



## Full length article

# Changes in malnutrition and quality of nutritional care among aged residents in all nursing homes and assisted living facilities in Helsinki 2003–2011



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## ABSTRACT

**Background:** While nutritional problems have been recognized as common in institutional settings for several decades, less is known about how nutritional care and nutrition has changed in these settings over time.

**Objectives:** To describe and compare the nutritional problems and nutritional care of residents in all nursing homes (NH) in 2003 and 2011 and residents in all assisted living facilities (ALF) in 2007 and 2011, in Helsinki, Finland.

**Methods:** We combined four cross-sectional datasets of (1) residents from all NHs in 2003 (N = 1987), (2) residents from all ALFs in 2007 (N = 1377), (3) residents from all NHs in 2011 (N = 1576) and (4) residents from all ALFs in 2011 (N = 1585). All participants at each time point were assessed using identical methods, including the Mini Nutritional Assessment (MNA).

**Results:** The mean age of both samples from 2011 was higher and a larger proportion suffered from dementia, compared to earlier collected samples. A larger proportion of the residents in 2011 were assessed either malnourished or at-risk for malnutrition, according to the MNA, than in 2003 (NH: 93.5% vs. 88.9%,  $p < 0.001$ ) and in 2007 (ALF: 82.1% vs. 78.1%,  $p = 0.007$ ). The use of nutritional, vitamin D and calcium supplements, and snacks between meals was significantly more common in the 2011 residents, compared to the respective earlier samples.

**Conclusions:** In 2011, institutionalized residents were more disabled and more prone to malnourishment than in 2003 or 2007. Institutions do seem to be more aware of good nutritional care for vulnerable older people, although there is still room for improvement

## 1. Introduction

The Mini Nutritional Assessment (MNA) screening tool was developed to evaluate the nutritional status of older people in different settings (Guigoz, Vellas, & Garry, 1996; Vellas, Guigoz, & Garry, 1997). It was intended to determine the risk of malnutrition at an early stage and to identify those older people who may benefit from early intervention (Guigoz, Lauque, & Vellas, 2002). The MNA has been recommended by the European Society of Clinical Nutrition and Metabolism for the nutritional screening of older people (Kondrup et al., 2003). In recent decades, the MNA has been used in many studies and a variety of settings, increasing the awareness of malnutrition and its associated

factors among older people (Bauer, Kaiser, Anthony, Guigoz, & Sieber, 2008; Guigoz, 2006). Reported prevalences for malnutrition in institutional care settings have ranged from 5%–70%, reflecting the heterogeneity of these residents (Bauer et al., 2008). In a study from Sweden in 2000, it was found that one third of the study subjects living in assisted living facilities, and over 70% of those living in nursing homes, were assessed as malnourished, according to the MNA (Saletti, Lindgren, Johansson, & Cederholm, 2000). A more recent study on Swedish nursing home residents revealed a malnutrition prevalence of only 30%, indicating a better nutritional situation than a decade ago (Torma, Winblad, Cederholm, & Saletti, 2013). Recent Belgian and German studies found prevalences of malnutrition, according to MNA,

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to be 19% and 15%, respectively, among nursing home residents (Diekmann et al., 2013; Verbrugghe et al., 2013).

Frail older people residing in long-term care facilities are considered to be at high risk for malnutrition (Kaiser et al., 2010) and their nutritional status tends to decline during their residence (Borgström Bolmsjö, Jakobsson, Molstad, Ostgren, & Midlöv, 2015). Functional dependency and the need for assistance increases the risk of malnutrition (Diekmann et al., 2013; Dion, Cotart, & Rabilloud, 2007; Fávoro-Moreira et al., 2016). The amount of food eaten and energy taken tends to decrease when eating dependency increases (Suominen et al., 2005). Chewing problems and dysphagia lead to a prolonged eating duration and are associated with malnutrition (Leow, Huckabee, Anderson, & Beckert, 2010; Saarela et al., 2011). Decreased mobility, diseases for example depression, polypharmacy and a decreased sense of smell and taste may impair appetite and lead to inadequate eating (Inzitari et al., 2011; Morley, 2012). In ageing, decreased food intake, malabsorption of nutrients and vitamins or increased metabolism may also lead to a deterioration in nutritional status (Morley, 1998). Additionally, impaired cognitive function and dementia are risk factors for malnutrition (Morley, 2012).

Despite our increasing awareness regarding nutritional problems and associated factors among older populations in institutional care, they have often been poorly recognized (Mowe et al., 2008; Suominen, Sandelin, Soini, & Pitkala, 2009). There are few studies on how nutritional care has changed in institutional care settings over time.

The aim of this study, using repeated cross-sectional datasets, was to investigate the change in the prevalence of malnutrition in institutional settings in Helsinki, Finland, from 2003 to 2011. In addition, we aimed to explore the quality of nutritional care in these settings over time.

## 2. Materials and methods

This study is part of a larger project exploring the nutritional status and changing nutritional care of residents in nursing homes (NH) and assisted living facilities (ALF) in Helsinki. Both facilities provide round-the-clock care with a registered nurse in charge of each ward. The environment in ALFs, however, is more home-like than in traditional NHs. In ALFs, residents live in their own apartments or, for people with dementia, group homes.

We combined four datasets: (1) residents from all NHs in 2003 (N = 2142), (2) residents from all ALFs in 2007 (N = 2091), (3) residents from all NHs in 2011 (N = 1946), and (4) residents from all ALFs in 2011 (N = 2503). All residents who were 65 years or older permanently living in these settings were approached to participate. Participation rates in NHs were 93% (N = 1987) in 2003 and 81% (N = 1576) in 2011, while the respective figures in ALFs in 2007 and 2011 were 66% (N = 1377) and 63% (N = 1585).

The data were collected using exactly the same instruments at each time point. Data were collected by registered nurses, who received training in the MNA<sup>2</sup> and its assessment protocols before each data collection cycle. The structured questionnaire included information on demographic data, medical history, digestive system problems and nutritional care. Information on mobility was obtained from an item on the MNA questionnaire asking whether the resident was bed- or chair-bound, able to get out of their bed/chair but does not go out, or goes out. We categorized this dichotomously into: 1 = not able to move independently and 2 = able to move independently. Medical records were used to retrieve medical diagnoses and medication use. Comorbidities were evaluated by the Charlson Comorbidity Index (CCI) which takes in to account both the number and severity of a person's medical conditions. High scores indicate a greater burden from comorbidities (Charlson, Pompei, Ales, & MacKenzie, 1987).

Nutritional status was assessed using the MNA (Vellas et al., 1997), which is an 18-item tool used to assess nutritional risk. The test includes anthropometric measurements (weight, height, weight loss and midarm and calf circumferences and), global assessment (lifestyle, medication

and mobility), a dietary questionnaire (number of meals consumed, food and fluid intakes, feeding autonomy), and a subjective assessment of health and nutrition. A MNA score of < 17 indicates malnourishment, a score between 17 and 23.5 indicates a person at-risk for malnourishment, and a score of > 23.5 indicates a good nutritional status. Body mass index (BMI) was calculated by dividing a person's weight (in kilograms) by the square of their height (in meters).

Swallowing difficulties and constipation were recorded with yes/no options. Information on the mode of feeding was obtained from the MNA. Consistency of food the resident typically eats was categorized as liquid, pureed, soft, and normal food. The average proportion of offered food that is eaten by the resident was assessed with the question "How much, on average, does the resident eat for their main meals?" The nurses used images of model portions to assess this and the responses were dichotomized into eats inadequately (eats only a little, eats less than half) and eats more than inadequately (eats half their meal, eats most of their meal or eats all or nearly all of their meal). The use of oral nutritional supplements, vitamin D supplements, and calcium supplements as well as snacks between meals was recorded with yes/no questions. Regular weight monitoring was inquired of with options: never, once a year or less frequently, 2–6 times a year, and > 6 times per year.

For all three years of data collection, the study protocol was approved by the local ethics committee of Helsinki University Hospital. Written informed consent was obtained from the participants or their closest proxies.

## 3. Statistical analysis

Statistical analyses were performed using SPSS and NCSS programs. Descriptive categorical variables were expressed as percentages and the continuous variables as means and standard deviations (SD). The differences between cohorts were analyzed using the chi square test for categorical variables or the Mann-Whitney *U* test for non-normally distributed continuous variables. *P*-values < 0.05 were considered statistically significant. Logistic regression models were used to produce age and gender adjusted models for malnutrition.

## 4. Results

Table 1 presents the basic characteristics of residents in NHs in 2003 and 2011 and in ALFs in 2007 and 2011. In 2011, residents were older in both NHs and ALFs than in respective samples in 2003 and 2007. The proportion of male residents and the level of education in NHs increased between the two study years. In both NHs and ALFs, residents in 2011 were more dependent based on the proportion of those not able to move independently increasing significantly (in NHs, from 30.4% to 60.5%; in ALFs, from 15.0% to 28.8%). Overall, diagnosed dementia was more common in 2011 than earlier years. Similarly, mean CCI values were higher, indicating more severe comorbidity in 2011 than earlier years. However, the mean number of medications decreased in NHs from 7.9 in 2003 to 7.3 in 2011. In ALFs, though, the trend was reversed, from 8.1 in 2007 to 8.6 in 2011.

Table 2 presents the nutritional status, nutritional care and eating habits of residents in NHs and ALFs. In 2011, a larger proportion of residents were assessed as malnourished in both NHs and ALFs compared to 2003 and 2007, respectively (in NHs, from 28.6% to 31.7%; in ALFs, from 12.7% to 20.2%). Mean BMI significantly increased in NHs over the years from 23.7 kg/m<sup>2</sup> in 2003 to 24.2 kg/m<sup>2</sup> in 2011 (*p* = 0.012). Overall, a larger proportion of residents needed help eating and fewer residents were able to eat food of normal consistency in 2011 compared to previous years. On the other hand, there were changes in nutritional care in these settings. In 2011, residents in both settings more frequently used oral nutritional supplements, vitamin D supplements, and calcium supplements as well as snacks between meals than earlier samples. For example, the proportion of residents using oral

**Table 1**

Basic characteristics of nursing home (NH) residents in 2003 and 2011 and assisted-living facility (ALF) residents in 2007 and 2011.

Characteristics	NH residents			ALF residents		
	2003 (N = 1987)	2011 (N = 1576)	P value <sup>a</sup>	2007 (N = 1377)	2011 (N = 1585)	P value <sup>a</sup>
Mean age (SD) <sup>†</sup>	83.7 (7.7)	84.5 (7.9)	0.005	83.0 (7.4)	84.3 (7.3)	< 0.001
Females, %	80.7	77.0	0.008	77.7	78.1	0.78
Education < 8 years, %	61.7	49.4	< 0.001	55.4	52.3	0.10
Not able to move independently, %	30.4	60.5	< 0.001	15.0	28.8	< 0.001
Dementia, %	69.5	76.5	< 0.001	59.5	70.1	< 0.001
Prior stroke, %	29.7	28.9	0.63	25.9	25.8	0.95
Cancer, %	11.3	8.2	0.0025	13.8	9.0	< 0.001
Pressure ulcer, %	15.1	16.1	0.41	12.5	15.4	0.023
CCI <sup>‡</sup> (SD)	2.1 (1.2)	2.3 (1.5)	< 0.001	2.1 (1.4)	2.4 (1.5)	< 0.001
Mean number of medications (SD)	7.9 (3.5)	7.3 (3.3)	< 0.001	8.1 (3.7)	8.6 (3.9)	< 0.001

<sup>a</sup> Differences between the cohorts were tested using the  $\chi^2$ -test for categorical variables and the Mann-Whitney *U* test for non-normally distributed continuous variables.

<sup>†</sup> SD = standard deviation.

<sup>‡</sup> CCI = Charlson comorbidity index.

nutritional supplements increased from 4.7% to 10.9% in NHs between the eight years of study ( $p < 0.001$ ) and from 2.9% to 10.5% in ALFs between the four years of study ( $p < 0.001$ ). Similarly, the proportion of residents using vitamin D supplements increased from 31.3% to 78.0% ( $p < 0.001$ ) in NHs and from 48.1% to 68.7% in ALFs ( $p < 0.001$ ). The residents were offered snacks between meals more often in both settings, increasing from 46.2% to 71.6% in NHs ( $p < 0.001$ ) and from 58.8% to 68.0% in ALFs ( $p < 0.001$ ). In addition, a resident's weight was monitored more frequently in 2011 than in previous years.

Although malnutrition increased in bivariate analyses in both settings over time, logistic regression model showed that odds ratio for malnutrition among NH residents decreased from 2003 to 2011 when adjusted for age and gender (OR 0.66, 95% CI 0.55–0.78) whereas dementia (OR 2.22, 95% CI 1.83–2.68) and poor mobility (OR 4.99, 95% CI 4.21–5.90) showed a high risk for malnutrition in the model. Respectively, odds ratio for malnutrition adjusted for age and gender among residents in ALF did not change significantly between 2007 and 2011 (OR 1.15, 95% CI 0.92–1.43) whereas dementia (OR 2.86, 95% CI 2.21–3.69) and poor mobility (OR 7.36, 95% CI 5.89–9.20) increased the risk for malnutrition. See Fig. 1.

## 5. Discussion

Since 2003, we have explored the nutritional status and changes in nutritional care among older people in NHs and ALFs in Helsinki. These repeated cross-sectional studies in 2003, 2007 and 2011 demonstrated that the prevalence of malnutrition among institutionalized older people increased during the eight year study period. On the other hand, in 2011, residents in these settings were older, more dependent, had more comorbidities and dementia than earlier time points which explained the increase in malnutrition. Positive developments in the quality of nutritional care could be observed.

To our knowledge, this is the largest study comparing the differences in the nutritional status institutionalized residents over time. The strengths of our study are in its representativeness of all institutional settings in Helsinki and the relatively large sample sizes. The data was collected using exactly the same questionnaire during every data collection period, enabling reliable comparison of the findings over the years. These repeated cross-sectional studies and valid measurements allow us to explore the change in prevalence of malnutrition among institutionalized older people. Registered nurses were specially trained in data collection before each data collection period and were familiar with the residents. Nutritional status was captured by the MNA instrument, which is easy to perform, was specifically developed for use in populations of older people, and has been validated in different

**Table 2**

Nutritional status, nutritional care and eating habits of nursing home (NH) residents in 2003 and 2011 and assisted-living facility (ALF) residents in 2007 and 2011.

Characteristics	NH residents			ALF residents		
	2003 (N = 1987)	2011 (N = 1576)	P value <sup>a</sup>	2007 (N = 1377)	2011 (N = 1585)	P value <sup>a</sup>
MNA <sup>†</sup>			< 0.001			< 0.001
< 17 (malnourished)	28.6	31.7		12.7	20.2	
17–23.5 (at-risk)	60.3	61.8		65.4	61.9	
> 23.5 (normal)	11.1	6.5		21.9	17.9	
BMI <sup>‡</sup> mean, (SD) <sup>§</sup>	23.7 (5.0)	24.2 (5.2)	0.012	25.3 (5.1)	25.5 (5.3)	0.40
Swallowing difficulties, %	14.6	24.5	< 0.001	12.0	15.1	0.016
Constipation, %	44.3	47.2	0.083	34.9	33.1	0.33
Mode of feeding, unable to eat without assistance, %	16.1	38.5	< 0.001	6.9	14.8	< 0.001
Food consistency, modified, %	33.5	50.6	< 0.001	12.1	22.2	< 0.001
Eating inadequately	23.6	25.1	0.31	24.9	26.4	0.010
Oral nutritional supplement, %	4.7	10.9	< 0.001	3.2	10.6	< 0.001
Vitamin D supplement, %	31.3	78.0	< 0.001	48.1	68.7	< 0.001
Calcium supplement, %	28.2	36.7	< 0.001	47.4	54.1	0.0056
Eating snacks between meals, %	46.2	71.6	< 0.001	58.8	68.0	< 0.001
Weight monitoring $\geq$ twice/year, %	83.6	95.4	< 0.001	71.8	91.1	0.0036

<sup>a</sup> Differences between the samples were tested using the  $\chi^2$ -test for categorical variables and the Mann-Whitney *U* test for non-normally distributed continuous variables.

<sup>†</sup> MNA = Mini Nutritional Assessment.

<sup>‡</sup> BMI = body mass index.

<sup>§</sup> SD = standard deviation.

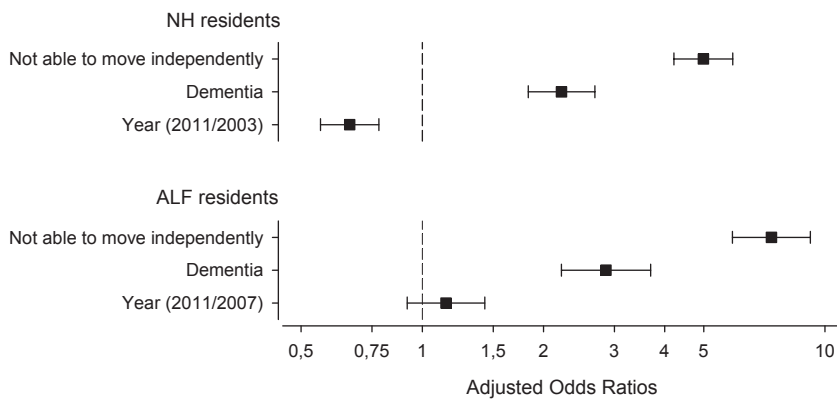


Fig. 1. Odds ratios with 95% confidence intervals for malnutrition (adjusted for age, gender) among nursing home residents (upper panel) and residents in assisted living facilities.

settings (Guigoz et al., 2002). The MNA items reflect specific conditions relevant for older people and are based on age-adapted thresholds for anthropometric measurements (Verbrugge et al., 2013). The key benefit of the MNA is its capacity to detect the risk of malnutrition (Guigoz, 2006; Kondrup et al., 2003). This is important to assure tailored nutritional care to protect a resident's functional capacity and quality of life (Starke, Schneider, Alteheld, Stehle, & Meier, 2011). In addition, information regarding medical diagnoses were retrieved from a resident's medical records, which supports the validity of data. One limitation of the study is that response rates fell from 2003 and 2007 to 2011. Another limitation is that we could not follow-up the same residents over time. These residents are living their last years of life, thus, most of them were deceased before the 2011 follow-up wave of data collection.

Our study shows that resident characteristics in these settings changed over time: the mean age and the number of comorbidities increased, while both physical and cognitive functioning declined. Dementia diagnoses were more common in both NHs and ALFs in 2011 than in the earlier data collection years. Dementia and disability showed a high risk for malnutrition which explained the increase in poor nutritional status. When taking these into account in logistic regression model and adjustments were made for age and gender, the change in malnutrition over time did no longer show increase. These changes in resident population were due to a transformation in the structure of the service system in Finland (Väyrynen & Kuronen, 2015). The amount of the population aged 75+ years increased 55% from 2003 (N = 25,921) to 2011 (N = 40,268) in Helsinki (OSF, 2016). At the same time, the absolute and relative number of NH beds have decreased, whereas the number of beds in ALFs have increased only a little. Thus, a growing number of frail older people who previously lived in NHs are now living in ALFs and many are living in their own homes with the aid of home nursing. ALFs are provided to those older people who cannot manage in their own homes, even with the home care services.

Due to increased disabilities and dementia, malnutrition was higher in 2011 among both NH and ALF residents, compared to earlier study periods. According to the MNA, 26% of the study population in 2011 was assessed as malnourished (in NHs, 31.7%; in ALFs, 20.2%). In line with our findings, a recent Swedish study found that 30% of individuals in NHs were assessed as malnourished and 63% were at-risk for malnutrition (Torma et al., 2013). However, in this Swedish study, the proportion of malnourished residents had decreased in NHs from 1996 to 2010 (Torma et al., 2013). The explanation for these differing findings is the change in the populations of Helsinki NH and ALF and in the Finnish structure of services, as described above. In the Swedish study, the mean age of residents in NHs increased over the study years, but the proportion of bed-bound residents and the number of acute illnesses had decreased (Torma et al., 2013). One limitation of this Swedish study is its relatively small sample size (n = 172) at the latest study wave. In review study including 32 studies and 6821 institutionalized

older people in retirement homes, NHs or long-term care facilities, 21% of participants, on average, were assessed as malnourished (range 5–71%) (Guigoz, 2006). The average prevalence of those at-risk for malnutrition was 51% (range 27–70%). Kaiser et al. (2010) combined dataset from different settings in 12 countries including 4507 older people and found that the average prevalence of malnutrition was 23%. In NHs specifically, 14% of 1586 participants were malnourished. Recently, in a Belgian study including 1188 NH residents, the prevalence of malnutrition was found to be lower (19.4%) than in our study (Torma et al., 2013).

However, a number of positive developments could be observed in the quality of nutritional care in our study settings. Without these developments the nutrition would probably have deteriorated. Finnish nutritional guidelines for older people were published in 2010 (Suominen et al., 2014). Many of the changes regarding nutritional care that took place in our institutional settings were in line with these guidelines, such as increased use of vitamin D and oral nutritional supplements, more frequent use of snacks, and weight monitoring. One explanation for these significant changes in nutritional care is that the nursing staff received systematic training in nutrition in recent years. Additionally, awareness of the need for vitamin D supplementation among the older population has grown.

## 6. Conclusions

In 2011, the institutionalized elderly resident population in Helsinki is more frail, more prone to malnourishment, and suffers from dementia more often than the previous 4–8 years. Nursing staff in these institutions seem to be more aware of good nutritional care for vulnerable older people, although there is still room for improvement. There is a continuous need to invest in staff education regarding nutrition and nutritional care of older people.

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## References

- Bauer, J. M., Kaiser, M. J., Anthony, P., Guigoz, Y., & Sieber, C. C. (2008). The mini nutritional assessment-its history, today's practice, and future perspectives. *Nutrition in Clinical Practice*, 23, 388–396.
- Borgström Bolmsjo, B., Jakobsson, U., Molstad, S., Ostgren, C. J., & Midlöv, P. (2015). The nutritional situation in Swedish nursing homes—A longitudinal study. *Archives of Gerontology and Geriatrics*, 60, 128–133.
- Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases*, 40, 373–383.
- Diekmann, R., Winning, K., Uter, W., Kaiser, M. J., Sieber, C. C., Volkert, D., et al. (2013).

- Screening for malnutrition among nursing home residents—A comparative analysis of the mini nutritional assessment, the nutritional risk screening, and the malnutrition universal screening tool. *Journal of Nutrition, Health and Aging*, 17, 326–331.
- Dion, N., Cotart, J. L., & Rabilloud, M. (2007). Correction of nutrition test errors for more accurate quantification of the link between dental health and malnutrition. *Nutrition*, 23, 301–307.
- Fávaro-Moreira, N. C., Krausch-Hofmann, S., Matthys, C., Vereecken, C., Vanhauwaert, E., Declercq, A., et al. (2016). Risk factors for malnutrition in older adults: A systematic review of the literature based on longitudinal data. *Advances in Nutrition*, 7, 507–522.
- Guigoz, Y., Vellas, B., & Garry, P. J. (1996). Assessing the nutritional status of the elderly: The mini nutritional assessment as part of the geriatric evaluation. *Nutrition Reviews*, 54, S59–65.
- Guigoz, Y., Lauque, S., & Vellas, B. (2002). Identifying the elderly at risk for malnutrition. The mini nutritional assessment. *Clinics in Geriatric Medicine*, 8, 737–757.
- Guigoz, Y. (2006). The mini nutritional assessment (MNA) review of the literature—what does it tell us? *Journal of Nutrition, Health and Aging*, 10, 466–485.
- Inzitari, M., Doets, E., Bartali, B., Benetou, V., Di Bari, M., Visser, M., et al. (2011). International association of gerontology and geriatrics (IAGG) task force for nutrition in the elderly. Nutrition in the age-related disablement process. *Journal of Nutrition, Health and Aging*, 15, 599–604.
- Kaiser, M. J., Bauer, J. M., Rämisch, C., Uter, W., Guigoz, Y., Cederholm, T., et al. (2010). Frequency of malnutrition in older adults: A multinational perspective using the mini nutritional assessment. *Journal of the American Geriatrics Society*, 58(9), 1734–1738.
- Educational and Clinical Practice CommitteeKondrup, J., Allison, S. P., Elia, M., Vellas, B., Plauth, M., et al. (2003). ESPEN guidelines for nutrition screening 2002. *Clinical Nutrition*, 22, 415–421.
- Leow, L. P., Huckabee, M. L., Anderson, T., & Beckert, L. (2010). The impact of dysphagia on quality of life in ageing and Parkinson's disease as measured by the swallowing quality of life (SWAL-QOL) questionnaire. *Dysphagia*, 25, 216–220.
- Morley, J. E. (1998). Protein-energy malnutrition in older subjects. *Proceedings of The Nutrition Society*, 57, 587–592.
- Morley, J. E. (2012). Anorexia of aging: A true geriatric syndrome. *Journal of Nutrition, Health and Aging*, 16, 422–425.
- Mowe, M., Bosaeus, I., Rasmussen, H. H., et al. (2008). Insufficient nutritional knowledge among health care workers. *Clinical Nutrition*, 27, 196–202.
- Official Statistics of Finland (OSF): Population structure [e-publication]. ISSN = 1797-5395. Helsinki: Statistics Finland [referred: 23.9.2016]. Access method: [http://www.stat.fi/til/vaerak/tau\\_en.html](http://www.stat.fi/til/vaerak/tau_en.html).
- Saarela, R., Lindroos, E., Soini, H., Suominen, M. H., Muurinen, S., & Pitkälä, K. H. (2011). Chewing problems and mortality. *Journal of the American Geriatrics Society*, 59, 181–183.
- Saletti, A., Lindgren, E. Y., Johansson, L., & Cederholm, T. (2000). Nutritional status according to mini nutritional assessment in an institutionalized elderly population in Sweden. *Gerontology*, 46, 139–145.
- Starke, J., Schneider, H., Alteheld, B., Stehle, P., & Meier, R. (2011). Short-term individual nutritional care as part of routine clinical setting improves outcome and quality of life in malnourished medical patients. *Clinical Nutrition*, 30, 194–201.
- Suominen, M., Muurinen, S., Routasalo, P., Soini, H., Suur-Uski, I., Peiponen, A., et al. (2005). Malnutrition and associated factors among aged residents in all nursing homes in Helsinki. *European Journal of Clinical Nutrition*, 59, 578–583.
- Suominen, M. H., Sandelin, E., Soini, H., & Pitkala, K. H. (2009). How well do nurses recognize malnutrition in elderly patients? *European Journal of Clinical Nutrition*, 63, 292–296.
- Suominen, M. H., Jyvakorpi, S. K., Pitkala, K. H., Finne-Soveri, H., Hakala, P., Mannisto, S., et al. (2014). Nutritional guidelines for older people in Finland. *Journal of Nutrition, Health and Aging*, 18, 861–867.
- Torma, J., Winblad, U., Cederholm, T., & Saletti, A. (2013). Does undernutrition still prevail among nursing home residents. *Clinical Nutrition*, 32, 562–568.
- Väyrynen, R., & Kuronen, R. (2015). *Institutional care and housing services in socialcare 2014*Finland: National Institute for Health and Welfare Statistical report 21/2015.
- Vellas, B. J., Guigoz, Y., & Garry, P. J. (1997). *Facts, research and intervention in geriatrics: Nutrition in the elderly. The mini nutritional assessment (MNA)* (3rd ed.). Paris: Serdi Publishing.
- Verbrugge, M., Beekman, D., Van Hecke, A., Vanderwee, K., Van Herck, K., Clays, E., et al. (2013). Malnutrition and associated factors in nursing home residents: A cross-sectional, multi-centre study. *Clinical Nutrition*, 32, 438–443.