FOOD CONSUMPTION AND LIFE SATISFACTION IN OLDER WOMEN: KUOPIO FALL PREVENTION STUDY (KFPS)

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The evaluation of nutritional status and risk of malnutrition and the formulation of suitable interventions for older adults are hindered by limited research on health status and lifestyle of this target population. New knowledge is needed on older adult's wellbeing, specifically on food consumption associated with life satisfaction in older people.

This study analyzed the associations of food consumption with life satisfaction in 914 Finnish older women (74-83 years old), belonging to the Kuopio Fall Prevention Study (KFPS) which is a 2-year randomized controlled trial. Baseline data was used for this cross-sectional study, consisting of 914 participants. Nutritional and life satisfaction data were obtained from the baseline questionnaire, and anthropometric measurements were collected by healthcare professionals at baseline visit. The associations between food consumption and life satisfaction (satisfied, intermediate, and dissatisfied) were analyzed with parametric and non-parametric tests, and the multinomial logistic regression model was adjusted for potential confounding variables, such as marital status, BMI, alcohol and aerobic exercise.

Decreased food intake in the last three months and protein-containing foods were significantly associated with life satisfaction. Women who did not decrease their food intake in the last three months were significantly more likely to be satisfied. Satisfied women were more likely to consume protein containing foods twice a week compared to once/week, while women conuming protein containing foods more than twice a week were more likely to be dissatisfied. After adjustment, significant differences between life satisfaction categories were confirmed, as participants who did not decrease their food intake in the last three months were less likely to be dissatisfied with life. Background variables, such as marital status and smoking, were also significantly associated with life satisfaction. Married/cohabiting women and non-smokers were more likely to be satisfied with life.

In conclusion, life satisfaction was associated with decreased food intake and protein containing foods consumption in older women in Finland. The associations between food consumption and life satisfaction in older women highlight the need for a greater focus on the possible interactions that occur between nutrition and subjective wellbeing in older adults and how these factors are influenced by the individual, culture, and society.

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ABBREVIATIONS

ESPEN (European Society for Clinical Nutrition and Metabolism)

FFMI (Fat Free Mass Index)

FFQ (Food Frequency Questionnaire)

HRQoL (Health Related Quality of Life)

KFPS (Kuopio Fall Prevention Study)

LS (Life Satisfaction)

MNA (Mini Nutritional Assessment)

OECD (Organisation for Economic Co-operation and Development)

QoL (Quality Of Life)

SWB (Subjective Well-Being)

T2DM (Type 2 Diabetes Mellitus)

WHO (World Health Organization)

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1 INTRODUCTION

The global population is aging fast and the wellbeing of older people is of considerable interest. As the number of older persons is expected to double by 2050 and nearly reach 2.1 billion, older people will outnumber people under the age of 15 for the first time in history, triggering consequences to almost all aspects of health and healthcare, including healthcare economy and resource utilization (United Nations 2017). Finland's main contributor to population aging is increased life expectancy, with women living over 5 years more than men (84.5 years and 78.9 years, respectively). Finland's life expectancy at birth is 81.7 years old and has steadily increased since 2000 (OECD/European Observatory on Health Systems and Policies 2019). Finnish population in 2018 was composed of 19.2% of older adults aged 65-84 and it is estimated to reach 22.3% by 2030 (Statistics Finland 2019).

The elderly age is characterized by a cognitive and functional decline (Harada et al. 2013, Colón-Emeric et al. 2013). Nutritional intake is compromised within the geriatric population, and malnutrition is common symptom in older population. Major physiological factors influencing nutrition in senior citizens include reduced appetite and energy intake, reduced sense of smell, poor dentition, altered absorption, deficiency of macro- and micronutrients, hospitalization, and diseases (Agarwal et al. 2013). The wellbeing of older adults is important, and evidence suggests that physical health, longevity, quality of life (QoL), and subjective well-being (SWB) might be influenced by physiological and nutritional changes occurring within the aging process (Steptoe et al. 2015, Raggi et al. 2016).

The promotion of healthy aging and the improvement in QoL and health-related quality of life (HRQoL) are major aspects of current health promotion policies and interventions targeting seniors (Milte & McNaughton 2016). Nonetheless, research on SWB and health at older ages is still primitive. Even though research on Finnish older adults' wellbeing and nutritional status is growing, the relationship between food consumption, nutritional status and self-reported LS is understudied. This study aims to address the association between nutritional status and food consumption on life satisfaction (LS), using food-related variables to assess the food consumption pattern and utilizing LS as an indicator of SWB at baseline in older Finnish women aged 71-84 years living in Kuopio (city and municipality in the region of Northern Savonia) who participated in KFPS (Kuopio Fall Prevention Study).

2 LITERATURE REVIEW

2.1 NUTRITIONAL STATUS AND FOOD CONSUMPTION IN OLDER ADULTS

2.1.1 Nutritional status and aging

Nutrition and health are major concerns in older adults (O'Keeffe et al. 2019). A healthy diet that offers protection against malnutrition and noncommunicable diseases is a vital element of healthy aging due to preventive effect on multiple health outcomes (Safouris et al. 2015), and support of normal immune function (Maggini et al. 2018). An individual's nutritional status can be influenced by several physiological and lifestyle changes which are discussed in this chapter (Upadhyay & Tripathi 2017).

Physiological changes

The identification of the factors responsible for dysfunctional age-related changes is challenging, though it is evident that both men and women are subject to a reduction in both total energy expenditure (Manini 2010) and physical activity levels (Milanović et al. 2013). Unintentional weight loss in individuals over 70 years old is common and is frequently due to an association of physiological anorexia of aging with lean mass and fat mass loss (Stajkovic et al. 2011), placing older people at higher risk of pathological weight loss (Wilson & Morley 2003). Weight loss generally predicts poor outcomes for older adults increasing the risk of decreased QoL in older adults (Crogan 2017). Overall, weight loss is associated with muscle and fat loss (Dunne et al. 2019), frailty (Rockwood & Howlett 2018), functional deterioration (Morley 2007), and mortality (Bulut et al. 2019).

Other nutrition-related physiological changes in body composition include loss of body water (Lorenzo et al. 2019) and a relative increase in fat mass (Jafari Nasabian et al. 2017). Digestive tract diseases in older adults are frequently common and exert influence on nutritional status (Dumic et al. 2019). Decreases in taste and smell acuity, deteriorating dental health, and/or changes in the neuronal tissue together with changes in the olfactory system (smell) contribute to decline in overall sensory perception of food (Burks et al. 2017), which favors decrease or loss of appetite (Pilgrim et al. 2015).

Changes in dietary requirements

The set of physiological changes occurring in aging affect dietary requirements and food consumption. Compared to younger population, older adults have lower energy requirements, yet micronutrient requirements remain unchanged. The aging population is subject to a decline in metabolic rate, secondary to reduced weight and muscle mass loss and a decrease in daily activity levels. One form of older adult malnutrition is manifested as sarcopenia, a condition characterized by skeletal muscle mass and function loss due to decreased levels of physical activity and/or protein intake inadequacy (Santilli et al. 2014). Therefore, nutrient density of the diet is of primary importance to prevent malnutrition and promote wellbeing (Mann & Truswell 2012).

Mechanisms behind energy expenditure in older adults are explained in Figure 1. The aging process influences the food behavior of individuals, producing a linear decrease in energy intake and a simultaneous decrease in macronutrient and micronutrient intake (Ter Borg et al. 2015, Clegg & Williams 2018). Both changes in dietary pattern composition and variety of foods consumed contribute to a further reduction in energy intake in older adults (Roberts & Rosenberg 2006). Despite the reduced needs, these metabolic changes still pose a risk of nutritional imbalance.

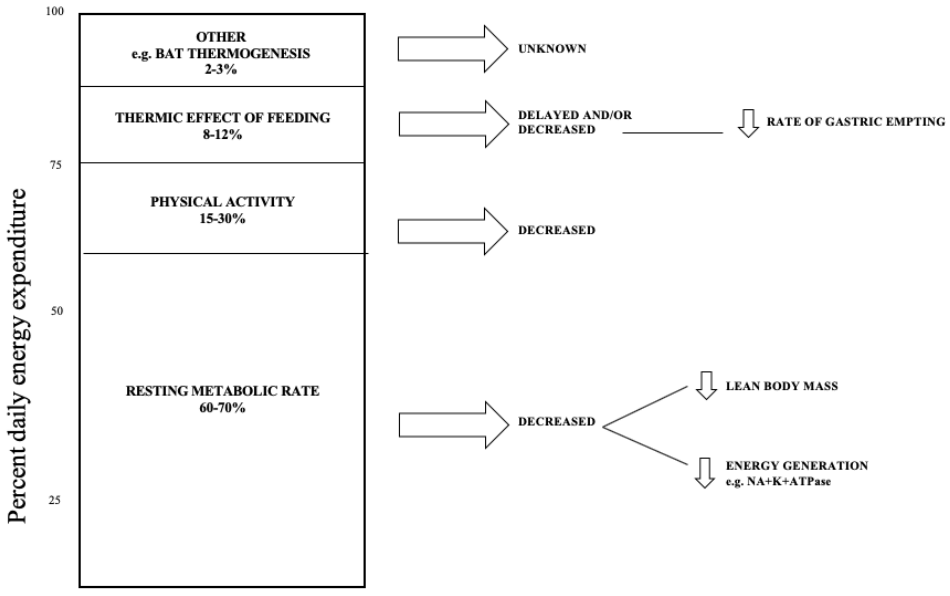

Figure 1. Effects of aging on energy expenditure. Adapted from: Manini (2010) and Roberts et al. (1996).

BAT, Brown Adipose Tissue; RMR, Resting Metabolic Rate; NA, Sodium; K, Potassium; ATPase, adenosine triphosphatase.

Dietary changes in older adults are also due to lifetime preferences, taste, physiological transitions in aging, social aspects, e.g. loneliness, economic status, and disability, that are considered key determinants affecting dietary routine (Suominen 2007), represented in Figure 2.

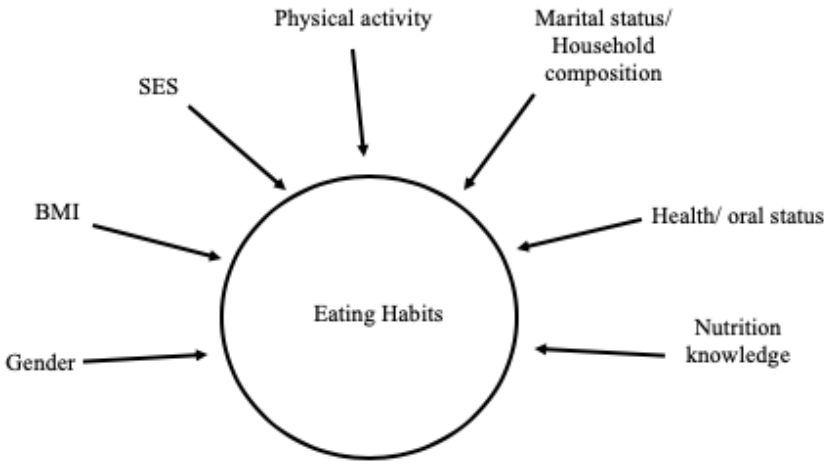

Figure 2. Some key determinants of eating habits among older adults. Adapted from: Dunneram & Jeewon (2015).
BMI, Body Mass Index; SES, Socio Economic Status.

2.1.2 Nutritional recommendations for older adult population

The European Society for Clinical Nutrition and Metabolism (ESPEN) developed nutrition and hydration guidelines for the geriatric population (Volkert et al. 2019) which include a series of effective strategies to counteract adverse symptoms like malnutrition and dehydration. The guidelines are presented in Table 1.

Table 1. ESPEN guidelines on clinical nutrition and hydration in geriatrics.

ESPEN guidelines on clinical nutrition and hydration in geriatrics
• Protein intake in older persons should be at least 1g protein per kg body weight and day. The amount should be individually adjusted regarding to nutritional status, PAL, disease status and tolerance.
• Provided that there is no specific deficiency, micronutrients should be delivered according to the recommendation for healthy older persons.
• All older persons independent of specific diagnosis and including also overweight and obese persons shall routinely be screened for malnutrition with a validated tool in order to identify those with (risk of) malnutrition.
• A positive malnutrition screening shall be followed by systematic assessment, individualized intervention, monitoring and corresponding adjustment of interventions.
• Nutritional and hydration care for older persons shall be individualized and comprehensive in order to ensure adequate nutritional intake, maintain or improve nutritional status and improve clinical course and QoL.
• Potential causes of malnutrition and dehydration shall be identified and eliminated as far as possible.
• Dietary restrictions that may limit dietary intake are potentially harmful and should be avoided.
• Older persons with malnutrition or at risk of malnutrition and with eating dependency in institutions as well as at home shall be offered mealtime assistance in order to support adequate dietary intake.

PAL, Physical Activity Level; QoL, Quality of Life.

The food guide pyramid for older adults is an educational tool displaying the optimal servings to be consumed every day from each basic food group to help people 50 years or older reach adequate nutrient intakes (Rizvi 2009). “My plate for older adults” is a recent and updated important tool to provide guidance on food, fluid, and physical activity for 50+ years old individuals developed by nutrition scientists at Tufts University Jean Mayer USDA Human Nutrition Research Center on Aging (2016). Finland adopted a similar graphic for food guidance for the general population (Finnish Food Authority, 2019c) highlighting importance of good nutrition for maintenance of health, functional ability, and QoL and acceleration of recovery.

The Finnish nutritional recommendations are built on the Nordic Nutrition Recommendations (2012). More specifically, for an adult over 75 years old, with low to moderate PAL, recommendations suggest an energy requirement reference value of 1700-1900 kcal (7.1 to 8.2 MJ)/day for females and for males 2010 to 2300 kcal (8.4 to 9.6 MJ)/day at group level

(Wahlqvist 2005). Minimum values are set at 1500 kcal/day (Finnish Food Authority, 2019b). Special recommendations for Finnish older adults include a versatile, tasty, colorful and protein-rich diet, low salt consumption, and high-quality vegetable fats. Supplementation of vitamin D (20 micrograms all year round) and regular physical activity (endurance and muscular strength training) is advised (Finnish Food Authority, 2019a). A summary for Nordic and Finnish nutrition recommendations for older adults are presented in Table 2.

Table 2. Nordic and Finnish nutrition recommendations for older women. Adapted from: Nordic Nutrition Recommendations (2012), Fogelholm et al. (2014), Suominen et al. (2014).

Energy and macronutrients	**Nordic Nutrition Recommendations (women, ≥75)**	**Finland nutrition guidelines (≥75)**
Energy (Kcal/MJ)	1700-1900 kcal (7.1 to 8.2 MJ)/day, minimum values are set at 1500 kcal/day.	1500 kcal/day The energy needs of adults are approx.: 30 kcal/kg*/day in bed patients or in low-motion, normal-weight subjects 35 kcal/ kg*/day underweight 25 kcal/kg*/day for obese A suitable body mass index for the healthy elderly is 25-30 kg / m2
Carbohydrates (E%)	45-60, dietary fibre 25-30 g/day (3g/MJ)	45–60, dietary fibre 25-35 g/day (3g/MJ)
Protein (E%)	15–20 (1.1-1.3 g/kg BW/d)	15-20 (<8 MJ / day), should increase accordingly 1.2-1.4 g/kg for people over 65
Fat (E%)	25-40	25-40

BW, Body Weight.
*target weight kg (BMI 21-23 kg/m2)

The five key nutritional guidelines for Finnish older adults are presented by the Finnish Nutritional Council (Suominen et al. 2014):

1. The nutritional needs in different age and disability groups should be considered.
2. The nutritional status and food intake of older individuals should be assessed regularly.
3. An adequate intake of energy, protein, fibre, other nutrients and fluids should be guaranteed.
4. The use of a vitamin D supplement (20 μg per day) recommended.
5. The importance of physical activity is highlighted.

2.1.3 Food consumption in older Finnish adults

Dietary trends in older people in Finland are routinely monitored with health behavior surveys collected in reports published by the National Institute for Health and Welfare (THL) (in Finnish: Terveyden ja hyvinvoinnin laitos). The latest report on health behavior and health among the Finnish elderly displays trends in the time period of 1993–2013 (Helldán & Helakorpi 2014) and shows dietary improvement in the age group between 65 and 84 years old. A reduction in butter and high-fat milk contrasted an increase in mixture of butter and oil on bread and for cooking, compared with the previous years. Daily bread consumption among people aged 65-79 fell the most. More specifically, the proportion of subjects who have eaten at least 1-3 slices has decreased compared to 2011, whereas the proportion of subjects who do not consume dark bread at all has increased. In 2013, 29% of women aged 65-84 reported eating at least 4 slices of dark bread daily, compared with 35% in 2011. The use of white bread (French bread or similar) also decreased: only 6% of women eat a slice or more of white bread daily. In 2013, 36.8% of women did not consume any glass of milk/day, 45.5% consumed 1-2 glasses/day, and 16.9% drank 3-4 glasses/day. The use of fatty cheeses decreased between 1997 and 2007 but increased again between 2007 and 2013. Daily consumption of vegetables, fruits and berries increased in the long term in both men and women. In 2013, 37% of women reported eating fresh vegetables every day. In this age group, 35% of men, and 40% of women report eating berries and fruits every day.

Consumption of warm meals is less common among older adults than at younger age. Eating two hot meals a day has decreased between 1993 and 2013. In 2013, about one-third of retired people aged 65-84 reported eating both lunch and dinner. Eating two hot meals was more common in older age groups. Interestingly, breakfast is becoming more common: in 2013, 97% of women had breakfast in the morning. Although diets seem healthier than before, the number of warm meals consumed by older adults decreased. According to the literature, most individuals consume breakfast and lunch and skip dinner (Holstila et al. 2012, Helldán and Helakorpi 2014).

In 2013, 40% of women aged 65-84 reported having not consumed alcohol in the past year, compared with 62% for women in 1993. The proportion of men and women of retirement age drinking alcohol at least once a week has increased significantly between 1993 and 2013. In 2013, 24% of women reported drinking alcohol at least once a week, compared with 8% in

1993. Also, among women aged 65-79, the proportion of those who drink at least 5 alcohol servings per week has increased during follow-up. In contrast, in women aged 80 to 84, weekly consumption of at least five doses of alcohol remained rare (Helldán & Helakorpi 2014).

2.1.4 Food consumption assessment tools and importance in older adults

Habitual diets and the drop in food consumption complicate the ability for older adults to meet nutritional needs (Robinson et al. 2012). Thus, the relevance of overall quality of diet and nutrient-density in older age must not be overlooked, as the maintenance, or the increase in diet quality, may complicate the attainment of sufficient nutrient intake (Robinson et al. 2018). Screening of inadequate dietary intake or malnutrition is essential to determine at-risk individuals in the geriatric population and support nutrition management (Isautier et al. 2019). Care-dependent older adults require monitoring with observational records by trained dietitians or health professionals, whereas healthy older adults are usually assessed with dietary recall methods or food frequency questionnaire (FFQ), a useful and valid tool for the nutrient assessment of older women in epidemiological research (Erkkilä et al. 2012).

A short FFQ is an easy-to-use tool that provides useful information about food consumption of older adults, it does not imply analysis of nutrients, and it can be used by non-specialist researchers (Robinson et al. 2017). Short questionnaires are advantageous tools for investigating correlations for the consumption of determined food or food categories and to rank individuals according to their consumption of specific foods/food groups (Eysteinsdottir et al. 2012). Therefore, they may be used to study the relationship between the consumption of several specific foods/food groups and various health and wellbeing-related endpoints. Another advantage is that it does not rely on short-term memory and involves relatively short respondent burdens, compared with many other dietary assessment methods (Shim et al. 2014). The main limitation of the FFQ is low accuracy caused by limited recall due to fading memory and varying degrees of cognitive decline (recall bias) (Jia et al. 2008). Being able to determine whether cognitive and functional abilities are sufficient in order to correctly recall, record and perform dietary assessment remains a big challenge for health professionals (De Vries et al. 2009). The most common problem in these methods is considerable over- or underreporting of the foods consumed (Shim et al. 2014). Examples of short FFQ are displayed in Table 3.

Table 3. Short food questionnaires for food consumption assessment in older adults.

Questionnaire name	Description
SFFFQ (Cleghorn 2017)	A qualitative short FFQ (25 items) focusing on fruit, vegetables, fibre-rich foods, high fat and high-sugar foods, meat, meat products and fish. Aim: measure dietary quality and estimate a dietary quality score (DQS) for population surveys.
AGES-FFQ (Eysteinsdottir et al. 2012)	A short FFQ on present dietary intake developed especially for the Age, Gene/Environment Susceptibility-Reykjavik Study (AGES-Reykjavik Study) used to rank individuals according to their level of intake of several important foods/food groups.
Short Diet Questionnaire (SDQ) (Shatenstein & Payette 2015, Gilsing et al. 2018)	A 36-item qualitative FFQ focused on foods and nutrients, including total fat and fatty acids, dietary fibre, calcium, vitamin D, and fruits and vegetables. Used to estimate dietary intake in a subsample of the Canadian Longitudinal Study on Aging (CLSA).
Dietary Screening Questionnaire (Bailey et al. 2007)	A diet screening questionnaire to assess two distinct dietary patterns in a sample of adults 65 years and older. Possible outcomes include a "nutrient-dense" pattern characterized by fruit, vegetables, whole grains, dairy, and lean meats, and a "less healthy" pattern characterized by cakes, cookies, candies, ice cream, salty snacks, and processed meats.
Protein Screener (Pro55+) (Wijnhoven et al. 2018)	A short (10 food items) free questionnaire that estimates the chance of a low protein intake (<1.0 gram /per kilogram body weight/day) for older adults. Developed by the Vrije Universiteit Amsterdam (the Netherlands). A chance of more than 30% as a high risk on a low protein intake.
The Food Frequency Questionnaire (Clover et al. 2007)	A 15-item FFQ to estimate calcium intake in community-dwelling older adults and to be used as a screening tool to allow health professionals to identify those who are most at risk of inadequate dietary calcium intake.

FFQ, Food Frequency Questionnaire; DQS, Dietary Quality Score; AGES, Age Gene/Environment Susceptibility-Reykjavik Study; CLSA, Canadian Longitudinal Study on Aging.

2.1.5 Malnutrition

Malnutrition and the risk of malnutrition are prevalent in older adults (Soini et al. 2011). Malnutrition has been extensively studied in older adults, although several definitions have been developed, they are common in affirming malnutrition as the inequality between nutritional intake and the body's requirements eventually causing physiological changes. Table 4 presents the most common developed malnutrition definitions.

Table 4. Definitions of malnutrition.

Source	Definition
ICD 11 for Mortality and Morbidity Statistics (ICD 2019)	Undernutrition is a condition in which the body's requirements are unmet due to underconsumption or to impaired absorption and use of nutrients. It can be produced by lack of access to food, or as a consequence of illness. Undernutrition commonly refers to a deficit in energy intake, but can also refer to deficiencies of specific nutrients, and can be either acute or chronic.
World Health Organisation (WHO 2016)	Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses three broad groups of conditions: undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age); micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes, and some cancers).
White et al. (2012)	Malnutrition refers to the imbalance between nutrition intake and requirements that ultimately causes changes in body weight, body composition, and physical function.

ICD, International Statistical Classification of Diseases.

Etiology and prevalence of malnutrition

Malnutrition is known for its multifactorial etiology (Locher 2015) and occurs when diet components like energy, protein or both do not reach sufficient and satisfactory levels (Van der Pols-Vijlbrief et al. 2014, Morley 2018). Protein-energy undernutrition is classified according to the origin: primary, i.e. caused by decreased food intake of nutrients, or secondary, i.e. to gastrointestinal or metabolic disorders, and wasting (Morley 2018). The mechanism behind malnutrition etiology is further explained in Figure 3.

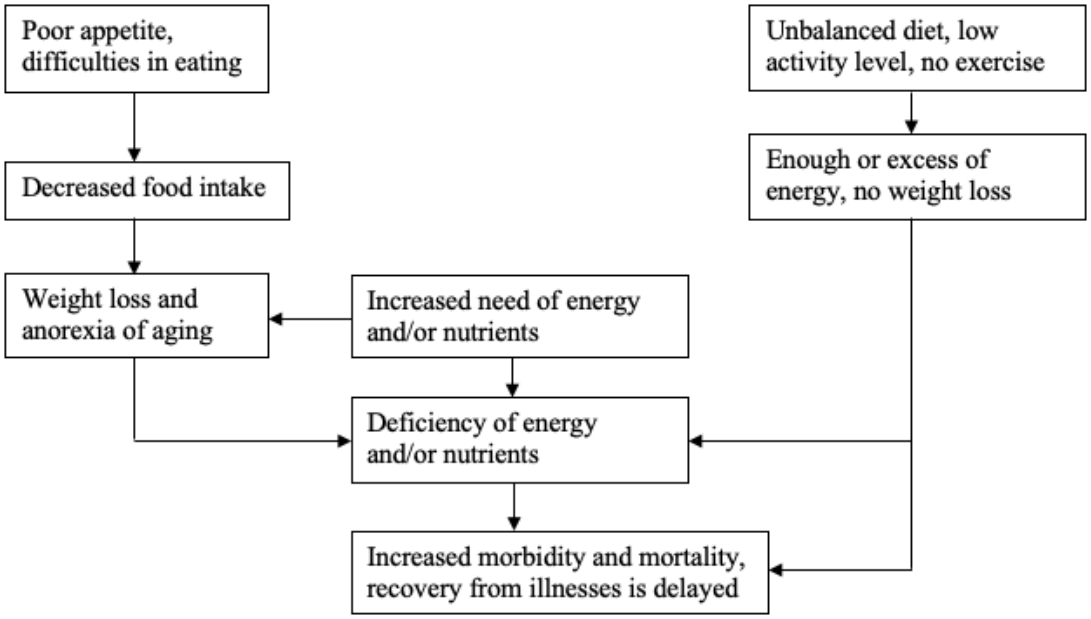

Figure 3. Paths leading to malnutrition in older adults. Adapted from: Suominen (2007).

In addition, older adults with malnutrition symptoms are typically trapped in a vicious cycle where they are sarcopenic, have limited mobility which leads to less activities of daily living including grocery shopping and cooking (Morley 2018), which consequently results in eating less frequent and worsening their nutrition and physical condition (Wysokiński et al. 2015, Fávaro-Moreira et al 2016).

The prevalence of malnutrition varies notably across different older adult population subgroups; in community-dwelling individuals malnutrition prevalence is less than 10%, whereas prevalence increases to 50% and higher for nursing home rehabilitation patients (Van Zwienen-Pot et al. 2017). In Finland, malnutrition prevalence among community-dwelling older adults ≥ 75 years is 15% (Nykänen et al. 2013), whereas studies conducted in nursing homes, indicated 11% to 57% of institutionalized individuals suffer from malnutrition, and 40% to 89% are at risk of malnutrition (Suominen et al. 2007).

Screening tools and diagnosis

Main components of nutritional screening include assessment of overall health condition, (including stability, deterioration, disease contribution to the acceleration of nutritional deterioration) and full nutritional status assessment, inclusive of biochemical and anthropometric measurements (Reynish & Vellas 2001) carried out by health professionals (Kondrup et al. 2002). The recently published ESPEN criteria for malnutrition diagnosis

recommend the use of validated nutrition screening tools for assessment of subjects at risk. Screening tool by ESPEN known as the Mini Nutritional Assessment (MNA) is the commonest developed method and the most frequently utilized tools at the global level together with the MNA-SFs (Kaiser et al. 2010). This is because of their specific focus on geriatric population (Kaiser et al. 2010), the appropriateness of use in community-dwelling older adults (Phillips et al. 2010), the predictive value (Tsai et al. 2014, Valentini et al. 2018, Helminen et al. 2019, Nestle Nutrition Foundation 2019), reliability and validity (Kaiser et al. 2011, Nestle Nutrition Foundation 2019), and short administration time (Donini et al. 2016). A weakness of the MNA is that some questions are targeted to community dwelling subjects only, excluding older adults in long-term care or receiving nutrition support (Hudgens & Langkamp-Henken 2004).

Diagnosis is based on the following criteria; either a low BMI (<18.5 kg/m_2), or the combination of weight loss with either reduced BMI (age-specific) or low fat-free-mass index (FFMI) with sex-specific cut-offs (Cederholm et al. 2015).

The Finnish guidelines for older people nutrition assessment highlight the usefulness of early assessment and regular weight control check (i.e. at least once a month when healthy and more frequently during acute illness phases, and healthcare professional's ability of malnutrition risk detection) (Nykänen et al. 2013). According to these guidelines (2013), valid screening tools developed appropriately for older adults should be used by healthcare professionals who aim to offer multidisciplinary support for effective nutritional care. The most common nutrition assessment tool used in Finland is the MNA (Soini et al 2011). It has been recently suggested including non-volitional weight loss, low BMI, reduced muscle mass, reduced food intake or assimilation, or increased disease burden/inflammation in malnutrition assessment to increase its validity (Cederholm et al. 2019).

Care and treatment

International management guidelines for malnutrition in older adults are provided by WHO in the "Integrated care for older people (ICOPE): guidance for person-centered assessment and pathways in primary care" (2019b). For older people at risk of malnutrition, ICOPE suggests dietary advice and nutritional intervention to reduce the risk of malnutrition development. For older people diagnosed with malnutrition, both ESPEN and WHO a comprehensive care plan with immediate nutritional intervention, help by healthcare professionals with specialized

knowledge, and oral supplements, as needed, is advisable (WHO 2019b, 2019d, Volkert et al. 2019).

2.2 LIFE SATISFACTION IN OLDER ADULTS

The concept of LS arises from SWB consisting of three components: positive affect, negative affect, and LS, which is the cognitive component (Diener 1984). The most updated definition of LS is "satisfaction with life represents the cognitive component of SWB and reflects a general cognitive evaluation regarding one's life across different domains" (Diener et al. 2013). Vaillant (2012), in a series of empirical models for conceptualizing positive mental health, understands mental health as SWB whose primary function is to facilitate an individual's self-care, thus becoming a counteracting agent to learned helplessness (Diener 2000). High SWB contributes to health and longevity, after controlling for income, education, weight, smoking, drinking, and disease (Diener & Chan 2011).

SWB and QoL are concepts that are used interchangeably in research and practice. Experts have shown that LS may be a positive predictor of older adults' QoL (Boylu and Gunay 2017) showing a positive correlation between QoL and LS, whereas others support that LS assessment can be considered a measure of QoL (Ferrans & Powers 1992). The complexity of the process for describing QoL can be explained by reporting a set of definitions belonging to different backgrounds (Table 5). However, there is a general agreement on the multidimensionality, objectivity, and subjectivity of QoL and wellbeing indicators (Skevington 2002).

Table 5. QoL definition.

Author	Definition
World Health Organization Quality of Life Assessment (WHOQOL) group (WHO 1998)	A broad multidimensional concept that usually includes subjective evaluations of both positive and negative aspects of life
National Cancer Institute at the National Institutes of Health - NCI dictionary of cancer terms (2019)	The overall enjoyment of life
Hörnquist (1982)	The degree of need and satisfaction within the physical, psychological, social, activity, material, and structural area

WHOQOL, World Health Organization Quality of Life Assessment; NCI, National Cancer Institute.

The knowledge behind SWB concepts, scenarios, and LS correlates comes from varied study designs, e.g. longitudinal, experimental, and intervention studies (Diener et al. 2018). Longitudinal and/or cross-sectional surveys using single and multi-item scales, (e.g.: Gallup, Gurin and colleagues, and Hadley Cantril scales), and momentary and global mood reports display the current academic knowledge of SWB (Lai et al. 2007, Diener et al. 2009, Baird et al. 2010, Goel et al. 2018). Overall, evidence explains that a set of conditions is necessary to reach high SWB levels, rather than one single determinant of SWB (Proctor 2014). Research findings propose that psychological variables like personality traits and temperament are responsible for most of the variance in SWB (Diener et al. 1996). Table 6 illustrates the determinants of LS in the general population.

Table 6. Life satisfaction determinants categories. Adapted by George et al. (2002).

Objective life circumstances	Personality and psychological traits
Attachments to social structure (education, occupation, marital status)	Neuroticism
Personal resources (health and income)	Extroversion vs. introversion
Involvement in and support from primary groups (family and friends)	Openness to new experience or cognitive flexibility
Participation in meaningful social and leisure activities	
Religious participation	

Other SWB determinants exerting influence on LS of the general population include temperament, cognition, goals, culture, adaptation coping efforts (Diener et al. 1999), good interpersonal relationships (Diener & Seligman 2002), marriage (Diener et al. 2003), age, culture (Diener et al. 1995), genetic variability (Røysamb & Nes 2018), environment (Diener & Seligman 2004), employment (Lucas et al. 2004), and individual characteristics (Diener & Diener 1995).

2.2.1 Life satisfaction measures

LS evaluation measurements are tailored according to different models, i.e. bottom-up vs. top-down, unidimensional vs. multidimensional (Table 7).

Table 7. Definition of top-down, bottom-up, unidimensional and multidimensional approaches.

Definition of LS models	
Top-down	A 'global' LS score is determined from one or more items that are domain-free in nature
Bottom-up	A 'general' LS score is calculated by summing responses to a variety of domain-specific items
Unidimensional	Providing a profile of LS in a single specific domain
Multidimensional	Providing a profile of satisfaction with life in various specific domains

The measurement tools implied for assessment of LS in the older population include the Satisfaction with Life Scale (Diener et al. 1985), the Temporal Satisfaction with Life Scale (Pavot et al. 1998), Quality of Life Index (Ferrans & Powers 1985), the Personal Wellbeing Index (Cummins et al. 2003), the Extended Satisfaction with Life Scale (Alfonso et al. 1996), the Quality of Life Enjoyment and Satisfaction Questionnaire (Endicott et al 1993), and the Life Satisfaction Index for the Third Age (Barrett & Murk 2006).

Within the general population, there are many different tools available for research and assessment of LS. However, when researching older adults, greater attention is needed as LS measurement tools differ across the age range. Diener and colleagues (1985) developed one of the most used LS scales, the Satisfaction with Life Scale (SWLS), which includes five items: 1) life being close to ideal, 2) life having excellent conditions, 3) being satisfied with life, 4) having gotten important things in life, and 5) no desire to change one's life. The SWLS is a valid and reliable 7-point Likert scale. Another common and frequently used measurement tool is the Cantril Ladder (Cantril 1965). An individual is faced with a scale going from 0 to 10 and is asked to define based on his feelings where on the ladder he does feel to currently be. The lower the position, the worst possible life situation, and vice versa.

The Nordic countries' most common used scale is the 4-item life satisfaction scale (LS-4, range 4-20) (Allardt 1973). According to prior literature, the LS-4 development was based on QoL assessment questionnaires by the Survey Research Center of the University of Michigan (Campbell et al. 1976, Andrews 1976). Subsequently, the scale underwent modifications by the Finnish sociologist, Erik Allardt (1973), author of a comparative survey in the Nordic countries.

Research investigation guidelines recommend LS multi-method assessments (Diener 2012). Though self-report issues are multiple (e.g. social desirability bias, number use, current mood influences, cultural differences in LS, controlling measurement artifacts and measurement

errors), self-report measures are the most used method for LS assessment due to the validity of LS scales (Diener et al. 2012), the subjective nature of LS and greater reliability over time (Diener et al. 2018).

2.2.2 Aging impact on LS

Questioning how LS changes with aging is challenging. Results from large studies provide different points of view. Overall, it seems that the relationship between age and LS may vary depending on meaningful contextual factors (Deaton 2008). Much cultural and social variation in wellbeing is linked to key cultural differences in understandings of the self and relationships. Evidence on aging and SWB provide an inconsistent pattern of results also due to study design, e.g. cross-sectional studies ask individuals of different age stages to answer a survey and self-report their levels of happiness or LS. For example, a cross-sectional study in a Taiwanese sample of older adults shows that LS decreases as age increases beyond 65 years old (Chen 2001). On the contrary, high level of LS indicators (i.e. physical health and functional status; self-resources; social support resources; and life activity) are shown by independently living adults aged 50–90 years across six EU countries (Austria, Italy, Luxembourg, The Netherlands, United Kingdom and Sweden) (Ferring et al. 2004). Other transversal studies on SWB, health and aging claim that the association between SWB and aging is U-shaped, favoring young adults and older adults to experience the highest LS levels throughout the entire lifespan while an average individual's SWB reaches its minimum level in middle age (Steptoe et al. 2015). Considering evidence representing the worldwide population, Diener and Suh (1998) conducted an international analysis on the relationship between SWB and aging and found that LS does not decline with age, exception made for specific assets like marriage and income that are associated with decline in wellbeing with aging.

LS average among the Finnish population is of 7.6 (on a scale from 0 to 10), meaning that the Finnish Nordic community is more satisfied with their lives than the Organisation for Economic Co-operation and Development (OECD) LS average of 6.5 (Organisation for Economic Co-operation and Development 2019), with women slightly more satisfied with disparate aspects of life than men (Findicator 2014). Moreover, Finns report LS as one of the three most important topics among the Better Life Index (Better Life Initiative 2017). Notably, LS is also extremely stable across age groups in Nordic countries like Finland and Sweden, as reported by studies of Realo & Dobewall (2011), supporting early-stage literature on the relationship between aging

and LS in Finland indicating the absence of age group differences in LS levels (Martikainen 2009).

2.2.3 Determinants of LS and SWB in older adults

Longitudinal (Gerstorf et al. 2008, Berg et al. 2009, Enkvist et al. 2012a) and cross-sectional studies (Helvik et al. 2011, Tse et al. 2013, Ferrara et al. 2015, Banjare et al. 2015, Hamdan Mansour et al. 2017, Tomstad et al. 2017, Rodgers et al. 2017) display the available knowledge on the science of LS, aging, and its determinants.

LS determinants in older adults include the two macro-categories by George et al. (2002): objective life circumstances, and personality and psychological traits. Although the objective life circumstances set is valid throughout the lifespan, some concepts vary in meaning and salience across different life stages. For example, marital status and health have higher importance for older adults than for young or middle-aged individuals; income has intermediate relevance for old adults and social relationships are equally significant for older and young adults when compared with individuals in their middle age (Kolosnitsyna et al. 2017). Important SWB determinants in older age are displayed in Table 8.

Table 8. SWB determinants in older adults.

SWB determinants in older adults	
Economic determinants	Financial security (Meggiolaro & Ongaro 2012), economic conditions (Prieto-Flores et al. 2012, Macia et al. 2015), personal income (Kolosnitsyna et al. 2017), perceived relative economic status (Ng et al. 2017), poverty and income generating work (Celik et al. 2018).
Socio-demographic determinants	Neighborhood (Prieto-Flores et al. 2012), education (Celik et al. 2018), marital status (Celik et al. 2018), social status (Kolosnitsyna et al. 2017), age (Voronin et al. 2018), gender, place of residence, access to social security provisions, commercialized insurances, living arrangements and social services available in the community (Ng et al. 2017), living arrangements and living alone (Mao & Han 2018).
Social determinants	Good social relations (Macia et al. 2015), social integration (Meggiolaro & Ongaro 2012), helping behaviors and social support (Bai & Knapp 2016, Mao & Han 2018), exposure to violence in women (Lamoureux-Lamarche & Vasiliadis 2017), relatedness (Cheng et al. 2006), sense of companionship and a supportive social network (Pan et al. 2019), leisure (Prieto-Flores et al. 2012).
Health determinants	Self-rated health (Ng et al. 2017, Celik et al. 2018), health status (Kolosnitsyna et al. 2017), life-threatening disease (Lamoureux-Lamarche & Vasiliadis 2017), regular physical examination (Ng et al. 2017), geriatric pain (Karadag Arli et al. 2018).
Physical determinants	Functional ability (Meggiolaro & Ongaro 2012), frailty (Yang et al. 2016), self-reported exhaustion (Voronin et al. 2018), decline in physical health, ability to chew, ability to do household activities (Celik et al. 2018).
Psychological determinants	Depression (Celik et al. 2018), loneliness, personality traits (Ng et al. 2017, Voronin et al. 2018), cognitive ability (Ng et al. 2017), self-reported exhaustion (Voronin et al. 2018), social withdrawn (Celik et al. 2018), early life emotional stability and extraversion (Vaillant et al. 2018).
Lifestyle determinants	Physical activity and sedentary behavior (Maher & Conroy 2015), dietary intake and nutritional status (Grunert et al. 2017), recent participation in physical activity (Voronin et al. 2018), instrumental activities of daily living (Ng et al. 2017).

2.2.4 Implications of LS score

The 4-item life satisfaction scale is considered a global wellbeing indicator (Koivumaa-Honkanen et al 2008) and increased LS has been consistently reported in individuals with positive SWB level (Lyubomirsky et al. 2005). Evidence shows that SWB is beneficial for health, supportive social relationships, longevity, work performance, citizenship and resilience (De Neve et al. 2013). Indeed, evidence from cross-sectional, longitudinal, and experimental

data asserts positive SWB to be a predictor of different positive outcomes (i.e. personal, behavioral, psychological, and social outcomes) (Lyubomirsky et al. 2005).

On the other hand, life dissatisfaction can worsen health, increasing the risk of contracting diseases. Life dissatisfaction showed a disease-specific and dose-dependent relationship with multimorbidity in a sample of postmenopausal women (Lukkala et al. 2016) and was predictor of symptoms of depression (Koivumaa-Honkanen et al. 2001a, 2004a), poor mental health and major depressive disorder (Koivumaa-Honkanen et al. 1996, 2004a, Rissanen et al. 2011), adverse alcohol use (Koivumaa-Honkanen et al. 2012), psychiatric and work disability (Koivumaa-Honkanen et al. 2004a, 2004b, Lukkala et al 2016), morbidity, unintentional and intentional fatal injury (Koivumaa-Honkanen et al. 2002), mortality (Koivumaa-Honkanen et al. 2000), and suicide (Koivumaa-Honkanen et al. 2001b).

2.3 FOOD CONSUMPTION AND WELLBEING IN OLDER ADULTS

Food is essential to any individual's physiologic wellbeing as the first provider of nutrients, subsistence, and energy. "What we eat, when and how we eat is also a major contributor to our social, cultural and psychological QoL as human beings" (Holder 2019). The heterogeneous and complex relationships between food and health, social interaction, and daily activities make food a significant life domain influencing a person's SWB (Schnettler et al. 2015). Older adults are particularly susceptible to affect from diet quality. Physical activity and adherence to current nutrition guidelines suggesting consumption of high quantities of vegetables, fruit, whole grains, poultry, fish, and low-fat dairy products, are important contributors to increased overall QoL population (Bernstein 2017). Although nutrition, physical activity, SWB, and QoL in older adults are closely connected during the whole lifespan (Lukkala et al. 2016), knowledge on food consumption and LS is still limited. Selected cross-sectional and prospective studies on food consumption and wellbeing are presented in Table 9 and Table 10.

2.3.1 Association between food consumption and QoL and HRQoL

Dietary food patterns seem to be in relation with QoL of older adults, although evidence is inconsistent (Govindaraju et al. 2018). Furthermore, previous research has associated HRQoL with LS even though the two concepts are not equivalent (Sinikallio et al. 2011).

Govindaraju and colleagues (2018) analyzed correlations between dietary patterns and self-reported QoL or self-rated health status. Most of the time, a healthy diet was associated with

better self-rated health and QoL, and adherence to healthy dietary patterns (e.g. Mediterranean diet) was significantly associated with improvement in at least one of the QoL domains. In a population-based study conducted among Russian aged 18-90 years old (n = 1968) by Averina et al. (2005), participants having low rates of fresh fruit and vegetable consumption were 1.6 times more likely to report low QoL (Cantril Ladder < 5) than participants consuming higher intake; similar findings were found in fish and meat, 1.4 and 1.3 times respectively.

Although evidence on the relationship of fish or omega-3 fatty acid intake and depression is inconclusive (Liu et al. 2016), fish consumption has been linked to health and mental distress, in particular to depression, and QoL. There seems to be a modest inverse association between fish or omega-3 fatty acid intake and risk of depression, especially in women, Liu and colleagues report in a recent meta-analysis conducted with prospective cohort studies (2016). Furthermore, in a population-based study with healthy participants (aged 36-88, mean age=60), fish consumption was related to QoL. According to the authors, "fish consumption may serve as a proxy for a healthy lifestyle or a favorable nutritional status, which is reflected in better QoL" (Schiepers et al. 2010).

Nutritional risk is a predictor of senior's QoL and it is measured by SCREEN (Seniors in the Community: Risk Evaluation for Eating and Nutrition) (Keller 2004). 367 community-living older adults at high risk of malnutrition had less good physical health days and LS when compared with risk-free seniors. Overall, the nutritional risk seems to be an independent factor predicting a change in HRQoL and results affirm a more holistic view of QoL in relationship with nutrition (Keller 2004). The link has also been investigated in (pre)frail community-dwellers aged 65 to 98 years, in which malnourished participants (45%) were significantly different in QoL domains like 'autonomy', and 'social participation', expressing the existing relationship between nutritional status (represented by the MNA®-LF scale) and QoL in aged population (Luger et al. 2016). Undoubtedly, adequate and balanced nutrition is one of the many important factors influencing HRQoL in older adults (Acar Tek & Karaçil-Ermumcu 2018).

Poor appetite and low food intake are common within older adults (Giezenaar et al. 2016) and appetite may be described as one major determinant of HRQoL, mental and physical health of home-dwelling older adults (Acar Tek & Karaçil-Ermumcu 2018).

2.3.2 Association between food consumption and SWB/psychological distress

As food intake is gaining attention from positive psychologists and consensus is developing on how food consumption may enhance wellbeing in a dose-response fashion, the mechanisms behind this link are still unclear (Holder 2019). Many studies relate food intake, especially increased consumption of fruit and vegetables, having breakfast regularly, and consuming more meals and snacks throughout the day, to intensified wellbeing (Holder 2019).

Evidence from cross-sectional studies linking positive affect with healthy lifestyle behaviors is mixed. Recent findings report an association between positive affect and prudent diet, regular physical exercise, smoking avoidance, alcohol consumption, and sexual risk behavior (Steptoe et al. 2009). They are all factors related to positive affect that seem to be acting as mediators of associations between positive psychological state and health outcomes (Steptoe et al. 2009).
The results of a cross-sectional study conducted in Norway yielded support on how a healthy dietary pattern in older people (65 years and more) is associated with lesser psychological distress when adjusting other lifestyle behaviors, wellbeing, health status, physical functioning and social support (Grønning et al. 2018).

Unhealthy food consumption is a modifiable risk factor for depression in the geriatric population (Grønning et al. 2018). A study conducted on older Taiwanese (67-year-old individuals) reported a significant association between the frequency intake of fruits, vegetables, and tea with depression. More specifically, more frequent consumption of fruits and vegetables (3 times/week) and more frequent consumption of tea (*Camellia Sinensis)* (3 times/week) was associated with a reduced risk of depression and to be predictive of a lower risk of depression in a 4-year follow up. Food groups like meat-poultry, dairy, legumes, fish, grain and nutritional supplements did not show significant benefits (Yu & Tsai 2011).

The relationship is also demonstrated by research conducted on online findings archives reporting evidence of the causal effect of healthy food habits on happiness (Veenhoven 2019). They confirm a pattern that seems to be universal, with minimal changes across individuals, times and geographical origin. More specifically, the highest levels of happiness are reached when one consumes more than three daily portions of fruits and vegetables.

From a socio-demographical point of view, being single or widow increases the risk of psychological stress. Single or widow older adults report reduced vegetable variety. Unhealthy dietary patterns are more common among males and older adults with reduced social support from friends (Grønning et al. 2018).

Nutrients and wellbeing

Nutrients provided by healthy food choices consist of macronutrients (i.e. protein, carbohydrate and lipids) and micronutrients (i.e. water-soluble vitamins, fat-soluble vitamins, minerals and other nutrients like carotenoids and β-Carotene). Among nutrients known to have a fundamental role in the maintenance of healthy neurons which help cognitive function and mental wellbeing, there are primarily vitamins. Deficiency of water-soluble vitamins such as C and the B complex (B6, B9, B12) and fat-soluble vitamins like vitamin E (Baugreet et al. 2017), and β-Carotene deficiency are associated with inferior cognitive function and poor mental wellbeing (Harrison 2012, Giannunzio et al. 2018). Most vitamins derive from high fruit and vegetable consumption, especially berries, green leafy vegetables and citrus, which have been recently confirmed to be associated with increased optimism and self-efficacy, reduced psychological distress and prevention of depressive symptoms (Glabska et al. 2020). These results give credit to the ongoing consensus on the positive influence of fruit and vegetable nutrients on mental wellbeing.

The choice of a healthy diet, such as the Mediterranean diet characterized by high intakes of fruit and vegetable, olive oil, fish, legumes, nuts, seed and cereals which provide a wide range of nutrients, (e.g. antioxidants, omega-3 fatty acids, and B vitamins) supporting brain development and protecting the brain membrane cells from oxidative stress and influencing brain mechanisms (e.g. neurotransmitters production, cell growth and the blood-brain barrier protection) is of extensive support for cognitive function and mental health, especially in older age. Overall, a healthy diet and mental wellbeing are associated in young adults, adults and also in the older adults (Milte and McNaughton 2016).

2.3.3 Association between food consumption and LS

Results from the Russian Longitudinal Monitoring Survey yield evidence on the statistically significant association between food consumption and LS levels of the general population

(Huffman & Rizov 2018). Calories, fat, and protein consumption, together with a greater diverse diet, show a positive and statistically significant association with LS. Surprisingly, while smoking is negatively associated with LS, alcohol consumption demonstrates a positive and statistically significant ($p<0.05$) relationship.

Among outpatient older adults aged 65 years and older in Nepal, LS was associated with a high nutritional score, assessed with the Mini Nutritional Assessment – Short Form (MNA-SF). Both undernutrition and depression were found to be significantly associated with LS where nutrition affected LS, influenced by depression as a mediator. LS showed a decline as nutritional and mental health status decreased (Ghimire et al. 2018).

Older adults (65 years and older), belonging to the HUNT3 sample of 96 099 Norwegian residents, following a healthy dietary pattern (i.e. a higher consumption of fruits, vegetables, boiled potatoes, oily fish, whole-grain bread and water) were more satisfied with life compared to individuals with "unhealthy" food pattern (i.e. a larger amount of foods and beverages such as; chocolate/candy, pasta, sausages, sugar-free and sugary soft drinks, whole milk juice, white bread, semi-grain bread), according to André and colleagues (2017). Consistency is found with studies where good-quality diets were linked with better emotional wellbeing (Milte & McNaughton 2016).
Furthermore, increased consumption of fruits, vegetables, and grain products in older Canadian men (n=1211) was associated with greater LS (Lengyel et al. 2009). A similar association was found in a study conducted by Blanchflower et al. (2013) where subjects belonging to the Scottish Health Surveys (n=14000) and consuming >8 daily portions of fruits and vegetables reported higher LS than those who ate fruits and vegetable less often. In an Australian sample of older adults participating in a longitudinal study (n=12 385, aged 15–93 years), wellbeing improvements by increased consumption of fruit and vegetables occurred within 2 years (Mujcic & Oswald 2016).

Overall, the frequency and quantity of fruit and vegetable intake were associated with the enhancement of wellbeing components in a dose-response fashion as demonstrated by Ocean and colleagues (2019), who reported that quantity and frequency of fruit and vegetable consumption both have a significant and positive relationship with LS. The systematic review by Tuck and colleagues (2019) found a positive association between increased consumption of

vegetables and higher SWB (positive affect, lower negative affect) and with increases in psychological wellbeing (e.g.: feelings of flourishing and vitality).

Nonetheless, evidence on the relationship between food intake and LS is inconclusive. In Sweden, low food intake levels and subsequent risk of undernutrition were found to have a negligible impact on LS despite both factors had a significant impact on physical and mental related QoL in seniors aged 60 years and above, belonging to the SNAC-B study (Naseer & Fagerstrom 2015).

2.3.4 Wellbeing influences food behaviour

The association of food and LS is bidirectional (Gacek 2017). Recently, the inverse relationship was brought to the scientific community's attention where level of wellbeing influenced individual's response to food (Gacek 2017, Gacek & Wojtowicz 2019, Holder 2019).

High LS has a predictive role in the development of healthy eating habits characterized by rational dietary choices of young physically active women. They consumed significantly more often whole-grain bread, whole-grain rice and pasta, curd cheese with reduced fat content, seafood, beef, and vegetable juices, and significantly less often sweets and confectionery than did women showing low LS levels. Similar results are found also within young adults (mean age = 20.9 years, SD = 2.27) attending Chilean state universities and participating in an online survey including the Satisfaction with Life Scale (SWLS), Satisfaction with Food-related Life Scale (SWFL), Health-related Quality of Life Index-4 (HRQoL), questions on place of residence, importance of food for wellbeing, frequency of meals in the place of residence and the frequency of consumption of eight food groups. Schnettler and colleagues (2015) found that the majority of highly satisfied with life and food-related life students tend to eat more frequently at home, have less health issues, have healthy eating habits and think about food as a fundamental responsible of their wellbeing.

Such relationship has also been observed in sick or diseased individuals, especially in women (40-65 years old) suffering from type 2 diabetes mellitus (T2DM), among which the frequency of consumption of recommended foods (i.e. vegetables, fruit, legume seeds, whole-grain cereals, dairy products with reduced fat content, and nuts) was low (Gacek & Wojtowicz 2019) and healthy dietary choices among the sample increased with age and perceived LS.

Table 9. Selected cross-sectional studies on food consumption/dietary intake and SWB, LS and QoL

Selected cross-sectional studies on food consumption/dietary intake and SWB, LS and QoL

Reference, country, study name	Sample size (%, men or women), age group, mean(s) age (± SD)	Food consumption/dietary intake and SWB, LS and/or QoL assessment	Results	Covariates
Gacek & Wojtowicz 2019 Poland	276 women aged 40-65 (47.92 ±5.53) years with T2DM	Specially designed questionnaire (metric data, duration of diabetes) and the Satisfaction with Life Scale (SWLS)	Women with T2DM showed a low consumption frequency of fruits and vegetables, legume seeds, whole-grain cereals, dairy products with reduced fat content, and nuts consumption. The scale of rational dietary choices (i.e. more frequent consumption of recommended products and less frequent consumption of less-recommended products) among women increased along with age and perceived LS. As the time from diagnosis passed, the SWLS decreased indicating the gradual decline in the quality of women's life in the course of diabetes. A decrease was also noted along with the increase in BMI.	--
Grønning et al. 2018 - Nord-Trøndelag Health Study (2006–2008) Norway	11,621 participants, 65 years or older	Hospital Anxiety and Depression Scale (HADS), sociodemographic information, measurements of lifestyle behaviors (including diet patterns), wellbeing, health status, social support and physical functioning.	Following a healthy diet is associated with less psychological distress in the older adults.	Lifestyle behaviors, wellbeing, health status, physical functioning and social support in elderly people
Ghimire et al. 2018 Nepal	289 Nepalese elderly, aged ≥60 years	Satisfaction with Life Scale (SWLS), Mini Nutritional Assessment – Short Form (MNA-SF), Geriatric Depression Scale (GDS).	LS was positively associated with being married, high family income, involvement in active earning, and a high nutritional score. Both nutrition (β = 0.48, bias-corrected and accelerated 95% CI: 0.27, 0.69) and depression (β = − 0.87, bias-corrected and accelerate 95% CI: -1.01, − 0.74) had significant direct associations with LS in mediation analyses.	Age, sex, ethnicity, marital status, educational status, smoking, alcohol use, perception of being ignored/hated, and perceived health status compared to peers

Acar Tek & Karaçil-Ermumcu 2018	407 elderly (142 men and 265 women) mean aged 71.7±6.54 years.	24-hour dietary recall, Mini Nutrition Assessment (MNA) and Mini Nutrition Assessment-Short Form (MNA-SF), Simplified Nutritional Appetite Questionnaire (SNAQ), Health related life quality scale (Short Form Health Survey -SF36).	HRQoL scores of women were significantly lower than men. Good nutritional (MNA-SF) and good appetite (SNAQ) status, increased 1.69, 1.48-fold in the mental component summary scale scores respectively. SNAQ was the best determinant of physical component summary scale score had the greatest positive effect, good appetite status increased approximately 2.2-fold in physical scores.	--
André et al. 2017 - Nord-Trøndelag Health Study (The HUNT Study) Norway	125 000 Norwegian participants aged 65+	Hospital Anxiety and Depression Scale (HADS), one-item general measure of QoL: "Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied?", Social Cohesion and Support Index (SCS)	Participants in the healthy food-patterns cluster had higher LS and lower anxiety and depression than those in the unhealthy food-patterns cluster.	--
Naseer & Fagerstrom 2015 - Swedish National Study of Aging and Care-Blekinge (SNAC-B)	Males and females 60-96 years of age (n=1402)	Validated Short Form health survey (SF-12) and Liang's life satisfactions index A (LSIA), nutritional status estimation by occurrence of at least one anthropometric measure (body mass index, mid-arm circumference, and calf circumference) below cut-off, in addition to the presence of at least one subjective measure (declined food intake, weight loss, and eating difficulty)	The risk of undernutrition was significantly associated with poor HRQoL, both in physical (OR 2.31, 95% CI 1.18-4.52) and mental (OR 2.34, 95% CI 1.22-4.47) health. No significant association was observed between nutritional status and LS (OR 1.30, 95% CI 0.70-2.40).	Age, gender, marital status, housing arrangement, and education
Gacek 2017 Poland	200 young women (20-30 years old)	Food consumption frequency (several times a day, once a day, several times a week, once a week, several times a month, and more rarely/never), Satisfaction With Life Scale (SWLS).	Women who displayed high LS significantly more often consumed whole meal bread ($p<0.01$), whole-grain rice and pasta ($p<0.001$), curd cheese with reduced fat content ($p<0.05$), seafood ($p<0.05$), beef ($p<0.001$) and vegetable juices ($p<0.05$), and significantly less often, sweets and confectionery ($p<0.05$) than did women displaying low LS.	--
Blanchflower et al. 2013 - Welsh Health Survey of	80,000 randomly selected	10-point LS score, self-reported health (How is your health in general? Very Good, Good, Fair, Bad, or Very Bad),	Individuals consuming 8+ portions a day have an adjusted LS score approximately 0.27 points higher than those who eat almost no fruit and vegetables.	Being sexually active, amount of exercise, smoking, BMI, being

2007–2010, Scottish Health Survey of 2008, and England Health Survey 2008 UK	British individuals	FFQ for fruit and vegetable consumption		religious, income, social class, education, region
Schiepers et al. 2010 Maastricht Aging Study (MAAS) The Netherlands	233 adults, age 60.0 (36–88 years old)	Short Form 36 Health Survey (SF-36), Fish consumption measured by means of a validated short self-report questionnaire (never, once a month, two to three times a month, once a week, and more often than once a week)	The SF-36 Physical Component Summary score showed no significant associations with the fatty acids of interest, whereas a significant positive relationship with fish consumption was found. Fish consumption, but not LCPUFA status, is related to QoL in the general population.	Age, sex, level of education, marital status, alcohol consumption, smoking, and BMI
Lengyel et al. 2009 - Manitoba Follow-up Study Canada	Older men (*n*=1211; mean age 80 ± 3.3)	Food group consumption (FGC), self-rated health, and LS	Men consuming fruits and vegetables daily vs. rarely were four times more likely to report better self-rated health OR = 4.00 (95%CI = 1.31, 12.3) and three times more likely to rate greater LS OR = 3.08 (95%CI = 1.00, 9.45).	--
Averina et al. 2005	Altogether 1968 men and 1737 women aged 18–90 years	Six-page questionnaire (111 questions): *depression*: Do you have long periods (2 weeks or more) during which you feel sad, blue or depressed (yes; no)?*; QoL*: Cantril Ladder (Cantril 1965); *nutrition*: How often do you eat fresh fruits and vegetables; fish or fish products; meat or meat products (rarely or never; once a week; 2–3 times a week; 4–5 times a week; almost daily)? How do you evaluate your nutrition (good; satisfactory; poor)?.	Participants having low fresh fruit and vegetable consumption frequency were 1.6 times more likely to report low QoL (Cantril Ladder <5) than participants consuming higher intake levels; similar findings were found in fish or fish products and meat or meat products, 1.4 and 1.3 times respectively.	Age, sex, smoking and alcohol.
Keller 2004 - SCREEN (Seniors in the Community: Risk Evaluation for	367 frail older adults	The Behavioral Risk Factor Surveillance System (BRFSS), a general whole-LS question, and a general change in QoL question.	Seniors with high nutritional risk had fewer good physical health days and whole-LS compared with those at low risk. In general, participants reported decreases in general QoL from baseline, with those in the moderate nutritional risk category most likely to report this change.	Gender, number of health conditions, perceived health, and age.

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BMI, Body Mass Index; BRFSS, Behavioral Risk Factor Surveillance System; CI, Confidence Interval; FFQ, Food Frequency Questionnaire; FGC, Food group consumption; GDS, Geriatric Depression Scale; HADS, Hospital Anxiety and Depression Scale; HRQoL, Health Related Quality of Life; HUNT Study, Nord-Trøndelag Health Study; LCPUFA, Long Chain Polyunsaturated Fatty Acids; LS, Life Satisfaction; LSIA, Liang's life satisfactions index A; MAAS, Maastricht Aging Study; MNA-SF, Mini Nutritional Assessment – Short Form; MNA, Mini Nutrition Assessment; OR, Odds Ratio; QoL, Quality of Life; SCREEN, Seniors in the Community: Risk Evaluation for Eating and Nutrition; SCS, Social Cohesion and Support Index; SD, Standard Deviation; SF-12, Short Form Health survey; SF36, Short Form Health Survey; SNAC-B, Swedish National Study of Aging and Care-Blekinge; SNAQ, Simplified Nutritional Appetite Questionnaire; SWB, Subjective Well-Being; SWLS, Satisfaction With Life Scale; T2DM, Type 2 Diabetes Mellitus.

Table 10. Selected prospective studies on food consumption and SWB, LS and QoL.

Selected prospective studies on food consumption and SWB, LS and QoL.				
Reference, country, study name	Sample size (% women), age group, mean(s) age (± SD)	Food consumption/dietary intake and SWB, LS and/or QoL assessment	Results	Covariates
Ocean et al. 2019 UK Household Longitudinal Survey (UKHLS) 2010 and 2017 UK	Over 45,000 individuals (mean age = 47.1, min = 15, max = 104)	The General Health Questionnaire (GHQ-12), "On a day when you eat fruit or vegetables, how many portions of fruit and vegetables in total do you usually eat?" (never, 1–3 days per week; 4–6 days per week; everyday)	Wellbeing increases in a dose-response fashion with the number of portions of fruit and vegetables consumed (on a day where there is non-zero consumption of fruit and vegetables) or with the number of days in which either fruits or vegetables are consumed in a given week.	Age, marital status, income, number of children, employment status, smoking, days walked > 10 min, long standing health condition, dairy consumption, bread consumption, education.
Huffman & Rizov 2018 - 1995-2005 data from the Russian Longitudinal Monitoring Survey (RLMS) Russia	10000 individuals/survey/year	24-hour dietary recall, LS: IMSATISL variable in the RLMS (see study for reference)	Diet measured as calories, fat, protein, and diversity of food consumption has a statistically significant effect on LS levels of the Russian population.	--
Milte & McNaughton 2016 Wellbeing, Eating and Exercise for a Long Life (WELL) Australia	Adults 55–65 years (n=1150 men and n=1307 women)	Self-rated HRQoL: RAND 36-item general health survey (RAND-36), a 111-item FFQ, the dietary guideline index (DGI), the recommended food score (RFS) and the Mediterranean diet score (MDS).	In women, associations between two indices of diet quality (DGI, RFS) physical function (OR = 1.66, CI: 1.19, 2.31 and OR = 1.70, CI: 1.21, 2.37 respectively) and general health (OR=1.83, CI: 1.32, 2.54 and OR=1.54, CI: 1.11, 2.14 respectively) were observed. DGI was also associated with overall physical component summary score (OR = 1.56, CI: 1.12, 2.17). Additional associations between emotional wellbeing and DGI (OR = 1.40, CI: 1.01, 1.93) and RFS (OR=1.44, CI: 1.04, 1.99),	Age, sex, education and urban/rural location, adjusted for smoking and total physical activity, BMI.

			and MDS and energy (OR=1.53, CI: 1.11, 2.10) were observed in the fully adjusted model, in women only. Older adults with better quality diets report better HRQoL, with additional associations with emotional wellbeing observed in women.	
Luger et al. 2016	83 older persons living at home, 12 men and 71 women (86%) aged 65 to 98 years.	Mini Nutritional Assessment® long-form (MNA®-LF), World Health Organization Quality of Life questionnaires.	Compared to the general population, persons with impaired nutritional status, significantly differed in the QoL domain 'autonomy' with mean (SD) scores of 50.0 (14.9) vs. 57.3 (13.7); p=0.022 and in the QoL domain 'social participation' with scores of 40.1 (13.6) vs. 47.0 (11.2); p=0.014, respectively. According to linear regression analyses, the MNA®-LF score was significantly associated with 'overall QoL' (β=0.26; p=0.016) and the QoL domains 'physical health' (β=0.23; p=0.036), 'autonomy' (β=0.27; p=0.015), and 'social participation' (β=0.28; p=0.013).	Functional status
Mujcic & Oswald 2016 Household, Income, and Labour Dynamics in Australia (HILDA) Survey Australia	12 385 randomly sampled Australian adults over 2007, 2009, and 2013	Longitudinal food diaries ("Including tinned, frozen, dried and fresh fruit, on how many days in a usual week do you eat fruit?" and "Including tinned, frozen and fresh vegetables, on how many days in a usual week do you eat vegetables?" with possible responses ranging from 0 (do not eat any fruit or vegetables in a usual week) to 7 days per week. "On a day when you eat fruit, how many serves of fruit do you usually eat?" and "On a day when you eat vegetables, how many serves of vegetables do you usually eat?". Self-reported LS,"All things considered, how satisfied are you with your life?", Medical Outcomes Short Form (SF-36) questionnaire.	Increased fruit and vegetable consumption was predictive of increased happiness, LS, and wellbeing, up to 0.24 life-satisfaction points (for an increase of 8 portions a day).	Incident changes in happiness and LS for people's changing incomes and personal circumstances.

Yu & Tsai 2011 - Survey of Health and Living Status of the Elderly Taiwan	2074 67 year-old individuals	Food consumption questionnaire and Center for Epidemiologic Studies Depression Rating Scale (CES-D10) for risk of depression	More frequent consumption (3 times/wk vs. 2 times/wk) of fruits and vegetables and more frequent consumption of tea (camellia sinensis) were significantly associated with reduced risk of depression (OR=0.62, 95% CI=0.44-0.87, p=0.005 and 0.62, 0.45-0.86, p=0.004, respectively) and more frequent fruits and vegetables and tea-drinking also significantly predicted a lower risk of depression (0.62, 0.42-0.93, p=0.022 and 0.56, 0.38-0.82, p=0.003, respectively) four years later.	Gender, age, education, living status, smoking, drinking, physical exercise, number of chronic diseases, self-rated health status, satisfaction with economic condition, functional status, BMI and appetite

BMI, Body Mass Index; CES-D10, Center for Epidemiologic Studies Depression Rating Scale; DGI, Dietary Guideline Index; FFQ, Food Frequency Questionnaire; GHQ-12, General Health Questionnaire; HILDA, Household, Income, and Labour Dynamics in Australia; LS, Life Satisfaction; MDS, Mediterranean Diet Score; MNA®-LF, Mini Nutritional Assessment® Long-Form; QoL, Quality of Life; RAND-36, RAND 36-item general health survey; RFS, Recommended Food Score; RLMS, Russian Longitudinal Monitoring Survey; SD, Standard Deviation; SF-36, Medical Outcomes Short Form; SWB, Subjective Well-Being; UKHLS, Household Longitudinal Survey; WELL, Wellbeing Eating and Exercise for a Long Life.

3 AIM OF THE STUDY

Due to the significant role of LS in individuals' QoL, health, wellbeing, and longevity, this study aimed to address the research gap regarding the relationship between nutrition and wellbeing, using food consumption variables and LS levels of older women .

The aim of the study was to evaluate the association between food consumption (i.e.: warm meals, fruit and vegetables, milk and products, cheese, bread, fish, meat and poultry, eggs, and decreased food intake in last 3 months) and LS among community-living older women of 74-83 years old living in Kuopio (Eastern Finland) participating in the KFPS study.

4 METHODOLOGY

4.1 KFPS design and subjects

This cross-sectional population-based study analyzed the baseline data of the 2-year randomized controlled trial KFPS study beginning in March 2016 and including 914 community-living older women of 71-84 years old (born 1932–1945) living in Kuopio (Eastern Finland). Majority of the study subjects (n=582) belong to the OSTPRE cohort (Kuopio Osteoporosis Study), a population-based prospective cohort study began in 1989 (Tuppurainen 1993). An additional group of 332 women within the same area (born in 1942–1945) recruited due to low initial attendance number. The KFPS participants were recruited within a reasonable distance (≤10 km) of Kuopio city centre to be able to attend the exercise sessions twice a week for the first 6 months. Exclusion criteria were insufficient self-ambulatory status (wheelchair, crutches etc.,), unstable angina pectoris, severe pulmonary disease or moderate to severe dementia) (Vilpunaho et al. 2019). The main aim of KFPS was to investigate the effect of exercise (gym workouts and Tai-Chi) in preventing falls and promoting wellbeing in elderly women.

The target population was composed of women aged 71-84 years living in Kuopio (n=914, intervention-group 457; control-group 457) who received fall prevention education and attended supervised exercise sessions twice a week for 6 months (1h gym + 1h Taiji) + 6 months unsupervised. The control group received fall prevention information, yet no supervised exercise. All clinical measurements were performed in Kuopio Musculoskeletal Research Unit of the Clinical research center of the University of Kuopio. The study visits were carried out at baseline, at 12 months, and 24 months. During the 24 months follow-up period, falls were recorded by SMS messages and a fall/exercise diary. The KFPS study was approved by the Research Ethics Committee of the Hospital District of North Savo and Kuopio University Hospital. The study was registered in Clinical trials.gov by the identification NCT02665169.

4.2 Data collection

Data used for the study were collected at baseline. The study focuses on the subject's response to the baseline questionnaire "OSTPRE Kuopion Kaatumisten Ehkäisy-Tutkimus". Researchers administered the questionnaire at the baseline, 12-month and 24-month follow-up to measure participants' changes throughout the period. Background variables included civil status (unmarried, married/cohabiting, divorced/single or widowed), housing typology

(detached house or townhouse, apartment building - with elevator, apartment building - no elevator, supported living), and whether they lived with somebody or alone. Other health behaviour variables such as smoking habit (non-smoker, current smoker), alcohol intake (measured as a continuous variable and expressed as intake in unit/month), accidents and falls, and physical activity and performance were also questioned.

At the baseline visit, trained staff collected information on lifestyle variables, body composition, functional tests. Anthropometric variables (weight, height and waist circumference) were assessed by trained staff. At each visit, the participant was also interviewed on possible changes in body weight in the last 3 months. Recruitment and baseline measurements were completed in April 2017. The trial was single blinded from staff to minimize possible bias in patient management. After completion of baseline measurements and receiving informed consent, women were allocated to either intervention or control group.

4.3 Food consumption

Food consumption data was obtained from a questionnaire with questions on warm meal consumption/week, fruit and vegetables daily intake, milk products consumption/day (milk, yogurt, sour milk), cheese slices/day, bread slices/day (dark and white), fish intake/week, meat and poultry intake/week, eggs/week, decreased food intake in last 3 months. Questionnaire items and responses with original and recoded assigned values are presented in Table 11. Nutrition variables were recoded into fewer categories based on earlier report (Helldán & Helakorpi 2014) and Finnish nutritional guidelines for older adults ‘Suomalaiset ravitsemussuositukset’ (2014).

Table 11. Questionnaire items and responses with original and recoded assigned values

Items	**Possible questionnaire responses assigned value**	**Recoded assigned value**
How many warm meals (morning breakfast, lunch or dinner) do you usually eat during week days?	1) more than two 2) two a day 3) one a day 4) one meal almost every day 5) one meal twice a week or less	1) = 1) two or more warm meals/day 2) = 1) two or more warm meals/day 3) = 2) one meal/day 4) = 3) at least one warm meal almost every day or less 5) = 3) at least one warm meal almost every day or less
Does your daily diet include two or more portions of fruit and vegetables?	1) no 2) yes	Unchanged
How many dl of milk products do you consume per day?	Average___dl	1) <0.5 liters/day 2) >0.5 liters/day
How many slices of cheese do you eat per day?	Average___slices	1) at least two/three slices/day 2) more than two/three slices/day
How many slices of bread do you eat per day?	Average___slices (dark and white bread separately)	1) None 2) 1-3 slices 3) 4-5 slices 4) 6-7 slices 5) 8 or more
How often do you eat fish? How often do you eat meat or poultry? How often do you eat eggs (consider also in meals)?	0) not at all 1) one or twice a week 2) once a week 3) a couple of times/week 4) 3-5 times a week 5) (almost) everyday	0) =1) None or once or twice per month 1) =1) None or once or twice per month 2) = 2) Once per week 3) = 3) Twice per week 4) = 4) More than twice 5) = 4) More than twice
Has your food intake decreased over the past 3 months?	0) no changes 1) dietary intake decreased slightly 2) dietary intake decreased significantly/considerably	0) = 1) ‘No’ 1) = 2) ‘Yes’ 2) = 2) ‘Yes’

4.4 Life satisfaction

Participants rated their LS with the Satisfaction with Life Scale (Allardt 1973, Koivumaa-Honkanen 1996), a four-item scale strongly associated with depression and evaluates SWB. In the past it has been used to measure LS of the healthy human being, as well as individuals suffering from psychiatric disease and it is currently used for predicting long term mortality, morbidity and health habits in the general and patient populations (Kuivasaari-Pirinen 2014). Current interest and happiness in life, ease of living and feelings of loneliness are the four items and answers range from 1 (‘very’) to 5 (‘not at all’) (Koivumaa-Honkanen 1996). The scale was modified from American Quality of Life studies and it has been used as an indicator of “happiness” in Finland.

LS studies prove the scale’s reliability and validity as it covers more than non-systematic events or individuals’ responses that are situation-dependent, meaning that a correlation is present between the self-report scales and other wellbeing indicators that are not dependent on respondent’s reports. The scale correlates with life events and changes in those conditions that usually affect life evaluations (Diener et al. 2012). The scale positively correlates with LS score, irrespectively of sex, age group, or health status and shows strong correlations with depression, HRQoL and sense of coherence (Koivumaa-Honkanen 1998). The two main components of the 4-item life satisfaction scale are LS (the global cognitive evaluation of the subject) and happiness (the affective assessment) of life as a whole. The four items include interest in life, happiness in life, ease of living, and self-perceived feelings of loneliness.

The LS scale was formulated by Heli Koivumaa-Honkanen, Professor of Psychiatry have been used used for general population (Koivumaa-Honkanen et al. 2000, 2001b, 2002, 2004a, 2004b, 2012) and psychiatric population assessment studies (Koivumaa-Honkanen et al. 1996, 1999, 2008, 2011). The LS scale items were rated as follows:

“Do you feel that your life at present is (score points in parentheses)

- very interesting (1), fairly interesting (2), cannot say (3), fairly boring (dull) (4) or very boring (dull) (5)?
- very happy (1), fairly happy (2), cannot say (3), fairly sad (unhappy) (4) or very sad (unhappy) (5)?
- very easy (1), fairly easy (2), cannot say (3), fairly hard (severe) (4) or very hard (severe) (5)?

- Do you feel that at the present moment you are very lonely (5), fairly lonely (4), cannot say (3) or not at all lonely (1)?".

The higher the obtained score, the higher the life dissatisfaction, and vice versa. Original guidelines suggest that a missing response for at least three times has to be considered missing data. In the study, missing values included all missing responses, from 1 out of 4 missing items to 4 out of 4 missing. Answers marked with more than one valid value (e.g. two circles instead of only one value) and invalid answers were considered as missing data. To develop the ultimate LS categorical variable, the creation of a continuous variable representing the LS score by summing up the four single items (interest and happiness in life, ease of living and feelings of loneliness) for each subject was necessary. The continuous LS score variable was used to classify the 3 categories, satisfied (i.e. subjects scoring 4-6), intermediate (score 7-11) and dissatisfied (score 12-20). The intermediate group consisted of those with LS score within ±1 standard deviations of the mean (Koivumaa-Honkanen 2000).The recodification into three categories created a subdivision of the sample into 'Satisfied' n= 164 (17.9% of sample) - range= 4-6; 'intermediate' n=614 (67.2%) - range= 7-11; 'dissatisfied': n= 103 (11.3%) - range= 12-18.

4.5 Other measurements and health examinations

The participants baseline characteristics variables include marital status, height (cm), weight (kg), waist circumference, waist circumference morbidity risk, weekly physical activity in the last year (aerobic activities, extra activities, endurance training, and muscle strength training), total alcohol consumption (gr) (beer, wine, strong alcohol), current smoking status, and falls (n). Baseline characteristic variables were recoded into fewer categorical variables for the simplicity of data analysis. BMI was calculated as weight (kg)/[height(m)]$_2$ and BMI category were retrieved and classified according to WHO guidelines (2019a) in underweight (<18.5), normal (18.5-24.9), overweight (25.0-29.9), obese (30.0-39.9). Waist circumference morbidity risk was computed as a categorical variable indicating at risk (>88 cm) and risk-free (<88cm) older women (WHO 2008, De Hollander 2012). Total alcohol consumption was calculated considering each portion as 12g (for example one can of beer 250-300 cc usually contains 4.5-5.5% alcohol, a wine bottle contains 120 g of alcohol per bottle and about 12-15 g alcohol per standard glass portion and same with heavy liquors), which was consequently multiplied for each can or bottle of beer, each number of wine glasses, and number of restaurant doses of heavy liquors and eventually summed up. Current smoking status was recoded into a binary

variable (yes/no). Physical activity was classified into 4 categories (never, once or twice/week, three or more days/week) according to proposed indications of the Geneve WHO report (2010).

4.6 Data analysis

Descriptive analysis for lifestyle and food consumption variables was run according to LS category. Continuous variables were checked for normality. Baseline characteristics were compared using Pearson chi-square test for categorical variables, and ANOVA continuous variables. Variables not following normal distribution were analyzed with Kruskal-Wallis nonparametric test. The results were expressed as means or frequencies with SD and %.

Multinomial regression models studying the association of decreased food intake and LS were adjusted for marital status, total alcohol consumption (g), decreased food intake in the last three months, and aerobic exercise (weekly frequency/last year) with multinomial logistic regression. Adjusted results are expressed as OR, 95% CI for Exp(B), and p-value. The cross-sectional analysis of data was carried out using the IBM SPSS Software version 25 for Mac (IBM Corp., Armonk, NY). Differences were considered statistically significant if $P < 0.05$.

4.7 Ethical considerations

KFPS study obtained ethical approval from the Hospital District of Northern Savo. Subjects were invited to participate in the study with informed consent, and an assurance of full confidentiality of their identifying information throughout the various stages of the study and beyond.

5 RESULTS

The participants' age range was 74-83–years. 7.7% of the participants were unmarried/single, 46.1% cohabitating/married, 16.4% divorced, 29.5% widow. Mean consumption of alcohol (wine, beer, heavy liquors) was 34.3 g/month. At baseline, 97.9% of women were not current smokers, 1.9% were current smokers. The sample mean of times fallen or tumbled in the last 12 months was 1.87 (SD±1.66). The LS scale ranged from 4 to 18 with a mean of 8.06 (SD±2.50) points. The sample did not score 19 and 20 (dissatisfied).

5.1 Baseline characteristics of KFPS participants by LS categories

Characteristics of women according to LS score category are presented in Table 12. Married/cohabiting women were more likely to be satisfied with life, while single, divorced and widowed women were more likely to be dissatisfied compared to their peers ($p>0.05$). Current smokers were significantly more likely to be dissatisfied with life, while non-smokers were significantly more likely to be satisfied.

Mean BMI was 27.3 kg/m2 (±4.50); where 33.1% of the participants had a BMI <25 kg/m2 and 66.8% ≥25 kg/m2. Mean waist circumference was 90.9 cm (SD±11.69), with 54.4% of the sample waist circumference at-risk (>88cm) and with 45.5% of the sample risk-free (<88 cm).

Table 12. Population baseline characteristics by LS category

Baseline characteristics	Satisfied (4-6) n= 164	Intermediate (7-11) n=614	Dissatisfied (12-18) n= 103	p-value
Marital status, n (%)				0.002[a]
Unmarried/single	7 (4.3)	54 (8.8)	9 (8.7)	
Married/cohabiting	86 (52.8)	292 (47.7)	32 (31.1)	
Divorced	18 (11.0)	103 (16.8)	19 (18.4)	
Widow	52 (31.9)	163 (26.6)	43 (41.7)	
Total alcohol consumption, g/month	37.3 (±83.1)	34.0 (±76.1)	34.7 (±88.8)	0.307[b]
Current smoking status, n (%)				0.009[a]
Currently smoking	2 (1.2)	9 (1.5)	6 (5.8)	
Non-smoker	162 (98.8)	603 (98.5)	97 (94.2)	
Self-reported falls[1]	1.64±1.1	1.90±1.8	1.98±1.5	0.368[a]
Height, cm	159.3±6.0	159.0±5.4	158.8±5.4	0.747[c]
Weight, kg	68.4±11.2	69.20±12.1	69.8±13.0	0.608[b]
BMI, kg/m2	27.0±4.3	27.4±4.5	27.7±5.2	0.579[b]
BMI category, n (%)				0.181[a]
Underweight (<18.5)	1 (0.6)	3 (0.5)	2 (1.9)	
Normal (18.5-24.9)	54 (32.9)	195 (31.8)	31 (30.1)	
Overweight (25.0-29.9)	73 (44.5)	265 (43.2)	35 (34.0)	

Obese (30.0-39.9)	36 (22.0)	150 (24.5)	35 (34.0)	
Waist circumference, cm	90.0±11.3	91.1±11.6	92.4±12.7	0.436[b]
Waist circumference morbidity risk, cm				0.997[a]
<88 cm	90 (54.9)	337 (55.0)	57 (55.3)	
>88 cm	74 (45.1)	276 (45.0)	46 (44.7)	

KW, Kruskal-Wallis nonparametric test; BMI, Body Mass Index.
[a] $\chi 2$-test, [b] Kruskal-Wallis test, [c] ANOVA, [1] in the last 12 months

Physical activity

Physical activity frequencies are presented in Table 13. Physical activity (weekly frequency in the last year) consisted of aerobic training (25.1% never exercised, 37.6% one or two times/week, 36.9% three or more times/week), endurance training (10.8% never exercised, 24.4% one or two times/week, 64.7% three or more times/week), muscle strength training (50.7% never exercised, 37.6% one or two times/week, 11.7% three or more times/week), and recreational physical activities (24.1% never exercised, 24.8% one or two times/week, 51.0% three or more times/week).

Table 13. Physical activity.

	Aerobic training	Endurance training	Muscle strength training	Recreational physical activities
Never	229 (25.1)	99 (10.8)	460 (50.3)	220 (24.1)
One or two times	344 (37.6)	221 (24.2)	341 (37.3)	225 (24.6)
Three times or more	337 (36.9)	586 (64.1)	106 (11.6)	463 (50.7)

5.2 Association of LS and food consumption

5.2.1 Carbohydrate and fibre-rich food sources

Carbohydrate and fibre food sources according to LS categories are presented in Table 14. In this data, 8.4% of the sample did not consume two or more portions of fruit and vegetables/day, 91.2% consumed two or more portions of fruit and vegetables/day.

The average consumption of bread was of 1-3 slices/day for each bread type (dark and white, average slices/day). Concerning white bread, 14.0% of the sample did not consume any slice, 60.8% consumed 1-3 slices of white bread, and 7.2% consumed four or more slices/day. Concerning dark bread, 2.5% of the sample did not consume any slice, 59.6% consumed 1-3 slices of white bread, 27.1% consumed 4-5 slices/day, and 6.4% consumed six or more

slices/day. We did not observe any statistically significant association between fruit and vegetable consumption dark and white bread consumption and LS.

Table 14. Carbohydrate and fibre-rich food sources by LS category

Carbohydrate and fibre-rich food sources	Satisfied (4-6) n= 164	Intermediate (7-11) n=614	Dissatisfied (12-18) n= 103	p-value
Two or more portions of fruit and vegetables, n/day (%)				0.170[a]
Yes	153 (93.9)	563 (91.8)	90 (87.4)	
No	10 (6.1)	50 (8.2)	13 (12.6)	
Bread, n (%)				
Dark				0.578[a]
None	3 (1.9)	17 (2.9)	2 (2.1)	
1-3 slices	97 (60.6)	369 (63.2)	66 (68.0)	
4-5 slices	52 (32.5)	160 (27.4)	21 (21.6)	
6-7 slices	7 (4.4)	32 (5.5)	8 (8.2)	
8 or more	1 (0.6)	6 (1.0)	0 (0.0)	
White				0.922[a]
None	26 (19.5)	86 (16.9)	10 (11.9)	
1-3 slices	95 (71.4)	378 (74.3)	67 (79.8)	
4-5 slices	11 (8.3)	41 (8.1)	6 (7.1)	
6-7 slices	1 (0.8)	3 (0.6)	1 (1.2)	
8 or more	0 (0.0)	1 (0.2)	0 (0.0)	

[a] $\chi 2$-test

5.2.2 Protein containing foods

Food sources of protein (fish, meat and poultry, and eggs), protein-containing foods (sum of fish, meat and poultry, and eggs), and dairy (milk, milk products, and cheese) according to LS categories are presented in Table 15. We did not observe any statistically significant association between meat and poultry or eggs intake and LS in older women. The association between consumption of fish and satisfaction with life and was close to statistical significance (p=0.064).

Women consuming protein-containing foods less than two times/week or 3-5 times/week were more likely to be intermediately satisfied, while women consuming protein-containing foods two times or 5 times and more/week were more likely to be dissatisfied compared to all other consumption frequencies. Satisfied women were more likely to consume protein containing foods twice a week compared to once/week.

5.5% of women consumed milk products <5 dl/day, and 94.3% of them consume >5 dl/day. At least 2-3 slices/day of cheese are consumed by 53.4% of the sample, while 45% consumed more

than 3 slices. We did not observe any statistically significant association between dairy sources, milk products, cheese slices consumption and LS.

Table 15. Protein sources by LS category.

Protein sources and dairy		Satisfied (4-6) n= 164	Intermediate (7-11) n=614	Dissatisfied (12-18) n=103	p-value
Fish					0.064[a]
	None or twice/ month	27 (16.7)	147 (24.1)	32 (31.1)	
	Once/week	69 (42.6)	244 (40.1)	32 (31.1)	
	Twice/week	50 (30.9)	184 (30.2)	31 (30.1)	
	More than twice/week	16 (9.9)	34 (5.6)	8 (7.8)	
Meat and poultry					0.907[a]
	None or twice/ month	7 (4.3)	27 (4.4)	6 (5.8)	
	Once/week	20 (12.2)	66 (10.8)	13 (12.6)	
	Twice/week	54 (32.9)	221 (36.1)	31 (30.1)	
	More than twice/week	83 (50.6)	299 (48.8)	53 (51.5)	
Eggs					0.770[a]
	None or twice/ month	38 (23.2)	113 (18.4)	22 (21.4)	
	Once/week	42 (25.6)	191 (31.2)	28 (27.2)	
	Twice/week	64 (39.0)	235 (38.3)	41 (39.8)	
	More than twice/week	20 (12.2)	74 (12.1)	12 (11.7)	
Protein-containing foods[b]					0.010[a]
	None or twice/ month	3 (2.0)	21 (3.6)	1 (1.0)	
	Once/week	9 (5.9)	30 (5.1)	11 (11.2)	
	Twice/week	113 (74.3)	449 (76.9)	61 (62.2)	
	More than twice/week	27 (17.8)	84 (14.4)	25 (25.5)	
Milk products (milk, sour milk, yogurt), n (%)					0.714 [a]
	<5 dl/day	10 (6.1)	31 (5.1)	4 (3.9)	
	>5 dl/day	153 (93.9)	582 (94.9)	99 (96.1)	
Cheese slices, n (%)					0.399 [a]
	at least 2-3 slices/day	81 (50.3)	326 (54.1)	60 (58.8)	
	more than 2-3 slices/day	80 (49.7)	277 (45.9)	42 (41.2)	

[a] $\chi 2$-test [b]sum of 'fish', 'meat and poultry', 'eggs' variables

5.2.3 Warm meal and decreased food intake

Food consumption according to LS categories is presented in Table 16. 77.6% of women were found to have two or more warm meals per day, 20.5% one warm meal per day, 1.6% at least 1 meal almost every day or less. 10.0% of the subjects decreased their food intake in the last 3 months, 89.8% did not decrease their food intake recently.

We did not observe any statistically significant association between warm meals consumption and LS ($\chi_2(4)=1.642$, $p=0.801$). We observed significant association between decreased food intake in last 3 months and LS categories ($\chi_2(2)=9.991$, $p<0.05$). Women who decreased their food intake in the previous three months were significantly more likely to be dissatisfied, while

those who did not decrease their food intake were significantly more likely to be satisfied (p=0.007) than their peers.

Table 16. Warm meal and decreased food intake by LS category

Warm meal and decreased food intake	Satisfied (4-6) n= 164	Intermediate (7-11) n=614	Dissatisfied (12-18) n= 103	p-value
Warm meals consumption, n (%)				0.801[a]
two or more/day	130 (79.8)	477 (77.8)	77 (74.8)	
one/day	30 (18.4)	125 (20.4)	25 (24.3)	
at least 1 meal almost every day or less	3 (1.8)	11 (1.8)	1 (1.0)	
Decreased food intake in last 3 months, n (%)				0.007[a]
Yes	9 (5.5)	62 (10.1)	18 (17.5)	
No	155 (94.5)	550 (89.9)	85 (82.5)	

[a] χ2-test

A multinomial logistic regression was used to analyse further association of decreased food intake in the last three months and LS with adjustments for marital status, BMI, alcohol, and aerobic exercise. The reference category for the outcome variable was 'satisfied'; each of the other categories were compared to this reference group. The estimated model does not represent a significant improvement in fit over the null model [$\chi^2(16)=36.075$, p=0.003]. The Deviance chi-square test indicates good fit [$\chi^2(1308)=1047.281$, p=1.00], while Pearson's chi-square test shows that the model poorly fits the data [$\chi^2(1308)=1311.486$, p=0.468]. The likelihood ratio test of the model fitting table reported that aerobic exercise was the only significant predictor in the model, although decreased food intake in the last 3 months was of borderline significance (p=0.065). Women who did not decrease their food intake in the last three months were 0.33 times less likely to be dissatisfied than satisfied (Exp(B) 0.334, p=0.024, CI 0.129-0.868). Marital status, BMI, and total alcohol consumption were not statistically significant predictors of LS.

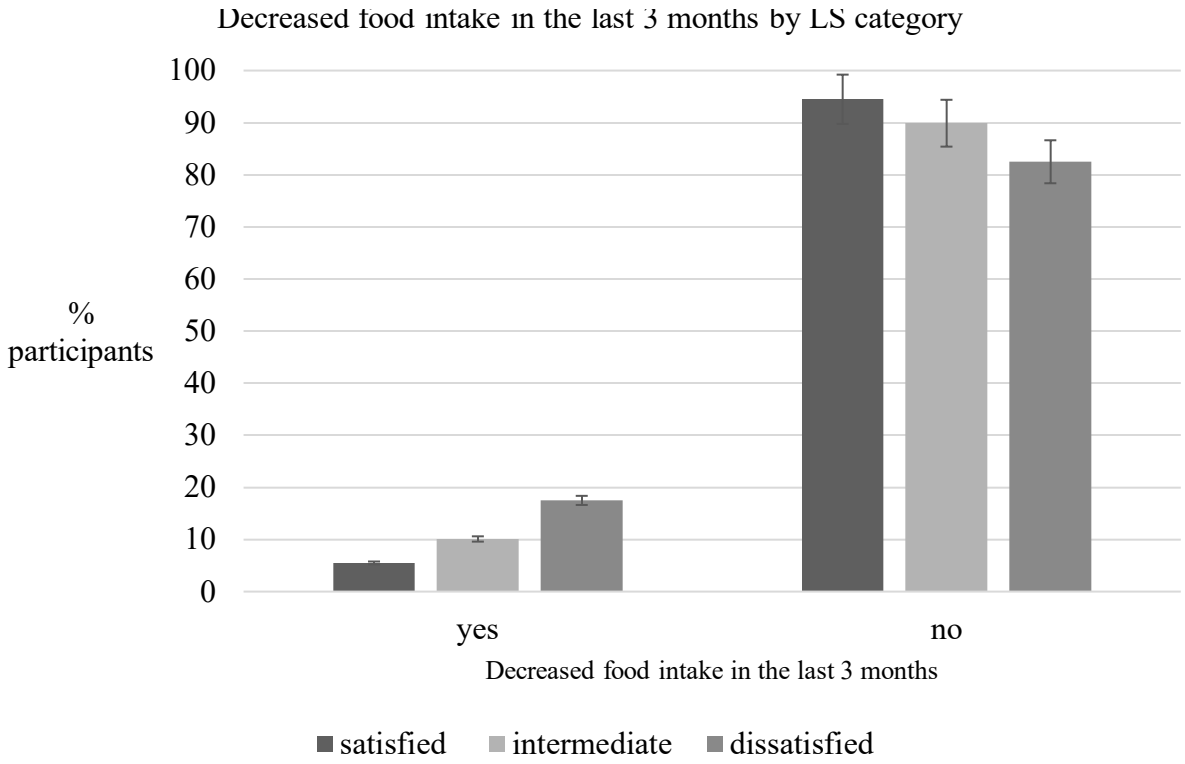

Figure 4. Frequency of women who have decreased food intake in the last 3 months by LS category. The model was adjusted for marital status, BMI (kg/m2), aerobic exercise (weekly frequence/last year) and total alcohol consumption (gr). The adjusted p-value of being dissatisfied is p=0.024.

6 DISCUSSION

This study is a preliminary analysis assessing food consumption and LS of Finnish older women. The main findings of our population-based study suggest that even if LS in the sample were intermediate and dissatisfaction was not much prevalent, a significant association existed between decreased food intake in the last three months and protein containing foods and LS. Our findings demonstrate that indicators of a healthy lifestyle, such as unaltered food intake in the last three months, being non-current smokers, and being married are associated with increased LS at baseline. Results showed no associations between food consumption variables like warm meal consumption, fruit and vegetable, bread, food sources of protein (fish, meat and poultry, and eggs), dairy products and LS. Similarly, no associations between LS and anthropometric measurements like height, weight, BMI, BMI categories, waist circumference, and between LS and factors like alcohol consumption and falls were found.

Although prior studies have contributed to describing the complex relationships between nutrition and LS, to our knowledge, the present study is the first to evaluate the relationship between food consumption and LS in a sample of healthy older women.

6.1 Food consumption

In our study, a decrease in food consumption occurred in the last three months is associated with reduced LS in older Finnish women. This is a new finding to our knowledge. The main interest of current analysis with multinomial logistic regression is to focus on the relationship between LS (3 categories – satisfied, intermediate and dissatisfied) and decreased food intake in the last three months controlling for marital status, BMI, alcohol, aerobic exercise. Our results are inconsistent with Naseer & Fagerstorm (2015), showing a weak association between decreased food intake and low LS though a significant impact on physical and mental related QoL in adults aged 65 and older.

A decrease in food intake in older women is associated with physiological weight loss, appetite, social eating and feeling of loneliness in previous literature (Morley 2001). The cause of physiological decline in food intake is multifactorial (taste and smell alterations, increased gastrointestinal satiation signals and a decline in central feeding drive) and is predominantly due to a decreased fat intake in healthy older adults (Morley 2001).

Poor appetite or loss of appetite are common among older adults and are considered relevant determinants of HRQoL (Acar Tek & Karaçil-Ermumcu 2018). Older adults with poor appetite reported lower dietary intake compared to their peers with good appetite (Van der Meij et al. 2017) and social setting is of vital importance for food intake in older adults (65 years old and more) (Holmes & Roberts 2011). These aspects could be investigated with LS indicators as older adults experiencing loneliness are also at higher risk for malnutrition development (Ramic et al. 2011).

Older women with a desire to decrease food intake and lose weight showed attitudes towards food and eating with restrained eating practices (e.g. dieting) that were significantly associated with lower LS (Carrard et al. 2018). This could be interesting for further investigation of LS within geriatric population.

The finding of a statistically significant association between decreased food intake in the last three months and LS was unanticipated and more research and investigations on decreased food intake and appetite in relation to LS in older adults is required to fully understand this question.

Warm meal consumption was not independently associated to LS. Holmes & Roberts (2011) found an association between eating alone at home and dietary habits in older adults aged 65 years or more where those eating at home alone showed preference for convenient food (easily accessible and ready-made) over cooked or hot meals. Loneliness, a fundamental component of LS, warm meal consumption and dietary habits might be interesting cues for future research.

Protein-containing foods and LS were associated in older Finnish women. A comparison with previous literature findings is challenging due to the nature of the ‘protein-containing foods’, a variable purposely created for this study to get a more comprehensive picture of protein consumption within the sample. In addition, the association is complex. From our study it seems that dissatisfied women have both increased and reduced their protein containing foods consumption frequencies when compared to the intermediate group, meaning there could be could be heterogenous subsamples, ill- dissatisfied- women who cannot consume protein containg foods or at risk people who try to improve their diet yet they are dissatisfied with their life. Previous studies on fish report that fish consumption is linked to depression (Liu et al. 2016) and QoL (Schiepers et al. 2010). Further investigation is recommended due to the lack

of evidence on the relationship between protein-containing foods and self-reported LS among seniors.

Our results suggested a non-significant relationship between fruit and vegetable consumption and LS among older women. A general consensus has been reached on the positive effect of increased intake of fruit and vegetable on wellbeing (Holder 2019) and similar studies report that increased consumption has been associated with happiness in adults (Veenhoven 2019) and lower risk of depression among 67-year old individuals (Yu & Tsai 2011). Higher fruit and vegetable intake predicted increased LS in cross-sectional (Blanchflower et al. 2013, André et al. 2017) and longitudinal studies (Mujcic & Oswald 2016) among young adults and older people. Further studies with more detailed measurements on the fruit and vegetable consumption pattern of Finnish older women are needed to better understand this question.

Our findings suggest that bread consumption and LS were not associated. Inconsistency is found with the cross-sectional study results among 96 099 Norwegian older adults (65 years and older) (André et al. 2017) in which residents with higher consumption of whole-grain bread, within a healthy dietary pattern, were more satisfied with life compared to individuals following unhealthy food patterns. Contrast is found with Gacek study findings (2013, 2017) reporting an association between higher levels of satisfaction with life and increased consumption of whole-grain bread ($p<0.01$), as well as with a decreased intake of white bread ($p<0.05$). Nonetheless, differences in sample age and size need to be noted.

6.2 Population characteristics

Civil status is a relevant aspect of social connection and, in line with previous literature, our study confirmed marital status to be a predictor of LS. Ghimire and colleagues (2018) findings reveal that LS was positively associated with being married in Nepalese elderly (60 years old and older). Similarly, in Turkish older adults (2,959 older adults over 65 years), Swedish oldest-olds (681 individuals aged 78–98 years), being married was a significant factor for increased LS (Celik et al. 2018, Enkvist et al. 2012b). The different cultural and aging influences need to be noted.

In Finland, marital status and cohabiting have been investigated only in relation to self-rated health (Joutsenniemi et al. 2006) and showed that married persons are healthier and live longer

than single, divorced, and widowed persons. Our study offers a new perspective on the topic. One possible explanation of the finding is that being married, or cohabiting might increase the ease of living, happiness and interest in life, and decrease self-perceived feelings of loneliness.

In our study, alcohol consumption (beer, wine and heavy liquors) was not associated with LS in older Finnish women. Our findings are inconsistent with Huffman and Rizov (2018) results, in which alcohol consumption was positively related to LS ($p<0.05$) among Russian population; and with Koivumaa-Honkanen et al. (2012) longitudinal studies on healthy Finnish adult twins, in which high alcohol consumption was a predictor of life dissatisfaction. Frequent alcohol users (women ≥400 gr/month) were more often dissatisfied with their life. Nonetheless, differences in the age of the sample should be noted and findings interpreted carefully.

In our study, current smokers ($p=0.009$) were more likely to be dissatisfied with life. Similarly, Huffman and Rizov (2018) found that smoking was negatively associated with LS in Russians, while smoking was positively associated with life dissatisfaction ($p<.001$) among 11,084 Finnish women (age 57–66 years) (Lukkala et al. 2016).

Our sample included physically active older women. Muscle strength training excluded, all other activities (aerobic training, endurance training, recreational physical activities) were frequently practiced by older women at baseline. The association between physical activity and LS is beyond the scope of our study therefore we exclusively report physical activity patterns of our sample.

6.3 Study strengths and limitations

This study presents the analysis assessing LS of older Finnish women in relation to food consumption in baseline KFPS study data. We provide preliminary support of the association between decreased food intake and self-reported LS in older women, which is a novel finding. LS was measured with the 4-item LS scale, a valid tool to evaluate global SWB. The LS scale is a short, easily administered assessment method that has been associated with HRQoL (Koivumaa-Honkanen et al. 2000, Sinikallio et al. 2011), mental health (Koivumaa-Honkanen et al. 2004), and depression (Koivumaa-Honkanen et al. 2008). The adequate sample size as the total final KFPS study population comprised 914 women (457 for each study group), a sample size favored by the significantly lower than estimated drop-out rate and a higher number of falls (Vilpunaho et al. 2019).

The study has some limitations that should be noted. Being limited to baseline data and to the cross-sectional design, the direction of associations is unknown. Chances are that diet affects life satisfaction and/or vice versa. Our study participants were healthy and physically active Finnish older women belonging to the general population. The demographics, food consumption patterns and LS of patients, physically inactive, ill or frail older adults may significantly differ from our sample and for this reason, the interpretation and generalization of results must be cautious. External validity might be limited due to the differences in food habits and LS of the Finnish population compared to other geographical areas. For example, inhabitants of Finland score higher in satisfaction with life than the average OECD countries (Organisation for Economic Co-operation and Development average 2019), especially women are slightly more satisfied than men (Findicator 2014) and food habits differ at large extent. Data analyses were adjusted for several possible confounders nevertheless the chance of residual and unmeasured confounding cannot be excluded.

We did not have complete data on the participants diet. The self-reported data used for the analysis (food consumption and LS), which is a common approach for gathering data in epidemiologic and medical research though highly susceptible to self-report bias (recall and social desirability bias), especially among older individuals (Jia et al. 2008) represents one of the shortcomings of the study. Since the data is self-reported and the answers are categorized in the questionnaire and subsequently re-categorized in the data analysis phase, there is a possibility of biased categorization.

6.4 Implications of the study

Nutrition, SWB and QoL are connected to some extent during the whole lifespan. Findings of this investigation complement those of earlier studies on the relationship between food consumption and QoL, HRQoL, and SWB, and partly fill the gap in knowledge on food consumption and LS in healthy older adults. Our findings have especially significant implications for the understanding of how food consumption is related to LS in healthy older women. Although this study focuses on food consumption and LS, the findings provide new insight into the relationship between decreased food intake and LS.

Several questions still remain to be answered and further work is required to fully understand the implications of our study findings and assess the impact of food consumption on older adults' LS. In terms of directions for future research, a natural progression of this work is to

explore modifications in food consumption behavior and LS using KFPS data collected at 12 and 24 months, especially on decreased food intake. Overall, this study strengthens the idea of the role of nutrition in promoting LS, providing early evidence on the impact of food consumption on LS among older women.

7 CONCLUSION

This research aimed to identify the plausible associations between food consumption and LS in older women.

Based on this preliminary quantitative analysis of LS in response to food consumption patterns, it can be concluded that LS is associated with decreased food intake and protein containing foods consumption in older women in Finland. Differently from previous literature findings, the association between fruit and vegetable consumption with LS was not significant.

Research into older adults' SWB and LS is at an early stage. Nevertheless, the wellbeing of the geriatric population is relevant and to better understand the implications of these results, future studies could address the topic with larger samples and prospective design.

8 REFERENCES

Abizanda, P., Sinclair, A., Barcons, N., Lizan, L., & Rodriguez-Manas, L. Costs of malnutrition in institutionalized and community-dwelling older adults: A systematic review. J.Am.Med.Dir.Assoc. 2016;17:17-23.

Acar Tek, N., & Karacil-Ermumcu, M. S. Determinants of health related quality of life in home dwelling elderly population: Appetite and nutritional status. J.Nutr.Health Aging 2018;22:996-1002.

Agarwal, E., Miller, M., Yaxley, A., & Isenring, E. Malnutrition in the elderly: A narrative review. Maturitas 2013;76:296-302.

Alfonso, V. C., Allison, D. B., Rader, D. E., & Gorman, B. S. The extended satisfaction with life scale: Development and psychometric properties. Social Indicators Research 1996.

Allardt, E. About dimension of welfare: An explanatory analysis of the comparative Scandinavian survey. Research Reports:1. University of the Helsinki, Research Group of Comparative Sociology. 1973.

André, B., Canhão, H., Espnes, G., Ferreira Rodrigues, A., Gregorio, M., & Nguyen, C. et al. Is there an association between food patterns and life satisfaction among Norway's inhabitants ages 65 years and older?. Appetite, 2017; 110, 108-115.

Andrews, F., Withey SB. Social indicators of well-being. New York: Plenum Press 1976.

Averina, M., Nilssen, O., Brenn, T., Brox, J., Arkhipovsky, V. L., & Kalinin, A. G. Social and lifestyle determinants of depression, anxiety, sleeping disorders and self-evaluated quality of life in Russia--a population-based study in Arkhangelsk. Soc.Psychiatry Psychiatr.Epidemiol. 2005;40:511-518.

Bai X Yang, S Knapp M. Social support, loneliness and life satisfaction in older adults living alone. Gerontologist 2016;56:714.

Bailey, R. L., Mitchell, D. C., Miller, C. K., Still, C. D., Jensen, G. L., Tucker, K. L., et al. A dietary screening questionnaire identifies dietary patterns in older adults. Jn 2007;137:421-426.

Baird, B. M., Lucas, R. E., & Donnellan, M. B. Life satisfaction across the lifespan: Findings from two nationally representative panel studies. Social Indicators Research 2010;99:183–203.

Banjare, P., Dwivedi, R., & Pradhan, J. Factors associated with the life satisfaction amongst the rural elderly in Odisha, India. Health and Quality of Life Outcomes 2015;13:201.

Barrett, A. J., & Murk, P. J. Life satisfaction index for the third age (LSITA): A measurement of successful aging. . In E. P. Isaac (Ed.), Proceedings of the 2006 Midwest Research-to-Practice Conference in Adult, Continuing, Extension, and Community Education: Impacting Adult Learners Near and Far. 2006.

Bauer, J. M., & Sieber, C. C. Significance and diagnosis of malnutrition in the elderly. Z.Arztl.Fortbild.Qualitatssich. 2007;101:605-609.

Baugreet, S., Hamill, R. M., Kerry, J. P., & McCarthy, S. N. Mitigating nutrition and health deficiencies in older adults: A role for food innovation? J.Food Sci. 2017;82:848-855.

Berg, A. I., Hoffman, L., Hassing, L. B., McClearn, G. E., & Johansson, B. What matters, and what matters most, for change in life satisfaction in the oldest-old? A study over 6 years among individuals 80+. Aging & Mental Health 2009;13:191-201.

Bernstein, M. Nutritional needs of the older adult. Phys.Med.Rehabil.Clin.N.Am. 2017;28:747-766.

Better Life Initiative. How’s life in Finland? 2017.

Blanchflower, D. G., Oswald, A. J., & Stewart-Brown, S. Is psychological well-being linked to the consumption of fruit and vegetables? Soc.Indicators Res. 2013;114:785-801.

Boehm, J. K., Winning, A., Segerstrom, S., & Kubzansky, L. D. Variability modifies life satisfaction's association with mortality risk in older adults. Psychol.Sci. 2015;26:1063-1070.

Boylu A, Gunay, G. Life satisfaction and quality of life among the elderly: Moderating effect of activities of daily living. Turkish Journal of Geriatrics 2017;20:61-69.

Bryman PN, D. N. Nutrition, immunity and aging. effects of immune and nutritional compromise. . AOA Health Watch 2014.

Bulut, E. A., Khoury, R., Lee, H., & Grossberg, G. T. Eating disturbances in the elderly: A geriatric-psychiatric perspective. Nutrition and Healthy Aging 2019;5:185-198.

Burks, C. E., Jones, C. W., Braz, V. A., Swor, R. A., Richmond, N. L., Hwang, K. S., et al. Risk factors for malnutrition among older adults in the emergency department: A multicenter study. J.Am.Geriatr.Soc. 2017;65:1741-1747.

Campbell A, Converse PE, Rogers WL. The quality of American life. 1976.

Cantril, H. The pattern of human concerns. New Brunswick, NJ: Rutgers University Press 1965;22.

Carrard, I., Kruseman, M., & Marques-Vidal, P. (). Desire to lose weight, dietary intake and psychological correlates among middle-aged and older women. The CoLaus study. Preventive Medicine, 2018; 113, 41-50.

Cederholm, T., Bosaeus, I., Barazzoni, R., Bauer, J., Van Gossum, A., Klek, S., et al. Diagnostic criteria for malnutrition - an ESPEN consensus statement. Clin.Nutr. 2015;34:335-340.

Cederholm, T., Jensen, G. L., Correia, M. I. T. D., Gonzalez, M. C., Fukushima, R., Higashiguchi, T., et al. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. Clin.Nutr. 2019;38:1-9.

Celik, S. S., Celik, Y., Hikmet, N., & Khan, M. M. Factors affecting life satisfaction of older adults in turkey. Int.J.Aging Hum.Dev. 2018;87:392-414.

Chen, C. Aging and life satisfaction. Soc.Indicators Res. 2001;54:57-79.

Cheng, S. T., & Chan, A. C. Relationship with others and life satisfaction in later life: Do gender and widowhood make a difference? J.Gerontol.B Psychol.Sci.Soc.Sci. 2006;61:46.

Clegg, M. E., & Williams, E. A. Optimizing nutrition in older people. Maturitas 2018;112:34-38.

Cleghorn, C. Short form FFQ2017, Retrieved 15/12/, 2019, from https://www.nutritools.org/tools/136

Clover, E., Miller, M., Bannerman, E., & Magarey, A. Relative validation of a short food frequency questionnaire to assess calcium intake in older adults. Aust.N.Z.J.Public Health 2007;31:450-458.

Colon-Emeric, C. S., Whitson, H. E., Pavon, J., & Hoenig, H. Functional decline in older adults. Am.Fam.Physician 2013;88:388-394.

Crogan, N. L. Nutritional problems affecting older adults. Nurs.Clin.North Am. 2017;52:433-445.

Cummins, R. A., Eckersley, R., Pallant, J., Van Vugt, J., & Misajon, R. Developing a national index of subjective wellbeing: The Australian unity wellbeing index. Social Indicators Research 2003.

De Hollander, E.,L., Bemelmans, W. J. E., Boshuizen, H. C., Friedrich, N., Wallaschofski, H., Guallar-Castillón, P., et al. The association between waist circumference and risk of mortality considering body mass index in 65- to 74-year-olds: A meta-analysis of 29 cohorts involving more than 58 000 elderly persons. Ije 2012;41:805-817.

De Neve, J.-E., Diener, E., Tay, L., & Xuereb, C. The objective benefits of subjective well-being. World Happiness Report 2013.

De Vries, J. H., de Groot, L. C., & van Staveren, W. A. Dietary assessment in elderly people: Experiences gained from studies in the netherlands. Eur.J.Clin.Nutr. 2009;63 Suppl 1:69.

Deaton, A. Income, health, and well-being around the world: Evidence from the Gallup World Poll. The Journal of Economic Perspectives: A Journal of the American Economic Association 2008;22:53-72.

Diener E, Suh E, Smith H, Shao L. National differences in reported subjective well-being: Why do they occur? . Social Indicators Research 1995;34:7–32.

Diener Ed. Subjective well-being . Psychological Bulletin 1984.

Diener Ed, Inglehart Ronald, & Tay Louis. Theory and validity of life satisfaction scales. Soc Indic Res 2013;112:497-527.

Diener, E., & Seligman, M. E. P. Beyond money: Toward an economy of well-being. Psychological Science in the Public Interest 2004;5:1-31.

Diener, E., Oishi, S., & Lucas, R. E. Subjective well-being: The science of happiness and life satisfaction. Oxford Library of Psychology. Oxford Handbook of Positive Psychology 2009;187-194.

Diener, E., Clark, A. E., Georgellis, Y., & Lucas, R. E. Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status. J.Pers.Soc.Psychol. 2003;84:527-539.

Diener, E., & Diener, M. Cross-cultural correlates of life satisfaction and self-esteem. J.Pers.Soc.Psychol. 1995;68:653-663.

Diener, E., Oishi, S., & Tay, L. Advances in subjective well-being research. Nat.Hum.Behav. 2018;2:253-260.

Diener, E. Subjective well-being: The science of happiness and a proposal for a national index. Am.Psychol. 2000;55:34-43.

Diener, E.,Suh, E., Lucas M., Richard E., Smith, Heidi L. Subjective well-being: Three decades of progress. Psychological Bulletin 1999;276-302.

Diener, E., & Chan, M. Y. Happy people live longer: Subjective well-being contributes to health and longevity. Applied Psychology: Health and Well-Being 2011;3:1-43.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. The satisfaction with life scale. J.Pers.Assess. 1985;49:71-75.

Diener, E., & Seligman, M. E. P. Very happy people. Psychol.Sci. 2002;13:81-84.

Diener, E., Suh, E., & Lucas, R. E. Discriminant validity of well-being measures. J.Pers.Soc.Psychol. 1996;71:616-628.

Donini, L. M., Poggiogalle, E., Molfino, A., Rosano, A., Lenzi, A., Rossi Fanelli, F., et al. Mini-nutritional assessment, malnutrition universal screening tool, and nutrition risk screening tool for the nutritional evaluation of older nursing home residents. J.Am.Med.Dir.Assoc. 2016;17:959.11-959.

Dumic A, Nordin T, Jecmenica M, Lalosevic M, Milosavljevic T, and Milovanovic T. Gastrointestinal tract disorders in older . Canadian Journal of Gastroenterology and Hepatology 2019.

Dunne, R. F., Loh, K. P., Williams, G. R., Jatoi, A., Mustian, K. M., & Mohile, S. G. Cachexia and sarcopenia in older adults with cancer: A comprehensive review. Cancers 2019;11.

Dunneram Y & Jeewon R. Determinants of eating habits among older adults. Progr Nutr [Internet] 2015;17:274-83.

Endicott, J., Nee, J., Harrison, W., & Blumenthal, R. Quality of life enjoyment and satisfaction questionnaire: A new measure. Psychopharmacology Bulletin 1993.

Enkvist Å, Ekström H, Elmståhl S. What factors affect life satisfaction (LS) among the oldest-old? Archives of Gerontology and Geriatrics. 2012 (a);54:140-145.

Enkvist Å, Ekström H, Elmståhl S. Life satisfaction (LS) and symptoms among the oldest-old: Results from the longitudinal population study called Good Aging in Skåne (GÅS). 2012 (b);54:145-150.

Erkkilä, A. T., Jarvinen, R., Karvonen, H., Keronen, L., & Tuppurainen, M. T. Validation of a semi-quantitative FFQ using food records as a reference in older women in the kuopio fracture prevention study (OSTPRE-FPS). Public Health Nutr. 2012;15:635-639.

Eysteinsdottir, T., Thorsdottir, I., Gunnarsdottir, I., & Steingrimsdottir, L. Assessing validity of a short food frequency questionnaire on present dietary intake of elderly icelanders. Nutrition Journal 2012;11:12.

Fávaro-Moreira, N. C., Krausch-Hofmann, S., Matthys, C., Vereecken, C., Vanhauwaert, E., Declercq, A., et al. Risk factors for malnutrition in older adults: A systematic review of the literature based on longitudinal data. Advances in Nutrition (Bethesda, Md.) 2016;7:507-522.

Ferrans, C. E., & Powers, M. J. Quality of life index: Development and psychometric properties. Advances in Nursing Science 1985.

Ferrans, C. E., & Powers, M. J. Psychometric assessment of the quality of life index. Res.Nurs.Health 1992;15:29-38.

Ferrara, M., Langiano E., Crispino, D., & Vendictis, M., & Vito, E. Quality of life and level of satisfaction of elderly persons receiving home health care: A cross-sectional study. Igiene e Sanità Pubblica. 2015;71:39-50.

Ferring, D., Balducci, C., Burholt, V., Wenger, C., Thissen, F., Weber, G., & Hallberg, I. Life satisfaction of older people in six European countries: Findings from the European study on adult well-being. European Journal of Ageing, 2004;15–25.

Findicator. Life satisfaction 2014, https://findikaattori.fi/en/118

Finnish Food Authority (a). Elderly people, Retrieved 29/10/2019, from https://www.ruokavirasto.fi/en/themes/healthy-diet/nutrition-and-food-recommendations/elderly-people/

Finnish Food Authority (b). Nutrition recommendations for elderly people, Retrieved 30.10.2019, from https://www.ruokavirasto.fi/en/themes/healthy-diet/nutrition-and-food-recommendations/elderly-people/

Finnish Food Authority (c). The plate model - the plate model guides you towards a healthy diet, Retrieved 30.10.2019, from https://www.ruokavirasto.fi/en/themes/healthy-diet/nutrition-and-food-recommendations/the-plate-model/

Fogelholm M, Hakala P, Kara R, Kiuru S, Kurppa S, Kuusipalo H, et al. Finnish nutrition recommendations. Terveyttä ruoasta – suomalaiset ravitsemussuositukset 2014, Valtion ravitsemusneuvottelukunta.

Gacek, M. The sense of life satisfaction versus dietary choices of young women doing fitness for recreational purposes. Rocz.Panstw.Zakl.Hig. 2017;68:77-81.

Gacek, M. Selected individual determinants of cereal, fruit and vegetable consumption among menopausal women in view of potential health risks. Menopause Review/Przegląd Menopauzalny 2013;12:385-391.

Gacek, M., & Wojtowicz, A. Life satisfaction and other determinants of eating behaviors among women aged 40-65 years with type 2 diabetes from the Krakow population. Przeglad Menopauzalny = Menopause Review 2019;18:74-81.

George, L., & Abou-Saleh MT, Katona C, Kumar A. Principles and practice of geriatric psychiatry. 2002.

Gerstorf, D., Ram, N., Estabrook, R., Schupp, J., Wagner, G. G., & Lindenberger, U. Life satisfaction shows terminal decline in old age: Longitudinal evidence from the German socio-economic panel study (SOEP). Developmental Psychology 2008;44:1148–1159.

Ghimire, S., Baral, B. K., Karmacharya, I., Callahan, K., & Mishra, S. R. Life satisfaction among elderly patients in Nepal: Associations with nutritional and mental well-being. Health.Qual.Life.Outcomes 2018;16:118-2.

Giannunzio, V., Degortes, D., Tenconi, E., Collantoni, E., Solmi, M., Santonastaso, P., Favaro, A. Decision-making impairment in anorexia nervosa: New insights into the role of age and decision-making style. European Eating Disorders 2018;26:302-314.

Giezenaar, C., Chapman, I., Luscombe-Marsh, N., Feinle-Bisset, C., Horowitz, M., & Soenen, S. Ageing is associated with decreases in appetite and energy intake--A meta-analysis in healthy adults. Nutrients 2016;8:10.3390/nu8010028.

Gilsing, A., Mayhew, A., Payette, H., Shatenstein, B., Kirkpatrick, S., Amog, K., et al. Validity and reliability of a short diet questionnaire to estimate dietary intake in older adults in a subsample of the canadian longitudinal study on aging. Nutrients 2018;10:1522.

Glabska, D., Guzek, D., Groele, B., & Gutkowska, K. Fruit and vegetable intake and mental health in adults: A systematic review. Nutrients 2020;12:10.3390/nu12010115.

Goel, V., Rosella, L., Fu, L., & Alberga, A. The relationship between life satisfaction and healthcare utilization: A longitudinal study. American Journal of Preventive Medicine 2018;55:142-150.

Gopinath, B., Russell, J., Flood, V. M., Burlutsky, G., & Mitchell, P. Adherence to dietary guidelines positively affects quality of life and functional status of older adults. Journal of the Academy of Nutrition and Dietetics 2014;114:220-229.

Govindaraju, T., Sahle, B. W., McCaffrey, T. A., McNeil, J. J., & Owen, A. J. Dietary patterns and quality of life in older adults: A systematic review. Nutrients 2018;10:971.

Grønning, K., Espnes, G.A., Nguyen, C., Rodrigues, A.M., Gregório, M.J., Sousa, R.D., Canhão, H., & André, B. Psychological distress in elderly people is associated with diet, wellbeing, health status, social support and physical functioning- a HUNT3 study. . BMC Geriatrics 2018.

Grunert,K.G. Food for the Aging Population (Second Edition). Chapter 1 - Older People, Food, and Satisfaction With Life, 2017; p.3-24.

Guigoz, Y. The mini nutritional assessment (MNA) review of the literature--what does it tell us? J.Nutr.Health Aging 2006;10:466-7.

Hamdan Mansour, A. M., Shehadeh, J. H., Puskar, K., El-Hneiti, M., & Haourani, E. M. Investigating physical, psychological and social well-being of older persons in jordan. Curr.Aging Sci. 2017;10:217-223.

Harada, C. N., Natelson Love, M. C., & Triebel, K. L. Normal cognitive aging. Clinics in Geriatric Medicine 2013;29:737–752.

Harrison, F. E. A critical review of vitamin C for the prevention of age-related cognitive decline and alzheimer's disease. Journal of Alzheimer's Disease : JAD 2012;29:711–726.

Helldán A, H. S. Health behavior and health among the Finnish elderly, spring 2013 with trends 1993—2013. National Institute of Health and Welfare 2014.

Helminen, H., Luukkaala, T., Saarnio, J., & Nuotio, M. S. Predictive value of the mini-nutritional assessment short form (MNA-SF) and nutritional risk screening (NRS2002) in hip fracture. Eur.J.Clin.Nutr. 2019;73:112-120.

Helvik, A., Engedal, K., Krokstad, S., & Selbæk, G. A comparison of life satisfaction in elderly medical inpatients and the elderly in a population-based study: Nord-Trøndelag Health Study 3. Scand.J.Public Health 2011;39:337-344.

Holder, M. The contribution of food consumption to well-being. Ann Nutr Metab 2019;74:44-52.

Holmes, B. A., & Roberts, C. L. Diet quality and the influence of social and physical factors on food consumption and nutrient intake in materially deprived older people. Eur.J.Clin.Nutr. 2011;65:538-545.

Holstila A-L, Helakorpi S, Uutela A. Eläkeikäisen väestön terveyskäyttäytyminen ja terveys keväällä 2011 ja niiden muutokset 1993–2011. terveyden ja hyvinvoinnin laitos. Raportti 56/2012.Suomen Yliopistopaino Oy, Tampere 2012.

Hörnquist, J. O. The concept of quality of life. Scand.J.Soc.Med. 1982;10:57-61.

Hudgens, J., & Langkamp-Henken, B. The mini nutritional assessment as an assessment tool in elders in long-term care. Nutr.Clin.Pract. 2004;19:463-470.

Huffman, S. K., & Rizov, M. Life satisfaction and diet in transition: Evidence from the russian longitudinal monitoring survey. Agricultural Economics 2018;49:563-574.

Hülür, G., Heckhausen, J., Hoppmann, C., Infurna, F., Wagner, G., Ram, N., & Gerstorf, D. Levels of and changes in life satisfaction predict mortality hazards: Disentangling the role of physical health, perceived control, and social orientation. . Psychology and Aging 2017;32:507-520.

ICD 11 for Mortality and Morbidity Statistics. Malnutrition 2019, from https://icd.who.int/browse11/l-m/en#/http%3a%2f%2fid.who.int%2ficd%2fentity%2f1517885800

Isautier, J., Bosnić, M., Yeung, S., Trappenburg, M., Meskers, C., Whittaker, A., & Maier, A. Validity of Nutritional Screening Tools for Community-Dwelling Older Adults: A Systematic Review and Meta-Analysis. Journal Of The American Medical Directors Association, 2019; 20(10).

Jafari Nasabian, P., Inglis, J., Reilly, W., Kelly, O., & Ilich, J. Aging human body: Changes in bone, muscle and body fat with consequent changes in nutrient intake. Journal of Endocrinology 2017;234.

Jia, X., Craig, L. C., Aucott, L. S., Milne, A. C., & McNeill, G. Repeatability and validity of a food frequency questionnaire in free-living older people in relation to cognitive function. J.Nutr.Health Aging 2008;12:735-741.

Joutsenniemi K., Martelin T., Koskinen S., Martikainen P., Härkänen T., Luoto R., Aromaa A., Official marital status, cohabiting, and self-rated health—time trends in Finland, 1978–2001, European Journal of Public Health, 2006: 16 (5), 476–483.

Kaipainen T, Tiihonen M, Hartikainen S, Nykänen I. Prevalence and risk factors for malnutrition among home care clients. . The Journal of Nursing Home Research 2015.

Kaiser, M. J., Bauer, J. M., Ramsch, C., Uter, W., Guigoz, Y., Cederholm, T., et al. Frequency of malnutrition in older adults: A multinational perspective using the mini nutritional assessment. J.Am.Geriatr.Soc. 2010;58:1734-1738.

Kaiser, M. J., Bauer, J. M., Uter, W., Donini, L. M., Stange, I., Volkert, D., et al. Prospective validation of the modified mini nutritional assessment short-forms in the community, nursing home, and rehabilitation setting. J.Am.Geriatr.Soc. 2011;59:2124-2128.

Karadag Arli, S., Bakan, A. B., Varol, E., & Aslan, G. Investigation of pain and life satisfaction in older adults. Geriatr.Gerontol.Int. 2018;18:5-11.

Keller, H., Ostbye, T., & Goy, R. Nutritional risk predicts quality of life in elderly community-living canadians. J.Gerontol.A Biol.Sci.Med.Sci. 2004;59:68-74.

Koivumaa-Honkanen H, Honkanen R, Antikainen R, Hintikka J, Laukkanen E, Honkalampi K, et al. Self-reported life satisfaction and recovery from depression in a 1-year prospective study. Acta Psychiatr Scand 2001(a);38-44.

Koivumaa-Honkanen H, Honkanen R, Antikainen R, Hintikka J, Viinamäki H. Self-reported life satisfaction and treatment factors in patients with schizophrenia, major depression and anxiety disorder. Acta Psychiatr Scand 1999;377-384.

Koivumaa-Honkanen H, Honkanen R, Koskenvuo M, Viinamäki H, Kaprio J. Life dissatisfaction as a predictor of fatal injury in a 20-year follow-up. Acta Psychiatr Scand 2002;444-450.

Koivumaa-Honkanen H, Honkanen R, Viinamaeki H, Heikkilae K, Kaprio J, Koskenvuo M. Life satisfaction and suicide: A 20-year follow-up study. Am J Psychiatry 2001 (b);433-439.

Koivumaa-Honkanen H, Kaprio J, Honkanen R, Viinamäki H, Koskenvuo M. Life satisfaction and depression in a 15- year follow-up of healthy adults. Soc Psychiatry Psychiatr Epidemiol 2004 (a);994-999.

Koivumaa-Honkanen H, Kaprio J, Korhonen T, Honkanen RJ, Heikkila K, Koskenvuo M. Self-reported life satisfaction and alcohol use: A 15-year follow-up of healthy adult twins. Alcohol Alcohol 2012;160-168.

Koivumaa-Honkanen H, Koskenvuo M, Honkanen R, Viinamäki H, Heikkilä K, Kaprio J. Life dissatisfaction and subsequent work disability in an 11-year follow-up. Psychol Med 2004 (b);221-228.

Koivumaa-Honkanen H, Rissanen T, Hintikka J, Honkalampi K, Haatainen K, Saharinen T, Viinamäki H. Factors associated with life satisfaction in a 6-year follow-up of depressive out-patients. Soc Psychiatry Psychiatr Epidemiol 2011;595-605.

Koivumaa-Honkanen H, Tuovinen TK, Honkalampi K, Antikainen R, Hintikka J, Haatainen K, et al. Mental health and well-being in a 6-year follow-up of patients with depression. Soc Psychiatry Psychiatr Epidemiol 2008;688-696.

Koivumaa-Honkanen H, Viinamäki H, Honkanen R, Tanskanen A, Antikainen R, Niskanen L, et al. Correlates of life satisfaction among psychiatric patients. . Acta Psychiatr Scand 1996;372-378.

Koivumaa-Honkanen, H. Life satisfaction as a health predictor. Kuopio: Kuopio University Publications D, Medical Sciences, 143, 1998.

Koivumaa-Honkanen, H., Honkanen, R., Viinamäki, H., Heikkilä, K., Kaprio, J., & Koskenvuo, M. Self-reported life satisfaction and 20-year mortality in healthy finnish adults. Am.J.Epidemiol. 2000;152:983-991.Kolosnitsyna, M., Khorkina, N., & Dorzhiev, H. Determinants of life satisfaction in older russians. Ageing Int. 2017;42:354-373.

Kolosnitsyna, M., Khorkina, N. & Dorzhiev, H. Determinants of life satisfaction in older Russians. Ageing Int 2017;42:

Komici, K., Vitale, D. F., Mancini, A., Bencivenga, L., Conte, M., Provenzano, S., et al. Impact of malnutrition on long-term mortality in elderly patients with acute myocardial infarction. Nutrients 2019;11:224.

Kondrup J, S. P. Allison, M. Elia, B.Vellas, M. Plauth. Guidelines for nutrition screening. Clinical Nutrition 2002;22:415–421.

Kshatriya, G. K., & Acharya, S. K. Gender disparities in the prevalence of undernutrition and the higher risk among the young women of indian tribes. PloS One 2016;11:e0158308.

Kuivasaari-Pirinen, P., Koivumaa-Honkanen, H., Hippeläinen, M., Raatikainen, K., & Heinonen, S. Outcome of assisted reproductive technology (ART) and subsequent self-reported life satisfaction. PloS One 2014;9:e112540.

Lai, J.HW., Bond, M.H. & Hui, N.HH. J. The role of social axioms in predicting life satisfaction: A longitudinal study in hong kong.2007;8:517.

Lamoureux-Lamarche, C., & Vasiliadis, H. M. Lifetime traumatic events, health-related quality of life, and satisfaction with life in older adults. Qual.Life Res. 2017;26:2683-2692.

Lechleitner, M., & Hoppichler, F. Gender aspects of malnutrition and associated sequelae. prevention and therapy. Z.Gerontol.Geriatr. 2013;46:511-516.

Lengyel, C. O., Tate, R. B., & Obirek Blatz, A. K. The relationships between food group consumption, self-rated health, and life satisfaction of community-dwelling Canadian older men: The Manitoba follow-up study. J.Nutr.Elder. 2009;28:158-173.

Leslie, W., & Hankey, C. Aging, nutritional status and health. Healthcare (Basel, Switzerland) 2015;3:648-658.

Li, F., Liu, X., & Zhang, D. Fish consumption and risk of depression: A meta-analysis. J.Epidemiol.Community Health 2016;70:299-304.

Locher J.L., Sharkey J.R. An Ecological Perspective on Older Adult Eating Behavior. In: Bales C., Ritchie C. (eds) Handbook of Clinical Nutrition and Aging. Nutrition and Health. Humana Press, Totowa, NJ. 2009.

Lorenzo, I., Serra-Prat, M., & Yebenes, J. C. The role of water homeostasis in muscle function and frailty: A review. Nutrients 2019;11:10.3390/nu11081857.

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. Unemployment alters the set point for life satisfaction. Psychol.Sci. 2004;15:8-13.

Luger, E., Haider, S., Kapan, A., Schindler, K., Lackinger, C., & Dorner, T. E. Association between nutritional status and quality of life in (pre) frail community-dwelling older persons. J.Frailty Aging 2016;5:141-148.

Lukkala, P., Honkanen, R., Rauma, P., Williams, L., Quirk, S., Kröger, H., & Koivumaa-Honkanen, H. Life satisfaction and morbidity among postmenopausal women. Plos One 2016;11.

Lyubomirsky S., Kennon S., Schkade D. Pursuing happiness: The architecture of sustainable change. Review of General Psychology 2005;111–131.

Macia, E., Duboz, P., Montepare, J. M., & Gueye, L. Exploring life satisfaction among older adults in dakar. J.Cross Cult.Gerontol. 2015;30:377-391.

Maggini, S., Pierre, A., Calder, P.C. Immune function and micronutrient requirements change over the life course . Nutrients 2018;10.

Maher, J. P., & Conroy, D. E. Daily life satisfaction in older adults as a function of (in)activity. Psychsocgerontology 2015;72:593-602.

Manini, T. M. Energy expenditure and aging. Ageing Research Reviews 2010;9:1-11.

Mann, J., & Truswell, A. Essentials of human nutrition. 2012.

Mao, X., & Han, W. Living arrangements and older adults' psychological well-being and life satisfaction in china: Does social support matter? Fam Relat 2018;67:567-584.

Martikainen, L. The many faces of life satisfaction among Finnish young adults. Journal of Happiness Studies 2009;721-737.

Meggiolaro, S., & Ongaro, F. Life satisfaction among older people in Italy in a gender approach. Ageing and Society 2015;35:1564.

Milanović, Z., Pantelić, S., Trajković, N., Sporiš, G., Kostić, R., & James, N. Age-related decrease in physical activity and functional fitness among elderly men and women. Clinical Interventions in Aging 2013;8:549-556.

Milte, C. M., & McNaughton, S. A. Dietary patterns and successful ageing: A systematic review. European Journal of Nutrition 2016;55:423–450.

Morley, J. E. Protein energy undernutrition 2018, Retrieved 12.11.2019, from https://www.msdmanuals.com/professional/nutritional-disorders/undernutrition/protein-energy-undernutrition-peu

Morley, J. E. Weight loss in older persons: New therapeutic approaches. Curr.Pharm.Des. 2007;13:3637-3647.

Morley, J. E. Decreased food intake with aging. J.Gerontol.A Biol.Sci.Med.Sci. 2001;56:81-88.

Mujcic, R., & J.Oswald, A. Evolution of well-being and happiness after increases in consumption of fruit and vegetables. Am.J.Public Health 2016;106:1504-1510.

Naseer, M., & Fagerstrom, C. Prevalence and association of undernutrition with quality of life among Swedish people aged 60 years and above: Results of the SNAC-B study. J.Nutr.Health Aging 2015;19:970-979.

National Cancer Institute at the National Institutes of Health. Quality of life - NCI dictionary of cancer terms. Retrieved 15.10.2019.

Nestle Nutrition Foundation. Mini nutritional assessment Retrieved 12.11.2019, from https://www.mna-elderly.com/default.html

Ng ST, Tey NP, Asadullah MN. What matters for life satisfaction among the oldest-old? Evidence from China. PLoS ONE 2017;12.

Nordic nutrition recommendations: Integrating nutrition and physical activity Nord 2014:002 ISSN 0903-7004 © Nordic Council of Ministers 2014.

Nykänen, I., Lonnroos, E., Kautiainen, H., Sulkava, R., & Hartikainen, S. Nutritional screening in a population-based cohort of community-dwelling older people. Eur.J.Public Health 2013;23:405-409.

Ocean, N., Howley, P., & Ensor, J. Lettuce Be Happy: The Effects of Fruit and Vegetable Consumption on Subjective Well-Being in the UK. SSRN Electronic Journal. 2018.

OECD/European Observatory on Health Systems and Policies. Finland: Country health profile 2019.

O'Keeffe, M., Kelly, M., O'Herlihy, E., O'Toole, P. W., Kearney, P. M., Timmons, S., et al. Potentially modifiable determinants of malnutrition in older adults: A systematic review. Clinical Nutrition 2019;38:2477-2498.

Organisation for Economic Co-operation and Development average. OECD life satisfaction index 2019, http://www.oecdbetterlifeindex.org/countries/finland/

Pan, Y., Chan, S. H. W., Xu, Y., & Yeung, K. C. Determinants of life satisfaction and self-perception of ageing among elderly people in china: An exploratory study in comparison between physical and social functioning. Arch.Gerontol.Geriatr. 2019;84:103910.

Pavot, W., Diener, E., & Suh, E. The temporal satisfaction with life scale. Journal of Personality Assessment 1998.

Phillips, M. B., Foley, A. L., Barnard, R., Isenring, E. A., & Miller, M. D. Nutritional screening in community-dwelling older adults: A systematic literature review. Asia Pac.J.Clin.Nutr. 2010;19:440-449.

Pilgrim, A. L., Robinson, S. M., Sayer, A. A., & Roberts, H. C. An overview of appetite decline in older people. Nursing Older People 2015;27:29-35.

Prieto-Flores, M., Antonio, M., Fernandez-Mayoralas, G., Rojo-Pérez, F., & Forjaz, M. J. The relative contribution of health status and quality of life domains in subjective health in old age. Soc.Indicators Res. 2012;106:27-39.

Proctor C. Subjective Well-Being (SWB). In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht, 2014.

Raggi, A., Corso, B., Minicuci, N., Quintas, R., Sattin, D., De Torres, L., Leonardi, M. Determinants of quality of life in ageing populations: Results from a cross-sectional study in Finland, Poland and Spain. . PloS One 2016;11.

Ramic, E., Pranjic, N., Batic-Mujanovic, O., Karic, E., Alibasic, E., & Alic, A. The effect of loneliness on malnutrition in elderly population. Med.Arh. 2011;65:92-95.

Realo, A., & Dobewall, H. Does life satisfaction change with age? A comparison of Estonia, Finland, Latvia, and Sweden. Journal Of Research In Personality, 2011; 45(3), 297-308.

Reber, E., Gomes, F., Vasiloglou, M. F., Schuetz, P., & Stanga, Z. Nutritional risk screening and assessment. Journal of Clinical Medicine 2019;8:1065.

Reynish, W., & Vellas, B. J. Nutritional assessment: A simple step forward. Age Ageing 2001;30:115-116.

Rissanen T, Viinamäki H, Honkalampi K, Lehto SM, Hintikka J, Saharinen T, Koivumaa-Honkanen H. Long-term life dissatisfaction and subsequent major depressive disorder and poor mental health. BMC Psychiatry 2011;140.

Rizvi, A. Nutritional challenges in the elderly with diabetes. International Journal of Diabetes Mellitus 2009;1:26-31.

Roberts, S. B., Fuss, P., Dallal, G. E., Atkinson, A., Evans, W. J., Joseph, L., et al. Effects of age on energy expenditure and substrate oxidation during experimental overfeeding in healthy men. J.Gerontol.A Biol.Sci.Med.Sci. 1996;51:148.

Roberts, S. B., & Rosenberg, I. Nutrition and aging: Changes in the regulation of energy metabolism with aging. Physiol.Rev. 2006;86:651-667.

Robinson S, Cooper C, Aihie Sayer A. Nutrition and sarcopenia: A review of the evidence and implications for preventive strategies. J Aging Res 2012.

Robinson, S.M., Jameson, K.A., Bloom, I., Ntani, G., Crozier, S.R., Syddall, H., Dennison, E.M., Cooper, C. and Sayer, A.A. Development of a short questionnaire to assess diet quality among older community-dwelling adults. The Journal of Nutrition, Health & Aging 2017;21:247–253.

Robinson, S. M. Improving nutrition to support healthy ageing: What are the opportunities for intervention? Proc.Nutr.Soc. 2018;77:257-264.

Rockwood, K., & Howlett, S. E. Fifteen years of progress in understanding frailty and health in aging. BMC Medicine 2018;16.

Rodgers, V., Neville, S., & La Grow, S. Health, functional ability and life satisfaction among older people 65 years and over: A cross-sectional study. Contemporary Nurse 2017;53:284-292.

Røysamb, E., & Nes, R. B. The genetics of wellbeing. Salt Lake City, UT: DEF Publishers. 2018.

Ruiz, A. J., Buitrago, G., Rodriguez, N., Gomez, G., Sulo, S., Gomez, C., et al. Clinical and economic outcomes associated with malnutrition in hospitalized patients. Clin.Nutr. 2019;38:1310-1316.

Safouris, A., Tsivgoulis, G., Sergentanis, T. N., & Psaltopoulou, T. Mediterranean diet and risk of dementia. Curr.Alzheimer Res. 2015;12:736-744.

Sanders, C., Behrens, S., Schwartz, S., Wengreen, H., Corcoran, C. D., Lyketsos, C. G., et al. Nutritional status is associated with faster cognitive decline and worse functional impairment in the progression of dementia: The cache county dementia progression Study1. Journal of Alzheimer's Disease : JAD 2016;52:33-42.

Santilli, V., Bernetti, A., Mangone, M., & Paoloni, M. Clinical definition of sarcopenia. Clinical Cases in Mineral and Bone Metabolism : The Official Journal of the Italian Society of Osteoporosis, Mineral Metabolism, and Skeletal Diseases 2014;11:177-180.

Schiepers, O., de Groot, R., Jolles, J., & van Boxtel, M. Fish consumption, not fatty acid status, is related to quality of life in a healthy population. Prostaglandins, Leukotrienes And Essential Fatty Acids, 2010; 83(1), 31-35.

Schnettler, B., Miranda, H., Lobos, G., Orellana, L., Sepúlveda, J., Denegri, M., et al. Eating habits and subjective well-being. A typology of students in chilean state universities. Appetite 2015;89:203-214.

Shatenstein, B., & Payette, H. Evaluation of the relative validity of the short diet questionnaire for assessing usual consumption frequencies of selected nutrients and foods. Nutrients 2015;7:6362-6374.

Shim, J., Oh, K., & Kim, H. C. Dietary assessment methods in epidemiologic studies. Epidemiology and Health 2014;36:e2014009.

Sinikallio, S., Koivumaa-Honkanen, H., Aalto, T., Airaksinen, O., Lehto, S. M., & Viinamaki, H. Life dissatisfaction in the pre-operative and early recovery phase predicts low functional ability and coping among post-operative patients with lumbar spinal stenosis: A 2-year prospective study. Disabil.Rehabil. 2011;33:599-604.

Skevington, S. M., & Bohnke, J. R. How is subjective well-being related to quality of life? do we need two concepts and both measures? Soc.Sci.Med. 2018;206:22-30.

Soderstrom, L., Rosenblad, A., Thors Adolfsson, E., & Bergkvist, L. Malnutrition is associated with increased mortality in older adults regardless of the cause of death. Br.J.Nutr. 2017;117:532-540.

Soini, H., Suominen, M. H., Muurinen, S., Strandberg, T. E., & Pitkala, K. H. Malnutrition according to the mini nutritional assessment in older adults in different settings. J.Am.Geriatr.Soc. 2011;59:765-766.

Stajkovic, S., Aitken, E. M., & Holroyd-Leduc, J. Unintentional weight loss in older adults. CMAJ : Canadian Medical Association Journal = Journal De L'Association Medicale Canadienne 2011;183:443-449.

Statistics Finland. Population structure, 2019.

Steptoe, A., Deaton, A., & Stone, A. A. Subjective wellbeing, health, and ageing. Lancet 2015;385:640-648.

Steptoe, A., Dockray, S., & Wardle, J. Positive affect and psychobiological processes relevant to health. J.Pers. 2009;77:1747-1776.

Suominen, M. H., Jyvakorpi, S. K., Pitkala, K. H., Finne-Soveri, H., Hakala, P., Mannisto, S., et al. Nutritional guidelines for older people in finland. J.Nutr.Health Aging 2014;18:861-867.

Suominen, M. Nutrition and nutritional care of elderly people in Finnish nursing homes and hospitals. University of Helsinki 2007.

Ter Borg, S., Verlaan, S., Hemsworth, J., Mijnarends, D. M., Schols, J. M. G. A., Luiking, Y. C., et al. Micronutrient intakes and potential inadequacies of community-dwelling older adults: A systematic review. Br.J.Nutr. 2015;113:1195-1206.

Tomstad, S., Dale, B., Sundsli, K., Saevareid, H. I., & Soderhamn, U. Who often feels lonely? A cross-sectional study about loneliness and its related factors among older home-dwelling people. Int.J.Older People Nurs. 2017;12:10.1111/opn.12162.

Tsai, A. C., Hsu, W., & Wang, J. The mini nutritional assessment (MNA) predicts care need in older taiwanese: Results of a national cohort study. Br.J.Nutr. 2014;111:1977-1984.

Tse, M. M. Y., Wan, V. T. C., & Vong, S. K. S. Health-related profile and quality of life among nursing home residents: Does pain matter? Pain Manag.Nurs. 2013;14:e173-e184.

Tuck, N., Farrow, C., & Thomas, J. M. Assessing the effects of vegetable consumption on the psychological health of healthy adults: A systematic review of prospective research. The American Journal of Clinical Nutrition 2019;110:196-211.

Tufts University. What is My Plate for older adults? 2016, https://hnrca.tufts.edu/myplate/what-is-myplate-for-older-adults/

Tuppurainen M., Honkanen R., Kröger H., et al. Osteoporosis risk factors, gynaecological history and fractures in perimenopausal women - The results of the baseline postal enquiry of the Kuopio osteoporosis risk factor and prevention study. Maturitas 1993;17:89–100.

United Nations. World population ageing 2017 - highlights 2017.

Upadhyay R., Tripathi KD. How can we assess the nutritional status of an individual? Journal of Nutrition & Food Sciences 2017;7.

Vaillant, G. Positive mental health: Is there a cross-cultural definition? World Psychiatry: Official Journal of the World Psychiatric Association (WPA) 2012;11:93-99.

Vaillant, G. Early and midlife predictors of wisdom and subjective well-being in old age. The Journals of Gerontology: Series B 2018;73:1514–1525.

Valentini A, Federici M, Cianfarani MA, Tarantino U, Bertoli A. Frailty and nutritional status in older people: The mini nutritional assessment as a screening tool for the identification of frail subjects.2018;1237-1244.

Van der Meij, B. S., Wijnhoven, H., Lee, J. S., Houston, D. K., Hue, T., Harris, T. B., … Visser, M. Poor appetite and dietary intake in community-dwelling older adults. Journal of the American Geriatrics Society 2017;65:2190–2197.

Van der Pols-Vijlbrief, R., Wijnhoven, H. A., Schaap, L. A., Terwee, C. B., & Visser, M. Determinants of protein-energy malnutrition in community-dwelling older adults: A systematic review of observational studies. Ageing Res.Rev. 2014;18:112-131.

Van Zwienen-Pot, J. I., Visser, M., Kuijpers, M., Grimmerink, M. F. A., & Kruizenga, H. M. Undernutrition in nursing home rehabilitation patients. Clin.Nutr. 2017;36:755-759.

Veenhoven, R. Will healthy eating make you happier? A research synthesis using an online findings archive. Applied Research in Quality of Life 2019.

Vilpunaho, T., Kröger, H., Honkanen, R., Koivumaa-Honkanen, H., Sirola, J., Kuvaja-Köllner, V., et al. Randomised controlled trial (RCT) study design for a large-scale municipal fall prevention exercise programme in community-living older women: Study protocol for the kuopio fall prevention study (KFPS). BMJ Open 2019;9:e028716.

Visvanathan, R., & Chapman, I. Preventing sarcopaenia in older people. Maturitas 2010;66:383-388.

Volkert, D., Beck, A. M., Cederholm, T., Cruz-Jentoft, A., Goisser, S., Hooper, L., et al. ESPEN guideline on clinical nutrition and hydration in geriatrics. Clin.Nutr. 2019;38:10-47.

Voronin, G. L., Zakharov, V., Kozyreva, P. M., Voronin, G. L., Zakharov, V. Y., & Kozyreva, P. M. Lonely old aged: Surviving or living an active life? Sotsiologicheskiy Zhurnal 2018;24:32-55.

Wahlqvist, M. Nordic nutrition recommendations: Integrating nutrition and physical activity. . Scandinavian Journal of Nutrition 2005;49:180.

Watson, L., Leslie, W., & Hankey, C. Under-nutrition in old age: Diagnosis and management. Reviews in Clinical Gerontology 2006;16:23-34.

White, J. V., Guenter, P., Jensen, G., Malone, A., Schofield, M., Academy Malnutrition Work Group, et al. Consensus statement: Academy of nutrition and dietetics and American Society for Parenteral and Enteral Nutrition: Characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). JPEN J.Parenter.Enteral Nutr. 2012;36:275-283.

WHO. The world health organization quality of life assessment (WHOQOL): Development and general psychometric properties. Soc.Sci.Med. 1998;46:1569-1585.

WHO. Waist circumference and waist-hip ratio report of a WHO expert consultation Geneva, 8–11 December 2008.

WHO. Global recommendations on physical activity for health 2010.

WHO. What is malnutrition? 2016, Retrieved 21.02.2019, from http://www.who.int/features/qa/malnutrition/en/

WHO. Body mass index - BMI 2019a, Retrieved 28.12.2019, from http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

WHO. Integrated care for older people (ICOPE): Guidance for person-centred assessment and pathways in primary care.Geneva: World Health Organization; 2019 (WHO/FWC/ALC/19.1). Licence: CC BY-NC-SA 3.0 IGO. 2019b.

WHO. Meeting the nutritional needs of older persons 2019c, Retrieved 30/10/, 2019, from https://www.who.int/nutrition/topics/olderpersons/en/

WHO. Supplemental nutrition with dietary advice for older people affected by undernutrition 2019d, Retrieved 30.10.2019, from https://www.who.int/elena/titles/nutrition-older-people/en/; https://www.who.int/elena/titles/guidance_summaries/nutrition-older-people/en/

Wijnhoven, H. A. H., Elstgeest, L. E. M., de Vet, H.,C.W., Nicolaou, M., Snijder, M. B., & Visser, M. Development and validation of a short food questionnaire to screen for low protein intake in community-dwelling older adults: The protein screener 55+ (Pro55+). PloS One 2018;13:e0196406.

Wilson, M., & Morley, J. Invited review: Aging and energy balance. . Journal of Applied Physiology 2003;95:1728-1736.

Wysokiński, A., Sobów, T., Kłoszewska, I., & Kostka, T. Mechanisms of the anorexia of aging - a review. Age 2015;37.

Yang, F., Gu, D., & Mitnitski, A. Frailty and life satisfaction in shanghai older adults: The roles of age and social vulnerability. Arch.Gerontol.Geriatr. 2016;67:68-73.

Yu, R., & Tsai, A. C. Association between the frequency of food consumption and the risk of depression in elderly Taiwanese. Taiwan Journal of Public Health 2011;30:123-134.