Self-Perceived Health and Nutritional Status among Home-Living Older People
A prospective study

Yvonne Johansson

Division of Nursing Science
Department of Medical and Health Sciences
Linköping University, Sweden

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During the course of the research underlying this thesis, Yvonne Johansson was enrolled in Forum Scientium, a multidisciplinary doctoral programme at Linköping University, Sweden.

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To everyone who participated in the study and
to future older generations

Each person is part of the present and
a link between history and the future
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ABSTRACT

The overall aim was to follow the development of nutritional status and its significance for general health status using an epidemiologic method in a representative population-based selection of older individuals in two cohorts. The main focus was to prospectively examine the significance of demographic, social and medical factors and to establish a basis to investigate the possibilities of preventive measures.

Methods: Five hundred and eighty-three individuals (278 women and 305 men), 75 and 80 years old, when included, living in a municipality in Östergötland in Sweden, participated in this study. Data collection took place 2001-2006 with one examination yearly. The examination included a single question regarding self-perceived health demographical questions, different questionnaires in the areas of nutritional status, symptoms of depression, cognitive function, health-related quality of life and well being and objective assessments such as anthropometrical, physical and biochemical measurements.

Results: Fifty percent of the women (I) and 58% of the men (II) perceived themselves as healthy. Important factors for women’s health (I) at baseline were no or few symptoms of depression, better physical mobility and better physical health. Among men who perceived themselves as healthy (II) at baseline, important factors were better physical health, maintaining a social network and the ability to walk outdoors. After one year 69% of the women and 75% of the men still perceived themselves as healthy. Among those women (I) who perceived themselves as healthy after one year, better physical mobility and better physical health were still important, with the addition of less or no pain. Important predictors for preserving health among men (II) were no symptoms of depression and the ability to walk up and down stairs.

The prevalence of risk for malnutrition (III) was 14.5% (n=84), among women 18.8% and men 10.6%. Risk factors for malnutrition at baseline were a lower TSF, lower handgrip strength and worse physical health according to the PGC MAI. The incidence was 7.6%-16.2%, and was distributed equally among women and men over time. Predictors for developing malnutrition were lower self-perceived health, increased number of symptoms of depression. Especially men with symptoms of depression ran a higher risk.

Reported energy intake (IV) was low in relation to the estimated requirement, on average 74% among women and 67% among men. Intake of vitamins A, D,
Abstract

E and folate was below the recommended intake and the same pattern was found over time. A smaller weight loss was found among women and men from baseline to Follow-up 2.

Conclusions: The experience of a good physical health was the only common factor for a good self-perceived health among women and men. The highest risk for developing malnutrition was a combination of impaired self-perceived health and increased number of symptoms of depression.

Clinical implications: A combination of nutritional status, self-perceived health and symptoms of depression can be a base for clinical judgement and can be used by different professionals in health and medical care and in home care service.

Key words: energy intake, gender, physical activity, risk for malnutrition, symptoms of depression
LIST OF PAPERS

This thesis is based on the following papers which will be referred to in the text by their Roman numerals:


(II) Johansson, Y., Ek, A-C., Carstensen, J., Bachrach-Lindström, M. Self-perceived health among older men living in their own residence; a four year follow-up study. (Submitted)


(IV) Johansson, Y., Ek, A-C., Bachrach-Lindström, M. Self-reported energy and nutrient intake among older people; a two year follow-up study. (Submitted)

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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
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<tbody>
<tr>
<td>ADL</td>
<td>Activity of Daily Living</td>
</tr>
<tr>
<td>AMC</td>
<td>Arm Muscle Circumference</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>BMR</td>
<td>Basal Metabolic Rate</td>
</tr>
<tr>
<td>BW</td>
<td>Body Weight</td>
</tr>
<tr>
<td>DXA</td>
<td>Dual Energy X-ray Absorptiometry</td>
</tr>
<tr>
<td>CC</td>
<td>Calf Circumference</td>
</tr>
<tr>
<td>E%</td>
<td>Energy Percent</td>
</tr>
<tr>
<td>EE</td>
<td>Estimated Energy expenditure</td>
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<tr>
<td>EI</td>
<td>Energy Intake</td>
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<tr>
<td>ER</td>
<td>Energy Requirement</td>
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<tr>
<td>FM</td>
<td>Fat Mass</td>
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<tr>
<td>FMI</td>
<td>Fat Mass Index</td>
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<tr>
<td>FFM</td>
<td>Fat Free Mass</td>
</tr>
<tr>
<td>FFMI</td>
<td>Fat Free Mass Index</td>
</tr>
<tr>
<td>GDS</td>
<td>Geriatric Depression Scale</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilocalories</td>
</tr>
<tr>
<td>MAC</td>
<td>Mid Arm Circumference</td>
</tr>
<tr>
<td>MJ</td>
<td>Mega Joule</td>
</tr>
<tr>
<td>MMSE</td>
<td>Mini Mental State Examination</td>
</tr>
<tr>
<td>MNA</td>
<td>Mini Nutritional Assessment</td>
</tr>
<tr>
<td>NHP</td>
<td>Nottingham Health Profile</td>
</tr>
<tr>
<td>NNR</td>
<td>Nordic Nutrition Recommendations</td>
</tr>
<tr>
<td>PAL</td>
<td>Physical Activity Level</td>
</tr>
<tr>
<td>PGC MAI</td>
<td>Philadelphia Geriatric Center Multilevel Assessment</td>
</tr>
<tr>
<td>SGA</td>
<td>Subjective Global Assessment</td>
</tr>
<tr>
<td>TSF</td>
<td>Triceps Skin-Fold</td>
</tr>
<tr>
<td>SCB</td>
<td>Statistiska Centralbyråns</td>
</tr>
<tr>
<td>SNFA</td>
<td>Swedish National Food Administration</td>
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</tbody>
</table>
INTRODUCTION

A greater portion of older people in Sweden live in their own residence, and many feel healthy and have the ability to live an active life. It is supposed that older people want to live independently in their own homes as long as possible and try to adapt to their situation. The average life expectancy in Sweden is increasing, and as a consequence of this invalidity and the need for care is expected to increase. From this perspective it is important to focus on maintaining good self-perceived health as long as possible. Considering older people’s own perception of different dimensions in their life, this would make it easier for society to plan for the older generation, thus promoting health and preventing disease. Risk for malnutrition is often associated with diseases and social factors (Pirlich et al., 2005) and can lead to consequences like complications associated with diseases and treatment, impaired health and impaired quality of life (Alberda et al., 2006). Earlier studies in Sweden have found that 5% of older home-living people were malnourished (Thorslund et al., 1990) and that 28.5% were malnourished upon admission to hospital (Larsson et al., 1990). The problem is still relevant: In a group of older people living in their own homes with home-care service, 41% were at risk for malnutrition (Saletti et al., 2005), and when moving to a nursing home 29-33% were at risk or were malnourished (Wikby et al., 2006). The following research questions arise: Is it possible to determine why older people develop malnutrition, and how and when can elderly people at risk for malnutrition be identified, in order to maintain self-perceived good health?

A prospective study with a holistic perspective offers the possibility to find predictors for preventing malnutrition and maintaining self-perceived good health and health-related quality of life. According to Statens offentliga utredningar (SOU 2003:91), more research among older people will be needed to find evidence- based measure to facilitate for older people’s remaining in their own residence.
BACKGROUND

Health, ageing and gender

Years of growing up and earlier experiences during life can be possible factors reflecting self-rated health in later life (Vuorisalmi et al., 2008). Older women and men have been influenced by the gender roles they encountered while growing up and during middle age. Women have adapted to a traditional gender role and feeling responsible for their family’s health, (Benyamini et al., 2000) which may have influenced them to include their family’s health and well being in their own self-perception of health (Benyamini et al., 2000; Irwin, 2003). Men were affected to a greater extent by serious diseases as a part of their health (Benyamini et al., 2000).

Older men have spent much more of their working lives outside the home than women have (Benyamini et al., 2000; Irwin, 2003), and have to a greater extent a longer education which often gives a better socio-economic status and better circumstances during one’s older days (Folkhälsorapport 2005). These aspect are important when self-rated health is evaluated among older people with different living circumstances and from different cultures (Vuorisalmi et al., 2008).

Various international studies have found a decreasing number of older people who perceived themselves as healthy (Hoeymans et al., 1997; Moussavi et al., 2007) as well as increasing chronic conditions (Moussavi et al., 2007) and several disabilities (Hoeymans et al., 1997). The contrary was found in a study in Sweden; self-perceived good health increased at the same time as the number of chronic conditions increased (Rosén & Haglund, 2005). In Sweden 40% of men at 80-85 years of age have some kind of disability compared with nearly 60% among women (Folkhälsorapport 2005).

Changes in health due to age are influenced by societal norms. Disabilities and health problems can be seen as normal for a higher age and may be ignored; these problems can also be incorporated and adapted to by older people as a normal condition (Idler, 1993). Opinions about health is not always the same
Background

older individuals have rated themselves as more healthy than their physician has (Kivinen et al., 1998). Individuals own perceptions of health have been found to be important in explaining active ageing (Bowling, 2008).

Health status among older people

The older population is increasing in Sweden; in 2007, 17.5% of the total population was 65 years of age or older and the average lifespan for women was 83 years and for men 79 years. The remaining average lifespan for people who retired in 2007 was 21 years for women and 18 years for men. Compared with 20 years ago and people born in 1923, life expectancy has increased by approximately three years (SCB 2009).

The number of chronic conditions are increasing with age (Larsson & Thorslund, 2006; Maaten et al., 2008) at the same time as older people live in their own residence to a greater extent than previously. The consequences of this might be increasing vulnerability, dependence and illness, the need to visit the primary care centre and an increased admissions to hospital (Larsson & Thorslund, 2006; Maaten et al., 2008). The reduction in average hospital stay might lead to older individuals’ needs not being met and their home situation perhaps becoming impaired. This affects one’s life while ageing and may leads to impaired self-perceived health.

In Sweden circulatory diseases are common among older people (Marengoni et al., 2009). The prevalence of diabetes, hypertension and heart diseases has increased in Sweden between 1980 and 2002 among older men by >20% and among women by 5-11% (Rosén & Haglund, 2005). Disabilities are not unusual and in Sweden 40% of men and nearly 60% of women at 80-85 of age have some kind of disability (Folkhälsorapporten 2005). Fall accidents at home cause injuries and are often followed by a hospital stay and rehabilitation. The older individual can experience difficulty returning to normal life in his/her own home, and there can also be consequences on his/her mental condition. About 11-15 % of older people are estimated to have depression (Jönsson et al., 2006; Marengoni et al., 2009); these symptoms can be hidden in physical symptoms and difficult to find (Jönsson et al., 2005). This is more common among men, who visit primary care for physical symptoms when depression is the cause (Jönsson et al., 2005).
Irrespective of diseases and symptoms of illness, older people has been found to perceive themselves as healthy (Kivinen et al., 1998; Rosén & Haglund, 2005). This might be due to different circumstances, like a sufficiently treated disease no longer having an affect on daily life or different disabilities the individuals have the ability to adapt to. To be able to continue living life like before in the surroundings they are accustomed to, people try automatically adapt to the problems they suffer from (Atchley, 1999). The adaption is a process, by which one adjust to and prepares for changes in life. As preparation for ageing it would be necessary to imagine the things that often occur in connection to ageing. There are different ways to adapt, depending on the individual’s earlier experiences, new decisions and strategies in the face of unexpected occurrences, and how much the changes affect daily life (Atchley, 1999). If the vital goal can be maintained, it is easier to adapt to the situation and probably to maintain self-perceived health. According to Nordenfelt’s theory, health is depending on the individual’s ability to realize his or her vital goal, given a set of standard or otherwise reasonable circumstances. This means that, despite disease and difficulty the individual can have health (Nordenfelt, 2000). On the other hand the individual is unhealthy if he/she has lost the ability to perform important tasks in daily life and has no possibility to get this back or relearn how to do it (Nordenfelt, 2000). Compared to Boorse’s health concept, health is the absence of disease and illness and the presence of normal biological functions within statistically normal reference values (Boorse, 1977). The same individual can thus have both health and ill-health depending on the theoretical standpoint. A third aspect is the individuals’ ability to adapt to the situation in a positive way and have positive relationships and social resources in the environment (Atchley, 1999). Thus, self-perceived health includes several dimensions; the individuals’ internal and external resources in combination with their perception of their physical and psychological health.

Society has different resources for older people who lose the ability to live independently. There are possibilities to get help with individual care, domestic tasks and meals-on-wheels (Socialtjänstlagen 2001). In 2006, 17.5% of older people ≥75 years had home-care service and 12.3% were living at nursing homes (SCB 2009). During 2001-2006, the demand for home-care service and the primary care increased (Larsson & Thorslund, 2006) at the same time as the need for help also increased by about 2.5%, 2001-2006 (SCB 2009). More women than men become widowed in older age and live alone to a greater extent. Women also get help from home-care service and move to a nursing
home more often than men do (SCB). In this situation women are vulnerable and often have a worse economic situation (Arber & Cooper, 1999; Pickett & Pearl, 2001).

**Self-perceived health**

Health-related quality of life is defined as a part of quality of life, including the subjective perception of symptoms of illness and objective measurements of diseases as well as the individual dimension of well being (Wiklund, 1992). Self-perceived health is every individual’s own perception of their health including important dimensions of life that are meaningful to their health. Self-perceived health, self-assessed health and self-rated health are synonymous and have been used in different studies to estimate the same thing; the individuals own perception of their health.

The question of self-perceived health is common in medical and social investigations (Pickett & Pearl, 2001; Rosén & Haglund, 2005) and has been found to be an important question in predicting morbidity and mortality (Johansson et al., 2008; Lyyra et al., 2009). Health is also explained by the absence of disease (Boorse, 1975) and by survivorship in longitudinal studies (Idler, 1993) and by different subjective assessments of grades of bodily (van den Brink et al., 2005), mental and cognitive function and the ability to perform different activities (Patel et al., 2006). Individuals perceive their health as good even if they have diseases and symptoms of illness (Rosén & Haglund, 2005). A positive attitude to life and health can make it possible to more readily accept symptoms of illness as a part of health (Idler, 1993). A self-defined healthy population in the USA perceived health as a state of mind and as including positive attitude toward life, socializations and physical health. Older people in England who perceived themselves as having impaired health defined health as “the state of absence of disease” as well as including mobility and independence (van Maanen, 1988, 2006).

**Nutrition and ageing**

One’s energy requirement depends on age, activity and weight. Promoting a good nutritional status in ageing, requires adaption to one’s living circumstances. It is just as important to eat not too little as it is to eat not too
Background

much. There are few studies in the literature concerning nutritional status among older home-living people without home-care service. Rothenberg (1994) found that healthy older people eat two to three complete meals and several snacks a day (Rothenberg et al., 1994), and eating regularly as well as variety were seen as important (McKie et al., 2000). Other studies found a change in meal habits to fewer complete meals after retirement (Sidenvall et al., 1996) and when older people lived and ate alone (Wissing et al., 2000). Meal habits in older couples are often adapted to the man’s wishes, and some women after becoming widowed describe this as the freedom to choose food (Maynard & Blane, 2009). Men who have participated in grocery shopping eat a varied diet when they begin living alone (Maynard & Blane, 2009). The age group of 75 years old showed a decreasing consumption of bread, vegetables and meat and fish compared with the age group of 60-74 years old (Vandevijvere et al., 2008). Problems with mobility and to carrying food home from the shop might cause a reduction in older people’s own cooking; they buy and eat more semi-prepared and prepared foods (McKie et al., 2000). Their dietary patterns can also be changed; for example women who had difficulty cooking their own food ate more snacks (Gustafsson et al., 2002). Being dependent in one’s daily life is a risk factor of malnutrition (Omran & Morley, 2000 A).

Risk for malnutrition

Malnutrition is defined as an imbalance between energy intake and nutritional requirements (Omran & Morley, 2000 A), and in this study is used to mean undernourishment. Ageing itself does not cause malnutrition (Morley, 1997), but combined with changes in physiological, psychological, and social factors does increase the risk (Hickson, 2006; Morley, 1997). A high risk for malnutrition is indicated by chronic disease (Chen et al., 2007) gastric and bowel syndromes, chewing and swallowing problems (Morley, 1997), dryness of the mouth (Hickson, 2006) and a decreasing sense of taste and smell (Morley, 1997). Decreased appetite followed by decreasing energy- and micronutrient intake gives a higher risk for malnutrition and longer hospital visits (Hickson, 2006; Pirlich et al., 2005). Older individuals are suggested to have an impaired ability to regain weight they have lost after disease for example (Hickson, 2006). An involuntary weight loss of 5% during the past 6 month is associated with risk for malnutrition (Beck & Ovesen, 1998).
Background

Psychological factors such as impaired mental status, like symptoms of depression (Chen et al., 2007; Visvanathan et al., 2003), influence the appetite negatively (Morley, 1997) and cause poor food intake (Feldblum et al., 2009). More people living alone and having shorter education are social factors contributing to the risk for malnutrition (Feldblum et al., 2009; Pirlich et al., 2005). Dependence on others and needing help eating are risk factors, as well as not taking enough time for adequate energy and micronutrient intake (Feldblum et al., 2009). Another important area is being forced to reduce one’s activity level due to different disabilities or/and diseases, i.e. not having enough energy. These individuals who display physical as well as psychological risk factors for malnutrition need to be observed in connection with diseases and after hospital discharge.

Nutritional Assessment

There is no golden standard for assessing malnutrition, but a combination of anthropometrical, bio chemical measurements and immunological tests are commonly used (Christensson et al., 2002; Larsson et al., 1990). Screening instruments have been developed to simplify the assessment of nutritional status and offer the possibility to determine whether older people are at risk for malnutrition (Pirlich et al., 2005). Two commonly used instruments are the Mini Nutritional Assessment (MNA) and the Subjective Global Assessment (SGA) (Pirlich et al., 2005). The MNA was developed for older people and consists of a combination of anthropometrical assessments and questions that are relevant to nutritional status (Guigoz et al., 1996), (further described in Methods). The MNA is the most extensively evaluated tool in different settings of older people and has been found suitable for use in different health care professions (Green & Watson, 2006). The SGA was developed and tested in a surgical context and consists of a physical examination and self-reported weight loss and gastric problems during the previous six months. The SGA has to be conducted by well-trained health professionals to reflect the best judgement (Detsky et al., 1987). It has been used in a geriatric context and correlates strongly with the MNA, but is suggested to be more useful in detecting established malnutrition (Anthony, 2008; Christensson et al., 2002).
Background

Anthropometry and body composition

The Body Mass Index (BMI) is used in studies of nutritional status as a parameter of under- or overweight. Different studies have different cut-off values for malnutrition, <18kg/m²-22kg/m², and 22kg/m²-27kg/m² as normal for older people (Omran & Morley, 2000 A). If there is natural weight loss at a higher age, it is probably less than 1% per year and an involuntary weight loss of 5% during the past six month is associated with risk for malnutrition (Beck & Ovesen, 1998). Several studies in different populations have found weight loss at older ages, among women 2kg-3.6kg and among men approximately 5kg between 70-80 years of age (Dey et al., 1999). Regarding height, women and men decreased an average of 1-2 cm between 75 and 84 years of age (Dey et al., 1999; Perissinotto et al., 2002). MAC and TSF are useful clinical examinations in investigations of malnutrition and are highly correlated with total body fat. MAC and TSF are used to calculate AMC which is an indicator of somatic protein reserve (Omran & Morley, 2000 A). Limits for arm anthropometry regarding age and gender associated with malnutrition have been worked out by Symreng (1982) and are used in studying malnutrition (Bachrach-Lindström et al., 2001; Christensson et al., 2002; Wikby et al., 2009).

FFM or muscle mass decreased 10% per decade in those over 60 (Rosenberg, 2000). FFM has been correlated to impaired muscle strength (Dey et al., 2009), and reduced physical activity. Decreased muscle mass negatively influences muscle strength and might have consequences on the daily life (Roubenoff, 2000). FM increases with higher age (Dey et al., 2009; Roubenoff, 2000) and this is more evident among men (Dey et al., 2009).

Lower values in handgrip strength have been found in ageing women and men (Samson et al., 2000). Older people with risk for malnutrition and those who have a low functional ability have lower handgrip strength compared to well nourished people and independent people. (Gale et al., 2006; van Lier & Payette, 2003)

Biochemical tests

Which biochemical tests should be used in connection with nutritional assessments differs over time. Albumin and transthyretin in combination with anthropometry are used as components in studies of malnutrition. Albumin
Background

and transthyretin are influenced by infections and liver disease and are therefore used in combination with C Reactive Protein (CRP) (Alberda et al., 2006; Bachrach-Lindström et al., 2001; Thorslund et al., 1990). The values of these tests have been discussed, due to their connection to disease and imbalance in the body rather than nutritional status (Covinsky et al., 2002; Omran & Morley, 2000 B).

Dietary assessments

Energy requirements depend on the individual’s body mass, physical activity level and age. The Nordic Nutrition Recommendations offer recommendations for macro- and micronutrients for different ages and requirements (NNR, 2004). Decreasing activity level and muscle mass reduce the energy requirement but the need for micronutrients remains the same (NNR, 2004). One part of nutritional status is the measurement of food habits and energy intake including macro- and micronutrients (Gibson, 2005). A weighed food record is preferable, and is used in nursing homes (Lammes & Akner, 2006), but is not always possible to perform among home-living older people (Gibson, 2005). The 24-h recall are performed in dietary assessments among older people in different settings (Gustafsson et al., 2002), and is based on an interview during which the individual is asked to recall all the food they have consumed during the previous 24 hours (Gibson, 2005). The advantage of the 24h-recall is that it does not burden the individual at home (Omran & Morley, 2000 A) but can instead enhance the participant’s interest in reporting their food intake (Adamson et al., 2009). Repeated 24-h recall is recommended for assessments on an individual level but multiple single-day recalls in different individuals can give a valid measurement of a group (Gibson, 2005). The disadvantage is the day-to-day variation, and one single day might not be representative of a person’s food habits. Other interview techniques are a detailed dietary history for estimating the usual food intake during a period of at least a month and the food frequency questionnaire, which assesses food items or groups consumed during a longer specified period (Gibson, 2005). The food frequency questionnaire has been found difficult to perform in an older population, because of the high number of food items it was difficult for them to maintain concentration (Adamson et al., 2009).
AIMS OF THE THESIS

The overall aim was to follow the development of nutritional status and its significance for general health status using an epidemiologic method in a representative population-based selection of older individuals in two cohorts. The main focus was to prospectively examine the significance of demographic, social and medical factors and to establish a basis to investigate the possibilities of preventive measures.

The specific aims are:

- To characterize women who perceive themselves as healthy and compare them with women who perceive themselves as less healthy with regard to demographical, social, medical and functional factors. Another aim was to describe changes within the healthy group after one year, and find predictors of self-perceived health.

- To characterize older men who perceive themselves as healthy and compare them with older men who perceive themselves as less healthy, with regard to demographical social, medical and functional factors. Another aim was to describe changes within the healthy group over time and find predictors of self-perceived health.

- To investigate and describe the prevalence and incidence of malnutrition among home-living older people, related to demographic and medical factors, self-perceived health and health-related quality of life. Another aim was to find predictors for developing risk for malnutrition.

- To investigate older women’s and men’s energy intake regarding macro- and micronutrients, related to nutritional status, symptoms of depression, self-perceived health and demographical factors. Another aim was to describe possible changes in energy intake during a period of two years.
METHODS

Study Design

The study was a prospective longitudinal study with yearly examination of the participants during the period 2001 to 2006. The individuals were selected randomly from two age cohorts (75 and 80 years) in the local national register.

Sample

The sample consisted of older people, 75 and 80 years old, living in a municipality with 134,000 inhabitants in 2001, in southern Sweden. The 75-year-olds were included in 2001 from a population of 1,016 individuals. The 80-year-olds were included in 2002 from a population of 931 individuals and in 2003 from a population of 844 individuals, (Figure 1). A total of 1,177 requests were posted to every second name on the lists. When needed, one reminder was sent two weeks later, if we had not received a reply. The individuals could answer our requests by mail or phone, or we contact them by phone within 1-2 weeks. All individuals who were willing to participate were included in the study.

Explanations for not participating included being too sick, being too old, having enough contact with health care, feeling healthy or not being interested in participating. However, 265 non-participating individuals answered questions about living circumstances, symptoms of illness, medications and self-perceived health. Using these answers it was possible to perform an analysis comparing participating and non-participating individuals (Table 1).

Procedure

The examinations were performed by the first author two assistant nurses and a dietician who were trained in taking anthropometric measurements. Most of the examinations including interviews and anthropometry were performed within the hospital environment or in the participant’s home. The Nottingham
Methods

Profile (NHP) was sent by mail to the participants and was completed by them at home before the visit. Biochemical tests, the Geriatric Depression Scale -20 (GDS-20) and the additional questions were completed at the beginning of the visit and the other instruments were issued in the following order: Mini Nutritional Assessment (MNA), Mini Mental State Examinations (MMSE) and the Philadelphia Geriatric Center Multilevel Assessment Instrument (PGC MAI), followed by anthropometric and physical measurements, dietary assessment and measurement of the body composition.

Figure 1. Older individuals living in the municipality at the beginning of the study, and the procedure of selection and included individuals

<table>
<thead>
<tr>
<th>Year</th>
<th>Age Group</th>
<th>Selected</th>
<th>Non-Participants</th>
<th>Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>75-year-olds</td>
<td>1,016</td>
<td>700</td>
<td>316 Women, 270 Men</td>
</tr>
<tr>
<td>2002</td>
<td>80-year-olds</td>
<td>931</td>
<td>245</td>
<td>636 Women, 320 Men</td>
</tr>
<tr>
<td>2003</td>
<td>80-year-olds</td>
<td>844</td>
<td>391</td>
<td>636 Women, 320 Men</td>
</tr>
</tbody>
</table>

Non-participants: 271 Women, 125 Men

Total included: 583 Participants, 278 Women, 305 Men
### Table 1. Characteristics of participants (n=583) and non-participants (n=265) who answered questions in the request for participation

<table>
<thead>
<tr>
<th></th>
<th>Participants</th>
<th>Non-Participants</th>
<th>Participants</th>
<th>Non-Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Women</td>
<td>Men</td>
<td>Men</td>
</tr>
<tr>
<td></td>
<td>n=278</td>
<td>Frequency (%)</td>
<td>n=303</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td></td>
<td>n=150</td>
<td></td>
<td>n=115</td>
<td></td>
</tr>
<tr>
<td><strong>Cohabitation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>131 (47.1)</td>
<td>76 (50.7)</td>
<td>252 (82)</td>
<td>80 (68.4)</td>
</tr>
<tr>
<td>No</td>
<td>146 (52.5)</td>
<td>74 (49.3)</td>
<td>53 (17.4)</td>
<td>37 (31.6)</td>
</tr>
<tr>
<td><strong>Living arrangement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own house</td>
<td>78 (28)</td>
<td>31 (20.7)</td>
<td>127 (41.6)</td>
<td>33 (28.2)</td>
</tr>
<tr>
<td>Own apartment</td>
<td>178 (64)</td>
<td>108 (72)</td>
<td>169 (55.4)</td>
<td>74 (63.2)</td>
</tr>
<tr>
<td>Other¹</td>
<td>19 (6.8)</td>
<td>10 (6.7)</td>
<td>9 (3)</td>
<td>10 (8.5)</td>
</tr>
<tr>
<td><strong>Doctor visit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>222 (79.9)</td>
<td>119 (79.3)</td>
<td>243 (79.7)</td>
<td>95 (81.2)</td>
</tr>
<tr>
<td>No</td>
<td>52 (18.7)</td>
<td>22 (14.7)</td>
<td>62 (20.3)</td>
<td>19 (16.2)</td>
</tr>
<tr>
<td><strong>Medication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>249 (89.6)</td>
<td>129 (86)</td>
<td>257 (84.3)</td>
<td>97 (82.9)</td>
</tr>
<tr>
<td>No</td>
<td>28 (10.1)</td>
<td>16 (10.7)</td>
<td>48 (15.7)</td>
<td>16 (13.7)</td>
</tr>
<tr>
<td><strong>Self-perceived health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy</td>
<td>139 (50)</td>
<td>62 (41.3)</td>
<td>175 (57.4)</td>
<td>48 (41.7)</td>
</tr>
<tr>
<td>Less Healthy</td>
<td>139 (50)</td>
<td>88 (56.7)</td>
<td>128 (42)</td>
<td>67 (58.3)</td>
</tr>
</tbody>
</table>

¹ Block of service flats, retirement home, retirement home, rented house or apartment in a child’s house

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**Methods**

Paper I

In this paper the women (n=278) were examined regarding their self-perceived health, 139 women (50%) perceived themselves as healthy or less healthy. A one year follow-up was preformed to find possible changes in health. Women who still perceived themselves as healthy after one year and those who perceived themselves as suffering from impaired health from baseline to follow-up were compared with baseline data.
Methods

Paper II
Three hundred and three men had answered the question about self-perceived health and were selected for Paper II, and were followed at two to four follow-ups. At baseline, 175 men perceived themselves as healthy and 128 as less healthy. The men who perceived themselves as healthy at baseline were followed regarding their health over time, and those who perceived impaired health were included in the analysis only once.

Paper III
Women (n=277) and men (n=302) who answered the questions in the MNA were included. They were divided into two groups; at risk for malnutrition and at no risk for malnutrition according to the MNA. These groups were compared at baseline to find characteristics of women and men who were at risk for malnutrition. The individuals were followed regarding their nutritional status at two to four follow-ups.

Paper IV
57 women and 58 men aged 80 years, who had been interviewed for a 24-h recall at baseline and at follow-ups one and two, were included. The women and men were separately divided into groups according to their self-reported energy intake. A limit of 1500 kcal/24h was used as cut-off value for adequate intake of macro- and micronutrients, as has been suggested in the NNR 2004. These groups were followed for two years and were compared at baseline and over time both within and between groups.

Instruments and additional questions

The single question about self-perceived health was formulated as follows: “How do you perceive your health at the present time?” The answer alternatives were excellent, good, acceptable, bad and very bad. The participants were divided into two groups according to their self-perceived health; one group who perceived themselves as healthy (excellent/good health) and the other who perceived themselves as less healthy (acceptable/bad/very bad health). The reason for the division into these groups was statistically significant differences between the group with acceptable health and those with good and excellent health. No difference was found between the group with acceptable health and those with bad or very bad health.
The (NHP) (I,I,II,III) developed for older people, is an instrument for measuring health-related quality of life (Hunt & McEwen, 1980) and has been tested for validity and reliability in Swedish conditions (Wiklund et al., 1988). This instrument consists of six dimensions; physical mobility (8), pain (8), sleep (5), energy (3), social isolation (5) and emotional reactions (9). The dimensions consist of weighted statements, answered with yes or no, with a summarized score of 100 in each dimension. Every answer of yes indicates a problem in that dimension (Hunt & McEwen, 1980; Wiklund et al., 1988).

The (GDS) (I,II,III,IV) was developed and validated for an older population (Yesavage & Brink, 1983) with a sensitivity of 88% and specificity of 88%-100% among older people living independently (Montorio & Izal, 1996). The GDS was modified from 30 to 15 items to be more suitable for use in an older population and has found to be more reliable in outpatients (Wancata et al., 2006). The GDS-15 has been translated and modified for Swedish conditions (Gottfries et al., 1997) with an additional of five statements (GDS-20) that have been found to reflect underlying symptoms of depression (Gottfries et al., 1997). The statements were answered with yes or no, and scores ranged between 0 and 20. A higher score indicates more depression symptoms, and a score higher than 5 indicates suspected depression. The GDS-20, which is used in this study, has been tested at two primary centres with good agreement (Gottfries et al., 1997). This scale has been used in Sweden among stroke patients (Jönsson et al., 2005).

The (MNA) (I,II,III,IV) was developed to assess nutrition status among older people. The original version contains 18 weighted questions distributed across four areas; anthropometric measurements (BMI, MAC and CC) global assessments (related to lifestyle), dietary questions (food and fluid intake) and subjective assessments of health (Guigoz et al., 1996; Guigoz et al., 1997). It has been widely used for nutritional screening in different settings with a various sensitivity and specificity (Guigoz, 2006). The MNA has been used in different settings in Sweden (Christensson et al., 2002; Saletti et al., 2005).

The (MMSE) (I,II,III) is a screening instrument developed for assessment of cognitive capacity in clinical conditions (Folstein et al., 1975). Its reliability and validity have been tested in different countries and among different groups of older people (Appelros, 2005; Folstein et al., 1975; Pangman et al., 2000). The MMSE includes the individual’s orientation in time or space, orientation,
short-term memory, attention, language and visual and writing tasks. Every correct answer or action gives one score and the summative score is between 0 and 30 (Folstein et al., 1975). A score of \( \leq 23 \) has been found to indicate cognitive impairment ((Appelros, 2005; Pangman et al., 2000).

The (PGC MAI) (I,II,III) was developed for assessing subjective well being among older people, and is based on a model of behavioural competence (Lawton et al., 1982). The intermediate-length version used in this study, has been tested for reliability and validity in the US (Lawton et al., 1983) and in an older population in Sweden (Minhage et al., 2007). Sixty-eight items are distributed across eight domains of different character. The cognitive domain consists of intellectual function and memory problems, mobility index (ability of transporting oneself from the neighbourhood), physical health domain (frequency of hospital and doctor’ visits as well as health behaviours), ADL domain (basic and instrumental ADL), time use domain (different ways of spending time), personal adjustment (psychological well being), social domain (contact with family and friends), environmental domain (subjective housing and neighbourhood) and a demographical sector. A higher score in every domain indicates better status of function. The PGC MAI has been used among older people in Poland (Jaracz et al., 2004) and in Sweden (Wissing et al., 2002).

All participants were also asked questions about their walking ability outside and inside, exercise and eating habits, functional capacity, hearing and sight functions and social interaction. These questions were tested in a smaller group of older people, and a minor modification to their formulation was made.
Table 2. Instruments used in the papers

<table>
<thead>
<tr>
<th>Score</th>
<th>Area</th>
<th>Used in study</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNA (0-30)</td>
<td>&lt; 17 malnourished</td>
<td>Nutritional status</td>
<td>I, II, III, IV</td>
</tr>
<tr>
<td></td>
<td>17-23.5 risk for malnutrition</td>
<td></td>
<td>Switzerland, US, Mexico,</td>
</tr>
<tr>
<td></td>
<td>24-30 well nourished</td>
<td></td>
<td>Sweden</td>
</tr>
<tr>
<td>GDS-20 (0-20)</td>
<td>&gt;5 symptoms indicate suspected depression</td>
<td></td>
<td>I, II, III, IV</td>
</tr>
<tr>
<td>MMSE (0-30)</td>
<td>≤ 23 indicate cognitive impairment</td>
<td></td>
<td>USA, Sweden</td>
</tr>
<tr>
<td>NHP</td>
<td>Physical mobility (0-100)</td>
<td>Health-related quality of life</td>
<td>I, II, III</td>
</tr>
<tr>
<td></td>
<td>Pain (0-100)</td>
<td></td>
<td>England, Sweden</td>
</tr>
<tr>
<td></td>
<td>Sleep (0-100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy (0-100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social isolation (0-100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emotional reactions (0-100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGC MAI</td>
<td>Cognition (0-5)</td>
<td>Well being</td>
<td>I, II</td>
</tr>
<tr>
<td></td>
<td>Mobility (2-16)</td>
<td></td>
<td>III, US, Poland, Sweden</td>
</tr>
<tr>
<td></td>
<td>Physical health (7-19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADL (4-12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time use (7-50)</td>
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<td></td>
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<tr>
<td></td>
<td>Personal adjustment (0-5)</td>
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</tr>
<tr>
<td></td>
<td>Social (4-48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environment (5-14)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objective measurements

Biochemical measurements (II, III)
Serum analyses included albumin, transthyretin and C-reactive protein (CRP). Blood glucose and haemoglobin were tested by the researchers in capillary blood with at least three hours fasting. The blood tests were assessed using standard techniques and local reference values were used.

Blood pressure (II, III) was assessed with the participant in a lying position, with a manual gauge after the participant had rested for at least 15 minutes.
Handgrip strength (II, III, IV) was measured in the dominant hand using the JAMAR, an electronic dynamometer. The participant sat comfortably with their elbow flexed at 90 degrees and their shoulder adducted and neutrally rotated. The test was repeated three times and the highest value was recorded, to measure the maximum handgrip strength (Gale et al., 2006; Payette, 2005).

Anthropometry (I,II,III,IV)
Height and weight were measured in order to calculate Body Mass Index (BMI), kg/m². Weight was measured using an electronic balance scale with the participants wearing light clothes, and height was measured to the nearest 0.5 cm in a standing position. Mid-arm circumference (MAC) and Triceps Skinfold (TSF) were measured at the midpoint of the upper arm and between the tips of the acromion and the olecranon processes. TSF was measured using a Harpender Skinfold Caliper. Calf Circumference (CC) was measured at the thickest part of the calf. Arm and calf measurements were taken on the non-dominant side using a non-elastic tape measured to the nearest millimetre. Arm Muscle Circumference (AMC) was calculated using the formula AMC=MAC-0.1 (π *TSF) (Symreng, 1982).

Dietary assessment (IV)
In the group of 80-year-olds a 24-h recall was performed at each visit. The participants were asked to describe their intake of fluids and food the night and day before the visit (Gibson, 2005). A picture book, “The Meal Model” was used, showing different portion sizes for different kinds of foods and meal components, as well as thicknesses of sliced items (SNFA, 1997). Reported food intake was divided into eating events. Every time an intake of fluid and/or food was reported, it was quantified and divided into eating events. All reported intake was calculated in a program, Dietist XP comprising 2,500 food items based on different products. Standard portions in Dietist XP were used when estimated weight in the 24-h recall was missing.

Energy requirement and assessments of energy expenditure (IV)
Basal Metabolic Rate (BMR) (MJ/24 hour) was calculated for each individual, using the Schofield modified equation, for women ≥75 years 0.041*BW(kg)+2.61 and for men ≥75 years 0.035*BW(kg)+3.434. Expressed in kcal the sum is divided by four. For the estimation of energy expenditure, Physical Activity Level (PAL) 1.6 was used. This is the norm for a less active lifestyle, which means “seated work with some requirements to move around but little leisure activity” in the NNR (2004 p 122). The total energy
expenditure for each individual was calculated as BMR*PAL. To estimate the ratio of reported energy intake (EI) and estimated energy expenditure (EE) the formula EI/EE*100 (%) was calculated for each individual (Black 2000).

Body composition (IV) was measured using the Lunar Prodigy DXA and performed at the osteoporosis unit at the university hospital in Linköping. Total Fat Free Mass (FFM) was calculated from Lean Body Mass weight (kg) + Bone Mineral Content weight (kg). Fat Free Mass Index (FFMI) was calculated from FFM weight (kg)/height (m²). Fat Mass Index (FMI) was calculated from Total Fat Mass (FM) weight (kg)/height (m²) (Kyle et al., 2003).

**Statistical methods**

Data are presented in frequency, percent, (I, II, III, IV), arithmetic means, standard deviation and Confidence Interval (I, II, III), median and quartile 1 and 3 (I,II,III,IV). In order to compare groups at nominal and ordinal level non-parametric tests were used, such as the Chi-squared test (I, II, III, IV), Fisher’s exact test for small groups (IV), the Mann Whitney U-test for independent groups (I,II,III,IV) and the Wilcoxon signed ranks test for dependent groups (L,IV). In Paper IV the Kruskall Wallis test for comparing more than two independent groups was performed at baseline. Friedman’s test for repeated measurements and related groups was used when comparing the three groups over time with the Bonferroni post hoc test, performed for multiple comparisons (IV) (Altman, 1991). For continuous data Student’s t-test for independent groups was used (I,II,III).

**Multiple logistic regression analyses in Papers I and II.**

Multiple logistic regression analyses, forward stepwise methods, adjusted for age, were performed to find factors and predictors regarding a good self-perceived health among women and men (I,II). In all multiple logistic regressions analyses at baseline and follow-ups in Paper I and II, health was the dependent factor; the Less Healthy group was coded as 1 and the Healthy group as 2. Statistically significant variables in univariate regression analyses (II) and the test of Spearman’s correlation (I) between dependent and independent variables were used as independent factors in all multiple logistic regression analyses.
Methods

In the multiple regression analysis at baseline of women's health, in Paper I the following independent variables were used: BMI, GDS-20, MNA, all dimensions of the NHP and domains of the PGC MAI except the social and cognition domains. At baseline in Paper II, regarding men's health, the following independent factors were used: age, cohabitant, doctor visits, symptoms of illness, medication, blood glucose, haemoglobin, handgrip strength, MMSE, MNA, GDS-20, all dimensions of the NHP except sleep, all domains of the PGC MAI except cognition and ADL, limitations to walking more than 2 km and walking up and down stairs, and being satisfied with the contact with and the ability to visit others.

The predictor was the search for having maintained good health after one year (I,II) among women and men who still perceived good health compared with individuals with impaired health. Independent factors in Paper I were all dimensions of the NHP except the social dimension, the domain of physical health in the PGC MAI and limitations to walking up and down stairs. In the analyses of men after one year (II) the independent variables were: age, BMI, education, limitations to walking 2 km and up and down stairs. A further analysis (II) was performed among men who perceived themselves healthy at follow-ups 1-4 (n=326), which meant that every individual could participate up to four times and that each occasion counted as an independent measurement. The analyses also involved men who perceived impaired health over time (n=73). Independent variables were blood pressure, the GDS-20, the physical mobility, pain and energy dimensions of the NHP, the physical health and time use domains of the PGC MAI, education and limitations to walking 2 km and up and down stairs.

Multiple logistic regression analyses in Paper III
In the multiple logistic regression analyses, forward stepwise method, in Paper III, the dependent factors at baseline, were risk for malnutrition=1 (n=84) and no risk for malnutrition=0, (n=495). In the multiple logistic regression analyses at follow-ups 1-4, the dependent factors were new risk for malnutrition (n=132) (code =1) and repeated measurements of individuals at no risk for malnutrition (n=975) (code=0). The groups were compared with data from the previous year. Independent factors both at baseline and follow-ups were biochemical tests, anthropometrical assessments, the MMSE, the GDS-20, all dimensions of the NHP, all PGC MAI domains except cognition and self-perceived health, age and further questions about social and demographic factors. A further multiple logistic regression analysis, enter as
Methods

Method; based on the outcome of the second analysis, an interaction model was constructed using gender*GDS-20. The dependent factor was new risk/no risk and the independent factor were age, gender, GDS-20, gender*GDS-20 and self-perceived health. The level of statistical significance was set to the level of p<0.05.

Table 3. Statistical methods used in the different papers

<table>
<thead>
<tr>
<th>Paper</th>
<th>Statistical methods</th>
</tr>
</thead>
</table>
| I Self-perceived health among older women living in their own residence | Chi square test  
Mann-Whitney U-test  
Student’s t-test  
Spearman correlation test  
Pearson correlation test  
Wilcoxon signed rank test  
Multiple logistic regression analysis |
| II Self-perceived health among older men living in their own residence | Chi square test  
Mann-Whitney U-test  
Student’s t-test  
Univariate regressions analysis  
Multiple logistic regression analysis |
| III Malnutrition in a home-living older population: prevalence, incidence and risk factors. A prospective study. | Chi square test  
Mann-Whitney U-test  
Student’s t-test  
Univariate regressions analysis  
Multiple logistic regression analysis  
Interaction analysis |
| IV Self reported energy and nutrient intake among older people: a two year follow-up study | Chi square test  
Fisher’s exact test  
Kruskall Wallis test  
Mann-Whitney U-test  
Wilcoxon signed rank test  
Friedman’s test for repeated measurements with Bonferroni post hoc test |
ETHICAL ASPECTS

Written and oral information about the study were given to the individuals before they agreed to participate, including the possibility to withdraw from the study without giving any reason. Before a participant’s inclusion, informed consent was obtained, and he or she was guaranteed confidentiality. The participants were informed that the measurement of body composition and bone density would be performed using the DXA-method and were given a weak radiation dose. If the measurement showed osteoporosis, a consultation was sent to the primary health centre for further treatment. The participants could decide whether they wanted to see the results of the biochemical tests, and if the values were subnormal the primary health centre was contacted by either the participant or the researcher for further investigation. Those participants who were judged as malnourished were contacted by a dietician. Ethical approval was obtained from the Regional Research Committee in Linköping, dnr 97370.
RESULTS

Health among women and men

More than half of the participants, (54% n=314) perceived themselves as healthy, 50% (n=139) among women (I) and 57.8% (n=175) among men (II). Both similarities and differences were found in women’s and men’s self-perceived health. Irrespective of how they perceived their health, no cognitive impairment was found among women or men, according to the MMSE (I,II).

Characteristics at baseline among women (I) who perceived themselves as healthy included fewer women with symptoms of illness, 73% compared with 23% in the less healthy group (p<0.001); 31% among healthy women had >3 prescribed medicines compared with 60% in the less healthy group (p<0.001). More women in the healthy group, 53% had a longer education (>7 years) compared with 33% (p=0.001) among women who perceived themselves as less healthy. More men (II) in the healthy group had a cohabitant, 87% compared with 76% in the less healthy group (p=0.009). Fewer men in the healthy group had symptoms of illness 63% compared with 90% (p<0.001); and 25% in the healthy group had >3 prescribed medicines compared with 53% in the less healthy group (p<0.001); they also had a doctor to a lesser extent (p<0.001) compared with the less healthy men.

Women (I) who perceived themselves as healthy had a higher score on the MNA md 27 (q1-q3, 25-27) compared with the less healthy women md 25.5 (q1-q3, 23.5-27) (p<0.001). Men (II) in the healthy group had a MNA score of md 27 (q1-q3, 25.5-28) compared with less healthy men, md 26 (q1-q3 24-27.5). More women (I) than men (II) had suspected depression at baseline (>5 score on the GDS); 32.4% of the less healthy women compared with 7.9% among healthy women (p<0.001) and 17.2% among men in the less healthy group compared with 5.7% of the healthy men (p=0.002).

The healthy women (I) had fewer problems in all dimension of the NHP compared with the less healthy women. Among men (II) there were similar
Results

results, but no statistical difference was found among the groups in the dimension of sleep. Regarding the PGC MAI, healthy women had a better status in the domains of physical health, ADL, personal adjustment and environment p<0.001 compared with the less healthy women. Healthy men (II) had a better status in all domains except the personal adjustment compared with the less healthy men (Table 4).

<table>
<thead>
<tr>
<th>Instrument Score (Items)</th>
<th>Healthy women n=139 Md (q1-q3)</th>
<th>Less Healthy women n=139 Md (q1-q3)</th>
<th>P-value</th>
<th>Healthy men n=175 Md (q1-q3)</th>
<th>Less Healthy men n=128 Md (q1-q3)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in NHP 0-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical mobility (8)</td>
<td>0 (0-10)^a</td>
<td>19 (7-42)^b</td>
<td>&lt;0.001</td>
<td>0 (0-10)</td>
<td>11 (0-31)^c</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pain (8)</td>
<td>0 (0-10)^a</td>
<td>24 (8-52)^b</td>
<td>&lt;0.001</td>
<td>0 (0-10)</td>
<td>10 (0-29)^c</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleep (5)</td>
<td>11 (0-29)^a</td>
<td>31 (11-56)^b</td>
<td>&lt;0.001</td>
<td>11 (0-20)</td>
<td>11 (0-33)^c</td>
<td>0.064</td>
</tr>
<tr>
<td>Energy (3)</td>
<td>0 (0-0)^a</td>
<td>24 (0-61)^b</td>
<td>&lt;0.001</td>
<td>0 (0-0)</td>
<td>0 (0-61)^c</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Social isolation (5)</td>
<td>0 (0-0)^a</td>
<td>0 (0-0)^b</td>
<td>0.003</td>
<td>0 (0-0)</td>
<td>0 (0-0)^c</td>
<td>0.005</td>
</tr>
<tr>
<td>Emotional reactions (9)</td>
<td>0 (0-0)^a</td>
<td>0 (0-20)^b</td>
<td>&lt;0.001</td>
<td>0 (0-0)</td>
<td>0 (0-15)^c</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Domains in PGC MAI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognition 0-5</td>
<td>5 (5-5)^a</td>
<td>5 (5-5)^b</td>
<td>0.690</td>
<td>5 (5-5)^a</td>
<td>5 (5-5)^c</td>
<td>0.014</td>
</tr>
<tr>
<td>Mobility 2-15</td>
<td>14 (8-15)^a</td>
<td>13 (7-15)^b</td>
<td>0.041</td>
<td>15 (14-15)^a</td>
<td>14(13-15)</td>
<td>0.001</td>
</tr>
<tr>
<td>Physical health 7-19</td>
<td>18 (17-18)</td>
<td>15 (14-15)^b</td>
<td>&lt;0.001</td>
<td>17 (16-18)^a</td>
<td>15 (13-16)^c</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ADL 4-12</td>
<td>12 (12-12)</td>
<td>12 (10-12)^d</td>
<td>&lt;0.001</td>
<td>12 (12-12)</td>
<td>11 (11-12)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Time Use 7-50</td>
<td>19 (16-24)</td>
<td>18 (14-22)^d</td>
<td>0.003</td>
<td>20 (16-25)^a</td>
<td>17 (14-20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Personal adjustment 0-5</td>
<td>5 (4-5)</td>
<td>4 (4-5)^b</td>
<td>&lt;0.001</td>
<td>5 (4-5)^a</td>
<td>5 (4-5)^c</td>
<td>0.076</td>
</tr>
<tr>
<td>Social 4-48</td>
<td>23 (19-27)</td>
<td>23 (19-26)^g</td>
<td>0.477</td>
<td>23 (19-26)^g</td>
<td>21.5 (18-24)^i</td>
<td>0.011</td>
</tr>
<tr>
<td>Environment 5-14</td>
<td>14 (13-14)^j</td>
<td>13 (12-14)^j</td>
<td>&lt;0.001</td>
<td>14 (13-14)</td>
<td>13 (12-14)^j</td>
<td>0.016</td>
</tr>
</tbody>
</table>

A low score on the NHP indicated fewer problems and a high score on the PGC MAI indicated better status
Individuals missing ^a=1 ^b=2 ^c=3 ^d=4 ^e=5 ^f=6 ^g=7

Women (I) with self-perceived good health had a lower BMI mean 25.4 kg/m^2 (SD 3.5) compared with less healthy women, 27.5 kg/m^2 (SD 4.5) (p<0.001). Men (II) in the healthy group also had a lower BMI, mean 25.7 kg/m^2 (SD 3.0)
compared with less healthy men 26.1 kg/m² (SD 3.0) (p=0.2). Regarding handgrip strength, statistical differences were found in the groups of women and men. Women (I) in the healthy group had a mean of 24 kg (SD 5.2) compared with less healthy women with a mean of 22 kg (SD 6.5) (p=0.023). Handgrip strength among the healthy men (II) had a mean of 42 kg (SD 8.0) compared with that of less healthy men, mean 39 kg (SD 9.0) (p=0.003).

In the multiple logistic regression analyses performed at baseline among women and men separately, both different and similar significant factors were found. Important factors for healthy women (I) were fewer symptoms of depression (p=0.016) and a better status in the physical health domain (p<0.001) (Table 5). A better status in the physical health domain (p<0.001) was also of importance for the healthy men, (II) as having no limitations to walking 2 km (p=0.012) (Table 6).

Gender-specific predictors for maintaining health during the course of a year were found among women and men at follow-up 1. In a logistic regression analysis less pain (p=0.001) was important for healthy women (I) (Table 5). Among men (II) were no limitations to walking more than 2 km (p=0.009) important compared with less healthy men (Table 6).

At the four-year follow-up, (II) the predictors for maintaining health had changed for men. Education ≥ 7 years (p=0.048) (OR 1.79) had decreased in importance, but was still a predictor, with the addition of symptoms of depression (p=0.002) (OR 0.8) and no limitations walking up and down stairs (p=0.003) (OR 2.6).
### Results

Table 5. Significant factors for self-perceived good health among elderly women at baseline and after one-year follow-up. Baseline: Healthy women n=107, Less healthy women n=91 Nagelkerke $R^2 0.57$. One-year follow-up: Healthy women n=93, Less healthy women n=18 Nagelkerke $R^2 0.26$.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Factors for women</th>
<th>Value</th>
<th>P-value</th>
<th>OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy=2 Less Healthy =1</td>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GDS 0-20 score</td>
<td>0.016</td>
<td>0.81 (0.68-0.96)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical mobility (NHP) 0-100 score</td>
<td>0.029</td>
<td>0.97 (0.94-0.99)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Health (PGC MAI) 7-19 score</td>
<td>&lt;0.001</td>
<td>2.17 (1.68-2.80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>One-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pain (NHP) 0-100 score</td>
<td>0.001</td>
<td>0.96 (0.93-0.98)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sleep (NHP) 0-100 score</td>
<td>0.021</td>
<td>0.98 (0.96-0.99)</td>
<td></td>
</tr>
</tbody>
</table>

Lower score on the Geriatric Depression Scale (GDS) indicated fewer symptoms of depression and lower score on the Nottingham Health Profile (NHP) indicated fewer problems. Higher score on the Philadelphia Geriatric Center Multilevel Assessment Instrument (PGC MAI) indicated better status.


<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Factors for men</th>
<th>Value</th>
<th>P-value</th>
<th>OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy=2 Less Healthy =1</td>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age year</td>
<td>0.002</td>
<td>1.24 (1.08-1.42)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy (NHP) 0-100 score</td>
<td>0.027</td>
<td>0.97 (0.97-1.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Health (PGC MAI) 7-19 score</td>
<td>&lt;0.001</td>
<td>1.69 (1.33-1.98)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social domain (PGC MAI) 4-48 score</td>
<td>0.001</td>
<td>1.13 (1.05-1.19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limitations to walking 2 km 1=yes 2=no</td>
<td>0.012</td>
<td>3.16 (1.22-5.13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>One-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Education &lt;7 years ≥7 years</td>
<td>0.031</td>
<td>2.62 (1.09-6.31)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limitations to walking 2 km 1=yes 2=no</td>
<td>0.009</td>
<td>3.61 (1.38-9.49)</td>
<td></td>
</tr>
</tbody>
</table>

Higher score on the Philadelphia Geriatric Center Multilevel Assessment Instrument (PGC MAI) indicated better status. Lower score on the Nottingham Health Profile (NHP) indicated fewer problems.
Results

Risk for malnutrition

At baseline, 14.5% (84/579) were at risk for malnutrition (assessed using the MNA); among women 18.8% (n=52) and among men 10.6% (n=32). Statistically significant common variables were found among women and men who were at risk for malnutrition compared with those who were at no risk. The risk group had visit a doctor to a greater extent the previous year; 90% of the women in the risk group compared with 77% of the women at no risk (p=0.029), and 94% among men at risk compared with 77% for men at no risk (p=0.015). Regarding health, 75% of the women at risk perceived themselves as less healthy compared with 44% among women at no risk (p<0.001), and 63% of men at risk compared with 38% at no risk perceived themselves as less healthy (p=0.003). Women in the risk group were less satisfied with their contact with others (p<0.001) compared with women at no risk. More women in the risk group, (63.5%) were living alone compared with 19% among men at risk.

Among those individuals who were at risk for malnutrition and at the same time perceived themselves as less healthy 31% (26/84) were suspected to suffer from depression. Distributed among the women 40.4% (21/52) were at risk for malnutrition and perceived themselves as less healthy; among the men this figure was 15.6% (5/32).

In health-related quality of life women in the risk group had more problems in all dimensions of the NHP compared with women at no risk (p<0.05). Men in the risk group had more problems in the NHP dimensions of physical mobility, sleep, energy and social isolation compared with men at no risk (p<0.005). When assessed using the PGC MAI, women at risk had a worse status in physical health, a worse ADL, and lower scores in time use, personal adjustment and the environmental domain (p<0.01) compared with women at no risk. Men in the risk group perceived worse physical health, a worse ADL, had fewer activities in the time use domain, and lower scores in personal adjustment domain (p<0.01) compared with men at no risk for malnutrition (Table 7).
### Results

Table 7 Baseline data of the groups at risk and no risk of malnutrition in dimensions of NHP and domains of PGC MAI

<table>
<thead>
<tr>
<th>Instrument dimension/domain</th>
<th>Women at risk n=52</th>
<th>Women at no risk n=225</th>
<th>Men at risk n=32</th>
<th>Men at no risk n=270</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHP Physical mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0-100)</td>
<td>20.4 (8-52.5)</td>
<td>0 (0-20.3)</td>
<td>10.2 (0-40.5)</td>
<td>0 (0-13.9)</td>
<td>0.018</td>
</tr>
<tr>
<td>Pain</td>
<td>19.6 (0-52)</td>
<td>0 (0-26.0)</td>
<td>0 (0-28.3)</td>
<td>0 (0-18.5)</td>
<td>0.779</td>
</tr>
<tr>
<td>Sleep</td>
<td>22.6 (0-75.3)</td>
<td>11.1 (0-33.7)</td>
<td>11.1 (11.1-37.7)</td>
<td>11.1 (0-19.6)</td>
<td>0.003</td>
</tr>
<tr>
<td>Energy</td>
<td>36.8 (0-94.1)</td>
<td>0 (0-23.8)</td>
<td>23.8 (0-60.6)</td>
<td>0 (0-23.8)</td>
<td>0.004</td>
</tr>
<tr>
<td>Social isolation</td>
<td>0 (0-14.6)</td>
<td>0 (0-0)</td>
<td>0 (0-0)</td>
<td>0 (0-0)</td>
<td>0.336</td>
</tr>
<tr>
<td>Emotional reactions</td>
<td>8.1 (0-24.7)</td>
<td>0 (0-7.7)</td>
<td>0 (0-8.8)</td>
<td>0 (0-0)</td>
<td></td>
</tr>
<tr>
<td>PGC MAI Cognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7-19)</td>
<td>5 (5-5)</td>
<td>0.039</td>
<td>5 (5-5)</td>
<td>5 (5-5)</td>
<td>0.662</td>
</tr>
<tr>
<td>Mobility</td>
<td>9 (6-15)</td>
<td>0.043</td>
<td>14 (11-15)</td>
<td>15 (14-15)</td>
<td>0.087</td>
</tr>
<tr>
<td>Physical health</td>
<td>15 (13-16)</td>
<td>0.001</td>
<td>14 (12-16)</td>
<td>16 (15-18)</td>
<td>0.001</td>
</tr>
<tr>
<td>ADL</td>
<td>11 (10-12)</td>
<td>0.001</td>
<td>12 (10-12)</td>
<td>12 (12-12)</td>
<td>0.001</td>
</tr>
<tr>
<td>Time use</td>
<td>17 (13-21)</td>
<td>0.004</td>
<td>16 (12-21)</td>
<td>19 (15-23)</td>
<td>0.020</td>
</tr>
<tr>
<td>Personal adjustment</td>
<td>4 (3-5)</td>
<td>0.001</td>
<td>4 (3-5)</td>
<td>5 (4-5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Environment</td>
<td>21 (16-25)</td>
<td>0.034</td>
<td>24 (17-27)</td>
<td>22 (19-25)</td>
<td>0.424</td>
</tr>
<tr>
<td>Social</td>
<td>13 (11-14)</td>
<td>0.002</td>
<td>13 (12-14)</td>
<td>14 (13-14)</td>
<td>0.052</td>
</tr>
</tbody>
</table>

Missing individuals: ²=1 ³=2 ⁴=3 ⁵=4 ⁶=5

Higher score on the PGC MAI better well being and lower score on the NHP indicated fewer problems at health related quality of life.
Results

In the logistic regression analyses explanations for the risk for malnutrition at baseline were found. Two important findings were a lower handgrip strength and worse physical health ($p<0.001$) (Table 8).

Table 8. Explanations of the risk for malnutrition at baseline according to the MNA, risk group (n=62) and group at no risk (n= 360).

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Predictors</th>
<th>Value</th>
<th>P-value</th>
<th>Or (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk/ no risk at malnutrition (Baseline data)</td>
<td>Age 75 and 80 years</td>
<td>0.025</td>
<td>1.166</td>
<td>(1.019-1.333)</td>
</tr>
<tr>
<td></td>
<td>Albumin g/l</td>
<td>0.002</td>
<td>1.173</td>
<td>(1.061-1.297)</td>
</tr>
<tr>
<td></td>
<td>TSF mm</td>
<td>0.015</td>
<td>0.932</td>
<td>(0.880-0.986)</td>
</tr>
<tr>
<td></td>
<td>Handgrip strength kg</td>
<td>&lt;0.001</td>
<td>0.938</td>
<td>(0.908-0.970)</td>
</tr>
<tr>
<td></td>
<td>Physical Health 7-19 score</td>
<td>&lt;0.001</td>
<td>0.65</td>
<td>(0.554-0.762)</td>
</tr>
</tbody>
</table>

For Albumin, TSF and Handgrip, strength is the real value noted. Physical Health was assessed using the PGC MAI, in which higher score indicated better health.

Follow-up 1-4
The incidence of risk for malnutrition was 10% (21 women and 22 men) at Follow-up 1 and 16% (28 women and 32 men) at Follow-up 2. Follow-ups 3 and 4 were performed only on the 75-year-old group; at the third follow-up 11% of 157 individuals (11 women and 6 men) were at risk for malnutrition and at Follow-up 4, 8% (3 women and 9 men) were at risk. Higher age ($p=0.005$), lower self-perceived health and more symptoms of depressions ($p=0.001$) were important predictors of developing malnutrition the forthcoming year (Table 9). The interaction analysis controlling for gender shows that depression symptoms appeared as stronger associations among men (Table 10). OR for men was 1.26 and for women 1.03, showing a higher risk in men of developing malnutrition.

In the group of women and men who were at new risk for malnutrition, 13% (9/69) were suspected to suffer from depression and were less healthy. Distributed according to gender, 11.7% (3/34) of the women and 17.1% (6/35) of the men were at new risk for malnutrition, suspected to suffer from depression and less healthy. In the group assessed to be at risk for malnutrition at follow-ups 1-4 compared with the risk group at baseline, more
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individuals perceived better physical mobility (p=0.035) and energy (0.023), in the dimensions of the NHP and better ADL (p=0.003) and a higher level of activity in the time use domain of the PGC MAI.

Table 9. Predictors of being at risk for malnutrition according to the MNA, based on data the previous year. Included in the model: risk group (n=91) and group at no risk (n= 723).

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Predictors</th>
<th>Value</th>
<th>P-value</th>
<th>Or (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New risk/ no risk of malnutrition</td>
<td>Age 75-82 years</td>
<td>0.005</td>
<td>1.161</td>
<td>(1.047-1.286)</td>
</tr>
<tr>
<td></td>
<td>Self-perceived health 1=Less healthy 2= Healthy</td>
<td>0.001</td>
<td>0.432</td>
<td>(0.267-0.701)</td>
</tr>
<tr>
<td></td>
<td>GDS-20 0-20 score</td>
<td>0.001</td>
<td>1.178</td>
<td>(1.071-1.295)</td>
</tr>
</tbody>
</table>

A higher score on the GDS indicated more symptoms of depression.

Table 10. Interaction model of predictors of gender according to a low score on the MNA, regarding the outcome of the multiple regression analyses shown in Table 9. Included in the model: risk group (n=119) and group at no risk (n= 896).

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Predictors</th>
<th>Value</th>
<th>P-value</th>
<th>Or (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New risk/ no risk of malnutrition</td>
<td>Age 75-82 years</td>
<td>0.015</td>
<td>1.117</td>
<td>(1.022-1.221)</td>
</tr>
<tr>
<td></td>
<td>Gender 1=man 2=women</td>
<td>0.042</td>
<td>1.946</td>
<td>(1.023-3.702)</td>
</tr>
<tr>
<td></td>
<td>Self-perceived health 1=less healthy 2= healthy</td>
<td>&lt;0.001</td>
<td>0.443</td>
<td>(0.289-0.676)</td>
</tr>
<tr>
<td></td>
<td>GDS-20 0-20 score</td>
<td>0.001</td>
<td>1.522</td>
<td>(1.185-1.954)</td>
</tr>
<tr>
<td></td>
<td>Gender*GDS-20 0-20 score</td>
<td>0.018</td>
<td>0.828</td>
<td>(0.707-0.969)</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A higher score on the GDS indicated more symptoms of depression.
Self-reported energy intake

Among the 115 individuals in the study, three groups appeared in the analysis with different self-reported energy intake both at baseline and over time. One group consisting of 11 women and four men had an energy intake of <1500 kcal/24h on all occasions, a second group consisting of 38 women and 28 men had a fluctuating energy intake, ±1500 kcal/24h, and a third group consisting of eight women and 26 men had an energy intake of ≥1500 kcal.

The reported energy intake was low among the 115 80-year-old individuals compared with the estimated energy requirement of 2000 kcal for women and 2400 kcal for men at baseline and the two follow-ups. Women reported an average of 1414 kcal - 1473 kcal and men reported an average of 1643 kcal - 1810 kcal, and both women and men reported the lowest energy intake at Follow-up 1.

At baseline, 15% reported an energy intake above the estimated requirement, 7% at Follow-up 1 and 8% at Follow-up 2. The reported average energy intake was 75% of the estimated requirement among women and 76% among men at baseline, and decreased over time. Risk for malnutrition according to the MNA was 13%-16.5%, increasing over time and fluctuating in different groups. More than five symptoms of depression were found in 9.6% (8 women and 5 men) at at least two visits with no correlation to the reported energy intake r=0.02.

Women and men in each group had on average a value within the limits for the recommended intake of E% Protein and E% Fat, and the groups were slightly below the limit for E% Carbohydrate. In all groups the vitamins A, D, E, and folate as well as the reported fibre intake at baseline and follow-ups were on average below the NNR recommendations.

Women had an average body weight of 65.9kg at baseline, range (46-94kg) and 63.7kg at Follow-up 2, (range 45-91kg). Men weighed an average of 79.1kg at baseline (range 60-100kg) and 78.4kg at Follow-up 2, (range 61-103kg). It was the women and the men in the fluctuating group who experienced significant weight loss over time, with the women losing 2.4kg (p=0.01) and the men losing 2 kg (p=0.01). Women who reported ≤1500 kcal had the lowest FFM
Results

(average 36.1kg) compared with 39.8kg in the group of ±1500 kcal (p=0.013) and 40.9kg in the group of ≥1500 kcal (p=0.003). Among the men there were no significant differences found when comparing groups. Handgrip strength was stable over time, on average 22kg among women and 39kg among men at all three visits.

Table 11. Weight, self-reported energy intake and intake of micronutrients among women (n=57), at baseline and the two follow-ups. They are divided in three groups with different self-reported energy intake, one group <1500 kcal, the second group ±1500 kcal and the third group ≥1500 kcal. Estimations are based on one 24 h recall/participant and year.

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Weight kg Md (q1-q3)</th>
<th>Energy Intake kcal Md (q1-q3)</th>
<th>Vitamin A/µg (700 µg)1 Md (q1-q3)</th>
<th>Vitamin D/µg (10µg)1 Md (q1-q3)</th>
<th>Vitamin E/mg (8 mg)1 Md (q1-q3)</th>
<th>Folate/µg (300 µg)1 Md (q1-q3)</th>
<th>Fibre/g (25-35g)1 Md (q1-q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1500 kcal</td>
<td>57.9 (53-60)</td>
<td>1338 (906-1477)</td>
<td>481 (431-629)</td>
<td>3.8 (2.1-4.7)</td>
<td>5 (4-6.1)</td>
<td>196 (99-267)</td>
<td>14.7 (10-19)</td>
</tr>
<tr>
<td>±1500 kcal</td>
<td>67.5 (58.9-76.6)</td>
<td>1452 (1231-1836)</td>
<td>540 (349-866)</td>
<td>3.9 (2.6-9.9)</td>
<td>6.4 (4.5-8.1)</td>
<td>172 (134-227)</td>
<td>14.5 (11-20)</td>
</tr>
<tr>
<td>≥1500 kcal</td>
<td>70.5 (66.1-75.8)</td>
<td>1729 (1457-1915)</td>
<td>454.5 (340-724.8)</td>
<td>2.4 (1.2-6.5)</td>
<td>5.4 (4.1-6.9)</td>
<td>189 (133-205)</td>
<td>15.3 (12-23)</td>
</tr>
</tbody>
</table>

Follow-up1

| <1500 kcal        | 57.4 (52.7-62.2)     | 1220 (1132-1296)              | 426 (341-627)                    | 3.1 (2.1-4.3)                    | 5.4 (4-6.7)                      | 172 (120-223)                 | 16.2 (11.3-179)               |
| ±1500 kcal        | 65.9 (59.2-75.3)     | 1415 (1174-1598)              | 574 (428-879.7)                  | 3.2 (2.0-4.0)                    | 5.3 (3.7-6.7)                    | 168 (132-211)                 | 15.1 (11.4-18.6)              |
| ≥1500 kcal        | 70.2 (63.6-76.4)     | 1653 (1598-1767)              | 588 (507.8-704.8)                | 3.2 (2.1-15.7)                   | 4.9 (3.5-6.6)                    | 195 (162-219)                 | 17.8 (14.3-21.4)              |

Follow-up2

| <1500 kcal        | 59 (50.8-61.5)       | 1251 (899-1484)               | 482 (333-915)                    | 2.7 (1.9-3.7)                    | 4.8 (3.8-6.7)                    | 161 (104-207)                 | 13.5 (9.8-19.2)               |
| ±1500 kcal        | 65.1 (58.8-74)a      | 1407 (1219-1684)              | 534.5 (353.3-854.5)              | 3.1 (2.3-6.1)                    | 4.8 (3.9-7.4)                    | 163 (134-246)                 | 15 (11.6-20.3)                |
| ≥1500 kcal        | 70.2 (62-76.1)       | 1747 (1655-1895)              | 643 (522.5-870)                  | 4.2 (3.8-5)                      | 6.3 (4.8-7.6)                    | 185 (155-230)                 | 16 (15.1-21.4)                |

1=Recommendations in NNR 2004

a= p<0.0167 women in the ± 1500 kcal group had lost 2.6 kg from baseline to Follow-up 2
Table 12. Weight, self-reported energy intake and intake of micronutrients among men (n=58), divided in three groups with different self-reported energy intake at baseline and the two follow-ups. One group reported <1500 kcal, the second group ±1500 kcal and the third group ≥1500 kcal. Estimations are based on one 24 h recall/participant and year

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Weight (kg) Md (q1-q3)</th>
<th>Energy intake kcal Md (q1-q3)</th>
<th>Vitamin A/µg (300 µg) Md (q1-q3)</th>
<th>Vitamin D/µg (10 µg) Md (q1-q3)</th>
<th>Vitamin E/mg (10 mg) Md (q1-q3)</th>
<th>Folate/µg (300 µg) Md (q1-q3)</th>
<th>Fibre/g (25-35g) Md (q1-q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=4</td>
<td>&lt;1500 kcal</td>
<td>87.9 (83.8-93.4)</td>
<td>1119 (998-1365)</td>
<td>373.5 (230-771)</td>
<td>2.1 (1.6-4)</td>
<td>101 (72-147)</td>
<td>10 (5.7-16.3)</td>
</tr>
<tr>
<td></td>
<td>±1500 kcal n=28</td>
<td>81.1 (73.6-85.5)</td>
<td>1769 (1517-2056)</td>
<td>844.5 (478-1154)</td>
<td>4.3 (3.2-8.2)</td>
<td>7.4 (5-9)</td>
<td>197.6 (156-256)</td>
</tr>
<tr>
<td></td>
<td>≥1500 kcal n=26</td>
<td>76.3 (66-85.6)</td>
<td>1863 (1665-245)</td>
<td>657 (441.5-1073)</td>
<td>3.2 (2.8-5.4)</td>
<td>5.9 (5.1-7.8)</td>
<td>190.4 (168-247)</td>
</tr>
<tr>
<td>n=4</td>
<td>&lt;1500 kcal</td>
<td>87.1 (77.5-89.9)</td>
<td>1231 (904-1392)</td>
<td>438.5 (237-820)</td>
<td>2 (1-2.4)</td>
<td>3.4 (4-5.7)</td>
<td>111.6 (107-117)</td>
</tr>
<tr>
<td></td>
<td>±1500 kcal n=28</td>
<td>79.7 (71.6-85.5)</td>
<td>1521 (1326-1775)</td>
<td>524 (427-766.5)</td>
<td>3.2 (2.7-6.1)</td>
<td>6.3 (4.7-9.2)</td>
<td>181 (152-220)</td>
</tr>
<tr>
<td></td>
<td>≥1500 kcal n=26</td>
<td>76.5 (66-85.7)</td>
<td>1834 (1650-2109)</td>
<td>712.5 (499.5-925)</td>
<td>4.3 (3-5.7)</td>
<td>6.4 (5-8.6)</td>
<td>228 (204-262)</td>
</tr>
<tr>
<td>Follow-up1</td>
<td>&lt;1500 kcal</td>
<td>84.3 (81.5-89.8)</td>
<td>1185 (1012-1380)</td>
<td>272 (208.5-627)</td>
<td>2.7 (2.2-3.8)</td>
<td>4.8 (3.8-6.8)</td>
<td>118 (79-146)</td>
</tr>
<tr>
<td>n=4</td>
<td>±1500 kcal n=28</td>
<td>79.1 (71.8-83.2)</td>
<td>1434 (4259-1778)</td>
<td>553 (407-780)</td>
<td>4.1 (2.6-7.9)</td>
<td>5.7 (4.6-8.4)</td>
<td>158 (146-184)</td>
</tr>
<tr>
<td></td>
<td>≥1500 kcal n=26</td>
<td>76.3 (66-82.8)</td>
<td>1911 (1722-2186)</td>
<td>697 (583-959)</td>
<td>4.1 (3-5.8)</td>
<td>7 (5.1-8.3)</td>
<td>221 (177-260)</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

1 Recommendations in NNR 2004

a = p<0.0167 men in the group ≥1500 kcal had lost 2 kg from baseline to Follow-up 2
b = p<0.0167 between <1500 kcal and ± 1500 kcal at baseline,
c = p<0.0167 between <1500 kcal and ≥1500 kcal at baseline
d = p<0.0167 regarding vitamin A and E within ≥1500 kcal, a higher intake at baseline than Follow-up 1
### Results

Table 13. Women (n=57) and men (n=58) regarding body composition assessed at baseline

<table>
<thead>
<tr>
<th></th>
<th>Fat Mass kg (Md (q1-q3))</th>
<th>Fat Mass Index (kg/m²) (Md (q1-q3))</th>
<th>Fat Free Mass kg (Md (q1-q3))</th>
<th>Fat Free Mass Index (kg/m²) (Md (q1-q3))</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500 kcal n=11</td>
<td>21.1 (19.4-23.9)</td>
<td>8.9 (8.2-10.9)</td>
<td>36.1 (31.9-37.3)a</td>
<td>14.9 (14.3-15.9)</td>
</tr>
<tr>
<td>±1500 kcal n=38</td>
<td>26.9 (21.3-32.7)</td>
<td>10.5 (8.1-12.8)</td>
<td>39.8 (36.1-43.8)</td>
<td>15.4 (14.4-16.3)</td>
</tr>
<tr>
<td>≥1500 kcal n=8</td>
<td>29.8 (20.5-32.8)</td>
<td>10.2 (7.2-13.2)</td>
<td>40.9 (38.0-46.2)</td>
<td>15.7 (14.2-17.1)</td>
</tr>
<tr>
<td>All Women</td>
<td>26 (20.7-31.4)</td>
<td>10.1 (8.1-12.1)</td>
<td>39 (36.1-43.5)</td>
<td>15.4 (14.4-16.3)</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500 kcal n=4</td>
<td>28.8 (23.7-35.4)</td>
<td>10.2 (7.8-12.1)</td>
<td>57.2 (52.5-58.7)</td>
<td>19.2 (17.9-20.3)</td>
</tr>
<tr>
<td>±1500 kcal n=28</td>
<td>23.3 (20.6-25.8)</td>
<td>7.7 (7.9-8.2)</td>
<td>54.4 (51.9-60.7)</td>
<td>18.4 (17.3-19.4)</td>
</tr>
<tr>
<td>≥1500 kcal n=26</td>
<td>21.8 (13.8-25.7)</td>
<td>7.2 (4.6-8.7)</td>
<td>55.7 (51.4-63.7)</td>
<td>18.5 (17.5-20.2)</td>
</tr>
<tr>
<td>All Men</td>
<td>23.5 (19.1-25.9)</td>
<td>7.7 (6.2-9)</td>
<td>54.9 (51.7-61)</td>
<td>18.5 (17.5-20)</td>
</tr>
</tbody>
</table>

Fat Mass (kg) = Total body fat mass, Fat mass Index = Total body fat mass kg/(height m²)
a=p<0.0167 women with an intake of <1500 kcal had the lowest FFM compared to those with intakes of ±1500 kcal and >1500 kcal.
DISCUSSION

The overall aim of this thesis was to follow the development of nutritional status and its significance to general health. Regarding to the purpose, different factors were found to be important for women’s and for men’s health. Risk factors for malnutrition and factors for developing malnutrition were also different. There was however a strong association between risk for malnutrition, feeling less healthy and symptoms of depression.

In the present study 50% women and 58% men perceived themselves as healthy and 52.5% of all women lived alone compared with 17.4% among the men. Men in the healthy group were living with a cohabitant to a greater extent than those in the less healthy group. Among women such a difference was not found; half of the women in the healthy group were living alone. A longer education, >7 years, was important for perceiving good health among women and for maintaining good health among men. Socioeconomic circumstances have been discussed in the literature as important for a good health (Arber & Cooper, 1999) and give older men an advantage compared with older women, since they more often had a longer education and better economy. Women are more vulnerable due to living alone to higher extent than older men do (Borglin et al., 2005).

How older people perceived their health differ in different cultures and countries. A Spanish study has found that about 50% of an older home-living population perceived themselves as healthy (Damian et al., 1999); in Russia this figure is only 10% and in Finland 39% feel healthy (Vourosalmi 2008). In the present study higher age was a factor of good self-perceived health, which might partly depend on the fact that there were more men in the 80-year-old group. (Eriksson et al., 2001) found that irrespective of age men perceived themselves as healthy to a greater extent than women did, but the contrary was found in Spain, where women perceived better health than did men of the same age (Damian et al., 1999). There can be several reasons for this contrary result, but three possible ones are the over- or underestimation of health (Eriksson et al., 2001; Undén & Elofsson, 2006) and/or increasing survivorship among people in the healthy group (Idler, 1993). Common for the studies above was that fewer symptoms of illness and disease were associated with better self-perceived health (Vuorisalmi et al., 2008).
Discussion

A better status in physical health according to the PGC MAI was the only common factor explaining good self-perceived health at baseline for both women and men. This domain included self-reported diagnoses such as heart diseases, cancer, muscular and skeletal problems. According to Boorse this part of physical health is confirmed diseases (Boorse, 1977). When looking at the number of individuals who had symptoms of illness regardless of their self-perceived health this would be discussed in terms of their ability to realize important goals in life (Nordenfelt, 2000). Both these theories would be useful in combination with each other and are not contrarily related.

Physical activity is one of the explanatory factors for self-perceived good health. Among women this was represented by physical mobility indoors and for men the ability to walk 2 km outdoors was most important. The ability to walk outdoors was still important after one year for maintaining self-perceived good health among men. This fact stresses the importance for men to have the ability to walk outdoors.

These two different patterns of activity seen from a life perspective could be partly explained by different activities among women and men in their lives. Upkeep of the home has principally been women’s work and is probably still important, while men have had a greater possibility to have outside activities together with others in combination with work (Irwin, 2003). Gale et al. (2007) found that men were more engaged in hobbies that involved activity outdoors. This could be a reason why it is important and for why men who become disabled and can not perform their normal activities experience a negative influence on their self-perceived health. On the other hand, the men in the study were living with a cohabitant to higher extent than the women were and thus carried the sole responsibility for the upkeep of their homes.

Other studies have found different results: A Finnish study found an improvement in walking outside and using stairs at ages 65-79, while limitations to mobility increased at 77 years and older in Sweden (Parker & Thorslund, 2007). Among men in the present study, physical activity was still important from a time perspective of two to four years, but it had become more important to walk up and down stairs. The group of men had aged and at the end of the study they were 79 and 82 years old, respectively. These predictors might indicate a displacement of the activity to the importance of moving indoors and the possibility to move around in the neighbourhood but not as important as moving a distance of 2 km outdoors, Parker (2007) asserts
that the nearest environment, both indoors and outdoors, is associated with self-perceived health and gives information for future interventions, as well as the need for aids (Parker & Thorslund, 2007). The experience of energy in the NHP dimension was a factor for a self-perceived health among men. This dimension might be associated with the importance of the physical activity outdoors, having energy and spending time with friends and next of kin. Such correlation has been found in a previous study in Finland (Uutela et al., 2003). Having energy facilitates the ability to perform hobbies as well as a positive attitude to life for successful aging.

At the one-year follow-up no common factor was found among women and men, which could explain good self-perceived health. For women, fewer problems with pain and sleep were important factors for maintaining good health, which could indicate that women had more problems in these areas than men did. In earlier studies this has been verified to decrease health-related quality of life (Borglin et al., 2005; Grimby & Svanborg, 1997). In general, self-reported pain has increased among older people in Sweden during the past two decades (Parker and Thorslund 2007). It might be those women who had problems with pain and sleeping who have experienced impaired health. Pain itself could be one of the causes for impaired sleep and may cause problems in physical mobility and the ability to perform activities in daily life. A study by Leville and co-authors (2007) found that pain increases disabilities among women over time, especially among women who are already disabled (Leville et al., 2007). This is an example of older people needing to adapt to the circumstances and change their daily life. This might be one of the reasons for that some people maintain their health and others do not (Atchley, 1999). From the perspective of life and how the gender roles have developed, there can be different strategies for women and men to maintain their health (Irwin, 2003).

In the present study, women and men who perceived themselves as healthy as well as being at no risk for malnutrition had had more contact with next of kin and friends. They also participated to a greater extent in social activities, and this is reflected in a higher score in the time use domain of the PGC MAI. More participation in social activities could create conditions for better health; on the other hand, people who feel healthy are more interested in participating in social activities. Irrespective of culture contact with others is important; a study from Korea found it be more important among older women (Lee et al., 2008), as well as in Sweden (Berg et al., 2006).
Discussion

No or few symptoms of depression were important for both women and men regarding self-perceived good health, but on different occasions. Among women it was a strong factor at baseline and for men it was a predictor for maintaining their self-perceived health over time. Regardless of living conditions and country poor health and symptoms of depression have been related (Alpass & Neville, 2003; Damián et al., 2008).

Symptoms of depression seem to be a link between the risk for malnutrition and feeling less healthy or the contrary – having no symptoms of depression is most important for maintaining a good nutritional status and good self-perceived health. On the other hand it could be the opposite: that no or few symptoms of depression and self-perceived good health indicate good nutritional status. Among men it seems to be more important over time the older they are, but among women it is a factor for health and a good nutritional status in general. Connected to the analysis over time, regarding nutritional status, symptoms of depression - especially among men - were seen as a strong predictor for developing malnutrition in combination with feeling less healthy. Depression symptoms have been found to be associated with the risk for malnutrition among individuals recently admitted to hospital (German et al., 2008), among hospitalized older people (Chen et al. 2007; Feldblum et al. 2009) and among older people with home-care service (Visvanathan et al., 2003).

In the present study, a higher number of women than men at risk for malnutrition lived alone. In a study by Pirlich et al. (2005) no differences were found among women and men at risk, but a higher rate of those in the risk group lived alone.

In the present study, objective measurements, lower handgrip strength, higher albumin and lower TSF, were risk factors for malnutrition at baseline. The albumin value was interestingly higher in the risk group, but within the reference value. Possible reasons for this is an imbalance of the hydration status or a confirmation of the weak association between albumin and malnutrition (Alberda et al., 2006). The anthropometrical average values in this study were within the normal range, but the distribution could be a sign of development toward malnourishment. Regarding those individuals who were at risk at the first visit, we had no knowledge from the previous year and they could thus have been at risk for a longer time. Earlier research has found that
Discussion

already malnourished individuals had subnormal values in objective nutritional parameters (Christensson et al., 2002).

Handgrip strength was significantly lower in the risk group for malnutrition compared with the group at no risk. This relationship was also found between the less healthy and the healthy groups. Handgrip strength is a simple assessment and can be used in investigations among older people and as a complement to the MNA. Different cross-sectional studies have found an association between low handgrip strength and risk for malnutrition (Gale et al., 2006; van Lier & Payette, 2003). Functional factors like handgrip strength might be a consequence of risk for malnutrition as well as a decreasing muscle mass.

Women and men who perceived themselves as healthy had a lower BMI than the less healthy groups did. The mean values in the whole sample were 26.5 among women and 25.9 among men, which are above the limit for overweight. A normal BMI for older people is suggested to be in the range of 24-27kg/m², since within this limit less morbidity has been found (Beck & Ovesen, 1998).

In the present study, 14.5% were at risk for malnutrition assessed with the MNA. Similar results, (12%) in home-living older people have been found in the UK (Margett et al., 2003). These figures differ; 5-40% was found in a mixed population (Beck & Ovesen, 1998) and in home-care service (Saletti et al., 2005; Visvanathan et al., 2003). Guigoz (2006) suggest that about 21% at risk for malnutrition in a mixed home-living population would be found. In the present study, the incidence of risk for malnutrition was between 7.5%-16% during a period of four years; this was equally distributed among women and men. Interestingly, the highest number of individuals at risk was at the second follow-up when the participants were 77 and 82 years old.

Lower health-related quality of life was found in the risk group and the less healthy group compared with the group at no risk and the healthy group. A review by Chen and co-author (2001) found that physical and social wellbeing was associated with risk for malnutrition. In the present study, only a few dimensions and domains appeared as factors for developing malnutrition in the regression analyses but differences in most areas were found between the groups in univariate analyses.
Discussion

Thirteen percent of the group who reported their energy intake was at risk for malnutrition according to the MNA, which was in proportion to the whole sample. In this study no correlation was found between low reported energy intake and being at risk according to the MNA. But the contrary was found in a review of the MNA by Guigo 2006. Those individuals, in the present study, who reported their energy intake and who were at risk for malnutrition varied over time, which could be because they were slightly above or below the limit for being at risk according to the MNA. A variation in symptoms of depression was also found; about 10% had more than five symptoms at at least two visits, but with no correlation to reported energy intake.

Both women and men had on average a low reported energy intake of 75% of the estimated requirement of 2000 kcal among women and 2400 kcal among men. Meal habits can change over time, and one 24-h recall a year is not enough to make an exact assessment of energy intake. Interestingly, 10% of the sample reported < 1500 kcal at every visit, without any weight loss, which could indicate an underreporting or day-to-day variation. This has been described in Black (2000) who found a variance of about 23% for one 24-h recall (Black, 2000). It could be suggested that there was great variation of activity in the group, and the estimated PAL 1.6 can apply to the group in its entirety. The same limit was used and fit a group of home-living women (Gustafsson 2002), and a PAL of 1.56 was estimated from the recorded energy intake of men at a nursing home (Adamson 2009).

In the present study, weight loss was seen mainly in the group with a fluctuating energy intake. Weight loss is one of the reasons for a higher risk for hospitalization (Jensen et al., 2001). Energy intake is underestimated in relationship to older people’s function and mobility (Rosenberg, 2000).

Food intake is associated with socializing and women in the present study who reported an energy intake <1500 kcal were all living alone. Meal quality impaired and the number of eating events is decreasing in older women (Sidenvall et al., 1996). Women who have recently become widows lose the “meaning” of the meal and eat less than previous (Gustafsson & Sidenvall, 2002). Women in the present study had an average energy intake over time between 1414-1473 kcal/day. This is in line with women living at a nursing home who had a recorded intake of 1474 kcal/day, which was above the measured BMR of 1174 kcal/day (Lammes & Akner, 2006).
Method discussion
Participation in the study was rather low, 49.5%. This is in line with other studies which have shown a similar response rate: 46% in a mixed population of different ages (Søgaard et al., 2003) and 47% in a home-living older population (Borglin et al., 2005). According to Søgard et al. (2003) the results can be equally even with higher participation if the socio-demographic data are similar in the participating and non-participating groups. In the present study, 265 non-participating individuals answered questions about health, demographical and medical factors and comparisons between these groups were possible. Interestingly, there were more differences among men than women. This might imply that the results would have reflected greater differences, especially among men, if more had chosen to participate. Generalizing the results of this study would be possible in studies performed in a similar population and area. The greater part of older people lives in their own residence under different circumstances and should be the best group to study. The participating group was positive to the research and this was shown through low drop-out over time, 76% of the 75-year-olds and 79.7% of the 80-year-olds fulfilled the study. The non-participating group was not interested, or considered themselves to be too healthy or too ill to participate.

The dichotomization of self-perceived health was based on the fact that statistical differences were found between the groups with acceptable health and good/excellent health and bad/very bad health. Thus acceptable health was more in line with bad/very bad health. It is likely a cultural habit to not complain when asked about one’s health.

A strength is that it was a prospective study with the possibility to follow the individuals over time and find predictors for maintaining good health and predictors of developing malnutrition. The method of using data from the previous year for developing malnutrition and maintaining good health was not found in a search of other studies.

The number of questionnaires can be both a strength and limitation. They represent different areas of life, and the combination of objective and subjective assessments gives a more holistic perspective in the study. All questionnaires used in the study were developed for older people, but since
Discussion

this is a heterogeneous group the floor and ceiling effect must be taken into account (Polit & Beck, 2008). Regarding the MNA, a critical aspect has been pointed out: there is a small limit between different grades of nutritional status, and individuals can be classified as being at risk for malnutrition when they are not (Beck et al., 2001). A review of the MNA showed sensitivity between 41-100% and specificity between 13-98 % (Guigoz, 2006).

A limit in the study is the use of a single 24-h recall during a period of a year but in this study it was based on one face-to-face interview in connection with the yearly examination. The interview was performed in peace and quiet and the combination of the use of a picture book with a description of the portion sizes has facilitated the participants’ descriptions. It would have been valuable if PAL had been assessed for every individual instead of using the estimated value, but the description of PAL 1.6 corresponds to the traditional understanding of older people’s activity.

Clinical implications
The present study has found predictors for maintaining health and the developing risk for malnutrition among older home-living people. These findings can be used by different professionals in medical and home-care service for a regular assessment, using the simple question of self-perceived health and using the MNA and the GDS. This combination of assessments can be a base for the judgement of nutritional status and self-perceived health and offers the possibility to discover problems and take action when needed. Hopefully, this will create conditions for older people to live in their own residence for a longer time with maintained health and decreasing risk for malnutrition.
CONCLUSIONS

The experience of a good physical health was the only common factor for a good self-perceived health among women and men.

No or few symptoms of depression and a good physical mobility were characteristics for women who perceived themselves as healthy. Experience of good sleep and having no problems with pain were important for maintaining health during a period of one year.

Having a good social network, ability to walk a distance outdoors and perceive energy were characteristics for men who perceived themselves as healthy.

The ability to walk a distance outdoors and a longer education were conditions for men to maintain their health during a period one year. No symptoms of depression and the ability to walk up and down stairs were predictors for maintaining health over time.

The prevalence of risk for malnutrition was 14.5%, and was higher among women than men. Lower handgrip strength, lower physical health and lower TSF were found in the risk group for malnutrition compared with the group without risk.

The incidence for developing risk for malnutrition at Follow-ups 1-4 was between 7.6% and 16.2%. The highest risk for developing malnutrition was a combination of impaired self-perceived health and increased number of symptoms of depression. Men with symptoms of depression had the highest risk of developing malnutrition.

Reported energy intake was low compared to estimated energy requirement. Risk for malnutrition, symptoms of depression and individuals who perceived themselves as less healthy were found irrespective of reported energy intake.

Hälften av kvinnorna hade en bra självskattad hälsa vid första besöket, trots att 73 % samtidigt hade sjukdomssymptom. För dem var det viktigt att kunna röra sig utan problem, att ha en bra fysisk hälsa och frånvaro av depressionssymtom. Kvinnorna som upplevde bra hälsa hade också bättre näringstillstånd och hälsorelaterad livskvalitet jämfört med dem som upplevde en sämre hälsa. Efter ett år hade 69% fortfarande en bra hälsa och i den gruppen var det viktigast att inte ha problem med smärta eller sömn och ha en bra rörelseförmåga framförallt inomhus.

Jämfört med kvinnorna var det fler män, 58% som angav att de hade en bra självskattad hälsa samtidigt som 63% hade besvär av olika sjukdomssymptom. Fler män, 87% i gruppen med bra självskattad hälsa levede tillsammans med en partner jämfört med 76% i gruppen som upplevde sämre självskattad hälsa. För att männen skulle uppleva en bra hälsa var det viktigt att ha en bra fysisk hälsa, bra socialt kontaktnät, och att kunna vara fysiskt aktiv utomhus. Även näringstillståndet var bättre hos de män som skattade sin hälsa som god jämfört med de män som upplevde sämre hälsa. Efter ett år hade 75 % fortfarande en bra hälsa, utomhusaktiviteter i kombination med utbildning längre än 7 år viktigast. Sett i ett tidperspektiv av två till fyra år, var
Sammanfattning på svenska

förmågan att kunna gå i trappor och frånvaro av depressionssymptom de viktigaste faktorerna för en självskattad bra hälsa.

När deltagarnas näringstillstånd bedömdes visade det sig att 14,5% hade risk för undernäring, 52 kvinnor och 32 män. Det var betydligt fler kvinnor i riskgruppen som levde ensamma jämfört med männen, och kvinnorna var mindre nöjda med sitt sociala kontaktnät. De som hade störst risk för undernäring var äldre, hade en lägre handstyrka, upplevde en generellt sämre hälsa och hade svårare att klara de dagliga aktiviteterna jämfört med dem som hade ett bra näringstillstånd. Mellan 10 % och 16 % utvecklade risk för undernäring under en tidsperiod av ett till fyra år. I den gruppen var det fler som skattade en försämrad hälsa och hade ett varierat antal depressionssymptom. Risken för att utveckla undernäring var störst för män med depressionssymptom.

En grupp 80-åringar, (57 kvinnor och 58 män) intervjuades vid tre besök, om vad de hade ätit och druckit under föregående dag. De allra flesta rapporterade ett för lågt energiintag i förhållande till behovet. Framförallt var intaget av vitaminerna A, D, E, och folat för lågt, men även fiberhalten i maten var lägre än det rekommenderade intaget för äldre personer. Både kvinnorna och männen minskade i vikt, kvinnorna minskade i genomsnitt med drygt två kg under 2 år och männen drygt ett kg under motsvarande tid. Totalt bedömdes 13,5%-16% vara i riskzonen för undernäring och ca 13% hade ett flertal depressionssymptom.

**Sammanfattning:** För kvinnor som hade en bra självskattad hälsa var det viktigt att utan problem kunna röra sig inomhus och för män att vara fysiskt aktiva utomhus är en viktig del. Depressionssymptom i kombination med att uppleva en försämrad hälsa och ha en sämre handstyrka ökar risken att utveckla undernäring. Av dem som genomförde en kostregistrering hade flertalet ett för lågt energiintag och ett för lågt intag av flera vitaminer.

Klinisk betydelse: För att kunna identifiera äldre personer som är i riskzonen för undernäring rekommenderas regelbunden bedömning av näringstillståndet i kombination med självskattad hälsa och frågor om depressionssymptom.

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