Original article

The Malnutrition Awareness Scale for community-dwelling older adults: Development and psychometric properties

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SUMMARY

Background & aims: Qualitative studies suggest that malnutrition awareness is poor in older adults. The aim of this study was to develop a questionnaire to quantitatively assess malnutrition awareness in community-dwelling older adults aged 60+ years.
Methods: The Malnutrition Awareness Scale (MAS) was developed based on the awareness phase of the Integrated-Change model, and included four domains: knowledge, perceived cues, risk perceptions, and cognizance. Twenty-six scale items were developed using results from mainly qualitative research and the expertise of the authors. Items were piloted in 10 Dutch older adults using the Thinking Aloud method to optimize wording. In a feasibility study, annoyance, difficulty and time to complete the MAS and its comprehensibility were tested. After final revisions, the MAS was applied to a large sample to test its psychometric properties (i.e., inter-item correlations, Cronbach's alpha, score distribution) and relevance of the items was rated on a 5-point scale by 12 experts to determine content validity.
Results: The feasibility study (n = 42, 55 % women, 19 % 80+ y) showed that the MAS took 12 ± 6 min to complete. Most participants found it not (at all) annoying (81 %) and not (at all) difficult (79 %) to complete the MAS, and found it (very) comprehensible (83 %). Psychometric analyses (n = 216, 63 % women, 28 % 80+ y) showed no redundant items, but two items correlated negatively with other items, and one correlated very low. After removal, the final MAS consists of 23 items with a min–max scoring range from 0 to 22 (with higher scores indicating higher awareness) and an overall Cronbach's alpha of 0.67. The mean MAS score in our sample (n = 216) was 14.8 ± 3.2. The lowest obtained score was 6 (n = 3) and the highest 22 (n = 1), indicating no floor or ceiling effects. Based on the relevance rating, the overall median across all 22 items was 4.0 with IQR 4.0–5.0.
Conclusion: The Malnutrition Awareness Scale is a novel, feasible and reliable tool with good content validity to quantitively assess malnutrition awareness in community-dwelling older adults. The scale is now ready to identify groups with poor malnutrition awareness, as a basis to start interventions to increase malnutrition knowledge and awareness.

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1. Introduction

In Europe, over 97 % of older adults live at home [1]. The prevalence of malnutrition in community-dwelling older adults is estimated to be 8.5 % (95 % CI 5.7–11.7) based on validated malnutrition screening tools [2]. Harmonized data from five aging

cohorts show that the prevalence of a low BMI (<22 kg/m^2) ranges between 4.2 and 10.8 % and that of weight loss (>3 kg in the past 3 months) between 2.3 and 8.0 % in community-dwelling older adults [3]. These characteristics show that a considerable number of older adults living at home have nutritional problems. Even higher numbers are at nutritional risk due to the presence of factors that increase the risk of malnutrition, including poor appetite, chewing problems or difficulties shopping and preparing meals [4]. Moreover, malnutrition often develops at home, resulting in many older adults being already malnourished when admitted to hospital or long-term care [5,6].

Despite these nutritional risks, routine malnutrition screening and referral to healthcare professionals is often lacking in primary and community care. Early signs of malnutrition and risk factors for malnutrition are often overlooked by healthcare professionals, as a greater focus is placed on overweight and its negative health consequences [7−9]. Non-dietetic healthcare professionals indicate not always having the time or experience to discuss malnutrition [10−14] which has been confirmed by older adults' experiences [15]. The lack of attention and confidence might partly be caused by the limited (mal)nutrition training incorporated in medical and nursing curricula [16−19]. Together, these findings may explain why malnutrition in older persons is often not addressed in the primary and community care setting. In addition to this low recognition, not all older adults have regular contacts with healthcare professionals [20], which further hinders identification of (risk of) malnutrition and initiation of nutritional interventions.

Therefore, it is important to empower community-dwelling older adults to recognize being at risk of malnutrition and take responsibility for seeking medical attention and receiving nutritional treatment. This empowerment is much needed, as research shows that many older adults with malnutrition are not aware of their weight loss or are not concerned [21,22]. They often consider declines in appetite, food intake and body weight a normal process related to aging, and inevitable due to their reduced physical activity [10,15,21−25]. Moreover, weight loss is often considered as something positive because thinness is valued and thought to improve health [21,23,25,26].

Qualitative studies consistently suggest that many older adults have a low level of malnutrition awareness. Increasing awareness of malnutrition has been frequently indicated as an important step in the strategy to empower older adults to fight against malnutrition [8,11,25,27−29].

Remarkably, to the best of our knowledge, no tool is currently available to objectively and quantitatively assess malnutrition awareness among older persons. Such a tool would be crucial for determining what the actual awareness level is, and for identifying important risk groups of older adults with poorer malnutrition awareness. A reliable and valid tool would also be required to evaluate the impact of strategies to increase malnutrition awareness. In this study, we aimed to develop the Malnutrition Awareness Scale (MAS) for community-dwelling older adults and determine its feasibility, content validity and psychometric properties.

2. Material & methods

2.1. Development of the questionnaire

The Malnutrition Awareness Scale (MAS) was developed based on the Integrated-Change model (I-Change model). The I-Change model includes a pre-motivational phase, or awareness phase, that precedes the motivation phase of a person, after which action and behavioural change may take place [30]. In this pre-motivational phase of the I-Change model, knowledge plays a role in combination with perceived cues, risk perceptions and cognizance. These four domains of awareness of the I-Change model were therefore incorporated into the questionnaire. For each domain, a set of specific items was generated by the first author using a deductive approach. Published information from qualitative studies regarding the knowledge, perceptions and behaviours of older adults with regard to malnutrition that were conducted in the target population as well as in healthcare professionals treating malnutrition in older adults was used. In addition, published information from quantitative studies investigating the determinants of malnutrition and the clinical consequences of malnutrition in older adults was used. The generated items were then critically reviewed by the other authors to ensure that the initial item pool reflected the desired construct.

Knowledge was interpreted as understanding the factual information about malnutrition. While previous studies have shown that increasing knowledge has only little impact on behavioural change, a direct influence on motivation has been observed [31,32]. Knowledge has been shown to be particularly important when the topic is new or less familiar. Nine true or false statements were developed to test malnutrition knowledge. Examples of a true and false statement are: 'Poor appetite increases the chance of unintentional weight loss' and 'It is normal to experience unintentional weight loss, when over 70 years old'. Participants were asked to indicate whether the statement was true, false or whether they did not know.

Cues refer to signals that a person perceives from the environment (external cues) as well as from own experiences (internal cues) [33]. Five items were developed referring to external cues and one item referring to internal cues. Examples of an external cue and an internal cue are 'Do you know anyone in your environment who had to eat more due to unintentional weight loss?' and 'Would you notice if you did not eat enough for one or two weeks?'. Response options were yes and no.

Risk perception was interpreted as realizing the negative consequences of having malnutrition, being aware of important factors that could increase your risk of malnutrition, as well as considering it bad to have malnutrition symptoms. Examples of the six questionnaire items developed in this domain are: 'Imagine not eating enough. How big would you estimate your chance that your muscles would weaken?' (5-point response option ranging from very small to very big) and 'How badly would you mind losing weight unintentionally?' (5-point response option ranging from very bad to not bad at all).

Cognizance, or being able to correctly estimate the extent to which one's behaviour corresponds to the desired behaviour, has been positively associated with motivational factors such as attitude and self-efficacy [34], and is considered important for nutrition-related behavioural change [35]. Examples of the five developed items are: 'Do you make sure that you eat enough and healthy to stay healthy?' and 'Do you regularly weigh yourself to check if you are losing weight unintentionally?' with response options yes and no.

The word malnutrition was purposely omitted throughout the questionnaire, as qualitative research shows that older adults associate malnutrition with hunger in developing countries or in times of war [26]. They also perceive negative connotations, such as neglect and poverty, and therefore can consider the term offensive [14]. Moreover, healthcare professionals have indicated that malnutrition is a medical term that patients do not want to hear and do not understand [14]. For these reasons, instead of using malnutrition as an overall concept, the criteria of malnutrition from the Global Leadership Initiative Malnutrition (GLIM) consensus definition were incorporated into the questionnaire

items [36]. The GLIM criteria include three phenotypic criteria: unintentional weight loss, low body mass index (referred to as 'too thin' and 'too skinny'), and reduced muscle mass (referred to as 'to lose muscles' and 'muscles would weaken'). The two etiological criteria of GLIM were also incorporated: reduced food intake (referred to as 'not eating enough' and 'skip a warm meal') and disease burden/inflammation (referred to as 'illness' and 'admitted to a hospital'). The term 'inflammation', which is part of the etiological criterion 'disease burden', was not used in the questionnaire as it was considered too medical and complicated to apply in the MAS. Poor appetite is a key driver of reduced food intake [37] and is also considered by older adults as an important barrier to food intake [15] and a determinant of malnutrition [38]. For this reason, poor appetite was incorporated into several items of the questionnaire.

2.2. Pilot study

A first version of the Dutch MAS containing 25 items was piloted using the Thinking Aloud method in 10 community-dwelling older adults (i.e., non-institutionalised adults aged 60 years and older who live at home independently or receive formal home care) recruited in the personal networks of the authors. The participants were asked to complete the MAS by themselves and to say whatever they were looking at, thinking and feeling at each moment [39]. One author observed this process and recorded what aspects of the MAS (questions as well as response options) were not understood or confusing, but were not allowed to help the participants in completing the questionnaire. After completing the questionnaire, participants were asked how annoying it was for them to complete the MAS, how comprehensible the questions were, and how difficult it was for them to answer the questions, using 5-point response scales. Finally, the author asked the participants whether they could think of any improvement to the MAS (open question). Ethical approval for the pilot study was obtained from the Research Ethics Review Committee of the Faculty of Science, Vrije Universiteit Amsterdam, No. 22−44).

2.3. Feasibility study

A feasibility study was performed in 42 community-dwelling adults aged 60 years and older and living in the Netherlands. Two trained students Nutrition and Dietetics from the Hanze University of Applied Sciences, Groningen recruited potential participants by convenience sampling to complete the second version of the Dutch MAS on paper, with one student present. Within the sample, a balanced representation across gender, age group and educational attainment was intended. The questionnaire also contained additional questions to characterize the sample: gender (male, female, other), age group (60−69, 70−79, 80−89, 90 years or older), highest educational attainment (nine categories ranging from 'elementary school' to 'university'), household size (1,2, 3 or more) and self-rated health (five categories ranging from 'very good' to 'very bad'), self-reported height and body weight, and self-reported weight loss in the past 6 months. Participants were also asked how annoying it was for them to complete the MAS, how comprehensible the questions were, and how difficult it was for them to answer the questions, using 5-point Likert scales. The time needed to complete the 25 MAS items was recorded by the students. Finally, any comments on the items of the MAS could be provided (open question). Ethical approval for this study was obtained from the Ethical Advisory Committee of the Hanze University of Applied Sciences, No. heac.2022.039.

2.4. Psychometric properties study

In a final study, trained Health Sciences students from the Vrije Universiteit Amsterdam performed interviews with 216 community-dwelling adults aged 60 years and older living in the Netherlands. The sample size was determined following the existing recommendations that suggest a range of 2 to 20 individuals per item, with an absolute minimum of 100 to 250 individuals [40]. Participants were recruited by convenience sampling, either orally, by telephone or by email through the students' own networks. Students were instructed to preferably recruit the oldest and frailest community-dwelling adults within their networks. Interviews were carried out by another student who was not acquainted, as per advice from the Research Ethics Review Committee. To make the MAS suitable for both self-administration and interviewer-administration, all cues, risk perception and cognizance domain items were changed from the first-person to the second-person point of view in this third version of the Dutch MAS. The interview also contained questions regarding gender (male, female, other), age group (60−69, 70−79, 80−89, 90 years or older), highest educational attainment (nine categories ranging from 'elementary school' to 'university'), household size (1,2, 3 or more), self-rated health (five categories ranging from 'very good' to 'very bad'), self-reported height and body weight, and self-reported involuntary weight loss in the past 6 months. No information regarding informal care was obtained. Any comments provided on the items of the MAS were recorded. Ethical approval for the study was obtained from Research Ethics Review Committee of the Faculty of Science, Vrije Universiteit Amsterdam, No. 22−44.

2.5. Content validity

To assess the content validity of the MAS, its items were reviewed by a group of 12 Dutch experts in the field of malnutrition in older adults, including experienced dietitians and researchers who were not involved in the project. The experts were asked to rate the relevance of each item (except for the priming item) for assessing malnutrition awareness in older adults using a 5-point response option ranging from 'not at all relevant' to 'very relevant'.

2.6. Translation and cultural adaptation of the questionnaire

The Malnutrition Awareness Scale was developed, piloted and tested for its psychometric properties in the Dutch language. The Dutch MAS is included in Supplement 1. For the purpose of this publication, the scale was translated and culturally adapted into English using the following steps [41,42]. First, the Dutch MAS was forward translated into English by two translators independently, who were native English-speaking persons with knowledge of the topic of malnutrition and fluent in the Dutch language. The two individual translations were compared and conceptual and semantic differences were discussed with four authors (MV, MS, EL, HJW) and both translators until consensus was reached (reconciliation phase), and merged into a single forward translation. Two native Dutch-speaking persons fluent in the English language, who were blinded to the original Dutch scale and were not knowledgeable on the topic of malnutrition, were asked to independently perform the backward translation. Discrepancies between the two backward translated scales and the original scale were discussed by four authors (MV, MS, EL, HJW), during which semantic equivalence, idiomatic equivalence, experiential equivalence and conceptual equivalence were considered. In the harmonization phase, the English version that resulted from the reconciliation phase was adapted if needed to harmonize with the

original Dutch version. This whole process resulted in the final English version of the MAS.

2.7. Statistical analyses

Educational attainment was categorized into three levels: low (elementary education, lower vocational or lower general education), middle (intermediate vocational, general secondary), and high (higher vocational, college and university education). Self-rated health was dichotomized into (very) good versus the other three response options. BMI (kg/m^2) was calculated by dividing body weight by body height squared. Descriptive characteristics of the participants of the feasibility and the psychometric properties studies were derived (frequencies or means with standard deviation). The evaluation of the psychometric properties of the prefinal questionnaire included an analysis of its reliability. Cronbach's alpha values were calculated before and after items were omitted based on the corrected item—total correlations (i.e., correlation of the score of each item and the scale score minus the contribution of that item to the score, CITC). Floor and ceilings effects were also tested and were considered present when more than 15 % of the participants scored the maximum or minimum possible [43]. The median and interquartile range (IQR) of the relevance rating obtained from the independent experts was calculated by item (except for the priming item) and across all items to determine content validity. A median <3 for an item was defined as low relevance. Data were analyzed using IBM SPSS® statistics version 27.

3. Results

3.1. Pilot study

The pilot testing in 10 older adults aged 62—86 years (mean age 76.3 y, 6 women and 4 men) indicated that completing the first, 25-item version, of MAS was 'not annoying' (n = 6) or 'not at all annoying' (n = 4). Eight pilot participants considered the questions '(very) comprehensible', and two participants 'not comprehensible'. The latter two indicated that only some items were not comprehensible. Moreover, the Thinking Aloud observations also indicated that two longer items took more time to read in order to fully understand the question. Therefore, these two specific items were revised by breaking up the question into shorter sentences.

Most participants (n = 8) considered it 'not (at all) difficult' to answer the questions, and two participants indicated difficulty as 'neutral'. Based on the Thinking Aloud observations and discussion with participants after completion of the MAS, the wording of some items was changed, and some items were made more specific (for example, 'in a period' was specified by 'one or two weeks'). Most importantly, during the pilot several participants struggled with the meaning of 'unintentional weight loss'. It was decided to add an introductory text to the questionnaire explaining this concept. These changes resulted in the second version of the MAS.

3.2. Feasibility study

In total, 42 older adults aged 60 years and older (19.0 % aged 80+ y, 54.8 % women) participated in the feasibility study (Table 1). The average time to complete the 25 items MAS was 12.4 min (SD 5.8, n = 41). The vast majority of the participants found it not (at all) annoying (80.5 %) to complete the MAS, found the MAS (very) comprehensible (83.4 %), and not (at all) difficult to complete (78.6 %) (Table 1).

Some participants provided suggestions to modify the wording of items of the MAS. These suggestions were reviewed

Table 1

Sample characteristics and experience completing the Malnutrition Awareness Scale (MAS) of 42 community-dwelling adults aged 60+ years who participated in the feasibility study.

Sample characteristics		N (%)
Gender	Male	19 (45.2)
	Female	23 (54.8)
	Other	0 (0)
Age group	60-69 y	19 (45.2)
	70-79 y	15 (35.7)
	80-89 y	8 (19.0)
Highest educational attainment	Low	6 (14.3)
	Medium	13 (31.0)
	High	23 (54.8)
Household size	1	14 (33.3)
	2	27 (64.3)
	3 or more	1 (2.4)
Self-rated health	(Very) good	33 (78.6)
	Fair or (very) bad	9 (21.4)
Low BMI[a]		7 (16.7)
Weight loss >5 % in past 6 months		5 (11.9)
Experience completing the MAS		
Annoyance	Very annoying	0 (0)
	Annoying	1 (2.4)
	Neutral	3 (7.1)
	Not annoying	12 (28.6)
	Not at all annoying	26 (61.9)
Comprehensibility	Not at all comprehensible	0 (0)
	Not comprehensible	1 (2.4)
	Neutral	6 (14.3)
	Comprehensible	28 (66.7)
	Very comprehensible	7 (16.7)
Difficulty	Very difficult	0 (0)
	Difficult	2 (4.8)
	Neutral	7 (16.7)
	Not difficult	21 (50.0)
	Not at all difficult	12 (28.6)
Time needed to complete[b]	<10 min	13 (31.7)
	10—19 min	24 (58.5)
	20—29 min	4 (9.8)

[a] Low BMI defined as BMI<20 kg/m^2; when age <70 y or BMI<22 kg/m^2; when age ≥70 y.
[b] N = 41.

and if considered relevant, the suggestions were incorporated. For example, the term 'regularly' was specified into 'more than twice a week', and 'skip a meal' was changed into 'skip a warm meal'. Furthermore, several participants indicated that they did not know how to respond to the item 'I weigh myself regularly to check whether I am involuntary losing weight', as they weighed themselves regularly but only to check weight gain. Therefore, a priming item 'Do you regularly weigh yourself to check if you are gaining weight?' was added before the item 'Do you regularly weigh yourself to check if you are losing weight unintentionally?'.

3.3. Psychometric properties study

The third version of the Dutch MAS thus contained 26 items and was used to conduct interviews with 216 community-dwelling older adults aged 60 years and older (27.8 % aged 80+ y, 62.5 % women) (Table 2). The vast majority (90.7 %) of the interviews was conducted face-to-face in the older person's home.

Psychometric analyses showed no redundant items, i.e., items that were scored the same by (nearly) all participants. The percentage of participants who scored to be 'aware' for an individual item ranged from 12.5 % (item: 'Do you skip a warm meal more than twice a week?') to 92.6 % (items: 'Illness can cause you to lose a lot of weight unintentionally' and 'Poor appetite increases the chance of unintentional weight loss').

Table 2
Sample characteristics of the 216 community-dwelling adults aged 60+ years who participated in the psychometric properties study of the Malnutrition Awareness Scale.

Sample characteristics		N (%)
Type of interview	Face-to-face	196 (90.7)
	Online (through video connection)	20 (9.3)
Gender	Male	81 (37.5)
	Female	135 (62.5)
	Other	0 (0)
Age group	60-69 y	70 (32.4)
	70-79 y	86 (39.8)
	80-89 y	57 (26.4)
	90+ y	3 (1.4)
Highest educational attainment	Low	94 (43.5)
	Medium	47 (21.8)
	High	75 (34.7)
Household size	1	69 (31.9)
	2	131 (60.6)
	3 or more	16 (7.4)
Level of independence	Fully independent	200 (92.6)
	Receiving formal home care	26 (7.4)
Self-rated health	(Very) good	150 (69.5)
	Fair or (very) bad	66 (30.5)
Low BMI[a]		28 (13.1)
Involuntary weight loss >5 % in past 6 months		9 (4.8)

[a] Low BMI defined as BMI<20 kg/m^2; when age <70 y or BMI<22 kg/m^2; when age ≥70 y.

Analyses also showed that two items correlated negatively with the scale score that excluded those items. These items were 'Eating enough can prevent unintentional weight loss' (knowledge domain, CITC = −0.005) and 'Have you ever experienced unintentional weight loss?' (cues domain, CITC = −0.03). After their removal, the overall Cronbach's alpha was 0.658. Finally, one item 'When you look in the mirror, do you think you are too skinny?' from the cues domain had a very low CITC (0.047). Its removal increased the Cronbach's alpha to 0.667. Thus, the final MAS consisted of 22 scoring items and one priming item, and the score could range from 0 (low malnutrition awareness) to a maximum of 22 (high malnutrition awareness). The knowledge domain contained items 1—8, the cues domain items 9—11, the risk perception domain items 12—17 and the Cognizance domain items 18—22. The mean MAS score in our study sample based on the final MAS was 14.8 ± 3.2. No ceiling and floor effects were observed. Individual scores ranged from 6 (n = 3) to 22 (n = 1), and indicated that no participants achieved the minimum MAS score and only one the maximum MAS score.

3.4. Content validity

Based on the rating of 12 independent experts, item 5 received the highest relevance score (5.0 with IQR 5.0—5.0), followed by items 7, 21 and 22 (5.0 with IQRs 4.8—5.0). Item 10 received the lowest relevance score (3.5 with IQR 3.0—4.0). No other items had a median below 4.0. The overall median across all 22 items was 4.0 with IQR 4.0—5.0.

3.5. Translation and cultural adaptation of the questionnaire

The MAS was translated into English by two native speakers. In total, 50 relevant differences between the translations were observed and discussed. During the reconciliation phase, these differences were discussed and a single, forward translation was derived based on consensus (Supplement 2). Supplement 2 also shows the eight adaptations made in seven MAS items during the harmonization phase, based on the two back translations and comparison with the original Dutch version. The final English version of the MAS is presented in Table 3. This table also indicates how the individual items of MAS should be scored in order to derive the malnutrition awareness score for an older adult.

4. Discussion

This study describes the development process of the Malnutrition Awareness Scale, the first questionnaire to objectively and quantitatively assess malnutrition awareness in community-dwelling older adults. The MAS includes 22 items covering the knowledge, cues, risk perception and cognizance domains of awareness and one 'priming' item. Its score can range from 0 (low malnutrition awareness) to 22 (high malnutrition awareness). The MAS showed good feasibility, as the majority of older adults could complete the scale within 20 min and found it comprehensible and not difficult or annoying to complete. Furthermore, the internal consistency of the MAS as indicated by the Cronbach's alpha was satisfactory [44] and no floor or ceiling effects were observed, indicating that the MAS is also a reliable tool to objectively assess malnutrition awareness in community-dwelling older adults. Overall, the items were rated to be relevant for measuring malnutrition awareness in older adults by experts in the field of malnutrition in older adults, indicating content validity.

Strength of the study is the step-wise and thorough developmental process of the MAS in close collaboration with community-dwelling older adults who gave their feedback on the individual scale items. The MAS is also based on an established theory and behavioural change model. MAS items are primarily based on the valuable results of qualitative studies conducted among older adults as well as conducted among healthcare professionals treating older adults. Care was also taken to recruit samples with a balanced representation across gender, age group and educational attainment, and to also include participants with poorer health or already experiencing a low BMI or involuntary weight loss in the past six months. Finally, the translation and cultural adaptation of the MAS from its original development language Dutch to the English language was performed using the high quality methodology as described previously [45].

A limitation of the study is that concurrent criterion validity and construct validity of the MAS could not be tested due to current lack of a criterion (gold standard) or a scale that measures a similar construct. Future research is necessary to further establish the validity of the MAS. Its predictive validity should be examined in prospective studies in order to establish whether older adults with poorer malnutrition awareness are more likely to develop malnutrition in the future, after adjustment for other malnutrition risk factors. Cross-cultural validation by investigating the psychometric properties of the translated MAS should also be performed. Moreover, future studies should examine the distribution of the MAS score across groups of older adults that are likely to differ in malnutrition awareness, for example those with high versus low health literacy. Another limitation is that ethnicity could not be assessed in our studies for ethical reasons. As 85.5 % of the population aged 65 years and older in the Netherlands has no migration background [46], future studies should determine whether the MAS is feasible, valid and reliable in other ethnic groups.

The MAS can be used to objectively assess the awareness level in populations and to identify subgroups of older adults with a poorer awareness. Future research should determine the characteristics of subgroups of older adults with a poorer malnutrition awareness as

Table 3
The English version of the Malnutrition Awareness Scale (MAS) and its scoring.

Item number	Section	Response options (and scoring)
	General introduction	
	This questionnaire is about diet and body weight. The term 'unintentional weight loss' is commonly used in the questionnaire. 'Unintentional weight loss' refers to weight loss without any conscious effort on your part. This questionnaire is about this type of weight loss. This questionnaire is not about 'intentional weight loss', in other words, weight loss because you have been dieting or exercising more.	
	The following general statements relate to diet and body weight. The statements do not refer to you specifically. Can you indicate whether these general statements are true or false? If you don't know, you can indicate that too.	
1	Illness can cause you to lose a lot of weight unintentionally.	True (1), False (0), I don't know (0)
	By 'unintentional weight loss' we refer to weight loss without a person's conscious effort.	
2	It is fine to skip a warm meal more than twice a week.	True (0), False (1), I don't know (0)
3	Being too thin increases the chance of falling and/or fractures.	True (1), False (0), I don't know (0)
4	It is normal to experience unintentional weight loss, when over 70 years old.	True (0), False (1), I don't know (0)
5	If you lose weight unintentionally, you also lose muscles.	True (1), False (0), I don't know (0)
6	Poor appetite increases the chance of unintentional weight loss	True (1), False (0), I don't know (0)
7	It is healthy to lose weight unintentionally when overweight.	True (0), False (1), I don't know (0)
8	You should see your doctor if you unintentionally lose too much weight.	True (1), False (0), I don't know (0)
	The following questions are about your diet and body weight. These questions refer to you specifically. Please answer the questions using the options provided.	
9	Do you know anyone in your environment who had to eat more due to unintentional weight loss?	Yes (1), No (0)
10	Have you read information or heard about unintentional weight loss or poor appetite in older people, in the past year?	Yes (1), No (0)
	For example, in a brochure, newspaper or magazine, on TV or social media?	
11	Would you notice if you did not eat enough for one or two weeks?	Yes (1), No (0)
12	Imagine being admitted to a hospital. How big would you estimate your chance of unintentionally losing weight?	Very small (0), Small (0), Neutral (0), Big (1), Very big (1)
13	Imagine not eating enough. How big would you estimate your chance that your muscles would weaken?	Very small (0), Small (0), Neutral (0), Big (1), Very big (1)
14	Imagine losing weight unintentionally. How big would you estimate your chance that this would impair your ability to climb stairs?	Very small (0), Small (0), Neutral (0), Big (1), Very big (1)
15	How badly would you mind losing weight unintentionally?	Very bad (1), Bad (1), Neutral (0), Not bad (0), Not bad at all (0)
16	How healthy would you consider being too skinny yourself?	Very unhealthy (1), Unhealthy (1), Neutral (0), Healthy (0), Very healthy (0)
17	How bad would you feel if you could not manage to eat enough any longer?	Very bad (1), Bad (1), Neutral (0), Not bad (0), Not bad at all (0)
18	Do you skip a warm meal more than twice a week?	Yes (0), No (1)
19	Do you make sure that you eat enough and healthy to stay healthy?	Yes (1), No (0)
20	If you don't feel hungry right before a warm meal, do you eat anyway?	Yes (1), No (0)
Priming item	Do you regularly weigh yourself to check if you are gaining weight?	Yes (0), No (0)
	If you do not have a scale: Do you regularly assess how your clothes fit to check if you are gaining weight?	
21	Do you regularly weigh yourself to check if you are losing weight unintentionally?	Yes (1), No (0)
	If you do not have a scale: Do you regularly assess how your clothes fit to check if you are losing weight unintentionally?	
22	If you were to lose weight unintentionally, would you worry about it?	Yes (1), No (0)
	TOTAL MAS SCORE (Scores can range from 0 (low malnutrition awareness) to 22 (high malnutrition awareness)	**Sum of 22 items**

these subgroups may be more susceptible to a later recognition of malnutrition and delayed treatment. These subgroups should be prioritized when developing and targeting strategies to increase their malnutrition awareness. A next step would be to translate and culturally adapt the MAS into other languages. Another step would be to determine whether the MAS is sensitive to change, for example by assessing whether the score increases in older adults who have been exposed to evidence-based information regarding malnutrition in old age. Once its responsiveness has been established, MAS could be used to evaluate strategies to increase malnutrition awareness in older persons, including local and national awareness campaigns and targeted (online) information on malnutrition such as brochures, videos and websites. Effective strategies could then be selected in order to empower community-dwelling older adults with regard to malnutrition and to support the early recognition and treatment of malnutrition in primary and community care.

5. Conclusion

The newly developed Malnutrition Awareness Scale is a novel, feasible and reliable tool with good content validity to objectively assess malnutrition awareness in community-dwelling older adults.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnu.2023.12.023.

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