Clinical Nutrition 36 (2017) 49–64

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

ESPEN Guideline

ESPEN guidelines on definitions and terminology of clinical nutrition

T. Cederholm [a, *], R. Barazzoni [b], P. Austin [c, y], P. Ballmer [d], G. Biolo [e], S.C. Bischoff [f], C. Compher [g, 1], I. Correia [h, 1], T. Higashiguchi [i, 1], M. Holst [j], G.L. Jensen [k, 1], A. Malone [l, 1], M. Muscaritoli [m], I. Nyulasi [n, 1], M. Pirlich [o], E. Rothenberg [p], K. Schindler [q], S.M. Schneider [r], M.A.E. de van der Schueren [s, z], C. Sieber [t], L. Valentini [u], J.C. Yu [v, 1], A. Van Gossum [w], P. Singer [x]

[a] Departments of Geriatric Medicine, Uppsala University Hospital and Public Health and Caring Sciences, Clinical Nutrition and Metabolism, Uppsala University, Uppsala, Sweden
[b] Department of Medical, Surgical and Health Sciences, University of Trieste, Trieste, Italy
[c] Pharmacy Department, Oxford University Hospitals NHS Foundation Trust, United Kingdom
[d] Department of Medicine, Kantonsspital Winterthur, Winterthur, Switzerland
[e] Institute of Clinical Medicine, University of Trieste, Trieste, Italy
[f] Institute of Nutritional Medicine, University of Hohenheim, Stuttgart, Germany
[g] School of Nursing, University of Pennsylvania, Philadelphia, PA, USA
[h] Department of Surgery, Federal University of Minas Gerais, Belo Horizonte, Brazil
[i] Department of Surgery and Palliative Medicine, Fujita Health University, School of Medicine, Toyoake, Japan
[j] Center for Nutrition and Bowel Disease, Department of Gastroenterology, Aalborg University Hospital, Aalborg, Denmark
[k] The Dean's Office and Department of Medicine, The University of Vermont College of Medicine, Burlington, VT, USA
[l] Pharmacy Department, Mount Carmel West Hospital, Columbus, OH, USA
[m] Department of Clinical Medicine, Sapienza University of Rome, Italy
[n] Nutrition and Dietetics, Alfred Health, Melbourne, Australia
[o] Department of Internal Medicine, Elisabeth Protestant Hospital, Berlin, Germany
[p] Department of Food and Meal Science, Kristianstad University, Kristianstad, Sweden
[q] Department of Internal Medicine III, Division of Endocrinology and Metabolism, Medical University Vienna, Vienna, Austria
[r] Department of Gastroenterology and Clinical Nutrition, Archet Hospital, University of Nice Sophia Antipolis, Nice, France
[s] Department of Nutrition and Dietetics, Internal Medicine, VU University Medical Center, Amsterdam, The Netherlands
[t] Institute for Biomedicine of Ageing, Friedrich-Alexander University Erlangen-Nürnberg, Hospital St. John of Lord, Regensburg, Germany
[u] Department of Agriculture and Food Sciences, Section of Dietetics, University of Applied Sciences, Neubrandenburg, Germany
[v] Department of General Surgery, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China
[w] Department of Gastroenterology, Clinic of Intestinal Diseases and Nutritional Support, Hopital Erasme, Free University of Brussels, Brussels, Belgium
[x] Department of Critical Care, Institute for Nutrition Research, Rabin Medical Center, Sackler School of Medicine, Tel Aviv University, Petah Tikva 49100 Israel
[y] Pharmacy Department, University Hospital Southampton NHS Foundation Trust, United Kingdom
[z] Department of Nutrition, Sports and Health, Faculty of Health and Social Studies, HAN University of Applied Sciences, Nijmegen, The Netherlands

ARTICLE INFO

Article history:
Received 9 September 2016
Accepted 9 September 2016

Keywords:
Terminology
Definition

SUMMARY

Background: A lack of agreement on definitions and terminology used for nutrition-related concepts and procedures limits the development of clinical nutrition practice and research.
Objective: This initiative aimed to reach a consensus for terminology for core nutritional concepts and procedures.
Methods: The European Society of Clinical Nutrition and Metabolism (ESPEN) appointed a consensus group of clinical scientists to perform a modified Delphi process that encompassed e-mail communication, face-to-face meetings, in-group ballots and an electronic ESPEN membership Delphi round.

* Corresponding author. Clinical Nutrition and Metabolism, Public Health and Caring Sciences, Uppsala University, Uppsala Science Center, Dag Hammarskjöldsväg 14B, 751 85 Uppsala, Sweden.
E-mail addresses: tommy.cederholm@pubcare.uu.se (T. Cederholm), barazzon@units.it (R. Barazzoni), peter.austin@uhs.nhs.uk (P. Austin), peter.ballmer@ksw.ch (P. Ballmer), biolo@units.it (G. Biolo), bischoff.stephan@uni-hohenheim.de (S.C. Bischoff), compherc@nursing.upenn.edu (C. Compher), isabel_correia@uol.com.br (I. Correia), t-gucci30219@herb.ocn.ne.jp (T. Higashiguchi), mette.holst@rn.dk (M. Holst), gordon.jensen@med.uvm.edu (G.L. Jensen), ainsleym@nutritioncare.org (A. Malone), maurizio.muscaritoli@uniroma1.it (M. Muscaritoli), i.nyulasi@alfred.org.au (I. Nyulasi), matthias.pirlich@pgdiakonie.de (M. Pirlich), elisabet.rothenberg@vgregion.se (E. Rothenberg), karin.schindler@meduniwien.ac.at (K. Schindler), stephane.schneider@unice.fr (S.M. Schneider), m.devanderschueren@vumc.nl (M.A.E. de van der Schueren), cornel.sieber@fau.de (C. Sieber), valentini@hs-nb.de (L. Valentini), yu-jch@163.com (J.C. Yu), Andre.VanGossum@erasme.ulb.ac.be (A. Van Gossum), pierre.singer@gmail.com (P. Singer).
[1] Global co-authors contributing late in the process.

http://dx.doi.org/10.1016/j.clnu.2016.09.004

Consensus
Malnutrition
Clinical nutrition
Medical nutrition

Results: Five key areas related to clinical nutrition were identified: concepts; procedures; organisation; delivery; and products. One core concept of clinical nutrition is malnutrition/undernutrition, which includes disease-related malnutrition (DRM) with (eq. cachexia) and without inflammation, and malnutrition/undernutrition without disease, e.g. hunger-related malnutrition. Over-nutrition (overweight and obesity) is another core concept. Sarcopenia and frailty were agreed to be separate conditions often associated with malnutrition. Examples of nutritional procedures identified include screening for subjects at nutritional risk followed by a complete nutritional assessment. Hospital and care facility catering are the basic organizational forms for providing nutrition. Oral nutritional supplementation is the preferred way of nutrition therapy but if inadequate then other forms of medical nutrition therapy, i.e. enteral tube feeding and parenteral (intravenous) nutrition, becomes the major way of nutrient delivery. *Conclusion:* An agreement of basic nutritional terminology to be used in clinical practice, research, and the ESPEN guideline developments has been established. This terminology consensus may help to support future global consensus efforts and updates of classification systems such as the International Classification of Disease (ICD). The continuous growth of knowledge in all areas addressed in this statement will provide the foundation for future revisions.

1. Introduction

Nutrition plays a pivotal role in life and in medicine. Acute and chronic diseases in most organ systems have pronounced effects on food intake and metabolism with increased catabolism, which lead to nutrition-related conditions associated with increased morbidity and eventually death. At the other end of the spectrum, diet is a major determinant of future health, i.e. the absence or postponement of disorders like cardio-vascular disease, diabetes, cancer and cognitive disease [1].

In order to handle nutritional challenges during disease, trauma, rehabilitation, and elderly care as well as for the nutritional prevention of disease it is essential to use professional language and standard terminology that is founded on evidence and widely accepted in the professional community. However, this is not always the case. For example, concepts and terms of nutritional disorders in the current International Classifications of Diseases (ICD-10) (http://www.who.int/classifications/icd/en/) may not always be consistent with modern understanding or terms commonly used in clinical practice and research.

Therefore, it is important for the nutritional practice and research communities, including dietitians, nurses, pharmacists, physicians and scientists as well as their respective scientific associations, to reach consensus on the terminology and criteria to be used for nutritional disorders as well as for core nutritional procedures such as screening, assessment, treatment and monitoring. A unification of the appropriate terminology would enhance the legitimacy, credibility and comparability of nutritional practices and could also support future updates of disease and procedure related classification systems, such as the ICD system. This may lead to improvements in clinical care and the advancement of the clinical and scientific nutrition fields.

These aims led the European Society for Clinical Nutrition and Metabolism (ESPEN) to appoint a Terminology Consensus Group with the mission to provide such a set of standard terminology with a main focus on adults.

2. Methodology

2.1. Aim and selection of the expert group

Part of the continuous work of ESPEN is to produce guidelines that support improvements in clinical care and facilitate research. In 2014 new standards for setting ESPEN Guidelines were established [2]. The presented Guideline standard operating procedures (SOP) aimed to generate high quality guidelines using a clear and straight-forward consensus procedure, with one of the goals to establish international leadership in creating up-to-date and suitable-for-implementation guidelines. To provide a terminology basis for the guideline development was one of the reasons for launching this initiative.

An international expert group of experienced clinical scientists was compiled to form the Terminology Consensus Group and to undertake a modified Delphi process. The consensus group participants, i.e. the authors, were selected to represent various clinical nutrition fields, as well as various professions; dietitians, nurses, nutritionists, pharmacists and physicians from clinical and basic science. It was agreed within the group to base the process on open e-mail communications, face-to-face meetings and open and closed ballots. The purpose was to ensure that communication was maintained at each milestone (see below) until a consensus was reached among all participants. Thus, the statements are based on consensus rather than on systematic literature searches.

This ESPEN Consensus Statement is partly based on the 2014 initiative by the German Society of Nutritional Medicine Working Group (DGEM WG) and the related publication “Suggestions for terminology in clinical nutrition” [3]. The WG consisted of delegates from DGEM as well as from the Austrian Society of Clinical Nutrition (AKE) and the Swiss Society of Nutritional Medicine (GESKES). In this DGEM WG-led process thorough literature searches were undertaken in order to create lists of potential nutritional terms. The terminology was discussed and definitions determined in face-to-face meetings and multiple electronic Delphi rounds [3].

Additional input was solicited from global contributors whose suggestions were considered by the writing group during the final writing phase. They are listed as co-authors due to their substantial contributions.

2.2. Defined milestones of the consensus process

The overall process was based on five major milestones according to the ESPEN Guideline methodology [2] with some modifications:

- Map and establish taxonomy of nutritional nomenclature
- Define criteria for nutritional conditions and concepts
- Describe general nutritional procedures and processes

- Define organizational forms of providing food and nutritional care that are available
- Define forms, routes and products for nutrition therapy and delivery

We resigned to structure the text thoroughly in statements and comments, because it seemed not adequate for the present topics. Moreover, we did not indicate levels of evidence for the statements, because for most issues clinical trials are lacking. However, we indicate the strength of consensus according to the ESPEN classification (Table 1).

Final consensus beyond the working group was achieved by a Delphi round using an electronic platform and offering five voting options (agree, rather agree, indecisive, rather disagree, disagree) and the possibility to place individual comments. Apart from the guideline authors, other ESPEN members were invited to participate within four weeks. A total of 38 experts took part and voted and provided comments. The main text was divided into 90 paragraphs open for voting. The voting results are indicated in the text using the classification of Table 1 and the exact percentage of agreement (sum of 'agree' and 'rather agree').

2.3. Map of nutritional terminology

A decision was taken to organize the terminology base into five categories as described in Table 2.

3. Results

3.1. Nutritional concepts

Nutrition science deals with all aspects of the interaction between food and nutrients, life, health and disease, and the processes by which an organism ingests, absorbs, transports, utilizes and excretes food substances [4]. [Strong Consensus, 97% agreement]

Human nutrition addresses the interplay of *nutrition* in humans. *Preventive nutrition* addresses how food intake and nutrients may affect the risk of developing disease such as cardiovascular disease (CVD), obesity, type 2 diabetes mellitus (T2DM), dementia and cancer, either for populations or for individuals. *Public health nutrition* targets actions on a population level in order to reduce the nutrition related major non-communicable diseases (some mentioned above) (Table 3). [Strong Consensus, 95% agreement]

Clinical nutrition is the focus of the present terminology consensus initiative, which is the discipline that deals with the prevention, diagnosis and management of nutritional and metabolic changes related to acute and chronic diseases and conditions caused by a lack or excess of energy and nutrients. Any nutritional measure, preventive or curative, targeting individual patients is clinical nutrition. Clinical nutrition is largely defined by the interaction between food deprivation and catabolic processes related to disease and ageing (Table 4, Fig. 2). Clinical nutrition includes the nutritional care of subjects with CVD, obesity, T2DM, dyslipidaemias, food allergies, intolerances, inborn errors of metabolism as well as any disease where nutrition plays a role such as cancer, stroke, cystic fibrosis and many more. Furthermore, clinical nutrition encompasses the knowledge and science about body composition and metabolic disturbances that cause abnormal changes in body composition and function during acute and chronic disease. [Consensus, 89% agreement]

Malnutrition/undernutrition, overweight, obesity, micronutrient abnormalities and re-feeding syndrome are clear nutritional disorders, whereas sarcopenia and frailty are nutrition related conditions with complex and multiple pathogenic backgrounds (Table 4, Fig. 1).

Table 1
Classification of the strength of consensus.

Strong consensus	Agreement of >90% of the participants
Consensus	Agreement of >75–90% of the participants
Majority agreement	Agreement of >50–75% of the participants
No consensus	Agreement of <50% of the participants

3.2. Clinical nutrition

3.2.1. Malnutrition. Synonym: undernutrition

Malnutrition can be defined as "a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease" [5]. Malnutrition can result from starvation, disease or advanced ageing (e.g. >80 years), alone or in combination [6].

Basic diagnostic criteria for malnutrition have been defined by an ESPEN Consensus Statement [7]. Those general criteria are intended to be applied independent of clinical setting and aetiology. A similar approach to define diagnostic criteria has been described by a working group of the American Society of Parenteral and Enteral Nutrition (ASPEN) and the Academy of Nutrition and Dietetics (Academy) [8]. For details, see respective papers. [Consensus, 82% agreement]

Briefly, the ESPEN criteria [7] could be summarized that prior to the diagnosis of malnutrition the criteria for being "at nutritional risk" according to any validated nutritional risk screening tool must be fulfilled. Any of two alternative sets of diagnostic criteria will confirm the diagnosis; i.e. either reduced body mass index (BMI) <18.5 kg/m^2 in accordance with the underweight definition provided by WHO, or combined weight loss and reduced BMI (age-dependent cut-offs) or reduced gender-dependent fat free mass index (FFMI).

Similarly a brief summary of the ASPEN and Academy [8] criteria for malnutrition is that six malnutrition criteria need to be considered for the potential diagnosis of malnutrition; i.e. low energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, fluid accumulation, and hand grip strength, whereof at least two should be fulfilled for the diagnosis of malnutrition.

There is an obvious need for the global nutrition community to come together and find a consensus on the crucial issue of which criteria to use for the malnutrition diagnosis [9]. [Consensus, 85% agreement]

Subordinate to the general diagnosis of malnutrition are the aetiology-based types of malnutrition. Table 4 and Fig. 2 describe and depict disease-related malnutrition with or without inflammation, and malnutrition/undernutrition without disease. Subclassifications of malnutrition are crucial for the understanding of the related complexities and for planning treatment. [Consensus, 85% agreement]

3.2.1.1. Disease-related malnutrition (DRM) with inflammation. DRM is a specific type of malnutrition caused by a concomitant disease. Inflammation is an important watershed for malnutrition aetiology [8,10–12]. Thus, one type of DRM is triggered by a disease-specific inflammatory response, whereas the other is linked mainly to non-inflammatory etiologic mechanisms. [Strong Consensus, 97% agreement]

DRM with inflammation is a catabolic condition characterized by an inflammatory response, including anorexia and tissue breakdown, elicited by an underlying disease. The inflammation triggering factors are disease specific, whereas the inflammatory

Table 2
Taxonomy of nutrition terminology, i.e. the structure of nutritional nomenclature as presented in this consensus statement.

A. Classification, definition and diagnostic criteria (when feasible) of core nutritional concepts and nutrition-related disorders (Tables 3 and 4, Figs. 1 and 2)
B. Descriptions of nutritional procedures, and explanations of how assessment, care, therapy, documentation and monitoring are performed (Table 5)
C. Organization and forms of delivery of nutritional care (Table 6)
D. Forms of nutrition therapy, i.e. types and routes (Table 7)
E. Nutritional products, i.e. formulas and types of products for oral, enteral and parenteral use

Table 3
Classification of nutritional concepts.

- ❖ Human nutrition
  - ➢ Preventive nutrition
    - ▪ Population based public health nutrition
  - ➢ Clinical nutrition

Table 4
Classification of clinical nutrition concepts; i.e. nutrition disorders and nutrition related conditions.

- ❖ Clinical nutrition
  - ➢ Malnutrition; Synonym: Undernutrition
    - ▪ Disease-related malnutrition (DRM) with inflammation
      - • Chronic DRM with inflammation; Synonym: Cachexia
        - ◆ Cancer cachexia and other disease-specific forms of cachexia
      - • Acute disease- or injury-related malnutrition
    - ▪ DRM without inflammation. Synonym: Non-cachectic DRM
    - ▪ Malnutrition/undernutrition without disease. Synonym: Non-DRM
      - • Hunger-related malnutrition
      - • Socioeconomic or psychologic related malnutrition
  - ➢ Sarcopenia
  - ➢ Frailty
  - ➢ Over-nutrition
    - ▪ Overweight
    - ▪ Obesity
      - • Sarcopenic obesity
      - • Central obesity
  - ➢ Micronutrient abnormalities
    - • Deficiency
    - • Excess
  - ➢ Refeeding syndrome

[Consensus, 80% agreement]

pathways leading to anorexia, reduced food intake, weight loss and muscle catabolism are fairly consistent across underlying diseases. The degree of metabolic response induced by the disease determines the catabolic rate and at what point during the disease trajectory when clinically relevant malnutrition occurs. The role of inflammation in the development of malnutrition is emphasized in a non-diagnostic definition, i.e. “malnutrition is a subacute or chronic state in which a combination of negative energy balance and varying degrees of inflammatory activity has led to changed body composition, diminished function and adverse outcomes” [5,11]. Advanced ageing *per se* may contribute to the state of inflammation [13]. Moreover, inactivity and bed rest accelerate muscle catabolism during DRM with inflammation.

A special concern is that malnutrition is an emerging occurrence among overweight/obese persons with disease, injury, or high energy poor quality diets in both developed and developing countries. The underlying general mechanism is a misbalance between the energy intake, energy expenditure and the quality of the nutrient intake. Fat mass/adipocytes in excess, especially in the form of central obesity, are associated with an inflammatory response that also likely contributes to the state of malnutrition (see also Section 3.2.4.1.1).

Subordinate concepts to DRM with inflammation are;

- chronic DRM with a milder inflammatory response, and;
- acute disease- or injury-related malnutrition that is characterized by a strong inflammatory response (Table 4, Fig. 2) [8,10–12,14]. [Strong Consensus, 100% agreement]

3.2.1.1.1. Chronic DRM with inflammation. Synonym: cachexia. The two concepts of chronic DRM with inflammation and cachexia are exchangeable, although cachexia is often incorrectly perceived as end-stage malnutrition. Cachexia is traditionally described as “a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle mass with or without loss of fat mass. The prominent feature of cachexia is weight loss in adults” [15,16]. The cachectic phenotype is characterized by weight loss, reduced BMI and reduced muscle mass and function in combination with an underlying disease that displays biochemical indices of on-going elevated inflammatory activity. Cachexia occurs frequently in patients with end-stage organ diseases that are complicated by catabolic inflammatory responses, which include cancer, chronic obstructive pulmonary disease (COPD), inflammatory bowel diseases, congestive heart failure, chronic kidney disease and other end-stage organ diseases. The systemic inflammation that drives the catabolism of such disorders is usually of milder character; i.e. for example serum concentrations of C-reactive proteins (CRP) seldom exceed 40 mg/L, although inflammatory flares may occur during disease exacerbations. CRP >5 mg/L is suggested as a lower limit to define relevant inflammation in this scenario; although other CRP cut-off levels for various given methods, as well as other biochemical inflammatory markers, could be considered.

Cachexia, as described in cancer, can progressively develop through various stages: pre-cachexia; cachexia; and refractory cachexia [16,17]. Cancer cachexia, which is a specific form of chronic DRM with inflammation, is according to Fearon et al. [17] defined by either weight loss >5% alone, or weight loss >2% if BMI is

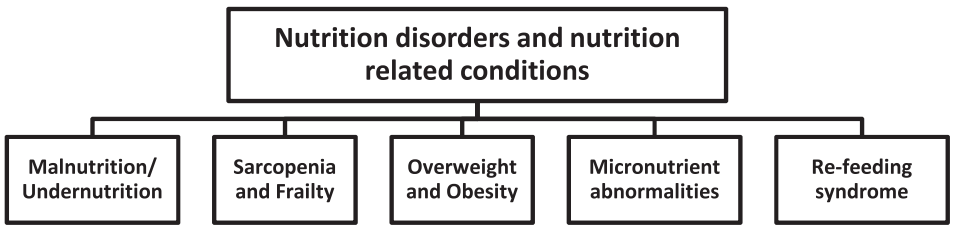

Fig. 1. Overview of nutrition disorders and nutrition-related conditions.

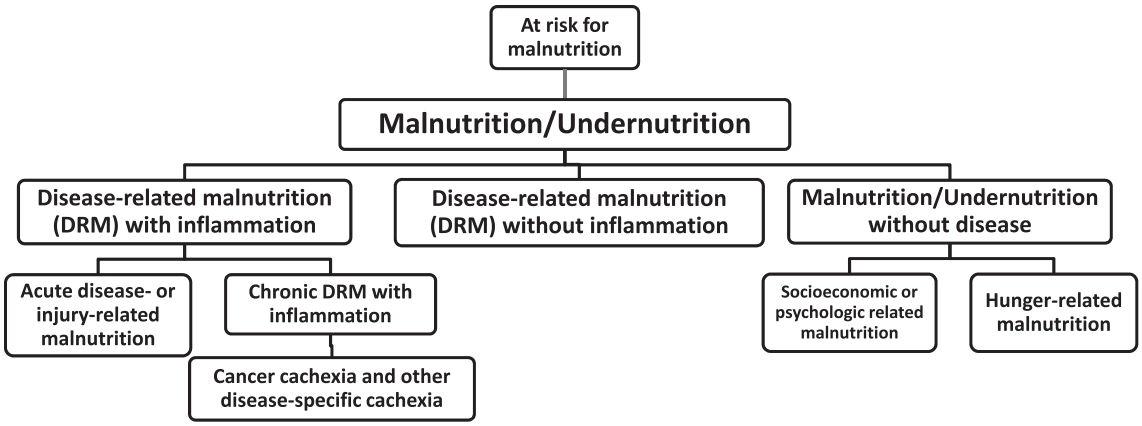

Fig. 2. Diagnoses tree of malnutrition; from at risk for malnutrition, basic definition of malnutrition to aetiology-based diagnoses

reduced (<20 kg/m^2) or fat free mass (FFM) is reduced; i.e. appendicular skeletal muscle mass index <7.2 kg/m^2 (men) or <5.5 kg/m^2 (women). [Strong Consensus, 93% agreement]

A similar concept known as cardiac cachexia has been established by Anker et al. [18] for patients with chronic heart failure which is based on non-intentional and non-oedematous weight loss >7.5% of the premorbid normal weight. Cardiac cachexia is associated with abnormal neuroendocrine and immunologic function and impaired prognosis independent of age and severity of disease.

Patients with pre-cachexia are at risk of malnutrition due to the inflammatory response elicited by the underlying chronic disease [16,17] (see Section 3.3.1.1).

Diagnostic criteria for chronic DRM with inflammation/cachexia are suggested to be the same as those for malnutrition combined with the simultaneous presence of an underlying disease and biochemical indices of either ongoing or recurrent inflammation. Biochemical indicators of inflammation include elevated serum CRP concentrations and/or reduced serum concentrations of albumin. [Strong Consensus, 97% agreement]

3.2.1.1.2. Acute disease- or injury-related malnutrition. Patients in an Intensive Care Unit (ICU) with acute disease or trauma (e.g. major infections, burns, closed head injury) or those after major surgical procedures display specific nutritional challenges with high risk of consequent malnutrition due to their often highly pronounced stress metabolism [14]. The combined action of high pro-inflammatory cytokine activity, increased corticosteroid and catecholamine release, resistance to insulin and other growth hormones, bed rest and no or reduced food intake pave the way for a fast decline of body energy and nutrient stores. Such patients need to have nutrition care plans initiated irrespective of body weight or any anthropometric measurement.

There are no agreed objective criteria for malnutrition in the ICU patient, but the obvious catabolic clinical picture always needs to be managed from a nutritional point of view. [Strong Consensus, 97% agreement]

3.2.1.2. DRM without inflammation. Synonym: non-cachectic DRM. DRM without inflammation/non-cachectic DRM is a form of disease-triggered malnutrition in which inflammation is not among the etiologic mechanisms. These alternative mechanisms could include dysphagia resulting from upper digestive obstruction, neurologic disorders such as stroke, Parkinson's disease, amyotrophic lateral sclerosis (ALS) or dementia/cognitive dysfunction. Psychiatric conditions like anorexia nervosa and depression, or malabsorption due to intestinal disorders such as short bowel syndrome (for example after bowel resection due to mesenteric infarction), are other mechanisms for the development of non-inflammation driven DRM. Advanced ageing *per se* may contribute to DRM without inflammation by anorexia; denoted "anorexia of ageing" [19] (see Section 3.2.3), that is caused also by non-inflammation related mechanisms. Inflammation may for some of the described diseases be involved in the initial phase of the malnutrition trajectory, but does not have a clinically relevant impact in the later phases of the malnutrition process. For some diseases, e.g. Crohn's disease, patients may oscillate between malnutrition with and without inflammation.

Diagnostic criteria for DRM without inflammation/non-cachectic DRM are identical with those for malnutrition, combined with an underlying disease but with no biochemical indices of present or recurrent inflammation. [Strong Consensus, 94% agreement]

3.2.1.3. Malnutrition/undernutrition without disease. Synonym: Non-DRM. Whilst DRM is the principal form of malnutrition in affluent societies, hunger is still the principal cause of malnutrition in poor developing countries. Hunger is mainly of non-DRM origin. Within the concept of non-DRM there are also miscellaneous socioeconomic/psychological mechanisms operating which are unrelated to availability of food. As indicated advanced ageing may contribute to any form of malnutrition/undernutrition.

The metabolic phenotype and the principles for treatment of non-DRM are in many respects similar for undernutrition/starvation due to hunger, socioeconomic/psychological factors, or DRM without inflammation. [Strong Consensus, 97% agreement]

3.2.1.3.1. Hunger-related malnutrition. Hunger-related malnutrition is caused by deprivation of food, and is mainly appearing in poor developing countries and can manifest through famine due to natural disasters like droughts or flooding.

Diagnostic criteria for hunger-related malnutrition are the same as those for malnutrition when hunger or food deprivation in the absence of disease is the clear cause for the condition. [Strong Consensus, 97% agreement]

3.2.1.3.2. Socioeconomic or psychologic related malnutrition. Non-DRM, other than hunger-related malnutrition as described above may emerge during difficult situations such as poverty, social inequities, poor care, mourning, poor dentition, self-neglect, imprisonments or hunger strike. Such conditions have effect not only on the energy intake, but also on the quality of the food intake. [Strong Consensus, 97% agreement]

3.2.2. Sarcopenia

Sarcopenia is a syndrome of its own characterized by the progressive and generalised loss of skeletal muscle mass, strength and function (performance) with a consequent risk of adverse outcomes [20–22]. Whilst often a phenomenon of the ageing processes (primary sarcopenia) preceding the onset of frailty (see below), it may also result from pathogenic mechanisms (secondary sarcopenia) [20] that are disease-related, activity-related (e.g. disuse) or nutrition-related (e.g. protein deficiency).

Diagnostic criteria for sarcopenia have not been firmly established to date. The ESPEN endorsed recommendations of the European Working Group on Sarcopenia in Older Persons [20], as well as the statement from the ESPEN Special Interests Groups of Cachexia in Chronic Disease and Nutrition in Geriatrics [16] indicate an algorithm based on loss of muscle mass and strength and/or function. Muscle mass can be estimated by any validated technique, which in clinical practice usually involves dual x-ray absorptiometry (DXA), bio-electric impedance analysis (BIA) or computed tomography (CT) scanning. For example, reduced muscle mass could be indicated by an appendicular skeletal muscle mass index <7.26 kg/m^2 (men) and <5.5 kg/m^2 (women) [20]. Reduced muscle function may be designated by reduced gait speed or failure of the chair standing tests (which tests lower extremities). Practical diagnostic cut-offs for gait speed are considered to be: <0.8 m/s [20] or <1.0 m/s [21]. Reduced muscle strength may also be measured by handgrip strength; suggested cut-off points are <20 kg for women and <30 kg for men [20]. [Strong Consensus, 94% agreement]

3.2.2.1. Sarcopenic obesity – see section 3.2.4.1.1. □

3.2.3. Frailty

The definition of frailty is evolving, as this emerging concept is still under discussion among experts in gerontology and geriatrics [23]. The general perception is that frailty is a state of vulnerability and non-resilience with limited reserve capacity in major organ systems. This leads to reduced capability to withstand stress such as trauma or disease and thus frailty is a risk factor for dependence and disability. Frailty is mainly related to advanced age but nevertheless it is considered to be modifiable by lifestyle interventions. The condition contains nutrition-related components; e.g. weight loss, and is linked to sarcopenia [24]. In that capacity physical frailty merits to be listed among nutrition-related conditions. Anorexia of ageing is an unintentional decline in food intake caused by factors such as altered hormonal and neuro-transmitter balance affecting hunger and satiety which may contribute to age-related weight loss [19]. Financial constraints, loneliness, depression, difficulties with chewing (including poor dentition) and presbyphagia (changes in the swallowing mechanism) are further examples of conditions that may contribute to malnutrition and thus to frailty in the more elderly.

Several sets of diagnostic criteria for physical frailty have been suggested. The phenotype of frailty as defined by Fried et al. [25] included the fulfilment of three out of five criteria: weight loss; exhaustion (fatigue); low physical activity; slowness (e.g. reduced gait speed); and weakness (e.g. low grip strength). Detailed cut-off values for each measurement have been suggested, but consensus is yet not achieved [26]. [Strong Consensus, 97% agreement]

3.2.4. Over-nutrition

3.2.4.1. Overweight and obesity. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health [27]. Classification of overweight and obesity in adults is achieved through the use of body mass index (BMI), which is a simple index of weight-for-height. It is defined as a person's weight in kilograms divided by the square of their height in meters.

Accordingly,

- BMI between 25 and 30 kg/m^2 implies overweight
- BMI greater than or equal to 30 kg/m^2 implies obesity

Obesity can be further classified in grades according to BMI

Obesity grade I: BMI 30 – <35 kg/m^2
Obesity grade II: BMI 35 – <40 kg/m^2
Obesity grade III: BMI ≥40 kg/m^2

Grading of obesity could be adjusted for race/ethnicity. Thus, corresponding lower cut-offs have been proposed for Asian populations both for diagnosis of obesity [28,29], and for risk of obesity-associated complications [30].

As previously mentioned in Section 3.2.1.1 it is also common for overweight/obese persons to be malnourished in the setting of disease or injury or consumption of high energy poor quality diets, such that over-nutrition and malnutrition may exist simultaneously. [Strong Consensus, 94% agreement]

3.2.4.1.1. Sarcopenic obesity. Sarcopenic obesity is defined as obesity in combination with sarcopenia that occurs for example in older individuals, in those with T2DM, COPD, and in obese patients with malignant disorders and post organ transplantations. Mechanisms include inflammation and/or inactivity induced muscle catabolism in obese patients [31,32]. The condition can occur virtually at all ages.

For body composition measurement in clinical practice DXA might be most accurate in obese individuals. Computed tomography (CT) scan is an alternative emerging technology for the measurement of muscle mass. There is no clear consensus about normal ranges for fat-free mass index (FFMI, fat-free mass/height^2), and the uncertainty is even larger for the obese individual, since the normal ranges might be different from the lean population [33]. Low FFMI and high FMI was associated with poor outcome in terms of length of hospital stay when compared with normal FFMI or FMI, when using BIA in a large cohort of hospital patients [34].

Currently, there are no commonly accepted criteria for sarcopenic obesity beyond those for sarcopenia and obesity separately. Muscle function can be assessed by strength and power as for sarcopenia, i.e. muscle strength by using hand grip measurements or chair stand tests. Muscle power could be measured by gait speed, or by assessing patient autonomy by Activity of Daily Living (ADL) scores and mobility by for example the Short Physical Performance Battery (SPPB) [35]. [Strong Consensus, 97% agreement]

3.2.4.1.2. Central obesity. Accumulation of intraabdominal fat is associated with higher metabolic and cardiovascular disease risk [27], which includes insulin resistance, T2DM, dyslipidaemia and hypertension. These associations are most relevant in moderately obese patients (BMI<35) as well as in non-obese individuals categorized as overweight (i.e. with BMI 25- 30). The presence of central obesity (also known as abdominal, visceral, upper-body or android obesity) can be clinically defined by increased waist circumference (WC) measured in the mid-horizontal plane between the superior iliac crest and the lower margin of the last rib [36]. Recent European consensus statements define abdominal obesity by WC ≥94 cm for men, and ≥80 cm for women [37], whereas US Guidelines indicate corresponding definitions of ≥102 cm and ≥88 cm respectively [38]. Like for obesity ethnic and regionally adapted cut-offs are also available.

Intraabdominal fat can also be assessed by imaging techniques but these are costly and not routinely available, and in addition

there are no clearly defined values for assessment. [Strong Consensus, 97% agreement]

3.2.5. Micronutrient abnormalities

Micronutrient abnormalities can involve a deficiency or excess of one or more vitamins, trace elements or minerals. Abnormalities may result from changes in food intake, absorption, losses, requirements and intake of medicines, alone or in combinations. Individual requirements can vary according to age and diet (foods may be fortified) as well as the presence of disease or injury. A complete nutritional assessment is important when assessing micronutrient status since specific micronutrient deficiencies are frequently associated with undernutrition [39]. Analysis of dietary records may suggest potential deficiency or excess based on recommended dietary allowances (RDA). RDAs are defined for healthy populations and may therefore not always match the needs of individuals with disease.

The laboratory assessment of micronutrient abnormalities is complex since measured concentrations do not necessarily reflect adequacy, for example an acute phase response can affect the concentration reported. Laboratory testing of micronutrient status is generally not routinely undertaken unless there is a specific acute concern, use of restrictive dietary regimes, a prolonged history of undernutrition or during supplementation. [Strong Consensus, 100% agreement]

3.2.5.1. Micronutrient deficiency. Micronutrient deficiency occurs when there is a deficit of one or more micronutrient/s compared to requirements [40]. Specific micronutrient deficiencies can have dramatic consequences such as rickets and osteoporosis from vitamin D deficiency, night blindness from vitamin A deficiency, or beriberi or Wernicke-Korsakov syndrome due to thiamine depletion. But micronutrient deficiencies can also lead to impaired function that may be less obvious such as poor wound healing or increased susceptibility to infection. These more subtle effects may be overlooked in clinical practice, for example after bariatric surgery [41].

Laboratory assessed concentrations may be valuable when there is concern about long-standing deficiency following clinical assessment or when infrequent periodic checks are required for long-term nutritional supplementation. [Strong Consensus, 94% agreement]

3.2.5.2. Micronutrient excess. Micronutrient excess occurs when there is too much of one or more micronutrients compared to requirements [42]. Micronutrient excess can lead to specific symptoms such as the movement disorders of manganese accumulation and subsequent toxicity, or to more general symptoms such as skin irritation and rashes from excessive niacin, hip fracture risk ensuing from excessive retinol intake or peripheral neuropathy following long lasting high intake of vitamin B6. Overprovision of micronutrients can result from incorrect prescription.

Clinical assessment and diagnosis play key roles in determining micronutrient excess, partly due to the difficulties with laboratory analyses. For patients on long-term nutritional supplementation laboratory monitoring every 6 months can be recommended [43]. [Strong Consensus, 94% agreement]

3.2.6. Refeeding syndrome

Refeeding syndrome (RS) is a severe disruption in electrolyte or fluid balance that is precipitated in malnourished subjects when feeding (oral, enteral or parenteral nutrition) is begun too aggressively after a period of inadequate nutrition. Patients at high risk are those with chronic alcoholism, subjects with severe chronic undernutrition, anorexia nervosa, or depleted patients with acute illness. Clinical symptoms can include fluid retention with peripheral oedema, congestive heart failure, cardiac arrhythmia, respiratory failure, delirium, encephalopathy, and other severe organ dysfunctions. RS usually occurs within the first four days after nutrition therapy is commenced. Hypophosphatemia that drives many of the medical complications of RS may be the most frequent electrolyte disturbance, with or without hypokalaemia, hypomagnesemia and hypocalcaemia [44].

Diagnostic criteria for RS include fluid imbalance, disturbed glucose homeostasis, hyperlactatemia suggesting vitamin B1 deficiency, but most frequently hypophosphatemia, hypomagnesemia and hypokalaemia. Screening for patients at risk of RS includes one or more of the following: BMI<16 kg/m^2; unintentional weight loss >15% in 3–6 months; little or no intake for >10 days; or low potassium, phosphate and magnesium before feeding. If two or more of the following factors exist a risk of RS should also be considered: BMI <18.5 kg/m^2; unintentional weight loss >10% in 3–6 months; little or no nutritional intake for >5 days; or a history of alcohol misuse or chronic drug use (insulin, antacids, diuretics) [43,45]. [Strong Consensus, 97% agreement]

3.3. Nutritional procedures - the nutrition care process

Nutritional care should be provided in a systematic sequence that involves distinct interrelated steps and this systematic sequence is called a nutrition care process (Table 5).

3.3.1. Malnutrition risk screening

Risk screening is a rapid process performed to identify subjects at nutritional risk, and should be performed using an appropriate validated tool in all subjects that come in contact with healthcare services. Depending on the care setting, screening should be performed within the first 24–48 h after first contact and thereafter at regular intervals. Subjects identified as at risk need to undergo nutritional assessment (see Section 3.3.2). There are several risk screening tools in use, and many are validated for predicting outcome, whereas some identify subjects that will benefit from nutrition therapy.

It is important to underscore that “risk of malnutrition” as it is identified by the screening tools (usually combining weight loss, reduced food intake and disease activity) is in itself a condition related to increased morbidity and mortality.

ESPEN suggests the use of Nutrition Risk Screening-2002 (NRS-2002) and the Malnutrition Universal Screening Tool (MUST). For older persons ESPEN recommends the use of the Mini Nutritional Assessment (MNA) either in its full or short form (MNA-SF). These tools are all compiled of various combinations of registered or measured BMI, weight loss, food intake, disease severity and age. Other validated tools that combine similar variables and which are frequently used include the Malnutrition Screening Tool (MST) and the Short Nutritional Assessment Questionnaire (SNAQ). Malnutrition risk screening tools are well described in the literature and will not be further described here [46–50]. [Strong Consensus, 97% agreement]

3.3.1.1. Pre-cachexia screening. The process to screen for pre-cachexia, a state that may precede cachexia, is performed in order to launch measures that may prevent or postpone the development of cachexia as early as possible. The procedure refers mainly but not exclusively to patients with cancer [16], and could be regarded as a form of DRM with inflammation risk screening procedure (see Section 3.3.1).

Pre-cachexia is diagnosed in patients affected by chronic diseases, including cancer, based on the concomitant presence of weight loss <5%, anorexia and metabolic disturbances related to

systemic inflammation as revealed by for example increased serum CRP levels [16,17]. [Strong Consensus, 97% agreement]

3.3.1.2. Sarcopenia screening. The ESPEN endorsed statement from the European Working Group on Sarcopenia in Older Persons recommends screening for sarcopenia from age 65 years onwards by measuring gait speed and then, based on the results handgrip strength and/or muscle mass [20]. [Strong Consensus, 100% agreement]

3.3.2. Nutritional assessment

Nutritional assessment should be performed in all subjects identified as being at risk by nutritional risk screening, and will give the basis for the diagnosis decision (see Section 3.2.1), as well as for further actions including nutritional treatment. Predefined assessment tools like Subjective Global Assessment (SGA) [51], Patient-Generated (PG)SGA and Mini Nutritional Assessment (MNA) could be used to facilitate the assessment procedure.

Assessment of the nutritional status comprehends information on body weight, body height, body mass index (kg/m^2), body composition (see Section 3.3.6.2) and biochemical indices (see Section 3.3.6.3). [Strong Consensus, 97% agreement]

Objectives of the assessment are to evaluate the subject at risk according to the following measures:

- A medical history should be taken, and physical examinations and biochemical analyses should be performed in order to decide the underlying disease or condition that may cause the potential state of malnutrition.
- Social and psychological history is taken to establish potential effects of living conditions, loneliness and depression on nutritional needs, and whether input from other professional groups may be of benefit.
- A nutrition history, including limitations in food intake, should be taken and examinations and observations should be performed in order to decide the underlying nutritional causes, and to identify major nutritional obstacles and calculate nutritional needs.
- Energy and fluid needs are determined by indirect calorimetry (energy expenditure) or calculated according to validated equations.
- Protein needs are established in the range from 0.8 g/kg/day (healthy adults) and up to 1.5 g/kg/day (in some cases even higher) according to age, disease and degree of protein depletion [52].
- Micronutrient needs should be determined according to prevailing recommendations and the clinical picture. [Strong Consensus, 94% agreement]

3.3.3. Diagnostic procedure

When the nutrition risk screening identifies subjects at risk, the nutritional assessment will provide the basis for the diagnosis of malnutrition according to the nutrition diagnostic procedure outlined in Section 3.3.1. This part of the assessment procedure is often neglected, mainly due to the absence of a global consensus for diagnostic criteria and their cut-offs [7–9]. [Strong Consensus, 97% agreement]

Table 5
The nutrition care process.

- Malnutrition risk screening
- Nutritional assessment
- Diagnostic procedure
- Nutritional care plan
- Nutritional care
  - ➢ Nutrition therapy
- Monitoring and evaluating the effects of nutritional care and therapy
- Documentation

[Strong Consensus, 97% agreement]

3.3.4. Nutritional care plan

The nutritional care plan is a scheme for nutrition therapy based on the results of the assessment. This plan should be developed by a multi/interdisciplinary team together with the patient and his/her carer in order to achieve patient centered treatment goals. A comprehensive nutritional care plan defines the rationale, explains the nutrition therapy and provides suggestions for monitoring the efficacy of the plan and reassessment.

The nutritional care plan includes information on:

- Energy, nutrient and fluid requirements
- Measureable nutrition goals (immediate and long-term)
- Instructions for implementing the specified form of nutrition therapy
- The most appropriate route of administration and method of nutrition access
- Anticipated duration of therapy
- Monitoring and assessment parameters
- Discharge planning and training at home (if appropriate)

[Strong Consensus, 100% agreement]

3.3.5. Nutritional care

Nutritional care is an overarching term to describe the form of nutrition, nutrient delivery and the system of education that is required for meal service or to treat any nutrition-related condition in both preventive nutrition and clinical nutrition. [Strong Consensus, 100% agreement]

3.3.5.1. Nutrition therapy. Nutrition therapy describes how nutrients are provided to treat any nutritional-related condition. Nutrition or nutrients can be provided orally (regular diet, therapeutic diet, e.g. fortified food, oral nutritional supplements), via enteral tube-feeding or as parenteral nutrition to prevent or treat malnutrition in an individualized way. [Strong Consensus, 97% agreement]

3.3.6. Monitoring

Monitoring of nutrition therapy is a measure to check and adjust that nutrition delivery is in progress and nutrition intake or provision is sufficient, as well as to assure tolerance and that goals and expected outcomes are achieved. The monitoring procedures require an individual plan where nutrition goals are defined. [Strong Consensus, 97% agreement]

Fact Box: Monitoring plan of nutritional care and therapy.

- Nutrition provision and intake: Are calculated requirements of fluid, energy and protein met?
- Weight, anthropometry, body composition: Does e.g. weight, fat free mass (FFM) or fat mass (FM) change as expected?
- Biochemistry: There are no good biochemical markers of the nutritional status. Plasma albumin and transthyretin/prealbumin concentrations may be used mainly to indicate and monitor catabolic activity. Their validity as nutrition indicators is low in view of their perturbation by inflammation.
- Function: e.g. hand grip strength (HGS), chair rise tests and gait speed, either alone or combined in the Short Physical Performance Battery (SPPB) [35] could be used.

- Quality of life (QoL): e.g. EQ-5D or HRQOL, or other tools relevant to the diagnosis, could be used.

It should be emphasized that current biochemistry, functional and QoL measurements may not be sensitive enough to capture relevant changes of the nutritional status. [Strong Consensus, 97% agreement]

3.3.6.1. Nutrition intake. In the hospital setting, recording of nutrition intake can be performed at the bedside by nurses or assistant nurses, using plate diagram sheets that have proven clinically useful [53,54], or using self-recorded diary by patients themselves [55]. Amount of food consumption could be estimated by food records during 2–4 days [56,57]. Food weight record, i.e. to weigh each food item before and after food consumption, is difficult to implement in clinical practice, but is often used in research. Modern digital technologies may provide new means to establish food intake [58]. [Strong Consensus, 100% agreement]

3.3.6.2. Weight and body composition. Monitoring of weight during hospitalization may not be sensitive due to disease or therapy related shifts in fluid balance. Nevertheless, weight should be recorded one to three times per week whilst a patient is in hospital with a decreasing frequency when in a stable condition. If the patient is undergoing ambulatory treatment the type of underlying condition will indicate the interval of weight measurement required. Regular weight measurements are not useful for patients in late palliative phases, or in any subject at end of life.

FFM and FM are estimated by bio-impedance analysis (BIA) or DXA-scan, but subject to the same limitations as weight measurements. Standard anthropometric measurements, such as mid-arm-circumference, calf-circumference or skinfold thickness are potential alternatives although subject to measurement variability [59]. [Strong Consensus, 93% agreement]

BIA is a quick non-invasive method to estimate body composition, but requires stringent standard procedures such as a fast for at least 2 h and urination before the test is carried out [60,61]. Single frequency-BIA (SF-BIA) is commonly used to estimate total body water (TBW) and fat free mass (FFM) with a validated formula. Multi frequency-BIA (MFBIA) and bioelectrical impedance spectroscopy (BIS) calculate intracellular water (ICW), extracellular water (ECW), TBW and FFM. BIS offers information of ICW and ECW distribution. From these FFM is predicted. BIA-derived phase angle has a strong prognostic value [62]. [Strong Consensus, 97% agreement]

DXA is regarded as a more accurate method on an individual level. It is an accepted reference method to evaluate BIS. DXA gives information on FM, lean soft tissue (LST) and bone mineral content (BMC). The radiation dose of a single DEXA measurement is dependent on the device and the age of the patient, but is low and therefore the expected lifetime risk of fatal cancer is negligible. However, DEXA is not recommended for pregnant women. [Strong Consensus, 100% agreement]

Computerized tomography (CT) imaging is being increasingly used to evaluate muscle mass depletion [63]. CT scanning is often performed in patients with malignant disorders, thus providing images that could be used for the evaluation of muscle mass. The fact that reference values are scarce for this technique will reduce its validity until such data are available. [Strong Consensus, 97% agreement]

3.3.6.3. Biochemical indices. Biochemical markers, e.g. serum concentrations of visceral proteins, should not be used as indicators of a patient's nutritional status. Monitoring visceral protein levels during refeeding in DRM with inflammation may be helpful, keeping in mind that variations are reflecting the degree of catabolism/inflammation rather than nutritional recovery [64]. Under some circumstances, and taking into account each protein's half-life, levels of albumin (T½ 21 days) and transthyretin/prealbumin (T½ 3 days) may be monitored for long- and short-term effects [65]. Especially in severely malnourished subjects where inflammation is not present, visceral protein levels may improve with nutritional resuscitation [64]. C-reactive protein serum concentrations are suggested for monitoring inflammatory activity (see also Section 3.2.1.1.1). [Strong Consensus, 100% agreement]

3.3.6.4. Physical function. Measurement of physical function is crude, but nevertheless a relevant way to monitor nutritional care and therapy. Hand grip strength by a hand held dynamometer, gait speed or chair rise tests are fairly easy to undertake for the measurement of changes in muscle function sensitive to nutrition interventions [66–68]. Composite functional scores, like the Short Physical Performance Battery (SPPB) [35], De Morton Mobility Index [69] or the Barthel Index [70] may also be relevant functional measures. [Strong Consensus, 100% agreement]

3.3.6.5. Quality of life. Health related quality of life assessed by a validated tool; e.g. EQ-5D [71] may be used as a crude non-specific measure of changes in nutritional status, and as an indicator of reduced food intake [72]. [Strong Consensus, 97% agreement]

3.3.7. Documentation

Nutritional care given has to be communicated at discharge from a healthcare facility to the next caregiver in order to secure continuation of the nutritional care and support. Documentation in medical, dietetic and care records should be provided for nutritional risk screening, diagnosis, assessment of risk factors, nutritional requirements, nutrition therapy, goals and outcomes for nutrition therapy, including estimated time to reach goals, as well a note of who is responsible for the follow-up [73]. The documentation should also provide information on need for help for servings and eating, need for oral care and which are the preferred meals [74] [Strong Consensus, 100% agreement]

3.4. Organization of nutritional care at hospitals and care facilities

Nutritional care in some form is provided to all patients within a hospital or care facility. Depending on the type and severity of the nutritional problems of the patients, the structure and organization of the nutritional care needs to be adapted (Table 6).

3.4.1. Care catering (hospital catering)

Care catering or hospital catering is the provision of menu services (in-house or outsourced) in health care facilities. The minimum requirements of hospital and care catering are to serve a variety of foods that are suitable and adapted to all types of patients with a variety of energy and nutrient densities. Special diets, food texture, allergies and specific cultural aspects have to be considered at all times. For patients with, or at risk, for malnutrition, informed choices with respect to food items and portion sizes have to be ensured. Twenty-four-hour access to nutritionally relevant and well-prepared food should be mandatory, and served portions must appear appetizing for the individual. Energy dense small size portions should be available as an option for patients at nutritional risk. [Strong Consensus, 97% agreement]

3.4.2. Nutrition steering committee (NSC)

A NSC is a committee at a hospital or care facility of a mixed interdisciplinary composition including directors, managers, health professionals and catering staff.

The main objective of a NSC is to set standards for the structure, procedures and management of clinical nutrition at the relevant institutions. Depending on the legal status of the NSC (mainly decided by the care facility management) it may also be responsible for the audit of the nutritional care and responding to nutritional incidents. [Strong Consensus, 97% agreement]

3.4.3. Nutrition support team (NST)

A NST is a multi-disciplinary team of physicians, dietitians, nurses and pharmacists. Other relevant professionals may also be part of the NST, e.g. physiotherapist and speech therapists.

The main objective of the NST is to support hospital staff in the provision of nutrition therapy, especially enteral or parenteral nutrition, to ensure that the nutritional needs of patients are satisfied, especially for those patients with complicated nutritional problems. Moreover, the objective includes ensuring that all nutrition therapy utilises state-of-the-art knowledge and techniques to prevent and treat disease-related malnutrition of both inpatients and out-patients [75]. [Strong Consensus, 97% agreement]

3.4.4. Obesity and other disease-specific support teams

In addition to Nutrition Support Teams (NSTs) that usually works across all hospital departments, disease or condition focussed teams linked to specific care facilities could also be available. For example, an Obesity team is a multidisciplinary team of specialists consisting of physicians, dietitians, nurses, physiotherapists, behavioural therapist (psychologist/psychiatrist) as well as other relevant professionals. The Obesity team provides personalized, patient-centred and comprehensive weight management/lifestyle programmes which take into account the comorbidities of the obese patients. The Obesity team should also assist “bariatric surgery” services for pre- and post-operative care. Similar team approaches are relevant for example for diabetes, chronic obstructive pulmonary disease, cancer and palliative care. [Strong Consensus, 100% agreement]

3.4.5. Clinical nutrition care unit

In many hospitals across different countries, dietitians represent a core of nutrition professionals at the hospital, with the specific objective to serve and support the staff as well as individual patients according to nutritional issues. Hospital dietitians could be organized in independent administrative units, or be formally integrated parts of the multi-disciplinary team at department level. [Strong Consensus, 93% agreement]

3.4.6. Clinical nutrition support unit

Based on hospital's organization, patients that require nutrition therapy or receive home artificial/medical nutrition who develop complications such as central line infection can be hospitalized in specific clinical nutrition support wards managed by a multidisciplinary team of specialized physicians, nurses, dietitians and pharmacists. [Strong Consensus, 93% agreement]

Table 6
Organizational forms of providing nutritional care and support.

- Care catering/Hospital catering
- Nutrition Steering Committee
- Nutrition Support Team
- Disease-specific Support Teams
- Clinical Nutrition Care Unit
- Clinical Nutrition Support Unit

[Strong Consensus, 97% agreement]

3.5. Forms of nutritional care

Nutrition care and therapy can be provided in many ways (Table 7).

3.5.1. Meal environment

3.5.1.1. Meal support. Meal support is specific efforts to promote food intake, which encompasses friendly social interactions with the caring staff as well as with other patients or residents during mealtimes. Suitable meal-time ambiance contributes to a relaxed and comfortable environment. The atmosphere or the perception of the entirety of the meal is the product of both material and immaterial factors. Protected mealtimes, i.e. not allowing medical or caring procedures to take place during the meal, is a further meal support action to promote oral intake [76,77]. Patients' choice from a la carte menus and meals-on-demand are increasingly offered [78]. [Strong Consensus, 100% agreement]

3.5.1.2. Eating support. Eating support encompasses actions to enable an individual to eat through verbal encouragement and physical support. Eating support prioritizes a number of factors such as positioning at the table, provision of assistive eating tools, assistance with cutting the food in smaller pieces, and helping patients to make informed food choices [76,79]. [Strong Consensus, 100% agreement]

3.5.2. Diets

Dietary advice and counselling about food choices and preparations may be relevant for patients, relatives and informal caregivers concerning all below described types of diets.

3.5.2.1. Regular hospital diet. Regular hospital diet should cover individual patient's nutrient and energy requirements according to recommendations based on scientific evidence. Diet composition takes local food habits and food patterns into account as long as there are no specific therapeutic requirements, in which cases a therapeutic diet or functional food is required (see below). [Strong Consensus, 97% agreement]

3.5.2.1.1. Food product. A food product is any food that is suitable for human consumption which provides energy-containing macronutrients (e.g. carbohydrates, protein, fats), and/or micronutrients (e.g. vitamins, minerals), and/or other substances which may contribute to fulfil the nutritional requirements of the patient. [Strong Consensus, 100% agreement]

3.5.2.2. Therapeutic diet. Therapeutic diets are prescribed according to the specific need of the patient.

3.5.2.2.1. Food modification. Some conditions or disorders, e.g. diabetes mellitus, hyperlipidaemia, hepatic encephalopathy, renal or celiac disease may require food modifications that could include adjustments of carbohydrate, fat, protein and micronutrient intake, or the avoidance of specific allergens. [Strong Consensus, 97% agreement]

3.5.2.2.2. Fortified food. Fortified food is food products to which vitamins, minerals, energy or other nutrients, or a combination of them, have been added to increase energy or nutrient density. [Strong Consensus, 97% agreement]

3.5.2.2.3. Food supplements. Food supplements are food products that supplement normal diet and which are concentrated sources of nutrients (e.g. vitamins or minerals) or other substances with a nutritional or physiological effect, alone or in combination, marketed in various dose forms: capsules, tablets and similar forms, sachets of powder, ampoules of liquids, drop dispensing bottles, and other similar forms oral dosage forms, liquids and powders designed to be taken in measured small unit quantities

(https://www.efsa.europa.eu/en/topics/topic/supplements).
[Strong Consensus, 100% agreement]

3.5.2.2.4. Functional food. Functional food is food fortified with additional ingredients or with nutrients or components intended to yield specific beneficial health effects. [Strong Consensus, 100% agreement]

3.5.2.2.5. Texture modified food and thickened fluids. Texture modified food and thickened fluids can be available in several various qualities. Although there are no harmonised descriptors they could be described as follows [80]:

- Liquidized/thin purée; Homogenous consistency that does not hold its shape after serving.
- Thick purée/soft and smooth; Thickened, homogenous consistency that holds its shape after serving and does not separate into liquid and solid component during swallowing, i.e., cohesive.
- Finely minced; Soft diet of cohesive, consistent textures requiring some chewing (particle size most often described as 0.5 × 0.5 cm).
- Modified normal; Normal foods of varied textures that require chewing, avoiding particulate foods that pose a choking hazard (particle size most often described as 1.5 × 1.5 cm). [Strong Consensus, 97% agreement]

3.5.3. Medical nutrition therapy

Medical nutrition therapy is a term that encompasses oral nutritional supplements, enteral tube feeding (enteral nutrition) and parenteral nutrition. The two latter has traditionally been called artificial nutrition, but this term is suggested to be replaced by medical nutrition therapy.

Nutrition products that are delivered via the gastrointestinal tract, i.e. provided orally or as tube feeding, are defined in the EU legislation as "foods for special medical purposes" (FSMPs) (Directive on foodstuffs intended for PARticular NUTritional useS 2009/39/EC 2013/609/EC (PARNUTS) [81,82]. FSMPs are defined as "specially processed or formulated and intended for the dietary management of patients, including infants, to be used under medical supervision; it is intended for the exclusive or partial feeding of patients with a limited, impaired or disturbed capacity to take, digest, absorb, metabolise or excrete ordinary food or certain nutrients contained therein, or metabolites, or with other medically-determined nutrient requirements, whose dietary management cannot be achieved by modification of the normal diet alone" - Regulation (EU) no 609/2013 of the European parliament and of the council. The PARNUTS directive will be replaced by the FSG regulation 2013 (Regulation on Food for Specific Groups), supplemented by delegated regulation (EU) 2016/128 on FSMP. [Strong Consensus, 100% agreement]

Table 7
Overview of forms and products for nutritional care and therapy.

- Meal environment
  - ≻ Meal support
  - ≻ Eating support
- Diets
  - ≻ Regular hospital diet
    - ▪ Food product
  - ≻ Therapeutic diet
    - ▪ Food modification
    - ▪ Fortified food
    - ▪ Food supplements
    - ▪ Functional food
    - ▪ Texture modified food and fluid
- Medical nutrition therapy
  - ≻ Oral nutritional supplements (ONS)
    - ▪ Nutritionally complete ONS
    - ▪ Nutritionally incomplete ONS
  - ≻ Enteral tube feeding/enteral nutrition
    - ▪ Total
    - ▪ Supplemental
    - ▪ Home
  - ≻ Parenteral nutrition
    - ▪ Total
    - ▪ Supplemental
    - ▪ Home
    - ▪ Subcutaneous fluid therapy
    - ▪ Intra-dialytic
- Palliative nutrition

[Strong Consensus, 96% agreement]

3.5.3.1. Oral nutrition therapy. Oral nutrition therapy is mainly given as oral nutritional supplements (ONS) and defined as FSMP (see above). ONS are developed to provide energy and nutrient-dense solutions that are provided as ready to drink liquids, crèmes or powder supplements that can be prepared as drinks or added to drinks and foods. Liquid ONS (either ready to drink or made up from powders) are sometimes referred to as sip feeds. Clinical effects and cost-effectiveness are well established [83–85]. [Strong Consensus, 97% agreement]

3.5.3.2. Enteral tube feeding. Synonym: enteral nutrition. Enteral tube feeding is nutrition therapy given via a tube or stoma into the intestinal tract distal to the oral cavity. Enteral formulas are defined as FSMP (see above). The tube could be inserted via the nose; i.e. naso-gastric, naso-jejunal or naso-post pyloric tube feeding; or via a stoma that is inserted endoscopically into the stomach; i.e. percutaneous endoscopic gastrostomy (PEG) or with a jejunal extension (PEG-J) or into the jejunum (percutaneous endoscopic jejunostomy (PEJ)). Finally, the tube may also be placed surgically; i.e. surgical gastrostomy or jejunostomy. [Strong Consensus, 97% agreement]

3.5.3.2.1. Total enteral tube feeding. Synonym: total enteral nutrition (TEN). Total enteral tube feeding (TEN) refers to conditions when all nutrient needs are provided through a feeding tube without significant oral or parenteral intake. [Strong Consensus, 97% agreement]

3.5.3.2.2. Supplemental enteral tube feeding. Supplemental enteral tube feeding is nutrition given to patients whose oral intake of food and fluids is inadequate for reaching their defined target alone. [Strong Consensus, 97% agreement]

3.5.3.2.3. Home enteral tube feeding. Synonym: Home Enteral Nutrition (HEN). When enteral tube feeing is used outside the hospital it is called Home Enteral Nutrition (HEN) or as in some countries Home Enteral Tube Feeding (HETF). It can be provided either as total or supplemental enteral nutrition. [Strong Consensus, 100% agreement]

3.5.3.3. Parenteral nutrition (PN) therapy. Parenteral nutrition is a type of nutrition therapy provided through intravenous administration of nutrients such as amino acids, glucose, lipids, electrolytes, vitamins and trace elements. PN can be central through a central venous line, or peripheral through a peripheral intravenous line. [Strong Consensus, 97% agreement]

3.5.3.3.1. Total parenteral nutrition (TPN). Synonym: exclusive parenteral nutrition. Total parenteral nutrition (exclusive parenteral nutrition) therapy refers to situations where the patient's complete nutritional needs (all macro and micro-nutrients) are covered by the PN, and in which nutrition is not given by any route other than intravenously. [Strong Consensus, 100% agreement]

3.5.3.3.2. Supplemental parenteral nutrition (SPN). Synonym: partial parenteral nutrition or complementary parenteral nutrition. Supplemental (partial or complementary) parenteral nutrition

refers to situations where nutrition is provided in addition to parenteral nutrition by any route other than intravenously. For example, this situation may arise when the oral or enteral tube routes cannot independently achieve the defined nutritional care plan target (See Section 3.3.4). [Strong Consensus, 100% agreement]

3.5.3.3.3. Home Parenteral Nutrition. When parenteral nutrition is used outside the hospital it is called Home Parenteral Nutrition (HPN). HPN used as TPN or SPN is often used for patients with chronic intestinal failure, malignant obstruction or partial obstruction of the gastrointestinal tract [86]. [Strong Consensus, 100% agreement]

3.5.3.3.4. Subcutaneous fluid therapy. The subcutaneous route is a special parenteral route primarily used to provide fluids (hypodermoclysis). It can also be used to provide limited amounts of glucose and amino acids, when the intravenous route is unavailable or unsuitable. It is mainly used in late life care. [Consensus, 87% agreement]

3.5.3.3.5. Intra-dialytic parenteral nutrition (IDPN). IDPN is PN given intravenously through the venous line of the dialysis circuit, and thus given cyclic during the dialysis session [87]. IDPN is not a routine technique for supplemental nutrition therapy, but may be indicated to prevent nutritional deterioration in patients receiving dialysis treatment when other methods of nutrition therapy have proved insufficient to meet nutritional and metabolic needs [88]. [Strong Consensus, 97% agreement]

3.5.4. Palliative nutrition

Palliative nutrition is the form of nutritional care and therapy that is provided to patients in late phases of end-stage disease. The major goal is to improve quality of life [89]. Food or nutrient restrictions are avoided. The nutrition measures are decided by the palliative phase. In the early phase energy, proteins and nutrients are provided by the best feasible route. In late phase of palliative care psycho-social support around meals and food intake for both the patient and relatives is prioritized. Parenteral nutrition could be considered to reduce stress around the meal situation. Monitoring of the nutritional status, e.g. recording weight changes, should be avoided to not add more stress during the final phase of life. [Strong Consensus, 94% agreement]

3.6. Nutritional products for medical nutrition therapy

3.6.1. Oral nutritional supplements (ONS)

There are two major types of ONS; those that are nutritionally complete and those that are nutritionally incomplete.

3.6.1.1. Nutritionally complete ONS. These are standard ONS that can be used as the sole source of nourishment for prolonged periods since they have a balanced nutritional composition of macro- and micronutrients, including essential amino acids, essential fatty acids and micronutrients that reflect dietary recommendations for healthy people. They are commonly used as a supplement to the general diet, when the regular food intake is insufficient. Nutritionally complete standard ONS can in some cases represent the only source of intake of energy and nutrients. [Strong Consensus, 100% agreement]

3.6.1.2. Nutritionally incomplete ONS. These are not suitable for use as the sole source of nutrients since they are adapted to contain some specific nutrients in higher amounts, whereas the content of other nutrients is lacking or insufficient.

Disease-specific ONS are modified in order to meet specific nutritional and metabolic demands for certain diseases for example diabetes, pressure ulcers, cirrhosis, cancer, renal failure and pulmonary disease, and can be complete or incomplete. [Strong Consensus, 94% agreement]

3.6.2. Enteral formulas

Standard enteral formulas have a composition that meets the nutritional needs of the general population. In general, energy, protein and micronutrient needs are covered by 1.5 L of standard enteral formula. They can have a standard nutrient profile or can be nutrient adapted for certain conditions or diseases. Most standard enteral formulas (and their high energy and high protein variants) contain fibre and are free of lactose and gluten. Whole protein formulas contain intact proteins, and typically contain lipids that are mostly provided in the form of long chain triglycerides, and carbohydrates that come predominantly as polysaccharides, e.g. maltodextrin. Enteral formulas are mostly nutritionally complete.

Formulas containing peptides and medium chain triglycerides can facilitate absorption in case of e.g. malabsorption or short bowel syndrome.

Disease specific enteral formulas are designed to meet specific nutritional and metabolic demands, for example for patients with diabetes, pressure ulcers, cirrhosis, cancer, renal failure and pulmonary disease. [Strong Consensus, 94% agreement]

3.6.3. Parenteral solutions

Parenteral solutions are composed of carbohydrates (glucose), lipids and amino acids and can include electrolytes, vitamins and trace elements as required. They are defined by the relative composition of the macronutrients, osmolarity, pH and calorie content. These solutions can be administered using separate bottles but are preferably administered using compounding or ready to mix bags. [Strong Consensus, 94% agreement]

3.6.3.1. Parenteral nutrition. Parenteral nutrition infusates for parenteral administration are intended to provide energy and nutrients, rather than hydration alone. They are usually given intravenously. PN infusates can aim to provide a single group of nutrients (e.g. the use of lipid emulsion alone) or a combination of nutrients that is more typically thought of as a PN infusate (e.g. a combination of amino acids, glucose, lipid emulsion, electrolytes and vitamins and trace elements in Water for Injection). [Strong Consensus, 93% agreement]

3.6.3.1.1. Three chamber bag/all-in-one PN. A three chamber bag (usually industry manufactured) or all-in-one (mainly pharmacy provided) PN infusate is an emulsion in which amino acids, glucose and lipid emulsion are combined in a single infusate, along with electrolytes, vitamins and trace elements as required.

Three-chamber bags contain all macronutrients and electrolytes in three separate compartments. The substrates are mixed together immediately prior to intravenous application by breaking the separation seals between the bag chambers. Three chamber bags are available with or without basic electrolytes. Vitamins and trace elements are injected into the bag prior to administration. This can be a relatively safe system for PN administration, e.g. the risk of infection is lowered by the closed system and by reduced manipulation.

Individually compounded all-in-one (AIO) admixtures allow for the provision of patient-specific ready-to-use PN infusates, adapted according to energy, volume and substrate needs. These are aseptically manufactured from various components, usually in hospital pharmacies, and are designed for immediate intravenous administration, with no mixing or admixing required prior to administration. These bags are usually compounded daily or weekly due to their often limited stability. They require appropriate storage under refrigeration at 2–8 °C prior to use, but should be gently warmed to

room temperature before administration. [Strong Consensus, 100% agreement]

3.6.3.1.2. Two chamber bag/two-in-one (lipid-free) PN. A two chamber bag (usually industry manufactured) or two-in-one (mainly pharmacy provided) PN infusate is a solution in which amino acids and glucose (no lipid emulsion) are combined in a single infusate, along with electrolytes, vitamins and trace elements as required. Two-in-one PN infusates may be required if a formulation is pharmaceutically unstable when lipid emulsion is included, or when the aim is not to provide lipids. [Strong Consensus, 100% agreement]

3.6.3.2. Parenteral nutrition components. A parenteral nutrition component is intended to be combined with other PN components to formulate the requirements of a prescription for PN. Individual products must be intended for parenteral use and must be combined in a suitable environment and under aseptic techniques that ensures sterility of the final product. In some cases, PN components are administered independently, except for Water for Injection (see E3.2.4). [Strong Consensus, 97% agreement]

3.6.3.2.1. Amino acid solution. Commercial crystalline amino acid solutions contain a mixture of different concentrations and profile of crystalline amino acids, and are available with or without the inclusion of electrolytes. [Strong Consensus, 97% agreement]

3.6.3.2.2. Glucose (dextrose) solution. Commercial glucose solutions contain glucose in Water for Injection at different concentrations, typically from 5% w/v up to 70% w/v. A concentration of 12.5% w/v is considered to be a limit to avoid complications from peripheral administration, although that is also patient dependent. [Strong Consensus, 97% agreement]

3.6.3.2.3. Lipid emulsion. Commercial lipid emulsions are a lipid-in-water emulsion that contains a mixture of triglycerides with different fatty acid chains. For some products, they are available in more than one concentration i.e. 10% w/v, 20% w/v and/or 30% w/v. The products contain the essential fatty acids, i.e. linolenic and linoleic acids, mainly derived from soy bean oil. There are several oils used in the production of lipid emulsions for intravenous administration. Other lipid sources include olive oil or fish oil. Soy bean, olive and fish oil provide long chain fatty acids (LCT), whereas coconut oil provides medium chain triglycerides (MCT). LCTs from soy bean, olive and fish oil have different metabolic characteristics.

[Strong Consensus, 100% agreement]

3.6.3.2.4. Water for Injection. Water for Injection contains no components other than sterile water suitable for parenteral administration. It should never be administered alone due to its low osmolarity. [Strong Consensus, 97% agreement]

3.6.3.2.5. Electrolyte solution. An electrolyte solution consists of an electrolyte salt in Water for Injection. Many are available in different volumes, concentrations, different units of concentration, types of container (e.g. glass or plastic), or with the intended electrolyte available as different salts. These differences lead to a number of considerations such as potential container contaminants, ordering and storage requirements (e.g. in some cases with high strength potassium solutions), conversion between different units, and differences in stability assessment when electrolyte solutions are combined with other components (e.g. the use of inorganic compared to organic salts).

For parenteral nutrition a standard dosage of vitamins and trace elements is generally recommended because individual requirements cannot be easily determined. Preferably, all vitamins and trace elements supplied with a normal diet should also be substituted with PN as available. The quantities of daily parenteral vitamin and trace element supplied are based on current dietary reference intakes for oral feeding. [Strong Consensus, 93% agreement]

3.6.3.2.6. Vitamin and trace element parenteral nutrition components. A vitamin parenteral nutrition component consists of a combination of water soluble vitamins, lipid soluble vitamins or water and lipid soluble vitamins that is intended for parenteral administration, and which may require reconstitution prior to use. Trace element components are products that consist of individual, or a combination of, trace elements, intended for parenteral administration. Trace element parenteral nutrition components are usually presented as a solution for injection. The omission of vitamins and trace elements from all-in-one or two-in-one PN infusates should be avoided (if not necessary) because ensuing deficiencies will lead to complications. [Strong Consensus, 100% agreement]

4. Discussion

This definition and terminology consensus statement presents an up-dated overview of terminology of core nutritional concepts, procedures and products. The purpose was to identify relevant nutrition terminology used in routine nutritional practice and research, to describe that terminology and when feasible to give diagnostic or descriptive criteria. Another objective was to identify gaps in the nutritional terminology and to provide consensus based and when possible evidence based definitions and diagnostic criteria.

The statement has particular importance with relation to the terminology for the diagnosis of malnutrition/undernutrition and its aetiology-based subgroups. The distinction between the two groups of DRM, i.e. DRM with and without inflammation is particularly emphasized, as well as the acknowledgement of the third major diagnosis group of “malnutrition/undernutrition without disease”. In 2012 ASPEN and the Academy of Nutrition and Dietetics launched a Consensus Statement [8] for the “identification and documentation of adult malnutrition (undernutrition)”. In this “white paper” the need to identify the presence of inflammation (or not) early in the diagnostic procedure of malnutrition in order to determine the aetiology of the malnutrition was emphasized. This current ESPEN statement could be seen as a development and amendment of this concept and the previous ASPEN/Academy statement.

The process to unify clinical nutrition terminology is a long term goal, as well as a sensitive issue due to the fact that agreement among stakeholders can be difficult to reach [90]. Recently, ESPEN launched diagnostic criteria for the general concept of malnutrition/undernutrition [7]. A similar measure to define diagnostic criteria for malnutrition was made by ASPEN and the Academy in the “white paper” mentioned above [8]. The ESPEN Terminology Consensus Group recognises that the continuous ongoing discussion between global stakeholders, and the expansion of understanding and knowledge, will provide the basis for a global consensus on how to diagnose malnutrition and which diagnostic criteria to use. Such a process will include the participation of all major nutrition societies across the world.

It should be emphasized that the definition of diagnostic criteria will not by any mean change or question the now well established practice of nutritional risk screening of all individuals that get in contact with health or elderly care. The risk screening procedure is the first mandatory step in any diagnostic process to identify malnutrition. Huge efforts are still needed to implement validated risk screening tools into clinical practice in most parts of the world. Already a poor nutritional risk status is associated with negative clinical outcomes. This implies that malnutrition is a process which

follows a trajectory where early and late stages of the condition could be identified.

Malnutrition impose increased financial burden to health organisations. Though nutrition risk screening, treatment and monitoring requires financial resources they are offset by for example reduction in length of stay in hospital [84,85].

Another approach to define terminology of clinical nutrition is represented by the on-going process of the Academy of Nutrition and Dietetics that since 2008 has developed a standardized model called the Nutrition Care Process (NCP) to guide dietitians in the provision of nutritional care [91]. It comprises four distinct steps: assessment, nutrition diagnosis, intervention, and monitoring and evaluation. The NCP and its terminology have been implemented in several countries worldwide and are supported by the European Federation of the Associations of Dietitians (EFAD). The terminology presented in this paper aligns to, but is not identical with, the Nutrition Care Process Terminology (NCPT). Furthermore, the NCPT includes additional terms that uniquely describe the nutritional care provided by dietitians. This could be compared to the use of classification systems such as ICD and International Classification of Functions (ICF) by other health care professions. The NCPT is accessible on line (eNCPT) (http://ncpt.webauthor.com.).

Finally, this terminology basis statement aims to support updates of the worldwide-used ICD system, as well as other relevant classification systems. For the ICD system this means the current ICD-10 or the ICD-11 update that is expected to be launched by WHO in 2018.

In summary, the Definition and Terminology Consensus statement reflects a current perception on how nutrition concepts and procedures could be described and defined. The alignment to parallel important international initiatives, openness to up-coming new knowledge and identification of gaps in the present statement will facilitate a constructive continuous process of development in order to find the most feasible nutritional terminology to support the efforts of the nutrition communities to provide patients faced with catabolic disorders the best possible nutritional treatment. For the benefit of the global nutrition community, an agreement and a consensus statement between the leading international nutrition societies has a high priority and could be achieved by constructive discussions.

Conflicts of interest

Cederholm T – receives unconditional grants for intervention research from Nestec Ltd and Nutricia. TC gives lectures that are organized by Nestec Ltd, Nutricia, Fresenius Kabi and other companies.

Barazzoni R – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Austin P – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Ballmer P – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Biolo G – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Bischoff SC – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Compher C – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Correia I – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Higaschiguchi T – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Holst M – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Jensen G – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Malone A – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Muscaritoli M – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Nyulasi I – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Pirlich M – gives lectures that are organized by Nutricia, Fresenius Kabi, and BBraun.

Rothenberg E – gives lectures and receives fees at meetings organized by Nutricia.

Schindler K – has no conflict of interest to declare in association with this manuscript.

Schneider SM – gives lectures that are organized by B. Braun, Baxter, Fresenius-Kabi, Nestlé Health Sciences, Nutricia, Shire and other companies, and consults for Nutricia. No COI in association with this manuscript.

Marian de van der Schueren – gives lectures that are organized by Nutricia, Baxter, Abbott, Fresenius-Kabi and other companies. No COI in association with this manuscript.

Sieber C – receives unconditional grants for intervention research from Nestec Ltd and Nutricia. CS gives lectures that are organized by Abbott, Danone, Nestec Ltd, Nutricia and other companies.

Valentini L – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Yu JC – declares no conflict of interest which might have interfered with the scientific validity of the present paper.

Van Gossum A – receives fees for consultancy for Fresenius-Kabi, Belgium and Shire; and for lectures in meetings organized by Baxter, Fresenius-Kabi, Nestle and Nutricia.

Singer P – receives unconditional grants for research from Abbott, Baxter, B Braun and Fresenius-Kabi and gives lectures that are organized by Baxter, B Braun, Cosmed, Fresenius-Kabi, General Electric and other companies.

Acknowledgement

Many colleagues in the nutrition community have reviewed the manuscript at various levels of its evolution. The Consensus group acknowledges contributions from Yitsal Berner, Ingvar Bosaeus, Michael Chourdakis, Mick Deutz, Henrik Hojgaard Rasmussen, Hinke Kruizenga, Ylva Orrevall, Matthias Plauth, Marjolein Visser, which does not necessarily imply each agrees with all statements in the final manuscript. Moreover, the thorough review and constructive contributions from the Medical Nutrition International Industry is very much appreciated. This work was funded by ESPEN, and has not received any external funding.

Finally, ESPEN is grateful to the German Society of Nutritional Medicine (DGEM) working group and the authors behind the DGEM report “Suggestions for terminology in clinical nutrition” that was published in Clinical Nutrition journal. Our thoughts are with the late professor Herbert Lochs, an outstanding researcher and inspirer, who was the senior author of the DGEM report.

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