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Opinion paper

Defining malnutrition: A plea to rethink

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SUMMARY

In a recent consensus report in Clinical Nutrition the undernourished category of malnutrition was proposed to be defined and diagnosed on the basis of a low BMI or unintentional weight loss combined with low BMI or FFMI with certain cut off points. The definition was endorsed by ESPEN despite recent endorsement of a very different definition. The approach aims to assess whether nutritional intake is sufficient but is imprecise because a low BMI does not always indicate malnutrition and individuals with increasing BMI's may have decreasing FFM's. The pathophysiology of individuals, considered to be malnourished in rich countries and in areas with endemic malnutrition, results predominantly from deficient nutrition combined with infection/inflammation. Both elements jointly determine body composition and function and consequently outcome of disease, trauma or treatment. When following the consensus statement only an imprecise estimate is acquired of nutritional intake without knowing the impact of inflammation. Most importantly, functional abilities are not assessed. Consequently it will remain uncertain how well the individual can overcome stressful events, what the causes are of dysfunction, how to set priorities for treatment and how to predict the effect of nutritional support.

We therefore advise to consider the pathophysiology of malnourished individuals leading to inclusion of the following elements in the definition of malnutrition: a disordered nutritional state resulting from a combination of inflammation and a negative nutrient balance, leading to changes in body composition, function and outcome. A precise diagnosis of malnutrition should be based on assessment of these elements.

1. Introduction

In a recent issue of Clinical Nutrition [1] a sizeable group of knowledgeable ESPEN members published a consensus report on Diagnostic Criteria for Malnutrition in both clinical and population setting. To arrive at this report, clinical scientists were chosen to represent the clinical fields of medicine, surgery, intensive care, oncology and geriatrics. Communication occurred in several ways and after each step in the procedure confirmation was sought from the participants. Ultimately a ballot was organized among the members of ESPEN to seek approval of the statements in the report.

Two alternative ways to diagnose malnutrition were formulated.

1. BMI <18.5 kg/m^2
2. Unintentional weight loss >10% of initial body weight irrespective of time or >5% in the last 3 months combined with either
   a. BMI <20 kg/m^2 if < 70 years of age, or BMI <22 kg/m^2 if older than 70 years or
   b. FFMI <15 and 17 kg/m^2 in women and men respectively.

Despite these efforts we have serious concerns regarding the conclusions drawn because they might add to the confusion rather

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than bringing clarity. In this commentary we will try to point out the shortcomings of the present "consensus" in this regard, and propose to stick to the earlier consensus statements published in 2010, endorsed by ESPEN [2] and ASPEN [3], which included a rational approach to the definition and assessment of malnutrition. In our opinion this can be achieved only when etiological factors such as inflammation and under- or overnutrition are considered. We will restrict this commentary to the undernourished state and its relationship to malnutrition states. In our opinion, it is not possible to dissociate the ways to diagnose malnutrition from its definition.

2. Definition of malnutrition

Part of the confusion in the nutritional world arises from the interpretation of the term "Definition". *A definition is a precise statement of the nature of a thing or condition.* In the nutritional and metabolic world we specifically want to define nutrition related disorders. Several efforts have been made in the past to formulate a definition to describe precisely the pathophysiology of undernutrition/malnutrition as it is encountered in the majority of individuals considered malnourished, both in areas with endemic malnutrition and in clinical settings.

A century ago two forms of undernutrition were distinguished in children in areas with endemic malnutrition. Marasmus was considered to result from lack of both energy and protein, and typically is characterized by loss of fat free mass and fat mass, without oedema and with relatively normal visceral proteins including albumin. Kwashiorkor was considered to result specifically from lack of intake of protein, and its phenomenology included oedema, disturbances in growth and colour of hair, skin lesions, fatty liver and hypoalbuminemia. The kwashiorkor children showed less growth retardation suggesting that their malnutrition was of more recent onset [4]. Later research revealed that this phenomenology was not restricted to children but also occurred in adults [5]. It has been suggested that the difference in symptomatology in endemic malnutrition resulted from the development of infectious diarrhoea: chronic in marasmus, acute in kwashiorkor and often occurring after suffering from measles or malaria [6,7]. More recently, some evidence has been published from a study of identical twins in Malawi, that differences in the gut microbiome were responsible for kwashiorkor type malnutrition occurring in one child of a pair of identical twins and marasmic malnutrition in the other [8]. Importantly the design of the study helps to confirm that it is unlikely that differences in diet were responsible for the differences in phenotype. Waterlow also questioned the postulated role of differing diets [4].

In the 1960s and 1970s it became increasingly clear that the features of kwashiorkor type malnutrition in our hospitals were predominantly related to infectious or non-infectious inflammation [5]. In addition, as long ago as the early 1930s Cuthbertson [9] had already pointed out that the inflammatory effects of trauma included net nitrogen losses. Although the concepts were correct and accepted by many clinicians in ESPEN, the nomenclature was not widely applied in clinical nutrition.

When observing severely malnourished individuals in the developed world as well as those in areas with endemic malnutrition, it is clear that their functions are impaired in every imaginable respect [10–12]. Indeed, insufficient food intake can only be considered to be significant when this has led to functional disturbances. Therefore in the 1980s the concept that diminished function is an essential element of malnutrition was developed within the ESPEN community [13]. The following definition was presented in courses and congresses:

1. *Malnutrition is a subacute or chronic state of nutrition, in which undernutrition has led to a change in body composition and diminished function.*

In the remainder of this manuscript the term "function" encompasses muscle function, cognitive function and immune function, supporting a host response leading to successful clinical outcome, appropriate growth in children, regeneration, restored quality of life and long term survival. The concept was strongly promoted by the BAPEN community [14], who added "clinical outcome" as a consequence of biological functioning to the definition. This was included in the ESPEN basic and advanced courses and in the third edition of the so-called "blue book" [12]. In addition both undernutrition and overnutrition were considered to be part of the malnutrition spectrum, leading to the following definition [15]:

2. *Malnutrition is a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein and other nutrients causes measurable adverse effects on tissue/body form (body shape, size, composition), body function and clinical outcome.*

A crucial problem with this definition is that there is no linear relationship between deficiency or excess of nutrients and body composition and function. This is because the state of malnutrition in clinical practice and in areas with endemic malnutrition is not often exclusively the result of a deficiency of nutrients. It is also substantially influenced by the presence of disease, chronic infection and other stressful factors leading to inflammation, which influences body composition, function, longevity and clinical outcome [12,16,17]. It is equally important that the catabolic effects of non-infectious or infectious inflammation cannot be overcome by nutritional support alone [18]. At best a beneficial healing response may be supported when inflammatory activity is long standing and cannot be rapidly treated.

If the nutritional world therefore wants to assess not only whether the individual does not eat or absorb enough or overfeeds, but also to assess the changes in body composition and functions to which this has led, then inflammatory status should be taken into account. In this way nutritional assessment identifies the pathophysiological state of the individual, and also includes assessment of the risk not to recover well from trauma and disease, and to have a low life expectancy. This is more relevant in clinical practice. These considerations have been the underlying reasons to attribute the "mal" in malnutrition to be more than under- or overnutrition but to view it as a syndrome consisting of inadequate nutrition and inflammation. This led to the following definition [19]:

3. *Malnutrition is a subacute or chronic state of nutrition, in which a combination of varying degrees of under- or overnutrition and inflammatory activity has led to changes in body composition and diminished function.*

Essentially inflammation has been added, but the other aspects might be adapted according to definition 2. for instance by adding "clinical outcome". The definition was included in the ESPEN LLL module on malnutrition, is included in the fourth edition of the blue book [20], and is consistent with consensus statements published in JPEN and Clinical Nutrition, endorsed by ASPEN and ESPEN [2,3].

3. Diagnosis of malnutrition

In the Shorter Oxford English Dictionary "diagnosis" is defined as "*Determination of a diseased condition by investigation of its*

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