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ORIGINAL ARTICLE

Factors associated with nutritional risk in 75-year-old community living people

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Aim. To identify risk factors for being at nutritional risk, by means of a nutritional screening, in a population based sample of 75-year-old people living in three county councils in Sweden.

Background. Undernutrition in older people is known to contribute to poor health. The instrument 'Nutritional Form For the Elderly' (NUFFE) helps to identify those at nutritional risk.

Method. The screening instrument 'Nutritional Form For the Elderly', background variables and health related questions were mail distributed. A total of 1461 persons (75 years old) were included in the study. Descriptive statistical methods were used in the analyses.

Results. One percent of the participants had high risk, 21.3% medium and 77.7% low risk for undernutrition. Medium or high risk was predicted by: living alone, receiving help and impaired perceived health. Low Body Mass Index was associated with low risk for undernutrition.

Conclusion. By using a simple nutritional screening instrument, significant risk factors were highlighted.

Relevance to practice. This instrument can identify older people at nutritional risk and is easy to use. Older people living alone have an increased risk of undernutrition.

Body Mass Index (BMI) should be used with caution as one and only indicator of nutritional risk in older people.

Key words: home-dwelling, nutritional screening, older people, perceived health

Introduction

Undernutrition is a common problem. It will usually be defined as a result of insufficient food intake (Chen *et al.*, 2001) and known to contribute to serious conditions and complications such as poor health, decreased quality of life (Chen *et al.*, 2001; Margetts *et al.*, 2003; Keller, 2004) and increased morbidity and mortality (Covinsky *et al.*, 1999; Correia & Waitzberg, 2003). Studies have confirmed a high prevalence of hospital patients at risk for undernutrition or suffering from undernutrition (Pablo *et al.*, 2003; Rasmussen *et al.*, 2004). Older hospitalised patients are particularly at high risk (Kagansky *et al.*, 2005; Pirlich *et al.*, 2005; Shum *et al.*, 2005). This is also applicable to older people in residential care (Christensson *et al.*, 2002; Ödlund Olin *et al.*, 2005; Wikby *et al.*, 2006) and in nursing homes (Saletti *et al.*, 2000). Older home-dwelling people have a lower risk for developing undernutrition compared to those living in institutions (Elia *et al.*, 2005). But older people living in their own homes, receiving home health care services, have also been found to be at high risk for developing undernutrition (Saletti *et al.*, 2005).

The use of a nutritional screening instrument can help to identify those individuals who are at nutritional risk or suffering from undernutrition. This is a recommended process and should be routine at admission to hospitals or institutions (Kondrup *et al.*, 2003), but it can also be used for home-dwelling older people in connection with home health care. When undernutrition is suggested by a nutritional screening instrument, a supplemental nutritional assessment, by a team of professionals, should be performed before treatment is planned (Arvanitakis *et al.*, 2008). However, studies should be undertaken in order to develop and validate simple nutritional screening methods (Kondrup, 2004). 'The Nutritional Form For the Elderly' (NUFFE) is an example of a nutritional screening instrument especially developed for older people and tested for reliability, validity, sensitivity and specificity among older hospitalised patients (Söderhamn & Söderhamn, 2001, 2002; Söderhamn, 2006; Söderhamn *et al.*, 2009). According to Green and Watson (2006), it is of considerable importance that nutritional screening instruments are meeting the criteria for reliability, validity, sensitivity and specificity. NUFFE should, therefore, be suitable to use as a screening instrument because the testing procedures have shown that this instrument has sufficient psychometric properties for nutritional screening. Furthermore, NUFFE should be appropriate to use, for example, among those who are living at home because it is a simple screening instrument, without anthropometrical measurements, that can be used as a self-report instrument. Although this instrument has been tested and used among older hospital patients it should be relevant to use among older home-dwelling people because it is developed to capture older people in general (Söderhamn & Söderhamn, 2001, 2002).

As undernutrition is a common problem among older people, and impaired perceived health has been found to be a predictor of poor nutritional status (Johansson *et al.*, 2009), early detection of those at risk must be an important task in order to prevent health problems. Moreover, living singly and not living in one's own home have also been found to be associated with undernutrition (Odencrants *et al.*, 2008). It is therefore of great importance to study possible contributing factors for the development of undernutrition among older home-dwelling people and older people in residential homes. Caregivers should be made aware of such contributing factors in order to detect older people at nutritional risk. According to Arvanitakis *et al.* (2008), awareness is a key word, together with information and implementation, to prevent and treat undernutrition in home care and care homes.

The aim of this study was to identify risk factors for being at nutritional risk, by means of a nutritional screening, in a population based sample of 75-year-old people living in three county councils in Sweden.

Methods

Study design and population based sample

This study, which is a part of a more comprehensive study, has a cross-sectional design and data were collected from three county councils in southeast Sweden. At the time of the data collection a total of 983 281 persons lived in the catchment area, 18.9% (184 793 persons) were 65 years or older and 50% were women. A total of 2100 individuals, all at an age of 75 years and living in urban and rural areas in the three county councils, were randomly selected (700 from each county council) from a national register. An invitation to participate in the study and information about it, together with a self-report questionnaire, were mail distributed during 2006. A reminder was sent after 4 weeks. Four individuals

had moved away and five of the selected persons were deceased. Answering and returning the questionnaire were seen as informed consent to participate in the study. One thousand five hundred and three (71.9%) of the remaining 2091 returned the questionnaire. Of these 1503, a group of 41 did not want to participate for different reasons. One individual had answered very few questions in the questionnaire and was therefore excluded. Consequently, a total of 1461 (69.9%) individuals were included in the study.

The questionnaire

The self-report questionnaire included the nutritional screening instrument NUFFE (Söderhamn & Söderhamn, 2001, 2002), questions about background variables – such as sex, marital status (i.e. unmarried, divorced/separated, widow/-er, which were classified as living alone, and married/cohabitant), type of dwelling and educational level – questions about weight, height, receiving help to manage daily life and perceived health.

The nutritional screening instrument NUFFE (Söderhamn & Söderhamn, 2001, 2002), a summated ordinal scale with 15 three-point items, was chosen because it was developed in the Swedish context especially for older people. It has been tested concerning reliability (Cronbach's alpha coefficient 0.70–0.72) and validity, and was shown to be a reliable instrument with good evidence of validity. The screening instrument involves dietary history, with questions about weight loss and changes in dietary intake, dietary assessment with questions about appetite, food and fluid intake and eating difficulties, and general assessment with questions about the possibility of obtaining food products, company at meals, activity and number of medications. Each item ranges between 0 and 2. The most favourable option gives a score of 0, the most unfavourable option a score of 2, and the intermediate option a score of 1. Maximum score total is 30. Higher screening scores indicate higher risk for undernutrition. In Table 1 some items of NUFFE are displayed.

In order to determine cut-off points of NUFFE for identifying individuals at low, medium and high risk for undernutrition, the instrument Mini Nutritional Assessment (MNA) (Guigoz *et al.*, 1996) was used as a criterion in a previous study (Söderhamn, 2006). For identifying individuals at medium or high risk for undernutrition, the MNA score ≤23.5 (indicating risk for undernutrition) and <17 (indicating undernutrition), respectively, were used. The following cut-off points of NUFFE were found: <6 (indicating low risk for undernutrition), ≥6 (indicating medium risk for undernutrition) and ≥13 (indicating high risk for undernutrition). The cut-off point ≥6 was based on the sensitivity and specificity values 71% and 86%, respectively, and the cut-off point ≥13 was based on the sensitivity and specificity values 70% and 98%, respectively. Receiver operating characteristic curves were performed that confirmed the cut-off points 6 and 13 for identifying older individuals at medium and high risk for undernutrition respectively (Söderhamn, 2006).

The question about receiving help to manage daily life was answered with yes or no. Perceived health was reported by means of a scale, numbered from 0 to 100. The scale was considered to be at ordinal level. A higher rating on the scale indicated a higher level of perceived health.

Table 1 Some examples of items of the Nutritional Form For the Elderly (NUFFE)

Item number	Item
3	What is your appetite now like?
5	What sized portions do you normally eat?
10	Is it difficult for you to eat because of mouth or dental problems or due to difficulties in swallowing?

Statistical analyses

Descriptive statistics were used for presenting the study population and the nutritional screening result. For identifying people at low, medium and high risk for undernutrition, the cut-off points for NUFFE scores were set to <6 (low risk), 6–12 (medium risk) and ≥13 (high risk), respectively, according to previous studies (Söderhamn, 2006; Söderhamn *et al.*, 2007).

Body Mass Index (BMI) (kg/m^2) was calculated. Student's *t*-test for independent samples (two-tailed significance) regarding BMI, Mann–Whitney *U*-test (two-tailed significance) regarding perceived health, and chi-square test with Yates' continuity correction or Fischer's exact test for nominal data were used for testing differences between groups. When multiple comparisons were performed for testing differences between groups with low and medium or high risk for undernutrition, Bonferroni's correction was used to adjust *P*-values in order to control the Type 1 error rate at no more than 5% (Altman, 1999).

A multiple stepwise logistic regression analysis was used to investigate predictors for being at medium or high risk for undernutrition. The dependent variable was to be at medium or high risk for undernutrition (coded as 1 for being at medium or high risk for undernutrition and 0 for being at low risk for undernutrition). Independent variables were sex (coded as 1 for female and 0 for male), marital status (coded as 1 for living alone, i.e. being unmarried, divorced/separated

or widow/-er, and 0 for being married/cohabitant), types of dwelling (coded as 1 for living in residential homes and 0 for living in their own home), educational level (coded as 1 for university college/university education and 0 for education on a lower level than university college/university), receiving help to manage daily life (coded as 1 for receiving help to manage daily life and 0 for not receiving help to manage daily life) and perceived health.

All analyses were performed using SPSS for Windows, version 15.0 (SPSS Inc., Chicago, IL, USA). *P*-values < 0.05 were considered statistically significant. There were data missing through the questionnaire, but these had the character of being completely at random. Missing data regarding the NUFFE items were replaced with the median value for that particular item.

Ethical considerations

When designing and performing the study, the intentions of the Declaration of Helsinki (WMA, 2008), ethical standard principles (Beauchamp & Childress, 2009) and Nordic ethical rules (NNF, 2003) were followed.

Results

Study population

Background variables of the study population ($n = 1461$) are presented in Table 2. More women than men responded to the questionnaire. Most of the participants were married or cohabitant and almost all lived in their own homes (Table 2).

Table 2 Background variables in the population based sample ($n = 1461$)

Background variables	*n* (%)
Sex	
Male	661 (45.2)
Female	795 (54.4)
Missing	5 (0.3)
Marital status	
Unmarried	86 (5.9)
Married/cohabitant	935 (64.0)
Divorced/separated	91 (6.2)
Widow/-er	335 (22.9)
Missing	14 (1.0)
Type of dwelling	
Own home	1436 (98.2)
Residential living	18 (1.2)
Missing	7 (0.5)
Educational level	
University	139 (9.5)
Lower than university	1303 (89.2)
Missing	19 (1.3)

Nutritional screening results and risk factors

The nutritional screening results showed that median NUFFE scores in the study population were 4 (inter-quartile range 2–5). The majority of the group ($n = 1135$, 77.7%) had NUFFE scores < 6 (median 3, inter-quartile range 2–4), indicating low risk for undernutrition, 311 individuals (21.3%) had NUFFE scores between 6 and 12 (median 7, inter-quartile range 6–8), indicating medium risk for undernutrition and 15 individuals (1.0%) had NUFFE scores ≥ 13 (median 15, inter-quartile range 14–18), indicating high risk for undernutrition.

Female sex, living alone, living in residential homes, receiving help to manage daily life and rating an impaired level of health, respectively, were factors found to be significantly associated with medium or high risk for undernutrition (Table 3). Females were to a greater extent living alone ($P < 0.001$) than males. BMI in males (mean 25.9 kg/m^2, SD 3.28) were lower ($P < 0.01$) than in females (mean 26.4 kg/m^2, SD 4.67). The mean BMI value in the study population was 26.2 kg/m^2 (SD 4.09). The individuals at low risk for undernutrition were found to have significantly lower BMI values (mean 25.8 kg/m^2, SD 3.52) than those at medium or high risk for undernutrition (mean 27.4 kg/m^2, SD 5.57; $P < 0.01$ adjusted with Bonferroni's method). There was no difference ($P = 0.77$ adjusted with Bonferroni's method) between being at low risk for undernutrition and being at medium or high risk for undernutrition regarding lower or higher educational level (lower than university college/university education or university college/university education).

In the logistic regression analysis (Table 4), three predictors for being at medium or high risk for undernutrition emerged, i.e. living alone, receiving help to manage daily life and impaired level of health.

Discussion

The nutritional screening results showed that in the study group of 75-year-old community living people 21.3% had medium risk and 1.0% high risk for undernutrition. This is a lower frequency of nutritional risk when compared with other nutritional studies performed among older people in hospitals (Kagansky *et al.*, 2005; Pirlich *et al.*, 2005; Shum *et al.*, 2005; Söderhamn *et al.*, 2007) and in residential living (Christensson *et al.*, 2002; Ödlund Olin *et al.*, 2005; Wikby *et al.*, 2006). Most of the participants in the present study

Table 3 Differences between groups with low risk and medium or high risk for undernutrition regarding some background variables, receiving help and perceived health

Variables	Low risk for undernutrition (n = 1135) NUFFE scores <6	Medium or high risk for undernutrition (n = 326) NUFFE scores ≥6	P-value
Males n (%)	543 (47.9)	118 (36.2)	<0.01
Females n (%)	587 (51.7)	208 (63.8)	
Missing n (%)	5 (0.4)		
Living alone n (%)	313 (27.6)	199 (61.1)	<0.01
Married/cohabitants n (%)	813 (71.6)	122 (37.4)	
Missing n (%)	9 (0.8)	5 (1.5)	
Own home n (%)	1123 (98.9)	313 (96.0)	0.014
Residential homes n (%)	8 (0.7)	10 (3.1)	
Missing n (%)	4 (0.4)	3 (0.9)	
Receiving help to manage daily life n (%)	139 (12.2)	113 (34.7)	<0.01
Not receiving help to manage daily life n (%)	984 (86.7)	211 (64.7)	
Missing n (%)	12 (1.1)	2 (0.6)	
Perceived health			
Median (inter-quartile range)	80 (69–90)	68 (50–79)	<0.01
Missing n (%)	78 (6.9)	34 (10.4)	

NUFFE, the Nutritional Form For the Elderly.
P-values were adjusted with Bonferroni's method.

Table 4 Predictors for being at medium or high risk for undernutrition in a population based sample (n = 1461) that emerged in the multiple stepwise logistic regression analysis

Dependent variable	Predictors	R^2 Nagelkerke	B	SE	df	P-value	OR (95% CI)
Medium or high risk for undernutrition		0.27					
	Living alone		1.579	0.154	1	<0.001	4.849 (3.587–6.555)
	Receiving help to manage daily life		0.935	0.185	1	<0.001	2.546 (1.772–3.658)
	Perceived health		−0.037	0.005	1	<0.001	0.964 (0.955–0.972)

were living in their own homes, and it is known that home-dwelling people have a lower risk of undernutrition than people living in institutions (Elia *et al.*, 2005).

The trend is that medium or high risk of undernutrition is increasing with increasing age (Margetts *et al.*, 2003; Söderhamn *et al.*, 2008). According to Johansson *et al.* (2009), high age predicted risk for undernutrition. That all participants in the present study were 75 years old and the most of them not living in institutions can be a possible explanation why the frequency of nutritional risk was rather low. However, Johansson *et al.* (2009) found in a group of older home-living people 14.5% were at risk for undernutrition, which is a lower figure than in the present study.

Female sex was found to be associated with medium or high risk for undernutrition. The same result has been seen in other nutritional studies, both among older in-patients (Castel *et al.*, 2006; Chen *et al.*, 2007) and among community living older people (Quandt & Chao, 2000). This is also in line with Margetts *et al.* (2003), who found that females were at greater nutritional risk than males, but it did not show a strong effect in a group consisting of older people from institutions and people who were home-dwelling. Another possible explanation for this result in the present study can be that the females to a greater extent lived alone. In the logistic regression analysis, living alone was one of three predictors for being at medium or high risk for undernutrition, i.e. those living alone had an increased risk for being at medium or high risk for undernutrition. Similar results have been found in other nutritional studies among older hospital patients (Brantervik *et al.*, 2005; Pirlich *et al.*, 2005; Söderhamn *et al.*, 2008).

Living in residential homes (n = 18) was associated with medium or high risk for undernutrition. This was also seen in the study by Margetts *et al.* (2003). It is also consistent with

other nutritional studies among older people living in residential homes in Sweden (Christensson *et al.*, 2002; Ödlund Olin *et al.*, 2005; Wikby *et al.*, 2006). However, in the present study, very few of the participants lived in residential homes.

Receiving help to manage daily life was associated with medium or high risk for undernutrition and it was also a predictor for being at medium or high risk for undernutrition. These results can be compared to other studies. For example, Brantervik *et al.* (2005) found that undernourished older patients received more help with personal care. According to Shum *et al.* (2005), total dependence in activities of daily living was a risk factor for undernutrition in a group of geriatric rehabilitation patients.

Furthermore, impaired levels of perceived health were found to be a predictor for being at medium or high risk for undernutrition in the logistic regression analysis, i.e. the risk for being at medium or high risk for undernutrition was increasing when perceived health was rated lower. This is in accordance with Christensson *et al.* (2002), who found that self-experienced health status was a strong negative predictor for being at nutritional risk or suffering from undernutrition. Other studies have also confirmed that there is an association between nutritional risk and poor perceived health in older people (Margetts *et al.*, 2003; Söderhamn *et al.*, 2008; Johansson *et al.*, 2009). This can be compared to the study by Johansson *et al.* (2007), who found that older women who were living in their own residence and perceived themselves as healthy had lower risk for undernutrition than those who perceived themselves as less healthy.

In this study, the group with medium or high risk of undernutrition had higher BMI values compared to the BMI values in the group at low risk. This was unexpected, because a low BMI usually is used as an indicator for being at risk for undernutrition, and BMI is used as a variable in several nutritional instruments (Kondrup *et al.*, 2003). According to Jeejeebhoy (2000), BMI is not able to distinguish overweight patients who involuntarily lose their weight. This indicates that a person can be at nutritional risk even if the BMI value is normal or high. Accordingly, it is important that the BMI values are not interpreted literally or too strictly. Caregivers may be conscious about this, which has been shown in a qualitative study by Söderhamn and Söderhamn (2009) among nurses. Furthermore, it has to be taken into consideration that the weight and height values were self-reported and that it is not known whether these were recently measured or not.

No association between high or low educational levels in relation to risk for undernutrition was found. In a group of older medical patients, Feldblum *et al.* (2007) found that an education less than ≤12 years was a risk factor for undernutrition. Similar results have been presented by Pirlich *et al.* (2005), i.e. those adult hospital patients with undernutrition had a lower education (< 12 years) than those who were well-nourished.

The Swedish original version of NUFFE was used in this study. However, NUFFE has been translated into other languages including Hungarian (Gombos *et al.*, 2008) and Norwegian and has been shown to be a reliable and valid instrument for nutritional screening in older people (Söderhamn *et al.*, 2009). In this study known risk factors have been identified by means of the nutritional screening result using NUFFE. These results can be seen to confirm the validity of NUFFE as a screening instrument of older community living people.

Limitations of the study

A limitation in the present study is that it was not possible to perform any drop-out analysis regarding, sex, types of dwelling and marital status. Another limitation is that the cognitive function of the participants was not investigated. However, to perform data collection by means of a mail distributed questionnaire with older people is always linked to some uncertainties regarding cognitive function and if the answers are reflective of the older persons own perceptions or not.

Furthermore, in a study with cross-sectional design it is not possible to determine the causal connections. Accordingly, the associations between nutritional risk and the obtained risk factors merely indicate that they are related to each other. The fact that three of them also emerged in the logistic regression analysis, support and highlight the association to nutritional risk in older community living people. It can also be seen as a limitation in this study that no questions were asked about home health care services. According to Saletti *et al.* (2005), older home-dwelling people, who are receiving home health care services are at high risk of developing undernutrition. Furthermore, in this study no analyses were performed regarding differences in nutritional risk and risk factors between those living in urban and rural areas – this might have been important to investigate. Two of the county councils had one respective two larger cities with a population of ca. 120 000–140 000 inhabitants. The remaining population in the three county councils lived in smaller towns or in the countryside. However, Zulkowski and Coon (2004) could not find any obvious differences regarding nutritional risk and risk factors between older people living in urban and rural areas.

Conclusions

By using a simple nutritional screening instrument it was shown that 22% of community dwelling older people were at medium or high risk of undernutrition. Predictors for being at medium or high risk of undernutrition were living alone, receiving help to manage daily life and perceiving impaired level of health. In order to identify risk factors and increase the knowledge about the importance of these factors, further studies are necessary. Further studies utilising NUFFE and other screening instruments is also of importance for the further testing of NUFFE and the possibility of comparing screening results in older patients and home-dwelling people living in rural and urban areas.

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Implications for practice

- NUFFE can identify older people at nutritional risk.
- NUFFE contains no anthropometry and can be used as a self-report instrument and is, therefore, easy to use with older community living people.
- Older people living alone have an increased risk of undernutrition.
- BMI should be used with caution as the one and only indicator of nutritional risk in older people.

Contributions

Study design: US, MB-L; data collection or analysis: MB-L, LC, EI, AKJ, US and manuscript preparation: US, MB-L, LC, EI, AKJ.

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