesens

Source: ESPEN.¹⁰

Care catering is the provision of menu services (in-house or outsourced) in health care institutions. In addition to the menu, this category also includes the ambience of the eating area for the patients, residents and staff.

1.6. Dietetics

GER: **Diätetik**, Diätologie (Austrian)

Source: German Dietitian Association (VDD), Stedman Medical Dictionary.¹¹

Dietetics is dietary care, dietary assessment and *dietary advice* with or without *nutritional therapy* to heal or treat a disease or a disease condition. Dietetics is the main responsibility of clinical dietitians, in most countries upon the request of a medical doctor.

Dietetics does not encompass the *nutritional care* to prevent or treat disease-related malnutrition or obesity. These are part of *nutritional support* and *obesity* management, respectively.

1.6.1. Dietary advice

Syn: *dietetic advice, nutritional advice, nutritional advice, dietary counselling, nutritional counselling*

GER: **Diätberatung**, Ernährungsberatung,

Source: Austrian Society of Dietitians,¹² NICE Guideline.⁷

Dietary advice is the provision of recommendations or training to individuals or groups on modifying food intake to improve nutrition or to heal or treat a disease condition.⁷ Dietary advice should be given by qualified persons (registered dietitians or equivalent education). Dietary advice can be part of a nutritional therapy but is not a nutritional therapy itself, because it lacks the necessary structural elements.

1.7. Obesity (as part of clinical nutrition)

GER: **Adipositas** (als Teilgebiet der Klinischen Ernährung)

Source: Summarized from Joint Guidelines of the German Obesity (DAG) Society, German Diabetes Society (DDG), German Society of Nutrition (DGE), German Society of Nutritional Medicine (DGEM) 2007,²⁴ Guidelines of the German Obesity Society 2005, 2000,^{25,26} Guidelines of the German Society of General- and Visceral Surgery – Surgical Society for Obesity Therapy (CA-ADIP) 2010,²⁷ Guidelines of the Bariatric Scientific Collaborative Group (BSCG) constituting the International Federation for the Surgery of Obesity (IFSO), European Association for Study of Obesity (EASO), European Childhood Obesity Group (ECOG), International Obesity Task Force (IOTF), 2008,²⁸ The European Association for the Study of Obesity – criteria for obesity management, 2011²⁹; Guidelines of the European Association for Endoscopic Surgery (EAES), 2005,³⁰ Guidelines of the National Institute for Health and Clinical Excellence

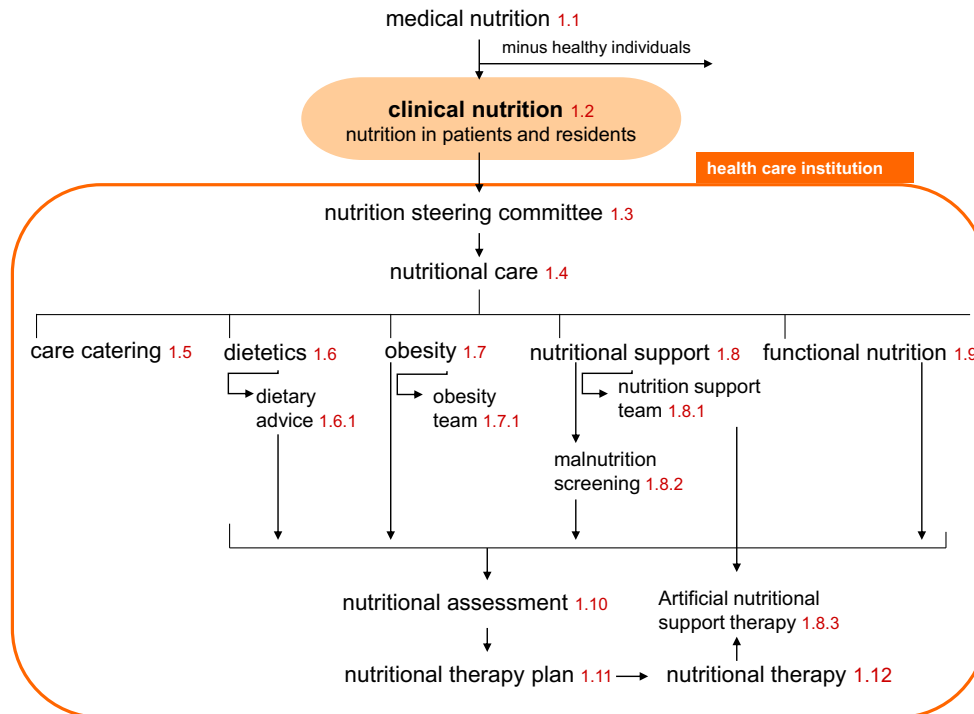


Fig. 1. The interrelation of terms introduced in chapter 1 “Fields and structure”.

(NICE), 2006 (31) Joint Guidelines of the American Association of Clinical Endocrinologists (AACE), The Obesity Society (TOS) and the American Society for Metabolic and Bariatric Surgery (ASMBS) 2008 (32), American Society for Metabolic and Bariatric Surgery Allied Health Nutritional Guidelines 2008 (33); Obesity Canada Clinical Practice Guidelines, 2007 (34).

Obesity in *clinical nutrition* integrates all research and *nutritional care* to treat or prevent obesity in the hospital setting and in out-patients.

The activities to treat or prevent obesity and related disorders in *clinical nutrition* are complimentary to public health interventions.

1.7.1. Obesity team

Syn: *health team, healthcare team*

GER: **Adipositasteam**

Source: see 4.7.

The *obesity team* is a structure element of clinical nutrition belonging to the field of *obesity*. It is a qualified multidisciplinary team of specialists experienced in obesity management. The team consists of a physician or obesity specialist, a dietitian, a physiotherapist and a behavioural therapist (psychologist/psychiatrist). The *obesity team* provides personalised, patient-centred and comprehensive weight management/lifestyle programmes which take into account the comorbidities of the patients, as well as offering behavioural, cultural, social, and economic support.

For patients directed towards bariatric surgery, the *obesity team* should be expanded upon to provide a “bariatric surgery team”. This team should provide pre- and postoperative care, such as nutrition education, *nutritional assessment*, psychological assessments and monitoring of nutritional status. Additional members to a bariatric surgery team would include: a bariatric surgeon, an anaesthetist, a nurse, an endocrinologist, a sleep medicine specialist, a cardiologist, a gastroenterologist or any other medical consultants deemed necessary. *Obesity teams* can be based at specialised centres or can be established as a network of healthcare professionals working in an out-patient setting.

1.8. Nutritional support

GER: Ernährungssupport

Source: NICE Guideline,⁷ AKE.¹³

Nutritional support is the provision of nutrition or nutrients either orally (*regular diet, therapeutic diet, fortified food, oral nutritional supplements*) or via *enteral nutrition* or *parenteral nutrition* to prevent or treat *disease-related malnutrition*. *Artificial nutritional support* is an important part of nutritional support.

1.8.1. Nutritional support team (NST)

Syn: *Nutrition Support Service (NSS), Metabolic Support Service (MSS – rare), Nutrition (support) advisory group (rare), Parenteral and Enteral Nutrition (PEN) team (rare), nutrition team (rare)*

GER: Ernährungsteam

Source: DGEM,^{14,15} AKE,^{13,16} NICE Guideline,⁷ A.S.P.E.N.^{9,17} and BAPEN.^{5,6}

A nutritional support team (NST) is a structure element of nutritional support. It is a multi-disciplinary team with dietetic, nursing, and medical expertise⁷ that manages the provision of *nutritional support therapy*.⁹ The minimum personnel requirements for a NST include the participation of [at least] one medical doctor, one nurse, and one dietitian. An experienced pharmacist should also be designated as a contact partner or can be integrated into the NST, as required.

The main objective of a NST is to ensure that all *nutritional support* activities utilise state-of-the-art techniques to prevent and treat *disease-related malnutrition* in health care institutions and in the out-patient setting.

1.8.2. Malnutrition screening

Syn: *Nutritional screening*

GER: **Mangelernährungsscreening**

Source: DGEM,¹⁸ AKE,^{13,16} ESPEN,^{19,20} A.S.P.E.N.^{9,21}

Malnutrition screening is a quick and simple process used to identify individuals who are malnourished or who are at risk of

disease-related malnutrition and to determine if a more detailed *nutritional assessment* is necessary.²¹ Malnutrition screening is a structure element of nutritional support.

In order to identify individuals at nutritional risk early on, malnutrition screening should be systematically and routinely carried out on all patients at the time of admission to acute care hospitals and thereafter at weekly intervals. In long-term care all residents or patients should be screened at admission and thereafter at regular intervals, e.g. every 3 months.²¹ In general practice it is recommended to screen, especially more elderly patients, at least once a year depending on their medical condition.^{21–23}

Malnutrition screening may indicate that¹⁹:

- 1) the patient is not at-risk of *disease-related malnutrition*, but needs to be re-screened at specified intervals, e.g. weekly during hospital stay;
- 2) the patient is at-risk of *disease-related malnutrition* and a full nutritional assessment is necessary.

1.8.3. Artificial nutritional support therapy

GER: **künstliche Ernährungstherapie**

Source: A.S.P.E.N.⁹

An artificial nutritional support therapy is a *nutritional therapy* with total or partial use of *oral nutritional supplementation, enteral and/or parenteral nutrition*. All obligatory conditions listed in 1.12 apply for artificial nutritional support therapies.

An artificial nutritional support therapy therefore includes the assessment, diagnosis, ordering, preparation, distribution, administration, and monitoring of *nutrition support*.⁹

1.9. Functional nutrition (as part of clinical nutrition)

GER: **Funktionelle Ernährung**

Source: own development.

Functional nutrition in *clinical nutrition* is the evidence-based provision of food to improve bodily functions above the normal level in presence of disease and independent of *disease-related malnutrition*.

Food applicable for functional nutrition can be common food, designed functional food, specific dietary foods for special medical purposes (FSMP) or specific bioactive compounds from edible sources, *such as* macronutrients (e.g. n-3 fatty acids, glutamine), micronutrients (e.g. selenium) or non-nutritive dietary substrates (e.g. polyphenols, probiotics).

Examples for bodily functions include

- disease-specific metabolism and specific organ and tissue functions (e.g. liver, kidney, brain, gut barrier, muscle) or
- immunologic response, disease activity and systemic inflammatory processes.

Functional nutrition can be implemented with or without use of *artificial nutritional support*. Functional nutrition should be exclusively used as on-top strategy complimentary to other nutritional therapies such as nutritional support. To justify the application of functional nutrition, it is important that a clear cause-effect relationship between the food and the said effect has been established in human randomized controlled trials.

1.10. Nutritional assessment

GER: **Ernährungsassessment**

Source: DGEM,^{3,4,18} ESPEN²⁰ and A.S.P.E.N.^{9,21}

Nutritional assessment is a comprehensive approach for diagnosing nutritional problems. It uses a combination of the following: Medical history, current medication, dietary assessment (current food intake, estimated nutrient requirements, individual preferences), anthropometric measurements (body weight, skinfold measurements, waist circumference), malnutrition assessment (e.g. Subjective Global Assessment – SGA, Minimal Nutritional Assessment – MNA), physical examination (for example: dentition, swallowing and bowel function), body composition (bioelectrical impedance analyses – BIA), and laboratory data.²¹ Nutritional assessment is typically performed by a dietitian or other expert clinician.²⁰

The nutritional assessment provides the rationale for a *nutritional therapy* and the development of an appropriate *nutritional therapy plan*.²⁰

1.11. Nutritional therapy plan

GER: **Ernährungsplan**

Source: A.S.P.E.N.⁹ (35–39).

The nutritional therapy plan is a design (or scheme) mandatory for each *nutritional therapy* and developed to achieve treatment goals. A comprehensive nutritional therapy plan must define the rationale, explain the *nutritional therapy*, and provide parameters, both to monitor the efficacy of the plan and to help with reassessment. It is often individually tailored, but can be also part of a standard operating procedure (SOP).

The nutritional therapy plan must include information on:

- energy and nutrient requirements
- measurable nutrition goals (immediate and long-term)
- instructions for implementing the specified form of nutrition
- monitoring and assessment parameters
- the most appropriate route of administration and method of nutrition access (mainly for nutrition support therapies)
- anticipated duration of therapy
- discharge planning and home training, if appropriate

1.12. Nutritional therapy

Syn: *Medical nutrition therapy (MNT), nutritional intervention*

GER: **Ernährungstherapie**, Ernährungsintervention, Klinische Ernährungstherapie

Source: A.S.P.E.N.⁹ (35–39).

Nutritional therapies are individualised and targeted *nutritional care* measures using *diet or artificial nutritional support*. Nutritional therapies can be therapeutic or preventive. They can be provided in a variety of settings, including in- and out-patient services (e.g. consultations provided in a home or medical practice). *Dietary advice* can be part of a nutritional therapy, but is not a nutritional therapy itself, because it lacks the necessary structural elements.

Nutritional therapies must include

- a detailed nutritional and medical history
- a nutrition intervention plan/programme
- amendment of the intervention plan, where appropriate
- clear and accurate documentation assessment of outcome, wherever possible.

2. NUTRITIONAL CONDITIONS WITH RELEVANCE TO NUTRITIONAL SUPPORT

Fig. 2 provides an overview on nutritional conditions associated with compromised nutritional status as introduced in this chapter.

	intake↓	inflammation	physical activity↓	age↑	single nutrient↓	Main therapeutic implication
Disease-related malnutrition						
Starvation related malnutrition		⊗				Increase energy intake
Chronic disease - related malnutrition		low to medium				Decrease inflammation / adjust energy intake
Acute disease-related malnutrition		severe	bed-rest			Decrease stress metabolism / induce physical therapy
Cachexia		low to medium				Decrease inflammation / adjust energy intake
Sarcopenia						Increase physical activity / pay attention to energy intake
Specific nutrient deficiency						Substitute nutrient

Fig. 2. Overview on nutritional conditions associated with compromised nutritional status as introduced in Chapter 2. The dark areas show the main pathoetiology for the respective nutritional condition. Red circle: exclusion criteria for definition.

2.1. Disease-related malnutrition (DRM)

GER: Krankheitsspezifische Mangelernährung

Source: ESPEN (40) and A.S.P.E.N.^{9,17} (41). Both societies endorse aetiology-based definitions by Jensen and colleagues (40,41). BMI and weight loss criteria were adopted from NICE⁷ and DGEM guidelines¹⁸ and fasting periods from A.S.P.E.N. definition of terms.⁹

Disease-related malnutrition is malnutrition caused by disease or disease symptoms.

It is subdivided into three aetiology-based categories:

- starvation-related malnutrition (undernutrition)
- chronic disease-related malnutrition
- acute disease-related malnutrition.

2.1.1. Starvation-related malnutrition (S-DRM)

GER: Krankheitsspezifische Unterernährung

Starvation-related malnutrition (S-DRM) is chronic starvation without inflammation in individuals who are receiving medical or nursing care (40,41). S-DRM is mainly characterised by reduced energy intake. Also falling into this category are patients suffering from the consequences of malabsorption and maldigestion in the absence of inflammation where energy intake may be normal. In those subjects with an body mass index <18.5 kg/m² (<65 years) or <20.0 kg/m² (≥65 years) the synonym undernutrition may be used.

S-DRM is considered likely to be significant if¹⁸

- 1) Energy intake is reduced to ≤75% of estimated energy requirement for ≥1 month¹⁷ OR
- 2) Body mass index (BMI) < 18.5 kg/m² (<65 years) or <20.0 kg/m² (≥65 years) OR
- 3) Unintentional weight loss >10% body weight (bw) within the previous 3–6 months (<65 years) or >5% bw (≥65 years) OR
- 4) BMI < 20 kg/m² AND unintentional weight loss >5% bw within the previous 3–6 months (<65 years)⁷ OR
- 5) Nil per os (no food intake) for more than 7 days⁹ OR
- 6) Triceps skin fold thickness < 10. percentile (mainly in research).
- 7) In surgical patients, a serum albumin below 30 g/L is a strong indicator for risk of post-operative complications (42,43), and

should be included in the nutrition assessment of this patient group as a marker for both disease activity and inflammation.^{18,19}

Routine inflammatory parameters should be within reference range.

Examples of this syndrome include anorexia nervosa in young females and anorexia in the elderly due to conditions such as dementia, depression or dysphagia.

2.1.2. Chronic disease-related malnutrition (C-DRM)

GER: Chronische krankheitsspezifische Mangelernährung

Chronic disease-related malnutrition (C-DRM) is disease-related malnutrition in the presence of a chronic disease that causes subclinical, mild, or moderate inflammation. In C-DRM malnutrition is at least partially due to decreased nutritional intake, but is also strongly linked to the effects of inflammation on the intermediary metabolism (40,41). The presence of systemic inflammation should be acknowledged, because of its diagnostic and therapeutic implications (44). Even at a subclinical level, chronic inflammation may cause alterations to nutrient requirements and body composition, mild forms of stress metabolism or anorexia.

Main criteria for the diagnosis of C-DRM are:

- (1) General criteria for disease-related malnutrition as listed in S-DRM points 1-7 OR
- (2) Reduced muscle mass: <10. Percentile arm muscle area or <80% creatinine-height-index¹⁸ AND
- (3) Signs of inflammatory activity (specific disease scores, e.g. Crohn's Disease Activity Index (CDAI), American College of Rheumatology criteria (ACR-criteria) or elevated CRP serum concentrations.¹⁸

Examples of this syndrome include inflammatory bowel diseases, pancreatic cancer, congestive heart failure, or rheumatoid arthritis.

The descriptive definitions of C-DRM and cachexia (see 5.2) overlap strongly; however, operational definitions show some more specific variations (45,46).

2.1.3. Acute disease- or injury-related malnutrition (A-DRM)

GER: Akutkrankheitsspezifische Mangelernährung

Acute disease- or injury-related malnutrition (A-DRM) is disease-related malnutrition caused by the massive and often uncontrollable protein catabolism as seen in the progression of an acute inflammatory response during critical illness or injury. The metabolic changes leading to acute disease- or injury-related malnutrition are commonly referred to as stress metabolism (47).

A-DRM is characterised by severe degrees of inflammation. A-DRM occurs for example during major systemic infections, in burns, trauma or head injury.

Main criteria for the diagnosis of A-DRM is the presence of an acute inflammatory response during critical illness or injury.

2.2. Cachexia

GER: Kachexie

Source: Selected journal articles (48–51).

Cachexia is a multifactorial syndrome defined as low- to medium grade inflammation combined with loss of weight, muscle atrophy, fatigue, weakness, and significant loss of appetite in someone who is not actively trying to lose weight (48,49,51).

The definition of cachexia in contrast to anorexia or starvation-related malnutrition implies that the loss of body mass cannot be fully reversed nutritionally. Cachexia is characterised by a loss of muscle and fat mass whereas simple starvation causes predominantly loss of fat. Operational definitions exist for cachexia in general (48) and for cancer cachexia (49).

Cachexia is frequently seen in patients with cancer, AIDS, chronic obstructive lung disease, multiple sclerosis, congestive heart failure and tuberculosis.

There is a strong overlap between cachexia as described here and chronic disease-related malnutrition (C-DRM) as defined in 5.1.2.

2.3. Sarcopenia

GER: Sarkopenie

Source: Six main approaches for operative definitions of sarcopenia were published recently (50,52–56) and later summarised (57). The earlier papers released between 1998 and 2010 (52–54) include muscle mass, but not muscle strength or muscle function; The remaining three published since 2010 (50,55,56) share the same criteria for muscle mass (appendicular lean mass/height² ≤ 5.67 kg/m² (f) or ≤ 7.24 kg/m² (m) and similar criteria for muscle function (gait speed between ≤ 0.8–1.0 ms⁻¹). However, only one offers criteria for muscle strength (55). So far it is unclear which of the three newer definitions works best (57).

Sarcopenia is a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength associated with a risk of adverse outcomes including physical disability, poor quality of life or even death (54,55,58).

Sarcopenia is a component of the frailty syndrome and in *clinical nutrition* is observed mainly in bedridden, immobile or elderly patients. For the diagnosis of sarcopenia, European consensus diagnostic criteria (55) were recently published applying the simultaneous presence of low muscle mass (appendicular lean mass) with low muscle function (gait speed) or low muscle strength (handgrip strength).

2.4. Specific nutrient deficiency

Syn: Isolated nutrient deficiencies

GER: Spezifischer Nährstoffmangel

Source: Specific nutrient deficiencies commonly rank among the malnutrition disorders.¹⁸ They are not included in the

definitions on disease-related malnutrition (DRM) above, because their presence does not necessarily correspond with the diagnostic criteria for DRM. Unlike DRM, their treatment comes under the responsibility of dietetics and not necessarily under nutritional support.

Specific nutrient deficiency is an isolated deficiency of an essential nutrient, predominantly of a micronutrient (e.g. iron or vitamin D) with or without the co-presence of disease-related malnutrition.

Diagnostic criteria are the clinical symptoms or deviation from reference value (e.g. bone mineral density, vitamin serum or tissue concentrations).

2.5. Refeeding syndrome

GER: Refeeding Syndrom

Source: NICE⁷ and AKE recommendations (AKE^{13,16} together with selected literature).

Refeeding syndrome¹³ (59–62) is defined as severe electrolyte and fluid shifts associated with metabolic abnormalities and micronutrient deficiencies in severely malnourished patients or patients with pre-existing deficiencies (electrolytes, thiamine etc.) in whom oral, enteral or parenteral nutrition is commenced.

Forced feeding in those patients (too much, too soon) can have potentially fatal consequences:

- hypophosphataemia → respiratory arrest
- hypocalcaemia → cardiac arrhythmia
- hypokalaemia → cardiac arrhythmia
- hypomagnesaemia → cardiac arrhythmia.

Refeeding can unmask latent thiamine deficiency and as a result may cause the development of lactic acidosis and Wernicke–Korsakow syndrome (encephalopathy combined with confusion, antero- and retrograde amnesia).

Hypophosphataemia is commonly used as the first indicator of refeeding syndrome. A fall in serum phosphate to less than 0.6 mmol/L is indicative for refeeding syndrome (63–65) and warrants close monitoring of electrolytes and implementation of a nutritional care plan to include the supplementation of thiamine. Most refeeding symptoms occur within 2–4 days after commencement of feeding. Although refeeding symptoms can occur with oral or enteral nutrition, it still belongs to the most common and also most avoidable metabolic complications in patients receiving parenteral nutrition (66).

The refeeding syndrome is well known in certain patients groups (e.g. patients with anorexia nervosa), yet is often overlooked in other patients groups, for example in elderly patients, whose nutritional status is often lower than it at first may appear.

Criteria for determining patients at high risk of developing refeeding problems were recently published.⁷

3. FORMS OF NUTRITION WITH RELEVANCE TO NUTRITIONAL SUPPORT

Fig. 3 provides an overview on the terms introduced in this chapter.

3.1. Diet

GER: **Ernährung** (corresponding to definition item 1) or **Diät** (corresponding to definition item 2)

Source: Stedman Medical Dictionary,¹¹ free medical dictionary (67).

Diet is defined as¹¹ (67)

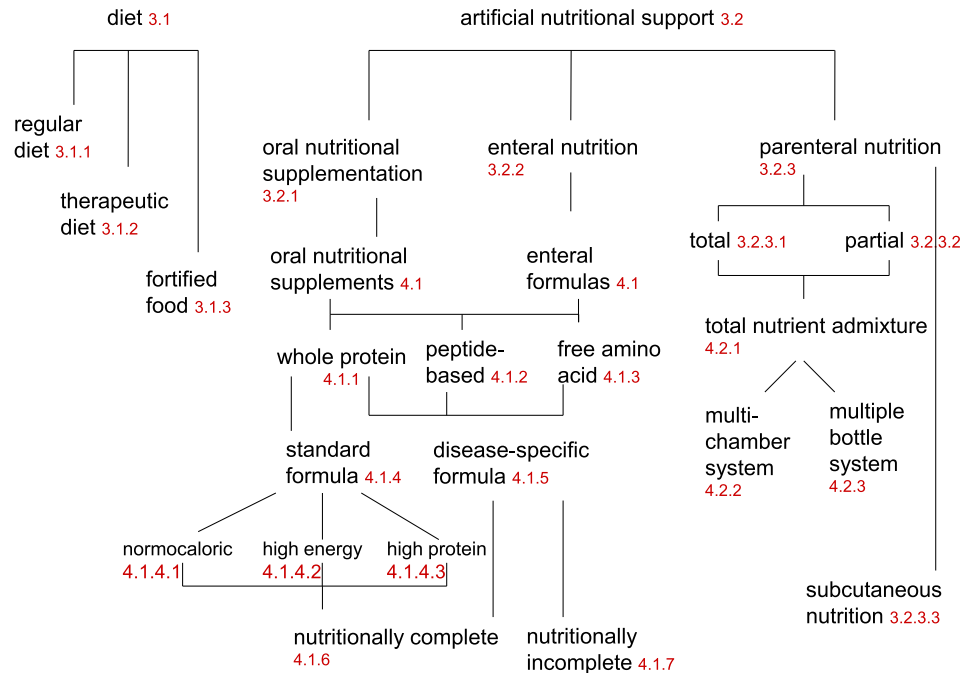


Fig. 3. The interrelation of terms introduced in chapters 3 and 4: forms of nutrition and products for artificial nutritional support.

- 1) Food and drink in general.
- 2) A prescribed course of eating and drinking in which the amount of and type of food, as well as the times at which the food has to be taken, are regulated for therapeutic purposes.

3.1.1. Regular diet

Syn: *normal diet, normal food, regular food, usual food, also hospital meals*

GER: **gewöhnliche/übliche Ernährung** (corresponding to definition item 1) or **Normalkost** (corresponding to definition item 2)

Source: A.S.P.E.N.,⁹ free medical dictionary (67).

Regular diet is either (67)

1. The usual diet of an individual, with no additional nutrition advice or intervention as it is normally consumed, for example at home or in a restaurant OR
2. A regular diet, which is offered by the care catering from a health care institution (e.g. hospital, nursing home). In institutional care a regular diet is defined as⁹ “a full, well-balanced diet containing all of the essential nutrients needed for optimal growth, tissue repair, and normal functioning of the organs. Such a diet contains foods rich in proteins, carbohydrates, high-quality fats, minerals, and vitamins in proportions that meet the specific caloric requirements of the individual”.

3.1.2. Therapeutic diet

Syn: *modified diets, special diets*

GER: **(Spezial-)Diät**

Source: A.S.P.E.N.⁹

A therapeutic diet is a diet that is used as part of a treatment or clinical condition to eliminate, decrease, or increase certain foods or compounds in the diet, e.g. gluten-free or lactose-free diets.

3.1.3. Fortified food

Syn: *enriched food*

GER: **Speisenanreicherung**

Source: own development.

Fortified food is food enriched with edible compounds to increase for example:

- 1) energy density (e.g. cream, butter, oils, medium chain triglycerides, maltodextrin)
- 2) protein intake (e.g. protein powder, eggs)
- 3) micronutrient intake.

3.2. Artificial nutritional support

GER: **Künstliche Ernährung**

Source: A.S.P.E.N.,⁹ NICE guidelines.⁷

Artificial nutritional support is the technique, science and practical use of *oral nutritional supplementation (ONS)*, *enteral nutrition* (tube feeding) and *parenteral nutrition*.

The main aim of artificial nutritional support is to prevent and treat *disease-specific malnutrition* in order to improve or maintain nutritional status or quality of life whilst enhancing the clinical outcome. Further aims include aspects of *functional nutrition*, such as improving disease-specific metabolism, organ- or tissue function, immune response, disease activity or systemic inflammation.

3.2.1. Oral nutritional supplementation (ONS)

GER: **orale Nahrungssupplementation**, enterale Ernährung ohne Sonde (Switzerland)

Source: EU commission directive 1999/21/EC (68), ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Oral nutritional supplementation (ONS) is the science and use of commercial *oral nutritional supplements* (ONS, see also 7.1) that are regulated by the EU commission directive 1999/21/EC where they are defined as “dietary food for special medical purposes” (FSMP). ONS is part of *artificial nutritional support*.

3.2.2. Enteral nutrition (EN) = tube feeding

GER: **Enterale Ernährung = Sondenernährung**

Source: NICE guideline,⁷ AKE^{13,16} and A.S.P.E.N.⁹; EU commission directives 1999/21/EC (68), 2006/82/EC (70), 2006/141/EC (71)

Enteral nutrition (tube feeding) is the technique, science and practical implementation of nutrition given via a tube or stoma into the intestinal tract distal to oral cavity. Enteral nutrition is part of *artificial nutritional support*. The term “enteral nutrition” does not include *oral nutritional supplementation* (see 6.2.1).

3.2.3. Parenteral nutrition (PN)

Syn: *i.v. nutrition, intravenous nutrition*

GER: **parenterale Ernährung (PE)**, intravenöse Ernährung

Source: A.S.P.E.N.,⁹ NICE guidelines,⁷ AKE.¹³

Parenteral nutrition is the technique, science and provision of *artificial nutritional support* through intravenous administration of nutrients such as amino acids, glucose, fat, electrolytes, vitamins and trace elements.

3.2.3.1. Total parenteral nutrition (TPN)

GER: **Totale parenterale Ernährung (TPE)**

Source: ESPEN Blue Book (72).

Total parenteral nutrition (TPN) refers to conditions when no food is given by other routes. All nutrients needs are provided intravenously without any significant oral or enteral intake.

3.2.3.2. Partial parenteral nutrition (PPN)

GER: **Supplementierende parenterale Ernährung (SPE)**

Source: ESPEN Blue Book (72).

Partial parenteral nutrition (PPN) is supplemental parenteral nutrition in patients whose oral or enteral food intake is inadequate.

3.2.3.3. Subcutaneous nutrition

GER: **subkutane Ernährung**

Source: ESPEN Blue Book (72)

Subcutaneous nutrition is a special form of parenteral nutrition used mainly in terminal care (e.g. geriatrics, long-term care facilities, palliative care). At present subcutaneous nutrition is used exclusively for the provision of fluids (hypodermoclysis).

4. PRODUCTS FOR ARTIFICIAL NUTRITIONAL SUPPORT

Fig. 3 provides an overview on the terms introduced in this chapter.

4.1. Oral nutritional supplement (ONS) and enteral (EN) formula

Syn: *enteral feed, tube feed, enteral formulation, enteral diet, sip feed, oral supplement*

GER: ONS: **orale bilanzierte Diät**; Trinknahrung, orale Nahrungssupplemente enteral formula: **Sondennahrung**

Source: ESPEN,¹⁹ EU commission directives 1999/21/EC (68), 2006/82/EC (70), 2006/141/EC (71)

Oral nutritional supplements (ONS) are commercial formulas for *oral nutritional supplementation (ONS)*. Enteral (EN) formulas are commercial formulas for *enteral nutrition (EN, tube feeding)*. Both are regulated by the EU commission directive 1999/21/EC where they are defined as “dietary food for special medical purposes” (FSMP).

4.1.1. Whole protein formula

Syn: *polymeric, high molecular weight or nutrient defined formula*

GER: **hochmolekulare Diät**, nährstoffdefinierte Diät

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Whole protein formulas are *ONS* or *enteral formulas* that contain intact proteins, commonly lipids in the form of long chain

triglycerides (LCT) and carbohydrates, predominantly as malto-dextrins or polysaccharides. Whole protein formulas can be used in up to 95% of patients on *ONS* or *enteral nutrition*. All *standard formulas* and several *disease-specific formulas* belong to this category.

4.1.2. Peptide-based formula

Syn: *oligomeric, oligopeptide, low-molecular weight, chemically defined formulas*

GER: **niedermolekulare Diät**, chemisch definierte Diät, Oligopeptiddiät

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Peptide-based formulas are *ONS* or *enteral formulas* that contain protein predominantly in peptide form (2–50 amino acids). The lipid fraction contains relevant amounts of medium chain triglycerides (MCTs) to facilitate absorption.

Only a small number of patients require peptide-based formulas. Indications¹³ (73) are mainly kept for when whole protein formulas are not tolerated.

4.1.3. Free amino acid formula

Syn: *elemental, monomeric, low molecular weight, chemically defined formula*

GER: **Elementardiät**

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Free amino acid formulas are *ONS* or *enteral formulas* that contain single amino acids as the protein source. They are rarely indicated, because oligopeptides have a lower osmolality and are better absorbed than free amino acids.

The main indications are congenital metabolic disease, severe protein allergies, short bowel syndrome, and if other formulas are not tolerated.

4.1.4. Standard formula

GER: **Standardnahrung**

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Standard formulas are *nutritionally complete ONS* or *enteral formulas* that have a composition corresponding to the reference values for macro- and micronutrients of a healthy population (with the exception of high protein standard formulas which contain a slightly higher amount of proteins). Standard formulas can contain fibre or not. Non-fibre containing standard formulas should only be used when fibre is contraindicated. Standard formulas can be used in the majority of patients (up to 95%).

4.1.4.1. Normocaloric standard formula

GER: **Normokalorische Standardnahrung**

Normocaloric standard formulas are *standard formulas* with an energy density between 1.0 and 1.2 kcal/mL.

4.1.4.2. High energy standard formula

GER: **Hochkalorische Standardnahrung**

High energy standard formulas are *standard formulas* that have an energy density of more than 1.2 kcal/mL. General indications for high energy standard formulas include fluid restrictions, e.g. in cardiac disease. They are also advantageous to increase compliance and quality of life of other patients because of decreased food volume and feeding time.

4.1.4.3. High protein standard formula

GER: **Proteinreiche Standardnahrung**

High protein standard formulas are *standard formulas* containing 20% or more of total energy from protein independent of the

energy density. General indications for high protein formulas are for wound healing and stimulation of protein-anabolic reactions in catabolic states or severe malnutrition.

4.1.5. Disease-specific formula

Syn: *therapeutic formulas*

GER: **Krankheitsspezifische Nahrung, Spezialnahrung**

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

All formulas for ONS and *enteral nutrition* that are not *standard formulas* fall into the category of disease-specific formulas. The group of disease specific formulas encompasses formulas with an incomplete macro- or micronutrient composition, peptide-based formulas, elemental formulas as well as formulas that have a macro- and micronutrient composition adapted for the needs of a specific disease and/or digestive or metabolic disorder, e.g. diabetes formulas, liver formulas, pulmonary formulas, immunomodulating formulas.

4.1.6. Nutritionally complete formula

GER: **Vollbilanzierte Diät**

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69), EU commission directives 1999/21/EC (68).

Nutritionally complete formulas are ONS or *enteral (EN) formulas* that can be used as a sole source of nutrition. Virtually all *enteral formulas* are nutritionally complete, whereas some ONS might not be. Mandatory labelling regulations stipulated in EU directive 1999/21/EC require a statement that the product is suitable for use as the sole source of nourishment.

4.1.7. Nutritionally incomplete formula

GER: **Teilbilanzierte Diät**

Source: ESPEN,¹⁹ Kategorisierungssystem enterale Ernährung (69).

Nutritionally incomplete formulas are ONS (and in rare cases *enteral formulas*) with an incomplete or imbalanced nutrient composition. Some nutritionally incomplete formulas contain high amounts of single nutrients, such as antioxidants, which potentially result in overdosing if the formula is used as the sole source of nutrition. Virtually all nutritionally incomplete products are intended for supplementary oral use (ONS).

4.1.8. Summary of suggested nomenclature for ONS and enteral formulas

Source: ESPEN,¹⁹ also Kategorisierungssystem enterale Ernährung (69).

Specifications are summarized in Table 2.

4.2. Parenteral solutions

4.2.1. Total nutrient admixture (TNA)

GER: **Gesamtnährlösung (GNL)**

Source: A.S.P.E.N.⁹

Total nutrient admixtures (TNA) are parenteral solutions in which all nutrient components are mixed into a single container (glucose, amino acids, lipids, electrolytes, trace elements and vitamins). TNA systems are recommended for hygienic reasons.

4.2.2. Multi-chamber bags

GER: **Mehrkammerbeutel**

Source: A.S.P.E.N.⁹

Multi-chamber bags are containers designed to promote extended stability of a parenteral solution by separating some components (e.g. intravenous fat emulsion) from the rest of the formulation. It consists of 2 or more chambers separated by a seal

Table 2

Summary of specifications for oral nutritional supplements and enteral formulas.

Recommended term	Definition
Low energy GER: niederkalorisch	<1.0 kcal/mL
Normocaloric GER: normokalorisch	1.0–1.2 kcal/mL
High energy GER: hochkalorisch	≥1.2 kcal/mL
High protein GER: proteinreich	≥20% energy from proteins
High fat GER: fettreich	>40% of total energy from lipids
MCT-rich GER: MCT	Significant amount of MCT
High MUFA GER: MUFA-reich	≥20% of total energy from monounsaturated fatty acids (MUFA)
Immune modulating GER: immunmodulierend	Contain substrates to modulate (enhance or decrease) immune response.

or tubing that is clamped. At the time of administration, the seal or clamp is opened to allow the contents of the chambers to mix and create an admixture.

4.2.3. Multiple bottle systems

GER: **Mehrflaschensysteme**

Source: ESPEN blue book (72).

Multiple bottle systems are systems in which amino acids, glucose and fat emulsions are administered in parallel from separate 0.5–1 litre bottles. Use of multiple bottle systems is not recommended for hygienic reasons.

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LV drafted the manuscript. All other authors discussed, commented, revised and worked on the final version of the manuscript.

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Appendix A. Supplementary material (References 31–73)

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