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## Disease-related malnutrition and nutritional assessment in clinical practice

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*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2018

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

ter Beek, L. (2018). *Disease-related malnutrition and nutritional assessment in clinical practice*. Rijksuniversiteit Groningen.

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# 4

## Unsatisfactory knowledge and use of terminology regarding malnutrition, starvation, cachexia and sarcopenia among dietitians

*Published in: Clinical Nutrition 2016*

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## ABSTRACT

**Background & Aims** Clinical signs of malnutrition, starvation, cachexia and sarcopenia overlap, as they all imply muscle wasting to a various extent. However, the underlying mechanisms differ fundamentally and therefore distinction between these phenomena has therapeutic and prognostic implications. We aimed to determine whether dietitians in selected European countries have ‘sufficient knowledge’ regarding malnutrition, starvation, cachexia and sarcopenia, and use these terms in their daily clinical work.

**Methods** An anonymous online survey was performed among dietitians in Belgium, the Netherlands, Norway and Sweden. ‘Sufficient knowledge’ was defined as having mentioned at least two of the three common domains of malnutrition according to ESPEN definition of malnutrition (2011): ‘nutritional balance’, ‘body composition’ and ‘functionality and clinical outcome’, and a correct answer to three cases on starvation, cachexia and sarcopenia. Chi-square test was used to analyse differences in experience, work place and number of malnourished patients treated between dietitians with ‘sufficient knowledge’ vs. ‘less sufficient knowledge’.

**Results** 712/7186 responded to the questionnaire, of which data of 369 dietitians were included in the analysis (5%). The term ‘malnutrition’ is being used in clinical practice by 88% of the respondents. Starvation, cachexia and sarcopenia is being used by 3%, 30% and 12% respectively. The cases on starvation, cachexia and sarcopenia were correctly identified by 58%, 43% and 74% respectively. 13% of the respondents had ‘sufficient knowledge’. 31% of the respondents identified all cases correctly. The proportion of respondents with ‘sufficient knowledge’ was significantly higher in those working in a hospital or in municipality (16%,  $P < 0.041$ ), as compared to those working in other settings (7%).

**Conclusions** The results of our survey among dietitians in four European countries show that the percentage of dietitians with ‘sufficient knowledge’ regarding malnutrition, starvation, cachexia and sarcopenia is unsatisfactory (13%). The terms starvation, cachexia and sarcopenia are not often used by dietitians in daily clinical work. As only one-third (31%) of dietitians identified all cases correctly, the results of this study seem to indicate that nutrition-related disorders are suboptimally recognized in clinical practice, which might have a negative impact on nutritional treatment. The results of our study require confirmation in a larger sample of dietitians.

## INTRODUCTION

Malnutrition can be described 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”<sup>1,2</sup>. Malnutrition is being used as an umbrella term for various nutrition-related disorders<sup>2</sup>, like starvation, cachexia and sarcopenia. Starvation can be described as a pure deficit of food intake resulting in gradual loss of both fat mass and muscle mass.<sup>3</sup> Cachexia has been defined as “a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle with or without loss of fat mass”<sup>4</sup> Whereas cachexia is related to chronic to subacute disease, sarcopenia can be considered a geriatric syndrome,<sup>5</sup> characterized by the age-associated loss of skeletal muscle mass and function.<sup>6</sup>

Clinical signs of malnutrition, starvation, cachexia and sarcopenia overlap, as they all imply muscle wasting to a various extent, however the underlying mechanisms differ fundamentally and therefore distinction between these phenomena has therapeutic and prognostic implications. In contrast to starvation, optimal nutritional therapy will not fully reverse decline of muscle mass in cachectic patients,<sup>7</sup> although this depends on the stage of the cachexia process.<sup>8</sup> Furthermore, sarcopenia is a multifactorial condition in which not only nutritional deficits play a role, but also age-related hormonal deregulation, changes in the neuromuscular system and mitochondrial function, as well as genetic susceptibility and sedentary behavior.<sup>5</sup>

It has been reported that better nutritional knowledge results in better nutritional practice.<sup>9</sup> To be able to distinguish starvation, cachexia, and sarcopenia from the umbrella term malnutrition, sufficient knowledge on the characteristics and underlying etiology of these phenomena is of utmost importance, to select adequate treatment. Thus far, the level of knowledge on the mentioned nutrition-related disorders among dietitians has not been extensively explored. A study in Australian dietitians reported that only 6% of the respondents correctly identified starvation, 21% cachexia and 46% sarcopenia in provided cases.<sup>10</sup> Furthermore, an American survey showed that only 50% of the respondents, mostly dietitians, were familiar with the 2012 Consensus Statement from the Academy of Nutrition and Dietetics on adult malnutrition.<sup>11</sup>

In this study, we primarily aimed to determine whether dietitians in selected European countries have sufficient knowledge regarding malnutrition, starvation, cachexia and sarcopenia, and use these terms in their daily clinical work. We hypothesized that respondents with more experience or treating more malnourished patients, or those working in a hospital or in municipality (including nursing homes), have more sufficient knowledge. Secondly, we aimed to provide an overview of current practices regarding diagnosis and treatment of nutrition-related disorders.

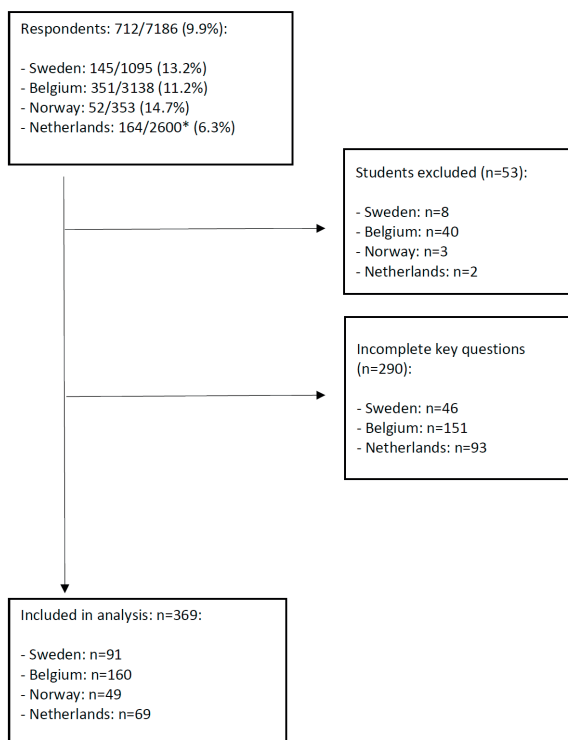
## **MATERIALS AND METHODS**

### **Study Population**

This study was performed among dietitians in Belgium, the Netherlands, Sweden, and Norway, who were recruited via national and regional Associations of Dietitians. Members of these associations received an email request from their association, with information on the study and a link to the anonymous online questionnaire. Dutch dietitians were invited to participate in the study via social media as well. In Belgium, both the Flemish and the French Association of Dietitians participated in recruiting respondents. The invitation provided a brief introduction to the survey to enable prospective participants to gauge their level of interest in the project. The total number of members of Associations of Dietitians that received the request was 7186. Exclusion criteria were: being a student, and incomplete answers to key questions related to demographics (age, employment status, working place and experience), and/or the definition of malnutrition, and/or cases. Demographic information from respondents who did not complete knowledge-related questions was taken into account to identify possible differences in demographics between the group that completed the knowledge-related questions and the group that did not. In the Norwegian questionnaire, the key questions were made mandatory automatically, and therefore had no missing data on these questions. The exclusion procedure is presented in Figure 1.

### **Survey/Questionnaire**

We received written permission from Alison Yaxley and Michelle Miller (Nutrition and Dietetics, Flinders Clinical and Molecular Medicine, School of Medicine, Flinders University, Adelaide, Australia) to use their questionnaire in this European study. We adapted the original questionnaire to the European context. A question on the definition of malnutrition was added. All participating countries reached consensus on the amendments. Table 1 shows the characteristics of the questionnaire which is available as online supplement.



\*estimated

Figure 1 Exclusion procedure

Table 1. Characteristics of questionnaire

Topic	Questions	Response format	Examples of content
<b>Demographic questions</b>	12	Multiple choice tick boxes, some with space for comment, space for numbers	Age, years of experience, employment status/hours
<b>Definition of malnutrition</b>	1	Open ended space for text	Theoretical or operational definitions of malnutrition
<b>Case studies</b>	3	4 multiple choice options, with space for comment	Case studies of starvation, cachexia and sarcopenia
<b>Terminology use</b>	1	6 multiple choice options, with space for comment	Malnutrition, starvation, cachexia and sarcopenia
<b>Screening and Assessment</b>	11	Multiple choice tick boxes, some with space for comment	Screening instruments and criteria for assessment
<b>Treatment options</b>	7	Multiple choice tick boxes, some with space for comment Yes/no tick box	High protein diet, omega 3 fatty acids, strength training
<b>Use of guidelines</b>	3	Open ended space for text, multiple choice tick boxes	Information on use of guidelines
<b>Total</b>	38		

The questionnaire was translated into the Swedish, Flemish, French, Norwegian and Dutch language. Between 3 and 9 people were involved in the pilot testing in each country, which resulted in changes in lay-out and text. Sweden carried out an extensive translational process<sup>12</sup> with expert review. Experts were asked to compare the translated and original versions and rate the translation. The Norwegian translation was reviewed against the Swedish version. Pilot-testers in all four countries were encouraged to give comments and suggestions for improvements.

In each country, data were collected via a web based questionnaire: 'LimeSurvey' in Belgium, 'ThesisTools' in The Netherlands, 'Nettskjema' by the University of Oslo in Norway, and 'Webropol' in Sweden. Between September 2013 and September 2014, the survey was online for three to four weeks in the four countries. One and/or two weeks after the initial request, reminders were sent.

### **Testing of hypotheses**

To test our primary hypothesis on the respondents' knowledge, we asked respondents to give a definition of malnutrition and provide a diagnosis on three cases regarding starvation, cachexia and sarcopenia. Definitions given by the respondents were compared to the well-established ESPEN definition of malnutrition published in 2011.<sup>1</sup> We divided the definition of malnutrition into three domains: 'nutritional balance', 'body composition' and 'functionality and clinical outcome'. We decided to score each domain or measurement belonging to a domain, for example weight loss or BMI for the domain of body composition. Scores varied from 0 for not mentioning any domain of the malnutrition definition, to 3 points for mentioning all domains. Respondents that referred to a definition without actually describing the definition itself received 0 points. Bad appetite or comparable problems were not scored for any domain, as these symptoms do not necessarily imply imbalance in intake of nutrients, but indicate a risk only. We defined 'sufficient knowledge on malnutrition' by scoring 2 or 3 points for the definition, in addition to a correct answer to all three case studies.

To test the other hypotheses, we compared the level of knowledge on malnutrition between respondents with short or long experience in treating patients, between respondents working in a hospital or in municipality versus other workplaces, and between respondents currently treating a few or large number of malnourished patients. To gain insight in the use of specific terminology, respondents were asked to note which terms they use in their patient documentation. To describe the nutritional assessment tools and therapies provided, respondents were asked which instruments are used at their workplace to screen for malnutrition and which criteria and therapies they apply for starvation, cachexia and sarcopenia.

### **Statistical analysis**

Answers from the questionnaire were analyzed using IBM SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics are noted as percentages (%) and frequencies (N).

Chi-squared or Fisher's exact tests were used to compare the answers to the definition of malnutrition and the cases with subgroups of respondents. Statistical significance was set at  $p < 0.05$ .

### Ethical statement

The Research Ethics Committees in Belgium and the Netherlands ruled that no permission from the Committee was needed to perform the study. In Norway and Sweden permission was given to conduct this study. Informed consent was obtained from all respondents upon completion of the survey. The answers to the questions were irreducible to personal identities.

## RESULTS

A total number of 712 persons responded to the online questionnaire, of which 369 respondents were included in the analysis (Figure 1). The group of 343 excluded respondents consisted of 53 students and 290 persons with incomplete answers to the key questions. Demographic characteristics of the respondents are shown in Table 2.

**Table 2.** Respondent characteristics

Demographic information	Belgium (n=160)		Netherlands (n=69)		Norway (n=49)		Sweden (n=91)		All (n=369)	
	N	%	N	%	N	%	N	%	N	%
<b>Age</b>										
</=30	85	53.1	8	11.6	11	22.4	26	28.6	130	35.2
31-40	32	20.2	13	18.8	20	40.8	21	23.1	86	23.3
41-50	24	15	19	27.5	11	22.4	28	30.8	82	22.2
>50	19	11.9	29	42	7	14.3	16	17.6	71	19.2
<b>Experience</b>										
< 1 year	26	16.3	7	10.1	8	16.3	13	14.3	54	14.6
1-5	56	35	14	20.3	16	32.7	17	18.7	103	27.9
6-10	33	20.6	6	8.7	7	14.3	20	22	66	17.9
11-20	20	12.5	12	17.4	9	18.4	23	25.3	64	17.3
>20	25	15.6	30	43.5	9	18.4	18	19.8	82	22.2
<b>Employment hours per week</b>										
1-17	4	2.5	8	11.6	1	2	3	3.3	16	4.3
18-35	56	35	48	69.6	8	16.3	21	23.1	133	36
>/=36	97	60.6	12	17.4	40	81.6	56	61.5	205	55.6
No current employment	3	1.9	1	1.4	-	-	11	12.1	15	4.1
<b>Primary workplace</b>										
Hospital	93	58.1	28	40.6	33	67.4	57	62.6	211	57.2
Primary healthcare	4	2.5	-	-	-	-	13	14.3	17	4.6
Municipality*	17	10.6	20	29.0	1	2.0	10	11.0	48	13.1
Other	46	28.8	21	30.4	15	30.6	11	12.1	93	25.2

\*Municipality includes elderly care and home care



Respondents that did not complete the mandatory questions included a larger percentage with little or no experience (27%; 77/290), as compared to those that completed all mandatory questions (15%; 54/369). Furthermore, in the group of participants that did not complete the mandatory questions, the number of persons working 36 hours per week or more was smaller (40%; 117/290) as compared to the group that completed all mandatory questions (56%; 205/369). In the group of Belgian respondents, the proportion of respondents aged 30 years or younger was larger (53%) than in the other countries (12 to 29%). Overall, the majority of the respondents (57%) was working in a hospital.

The results of the questions on the definition of malnutrition and the three cases are shown in Table 3.

**Table 3.** Results of questions on knowledge

Coverage of the definition of malnutrition	Belgium (n=160)		Netherlands (n=69)		Norway (n=49)		Sweden (n=91)		All (n=369)	
	N	%	N	%	N	%	N	%	N	%
3 domains	14	8.8	9	13.0	2	4.1	14	15.4	39	10.6
2 domains	54	33.8	14	20.3	16	32.7	29	31.9	113	30.6
1 domain	86	53.8	41	59.4	18	36.7	44	48.4	189	51.2
0 domains	6	3.8	5	7.2	13	26.5	4	4.4	28	7.6
<b>Domains</b>										
Nutritional balance	98	61.3	37	53.6	19	38.8	57	62.6	211	57.2
Body composition	97	60.6	43	62.3	30	61.2	64	70.3	234	63.4
Functionality & outcome	41	25.6	16	23.2	7	14.3	23	25.3	87	23.6
<b>Case studies</b>										
Starvation	74	46.3	49	71.0	28	57.1	63	69.2	214	58.0
Cachexia	47	29.3	41	59.4	22	44.9	49	53.9	159	43.1
Sarcopenia	112	70.0	51	73.9	35	71.4	75	82.4	273	74.0
Correct answers to all cases	27	16.9	33	47.8	15	30.6	38	41.8	113	30.6
'Sufficient knowledge'*	10	6.3	11	15.9	8	16.3	19	20.9	48	13.0

\* Defined as scoring 2 or 3 domains of the definition of malnutrition and correct answers to all cases.

Respondents gave either an operational or a theoretical definition of malnutrition, by stating they are using certain parameters to assess malnutrition, for example 'weight loss', or by describing the construct of malnutrition, for example 'a pathological state of too little food intake resulting in diminished muscle power'. Of all respondents, 13% (48/369) had 'sufficient knowledge', i.e. scored two or three points on the question of the definition of malnutrition and gave a correct answer to all cases. Forty-one percent scored 2 or 3 points for the definition of malnutrition. Of all respondents, 57% (211/369) mentioned the domain of nutritional balance and 63% (234/369) mentioned the domain of body composition. Functionality and clinical outcome was the least mentioned domain (24%; 87/369). As for

the cases, 58% (214/369) identified starvation, 43% (159/369) cachexia, and 74% (273/369) identified sarcopenia. Thirty-one percent (113/369) identified all cases correctly.

Terminology use by the respondents is presented in Table 4. A large majority (88%, 326/369) of the respondents used the term ‘malnutrition’ in their local language and 30% (109/369) used the term ‘cachexia’. Sarcopenia and starvation were rarely used terms, with 12% (43/369) and 3% (12/369) respectively.

**Table 4.** Use of terminology

Terms	Belgium (n=160)		The Netherlands (n=69)		Norway (n=49)		Sweden (n=91)		All (n=369)	
	N	%	N	%	N	%	N%	%	N	%
<b>Malnutrition</b>	154	96.3	66	95.7	41	83.7	65	71.4	326	88.3
<b>Starvation</b>	1	0.6	2	2.9	0	0.0	9	9.9	12	3.3
<b>Cachexia</b>	63	39.4	24	34.8	4	8.2	18	19.8	109	29.5
<b>Sarcopenia</b>	24	15.0	15	21.7	0	0.0	4	4.4	43	11.7
<b>Other/not applicable</b>	14	8.8	26	37.7	13	26.5	29	31.9	82	22.2

The number of dietitians with ‘sufficient knowledge’ on malnutrition, starvation, cachexia and sarcopenia did not significantly differ between dietitians with 0 up to 5 years of experience in treating patients (12%, 19/157) and dietitians with 6 or more years of experience (14%, 29/212).

Nineteen percent of the respondents (70/369) did not treat malnourished patients or did not submit an answer to the question on the number of malnourished patients treated. Furthermore, the number of dietitians with ‘sufficient knowledge’ on malnutrition, starvation, cachexia and sarcopenia did not significantly differ between dietitians treating 1-5 malnourished patients per week (13%, 21/158) and those treating 6 or more malnourished patients per week (16%, 22/141). However, the number of dietitians with ‘sufficient knowledge’ on malnutrition, starvation, cachexia and sarcopenia significantly differed ( $p=0.041$ ) between dietitians working in hospitals and municipality care (including nursing homes) (16%, 40/257) as compared to dietitians working in other work settings (7%, 8/108).

In Sweden the Swedish screening tool ‘Socialstyrelsen/Sveriges Kommuner och Landsting’ (SOS/SKL) and Mini Nutritional Assessment (MNA)<sup>13</sup> and/or MNA Short Form (MNA-SF)<sup>14</sup> were reported as the most frequently used malnutrition screening instruments, as were the MNA(-SF) and Nutritional Risk Screening 2002 (NRS 2002)<sup>15</sup> in Belgium, the NRS 2002 and the Malnutrition Universal Screening Tool (MUST)<sup>16</sup> in Norway, and the Short Nutritional Assessment Questionnaire (SNAQ)<sup>17</sup> and/or SNAQ Residential Care (SNAQ RC) or SNAQ 65+<sup>18,19</sup> and MUST in The Netherlands.

Sarcopenia was the nutrition-related disorder most frequently assessed in clinical practice by our respondents, as 63% reported using criteria to diagnose sarcopenia. Cachexia was assessed by 57% and starvation by 29% of the respondents (Table 5).

**Table 5.** Proportion of dietitians assessing starvation, cachexia and sarcopenia in clinical practice

Case	Belgium (n=160)		The Netherlands (n=69)		Norway (n=49)		Sweden (n=91)		All (n=369)	
	N	%	N	%	N	%	N	%	N	%
Starvation	110/160	68.8	6/69	8.7	30/49	61.2	24/91	26.4	170/369	46.1
Cachexia	65/160	40.6	21/69	30.4	37/49	75.5	62/91	68.1	185/369	50.1

The questions on which specific criteria were used to assess starvation, cachexia and sarcopenia were not mandatory for inclusion in the analysis and too few respondents completed these questions. The most frequently mentioned therapy options for starvation were a high energy diet, snacks and oral nutritional supplements. For cachexia and sarcopenia the most provided therapies were high energy diet, high protein diet and snacks. Due to a technical error in the online questionnaire, no data on the subject of provided therapies were collected in The Netherlands. Of all respondents, 65% (241/369) reported to use either local/regional, national or European guidelines in the treatment of malnutrition.

## DISCUSSION

In this survey performed in four Western European countries, we found a low percentage (13%) of dietitians with ‘sufficient knowledge’ regarding malnutrition, starvation, cachexia and sarcopenia. We also found that the terms starvation, cachexia and sarcopenia are not often used by dietitians in daily clinical work. Less than half of the respondents sufficiently scored on the definition of malnutrition. Moreover, only one third of the respondents identified all cases correctly. The findings of our study also indicated that the provided therapies for the different phenomena are not specifically aimed at a certain diagnosis, but rather at malnutrition in general. As hypothesized, we found that ‘sufficient knowledge’ on malnutrition, starvation, cachexia and sarcopenia is more frequently present in respondents working in a hospital or in municipality, including nursing homes, than in their colleagues. However, in contrast to our hypothesis, we did not find differences in knowledge on the nutrition-related disorders between respondents with more working experience, as compared to those with less working experience.

The finding that respondents reported limited use of the terms cachexia (30%), sarcopenia (12%) and starvation (3%) in their daily work documentation might indicate that these nutrition-related disorders are suboptimally recognized in clinical practice. However, in reality patients may suffer from multiple nutrition-related disorders at the same time and it may be likely that the most prominent phenomenon is being diagnosed, possibly explaining the more frequent documentation of cachexia as compared to starvation and sarcopenia.

Compared to the Australian survey,<sup>10</sup> our respondents performed better than the Australian respondents. In our study 58%, 43%, and 74% of the respondents recognized starvation, cachexia and sarcopenia, in contrast to 6%, 21% and 46% in the Australian survey. We speculate that the better performance of our respondents might be explained by increased worldwide awareness on nutrition-related disorders among dietitians, related to a number of consensus papers on terminology of these nutrition-related disorders in recent years.<sup>4,20-22</sup>

Between the four countries, the proportion of dietitians with 'sufficient knowledge' varied from 6% in Belgium to 21% in Sweden. Unfortunately our sample size was too small to test significance of differences found between countries. Respondents working in a hospital or in municipality (including nursing homes) have significantly more 'sufficient knowledge' than their colleagues in other workplaces. This finding suggests that working in an institutional environment is enhancing for the development of knowledge, probably because malnutrition, starvation, cachexia and sarcopenia are likely to be more present in patients in hospitals and municipality/nursing homes. Interestingly, we found no association between working experience or treating more malnourished patients and the level of knowledge. However, as our study was underpowered, we cannot rule out that the small sample size has resulted in a type II error.

The discussion on definitions of nutrition-related disorders is evolving. Consensus definitions of malnutrition have been published since 2003<sup>20,23</sup> up to 2015.<sup>1,2</sup> The first consensus definition of cachexia was published in 2008<sup>4</sup> and on sarcopenia in 2010,<sup>21</sup> indicating that these are relatively new concepts. Even though definitions, terminology and operationalisations might change over time, it remains important to recognize the etiology of nutrition-related disorders in clinical practice. In spite of the overlap in clinical appearance, adequate distinction between the disorders has therapeutic and prognostic implications. The awareness on this matter seems to increase, but since only 30% of our respondents performed a correct diagnosis in all three case studies, this study indicates a strong need for further practical guidance to make dietitians more skilled in assessment of nutritional status and supply adequate care accordingly. Dietitians and their patients do not seem to profit enough from scientific developments concerning the recognition of and distinction between the various nutrition-related disorders. Unfortunately we have no insight in perceived relevance of this distinction by dietitians. The recently developed ESPEN consensus statement on diagnostic criteria for malnutrition<sup>2</sup> gives guidance to dietitians on how to recognize and assess malnutrition. Thus far, it is unclear to what extent scientific developments on nutrition-related disorders have made their way into higher educational and post-graduate educational programmes.

The nutritional care process presupposes teamwork and can be considered an interdisciplinary responsibility, for which not only sufficient knowledge in dietitians is needed, but also in doctors, nurses and other relevant disciplines. Previous research has shown that insufficient knowledge among doctors and nurses might lead to inappropriate nutritional

practice.<sup>9</sup> Future research is needed to assess the knowledge on starvation, cachexia and sarcopenia in other members of the interdisciplinary team.

Our study had some limitations that need to be addressed. First, the response rate was lower than expected. However, our response rate (5.1%) was comparable to the Australian survey by Yaxley et al. (5.5%). Given the normal distribution of respondents among the age groups, there is no indication for large differences between target population and sample characteristics. The group that completed the mandatory questions differed in years of working experience and in working hours per week. However, the response rate has been underestimated due to the response by students. As a result of the recruitment method used, students had the opportunity to respond to the survey, although they were not the target population. As we did not have the possibility to exclude students from the survey beforehand, we had to exclude them, which lowered the response rate. Therefore it was not possible to perform statistical analysis to test differences between countries. For this same reason we cannot extrapolate the results to the European continent. Second, the number of questions in the questionnaire may have been too high, which may have contributed to the large proportion of respondents not completing all questions, and consequently to the small sample size. Third, the results on assessment in clinical practice demonstrate some contradiction to the low percentage of dietitians with sufficient knowledge and the limited use of specific terminology, suggesting that approximately 50% of our respondents assesses nutrition-related disorders. This implicates that our questions on assessment in clinical practice were not stated clear enough and the results should be interpreted with caution. Finally, one could argue that the method used to assess 'sufficient knowledge' may lack discriminating capacity. The questionnaire contained the same cases as the Australian survey by Yaxley et al., so that we would be able to compare the results, and was complemented with a question on the definition of malnutrition. We considered this relevant because the construct of malnutrition is basic dietetic knowledge and important when performing assessment and consequently providing adequate therapy.

In conclusion, the results of our survey among dietitians in four European countries show that the percentage of dietitians with 'sufficient knowledge' regarding malnutrition, starvation, cachexia and sarcopenia is unsatisfactory (13%) and that the terms starvation, cachexia and sarcopenia are not often used by dietitians in daily clinical work. Only one-third (31%) of the respondents identified all cases correctly. This seems to indicate that nutrition-related disorders are suboptimally recognized in clinical practice, which might have negative impact on nutritional treatment. The results of our study require confirmation in a larger sample of dietitians.

## **ACKNOWLEDGEMENTS**

We would like to thank Alison Yaxley and Michelle D. Miller for their original research and for providing us the questionnaire used in their study. Also we would like to thank Nieske de Boer and Elke Lammens, for participating in the data collection in the Netherlands and Belgium.

## REFERENCES

1. Sobotka L, Allison SP, Forbes A, et al. *Basics in clinical nutrition*. 4th ed. Prague, Czech Republic: Publishing House Galen; 2011.
2. Cederholm T, Bosaeus I, Barazzoni R, et al. Diagnostic criteria for malnutrition - an ESPEN consensus statement. *Clin Nutr*. 2015.
3. Thomas DR. Loss of skeletal muscle mass in aging: Examining the relationship of starvation, sarcopenia and cachexia. *Clin Nutr*. 2007;26(4):389-399.
4. Evans WJ, Morley JE, Argiles J, et al. Cachexia: A new definition. *Clin Nutr*. 2008;27(6):793-799.
5. Cruz-Jentoft AJ, Landi F, Topinkova E, Michel JP. Understanding sarcopenia as a geriatric syndrome. *Curr Opin Clin Nutr Metab Care*. 2010;13(1):1-7.
6. Fielding RA, Vellas B, Evans WJ, et al. Sarcopenia: An undiagnosed condition in older adults. current consensus definition: Prevalence, etiology, and consequences. international working group on sarcopenia. *J Am Med Dir Assoc*. 2011;12(4):249-256.
7. Valentini L, Volkert D, Schütz T, et al. Suggestions for terminology in clinical nutrition. *e-SPEN Journal*. 2014;9(2):e97-e108.
8. Laviano A, Koverech A, Mari A. Cachexia: Clinical features when inflammation drives malnutrition. *Proc Nutr Soc*. 2015:1-7.
9. Mowe M, Bosaeus I, Rasmussen HH, et al. Insufficient nutritional knowledge among health care workers? *Clin Nutr*. 2008;27(2):196-202.
10. Yaxley A, Miller MD. The challenge of appropriate identification and treatment of starvation, sarcopenia, and cachexia: A survey of australian dietitians. *J Nutr Metab*. 2011;2011:603161.
11. Patel V, Romano M, Corkins MR, et al. Nutrition screening and assessment in hospitalized patients: A survey of current practice in the united states. *Nutr Clin Pract*. 2014;29(4):483-490.
12. McGreevy J, Orrevall Y, Belquid K, Bernhardson BM. Reflections on the process of translation and cultural adaptation of an instrument to investigate taste and smell changes in adults with cancer. *Scand J Caring Sci*. 2014;28(1):204-211.
13. Vellas B, Villars H, Abellan G, et al. Overview of the MNA--its history and challenges. *J Nutr Health Aging*. 2006;10(6):456-63; discussion 463-5.
14. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the mini nutritional assessment short-form (MNA-SF): A practical tool for identification of nutritional status. *J Nutr Health Aging*. 2009;13(9):782-788.
15. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z, Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): A new method based on an analysis of controlled clinical trials. *Clin Nutr*. 2003;22(3):321-336.
16. Stratton RJ, Hackston A, Longmore D, et al. Malnutrition in hospital outpatients and inpatients: Prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' ('MUST') for adults. *Br J Nutr*. 2004;92(5):799-808.
17. Kruizenga HM, Seidell JC, de Vet HC, Wierdsma NJ, van Bokhorst-de van der Schueren, M.A. Development and validation of a hospital screening tool for malnutrition: The short nutritional assessment questionnaire (SNAQ). *Clin Nutr*. 2005;24(1):75-82.
18. Kruizenga HM, de Vet HC, Van Marissing CM, et al. The SNAQ(RC), an easy traffic light system as a first step in the recognition of undernutrition in residential care. *J Nutr Health Aging*. 2010;14(2):83-89.
19. Wijnhoven HA, Schilp J, van Bokhorst-de van der Schueren, M.A., et al. Development and validation of criteria for determining undernutrition in community-dwelling older men and women: The short nutritional assessment questionnaire 65+. *Clin Nutr*. 2012;31(3):351-358.

20. Lochs H, Allison SP, Meier R, et al. Introductory to the ESPEN guidelines on enteral nutrition: Terminology, definitions and general topics. *Clinical Nutrition*. 2006;25(2):180-186.
21. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the european working group on sarcopenia in older people. *Age Ageing*. 2010;39(4):412-423.
22. Muscaritoli M, Anker SD, Argiles J, et al. Consensus definition of sarcopenia, cachexia and pre-cachexia: Joint document elaborated by special interest groups (SIG) “cachexia-anorexia in chronic wasting diseases” and “nutrition in geriatrics”. *Clin Nutr*. 2010;29(2):154-159.
23. Stratton RJ, Green CJ, Elia M. *Disease-related malnutrition: An evidence-based approach to treatment*. 1st ed. Oxfordshire, UK: Cabi; 2003.



