Subjective evaluation and attention to individual aspects of a health-promoting diet in healthy older people

Hanna Maria Siebentritt*, Eva Kiesswetter*, Anne Hannink, Beate Brandl, Thomas Skurk, Nina Wawro, Jakob Linseisen, Hans Hauner, Dorothee Volkert

Abstract

Older people are considered to have a relatively high level of nutritional awareness. However, it is not yet known which importance they attach to individual aspects of a healthy diet. Using standardized questionnaires, 159 healthy seniors (78 ± 3 years, 50% female) were asked about the importance of and attention to 15 nutritional aspects and about their usual food consumption. The recommendation "drinking 1–1.5 liters a day" was rated most frequently as "very important" (69.8%), while "not eating too little" and "eating legumes" were rated least frequently (10.1% each). There was a high level of agreement between rating of importance and attention, with high ratings of importance more common across the board. For most nutritional aspects, ratings of importance or attention were also reflected in reported food intake. The discrepancies identified between rating and attention imply that, in addition to purely imparting knowledge, nutrition education and counseling should also address the possibilities for implementing nutrition aspects in everyday life.

Keywords: health-promoting diet, senior citizens, private household, dietary attitudes

Introduction

Why do older people eat what they eat? Besides appetite and taste, the motive "health" plays a major role [1, 2]. This seems intuitively convincing, since perception and objective prevalence of health impairments increase in older age. A balanced diet can contribute significantly to the goal of healthy aging [3]. This is particularly feasible for healthy seniors who live independently and still have good resources to organize their daily lives, including shopping and meal preparation, in a self-determined manner. However, not all older people eat according to the recommendations and often energy and nutrient intake is insufficient, even for older people living independently [4–6].

Regardless of age, evidence shows that people who place a high value on health in their food choices actually eat healthier – however, this relationship is rather weak and only applies to certain aspects of a healthy diet, e.g. fruit and vegetable consumption [7, 8]. In addition, certain components of a balanced diet are rarely considered by older people at the behavioral level – even when they report that their eating behavior is highly health-oriented [9] or follows dietary recommendations [10]. Therefore, for improved target group-specific nutrition education, both knowledge of the extent to which older people are aware of the principles of a balanced diet and knowledge of the extent to which these are taken into account in their own eating behavior could be useful.

The aim of this study was therefore to investigate (a) how important older people rate certain aspects of a health-promoting diet and to what extent they pay attention to them, and (b) whether these statements are also reflected in their usual food consumption.

Citation
Siebentritt HM, Kiesswetter E, Hannink A, Brandl B, Skurk T, Wawro N, Linseisen J, Hauner H, Volkert D: Subjective evaluation and attention to individual aspects of a health-promoting diet in healthy older people. Ernahrungs Umschau 2022; 69(4): 40–7.
This article is available online:
DOI: 10.4455/eu.2022.011

Peer reviewed
Manuscript (original) submitted: 13 January 2022
Revision accepted: 18 February 2022

Corresponding author
Prof. Dr. Dorothee Volkert
dorothee.volkert@fau.de

* shared first authorship

Methodology

Study design

As part of the program of the competence cluster of nutrition research *enable*, 159 older people aged between 75 and 85 years living independently in private households were recruited in Nuremberg and Freising from April 2016 to February 2018. Exclusion criteria included body mass index (BMI) < 18.5 or ≥ 35 kg/m², smoking, immobility, need for long-term care, cognitive impairment, unintentional weight loss > 5% in the last 3 months, medically diagnosed chronic diseases, and taking certain medications [11].

All data were collected during two visits of several hours at the study center using standardized self-completion questionnaires.

The study protocol was approved by the ethics committees of the Friedrich-Alexander Universität Erlangen-Nürnberg (No. 291/15B) and the Technical University of Munich (No. 452/15) and is registered in the German Clinical Trials Registry (DRKS-ID: DRKS00009797). All participants had given their written informed consent before the start of the study.

Data collection

Characteristics

Age, gender, living situation, marital status, educational status, self-rated physical activity, and subjective health were asked in a standardized manner. Body height was measured with a stadiometer and body weight with a calibrated scale. BMI [kg/m²] was calculated.

Evaluation and attention to individual nutrition aspects

Rating of importance ("How important do you consider the following aspects for health and well-being?") and attention ("How much do you personally usually pay attention to the aspects mentioned?") were asked for the following 15 nutrition aspects: (1) healthy diet, (2) eating many different foods, (3) not eating too much, (4) not eating too little, (5) eating fruit several times a day, (6) eating vegetables several times a day, (7) eating at least two servings of dairy products a day, (8) eating bread and rice, pasta, or potatoes daily, (9) eating legumes, (10) not eating meat every day, (11) eating fish 1–2 times a week, (12) drinking 1–1.5 liters a day, (13) eating whole grain products, (14) using olive oil, and (15) moderate alcohol consumption. The selection of items was based on the 10 rules of the German Nutrition Society (DGE) for a wholesome diet [12]. Using 5-level scales, the aspects were assessed in terms of importance (very important, important, moderate, less important, unimportant) and attention (very strong, strong, moderate, somewhat, not at all).

Usual intake

Food intake was recorded by a food frequency questionnaire [13] and two short questionnaires on food intake on the previous day [14]. From these, the usual intake of individual food groups (fruits, vegetables, dairy products, meat and meat products, fish and seafood, cereal products [bread, rice, pasta] and potatoes, legumes, and alcoholic beverages) and daily energy intake [kcal/day] were calculated. For details on the methodology, see [15].

Statistical analysis

Correlations between rating of importance and attention of the 15 nutrition aspects were tested by means of correlation analyses (Spearman ρ). For further analysis, the variables rating of importance ([very] important vs. moderate to unimportant) and attention ([very] strong vs. moderate to not at all) were dichotomized and their agreement tested using Fisher's exact test. Differences in consumption of the food groups depending on importance of or attention to the respective nutritional aspects were tested by analyses of covariance, adjusted for sex, age, BMI, and energy intake. Because the condition of homoscedasticity was not always met, analyses were performed adjusting for a robust standard error (HC3). Results are reported as mean with 95% confidence interval. For these analyses sample size is reduced (n = 134) because intake data were not available for all participants. There were no differences in the rating of importance and attention to nutritional aspects between the groups with and without consumption data. The significance level is set at $p < 0.05$. Analyses were performed using IBM SPSS version 26.

Results

Characteristics

The mean age of the participants was 78.2 ± 2.8 years, and 49.7% were female. Other characteristics are shown in ◆ Table 1 for the total sample and stratified by sex.

Evaluation and attention to the 15 aspects of a health-promoting diet

For all aspects surveyed, the evaluation of importance was more frequently rated high than the attention (◆ Figure 1). Most frequently rated as "very important" was "drinking 1–1.5 liters a day" (69.8%), followed by "healthy diet" (53.5%). The items least frequently rated as "very important" were "not eating too little" and "eating legumes" (both 10.1%). A similar picture emerged with regard to attention. The aspects "eating vegetables several times a day" ($p = 0.005$), "eating at least two servings of dairy products a day" ($p = 0.001$) and "eating whole grain products" ($p = 0.026$) were rated higher by women than by men. In terms of attention, men more often than women reported paying (very) strong attention to "eating fish 1–2 times a week" ($p = 0.039$).

	Total (n = 159)	Men (n = 80)	Women (n = 79)
age [years]	78.2 ± 2.8	78.2 ± 2.6	78.1 ± 2.9
living alone [%]	54.1	35.0	73.4
marital status [%]			
married	40.9	58.8	22.8
separated/divorced	16.3	16.3	16.6
single	6.9	3.8	10.1
widowed	35.8	21.3	50.6
educational attainment [%]			
certificate of secondary education/ elementary school	32.7	30.0	5.4
general certificate of secondary education	29.5	22.6	36.7
technical college entrance qualification	13.2	20.0	6.3
A-levels, university entrance qualification	23.3	27.5	19.5
other degree	1.3	0.0	2.5
BMI [kg/m²]	26.5 ± 3.9	27.2 ± 3.5	25.9 ± 4.2
subjective health [%]			
very good	15.1	20.0	10.1
good	71.7	71.3	72.2
less good	12.6	8.8	16.5
poor	0.6	0.0	1.3
very poor	0.0	0.0	0.0
physical activity [%]			
very active	9.4	11.3	7.6
active	67.3	68.8	65.8
little active	20.8	18.8	22.8
rather inactive	2.5	1.3	3.8
completely inactive	0.0	0.0	0.0
energy intake [kcal/Tag]	1,972 ± 422	2,188 ± 440	1,764 ± 274

Tab. 1: **Characteristics of the sample**
Mean ± standard deviation

With the exception of "healthy diet", "eating many different foods", "not eating too much", and "not eating too little", the correlation analyses showed a clear relationship between the rating of importance and attention with Spearman correlation coefficients > 0.650 (◆ Table 2). Likewise, the dichotomized evaluation shows that the large majority of the participants (more than two thirds in each case) who rated the respective aspect as (very) important also stated that they paid (very) strong attention to it. Just for "not eating too little" and "eating legumes" was this proportion only about 50%. Conversely, participants who considered certain nutritional aspects to be moderate to unimportant also indicated that they paid (very) strong attention to them (e.g., "not eating too much" 25%, moderate alcohol consumption 22%) (◆ Table 2).

Food intake dependent on evaluation and attention

The evaluation of importance and the attention are predominantly also reflected in the actual intake (◆ Table 3). Only the intake of fruit, meat (products), and alcoholic beverages did not differ between persons who rated the aspects as (very) important and as moderate to unimportant. There was also no difference in intake between participants who stated that they pay (very) strong or moderate to no attention to eating legumes.

Discussion

The present study shows the importance that people living independently between the ages of 75 and 85 attach to various aspects of a health-promoting diet and the extent to which they take these aspects into account in their own eating behavior. This sets the study apart from previous work, the majority of which examined health motives in the context of a healthy diet in general or only individual components of a healthy diet (e.g. fruit and vegetable consumption) [1]. The findings provide a valuable basis for tailoring nutrition information and interventions more specifically to the level of knowledge and needs of healthy older people.

Overall, it became clear that healthy older people predominantly rate the importance of many aspects of a healthy diet high. This finding is in line with the results of the study "*Ernährung ab 65*" (Nutrition over 65), in which 87% of the participants stated that they considered a balanced diet to be (very) important for health and well-being [16]. Although, on average, importance was rated higher than attention in the present study, for 11 of the 15 nutritional aspects, more than half of the participants reported paying (very) strong attention to them (◆ Figure 1). This suggests that nutrition knowledge in this collective is good and, according to their own statements, often plays a role in their own eating behavior. One reason for this could be that a healthy lifestyle is becoming more important for older people due to impending or existing health impairments [17]. In addition, the results could reflect the increasing thematization of a balanced diet both in the media and in medical-therapeutic settings. This is supported by the fact that especially those aspects are rated as (very) important and (very) strongly considered that are prominently formulated in the 10 rules of the DGE [12]. The consumption of dairy products and legumes as well as the aspect of not eating too little were rated as least important. These findings therefore require special attention, since dairy products

		Importance		
Attention	ρ[a]	(very) important (n) ,%	moderate to unimportant (n), %	p-value[b]
healthy diet	0.356			
(very) strong		(113), 72.9	(0), 0.0	0.006
moderate to not at all		(42), 27.1	(4), 100.0	
eating many different foods	0.574			
(very) strong		(110), 75.3	(1), 7.7	< 0.001
moderate to not at all		(36), 24.7	(12), 92.3	
not eating too much	0.455			
(very) strong		(93), 68.9	(6), 25.0	< 0.001
moderate to not at all		(42), 31.1	(18), 75.0	
not eating too little	0.504			
(very) strong		(49), 51.6	(8), 12.5	< 0.001
moderate to not at all		(46), 48.4	(56), 87.5	
eating fruit several times a day	0.753			
(very) strong		(93), 75.6	(1), 2.8	< 0.001
moderate to not at all		(30), 24.4	(35), 97.2	
eating vegetables several times a day	0.748			
(very) strong		(77), 67.5	(1), 2.2	< 0.001
moderate to not at all		(37), 32.5	(44), 97.8	
eating at least two servings of dairy products a day	0.733			< 0.001
(very) strong		(48), 70.6	(6), 6.6	
moderate to not at all		(20), 29.4	(85), 93.4	
eating bread and rice, pasta, or potatoes daily	0.738			
(very) strong		(103), 83.7	(3), 8.3	< 0.001
moderate to not at all		(20), 16.3	(33), 91.7	
eating legumes	0.700			
(very) strong		(35), 47.3	(0), 0.0	< 0.001
moderate to not at all		(39), 52.7	(84), 100.0	
not eating meat every day	0.777			
(very) strong		(88), 76.5	(5), 11.4	< 0.001
moderate to not at all		(27), 23.5	(39), 88.6	
eating fish 1–2 times a week	0.696			
(very) strong		(81), 68.1	(3), 7.5	< 0.001
moderate to not at all		(38), 31.9	(37), 92.5	
drinking 1–1.5 liters a day	0.668			
(very) strong		(129), 84.9	(0), 0.0	< 0.001
moderate to not at all		(23), 15.1	(7), 100.0	
eating whole grain products	0.794			
(very) strong		(98), 81.7	(1), 2.6	< 0.001
moderate to not at all		(22), 18.3	(38), 97.4	
using olive oil	0.755			
(very) strong		(95), 81.9	(1), 2.3	< 0.001
moderate to not at all		(21), 18.1	(42), 97.7	
moderate alcohol consumption	0.674			
(very) strong		(90), 82.6	(11), 22.0	< 0.001
moderate to not at all		(19), 17.4	(39), 78.0	

Tab. 2: **Correlation and agreement between importance of and attention to certain aspects of nutrition (n = 159)**

[a] Spearman correlation coefficient, all p < 0.001

[b] Fisher's exact test

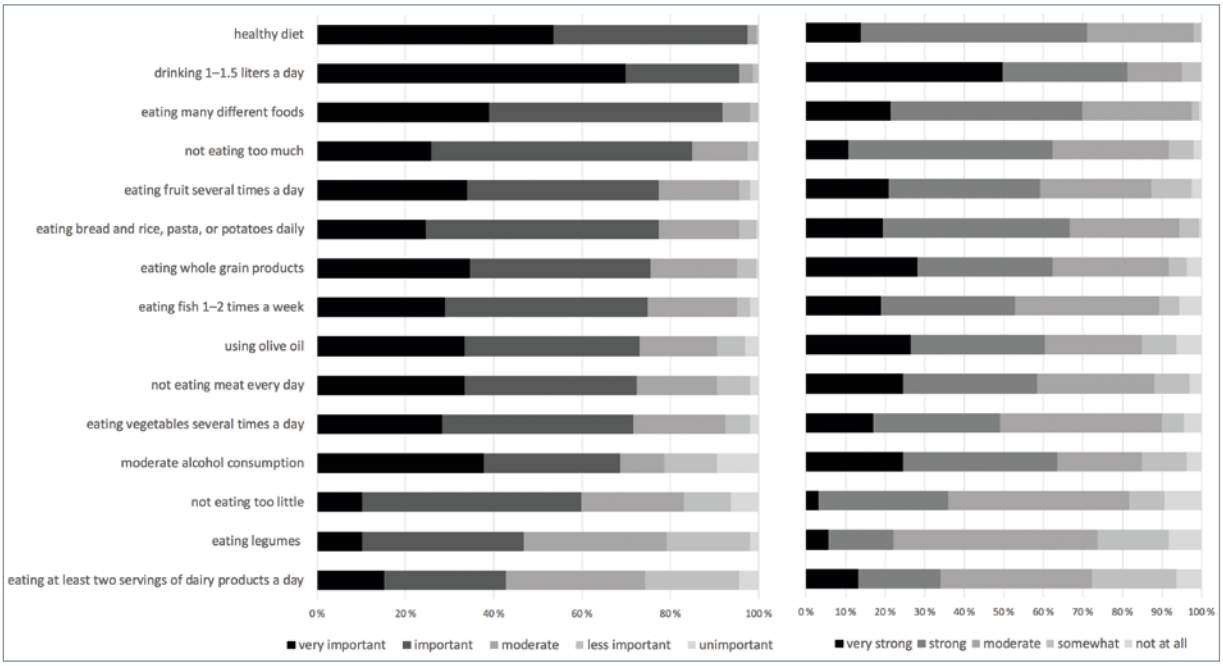

Fig. 1: **Frequency of importance of (left) and attention to (right) individual aspects of a health-promoting diet by healthy older people (n = 159), sorted by "(very) important"**

	Importance			Attention		
Food group	**(very) important**	**moderate to unimportant**	**p-value**	**(very) strong**	**moderate to not at all**	**p-value**
fruit	n = 103 243.4 (227.4–259.3)	n = 31 217.2 (187.4–246.9)	0.233	n = 80 262.9 (245.8–280.0)	n = 54 199.4 (178.4–220.3)	< 0.001
vegetables	n = 95 186.3 (176.9–195.8)	n = 39 167.6 (152.6–182.7)	0.016	n = 68 190.4 (179.2–201.5)	n = 66 171.1 (159.8–182.5)	0.009
dairy products	n = 56 254.2 (224.3–284.2)	n = 78 211.6 (186.5–236.7)	0.032	n = 45 274.1 (242.1–306.1)	n = 89 206.9 (184.4–229.3)	0.001
meat (products)	n = 95 98.7 (93.6–103.9)	n = 39 106.5 (98.3–114.6)	0.140	n = 77 96.7 (91.0–102.4)	n = 57 106.7 (100.1–113.4)	0.046
fish/seafood	n = 100 29.5 (26.8–32.1)	n = 34 19.6 (15.1–24.1)	< 0.001	n = 72 31.4 (28.2–34.5)	n = 62 21.9 (18.5–25.2)	< 0.001
bread/pasta/ potatoes	n = 105 246.6 (238.4–254.8)	n = 29 225.5 (209.9–241.2)	0.014	n = 93 246.9 (238.1–255.7)	n = 41 231.1 (217.6–244.6)	0.057
legumes	n = 59 6.7 (6.1–7.4)	n = 75 5.5 (4.9–6.1)	0.012	n = 29 6.4 (5.4–7.4)	n = 105 5.9 (5.4–6.5)	0.571
alcoholic beverages	n = 94 140.4 (111.6–169.2)	n = 40 142.7 (98.1–187.2)	0.933	n = 88 121.6 (92.1–151.1)	n = 46 178.2 (136.9–219.5)	0.048

Tab. 3: **Intake of individual food groups (g/day) depending on the importance of or attention paid to the corresponding aspects in the diet (n = 134)**
Mean values (95% confidence interval), analysis of covariance (ANCOVA) adjusted for gender, age, BMI, energy intake (kcal/day)

and legumes are valuable sources of protein and adequate protein intake is of great importance for maintaining muscle mass in old age [18]. Dairy products are also important sources of calcium and are relevant for reducing the risk of osteoporosis in old age. The comparatively low rating and, above all, attention to regular consumption of dairy products could result from the fact that the consumption of animal products is increasingly viewed critically for sustainability reasons. Legumes – as also indicated by the consumption data – have so far been little integrated into the dietary habits of older people. In "traditional German cuisine", filling side dishes such as potatoes, rice, and pasta still play a greater role. In addition, the sometimes complex preparation and a hard digestibility might limit the consumption of legumes in older people [19]. The medium to low importance and attention to the aspect "not eating too little" can probably be attributed to the fact that it is likely to be relevant for only a few of the healthy seniors in the collective. Malnutrition affects 0–11% of older people living at home, depending on the diagnostic criteria [20].

Compared to men, women rated the importance of some nutritional aspects higher. This phenomenon has already been observed in previous studies [21, 22] and could be due to the fact that women are more involved with nutritional issues – especially in an older generation in which the selection and preparation of food is often still regarded as a "woman's job". Surprisingly, however, these differences did not show up in the attention paid to the relevant aspects in their own eating behavior. On the contrary, men even more frequently reported paying (very) strong attention to eating fish regularly. It is possible that women respond more "socially desirable" when asked to rate health aspects. Another reason could be that more than half of the male participants live in a partnership and eating habits are often shared with the female partner. The small gender differences could also be due to the special collective of very healthy seniors, who presumably have a high level of health awareness in general.

Even though the overall agreement between the respondents' rating of importance of and attention paid to nutritional aspects is quite high, there are clear discrepancies for some aspects. Certain aspects are rated as (very) important, but are only moderately or not at all considered in eating behavior or – surprisingly – vice versa. The fact that eating behavior is very complex and influenced by very different factors could be decisive for a higher rating and weaker attention [1, 21]. In addition, the answer to the question about the evaluation of an aspect could rather represent the nutritional knowledge, which is understood as generally valid, whether relevant for the own eating behavior or not. Regarding legumes, it is conceivable that the implementation of knowledge at the behavioral level does not occur due to barriers regarding preparation and tolerability [23]. Surprisingly, "moderate alcohol consumption" is rated as moderate to unimportant by almost one third of the participants, and nevertheless (very) strongly considered by 22% of these participants. Apparently, the risks of alcohol consumption for health are still underestimated and attention at the individual level is possibly paid more for reasons of tolerance than for health considerations.

The second part of our analysis showed that the rating of many nutritional aspects was related to actual intake – a finding that underlines the influence of knowledge and attitudes on eating behavior [7]. No association between reported attention and intake was found for the bread/pasta/potato food group. It is possible that this is an integral part of many meals, so that conscious attention has no effect. In addition, there are foods in this group that are considered "healthy" (e.g., whole grain products) as well as those that are considered "unhealthy" (e.g., white flour products). Likewise, there is no correlation between reported attention and intake in the case of legumes, which could be attributed to the very low legume intake overall.

When interpreting the findings, several points must be taken into account. The participants were very healthy seniors with hardly any functional limitations. Numerous exclusion criteria were used to recruit healthy individuals from different age groups for the *enable* cohort in order to be able to examine age differences independently of health influences [11]. The results are thus limited to a specific group of older people and cannot be generalized. This is also supported by the fact that the participants tend to have a high level of education, which is often associated with healthier eating behaviors compared to individuals with lower education [10]. Also, the willingness to participate in a nutrition study suggests an above-average interest in nutrition. Furthermore, collecting dietary intake data based on self-reports always carries the risk of bias [24], even if the participants were given detailed information on how to complete the questionnaires.

Conclusion

A healthy diet has a high priority for the vast majority of the very healthy seniors studied. Nevertheless, certain aspects of a balanced diet are often not or only rarely taken into account in eating behavior – even when they are rated as important.

For practical purposes, the following conclusions can be drawn: A pronounced knowledge of the importance of a healthy diet is a good prerequisite for motivating older people to pay more attention to certain aspects in their eating behavior. The identified discrepancies between evaluation of importance and attention imply that, in addition to imparting knowledge, assistance should always be provided for the practical implementation of nutritional as-

pects in everyday life. Taking into account individual needs, the life situation and possible barriers, possibilities for simple preparation of protein-rich foods with the inclusion of plant-based alternatives could, for example, be demonstrated or even tested together in practice.

Conflict of Interest
The authors declare no conflict of interest.

Funding
The project was funded by the German Federal Ministry of Education and Research (grant number 01EA1409C). The work is part of the *enable* cluster (*enable* 82).

Dr. Hanna Maria Siebentritt[1]
Dr. Eva Kiesswetter[1]
Dr. Anne Hannink[1]
Dr. Beate Brandl[2, 3]
Prof. Dr. Thomas Skurk[2, 3]
Dr. Nina Wawro[4, 5]
Prof. Dr. Jakob Linseisen[4, 5]
Prof. Dr. Hans Hauner[3, 6]
Prof. Dr. Dorothee Volkert[1]
[1] Institut für Biomedizin des Alterns
Friedrich-Alexander-Universität Erlangen-Nürnberg
[2] ZIEL – Institute for Food & Health
Technische Universität München
[3] Else Kröner Fresenius Zentrum für Ernährungsmedizin
Technische Universität München, Freising
[4] Selbständige Forschungsgruppe Klinische Epidemiologie
Helmholtz Zentrum München
Deutsches Forschungszentrum für Gesundheit und Umwelt (GmbH), Neuherberg
[5] Lehrstuhl für Epidemiologie
Universität Augsburg, am Universitätsklinikum Augsburg, Augsburg
[6] Institut für Ernährungsmedizin
Klinikum Rechts der Isar
Technische Universität München

References

1. *Rempe HM, Sproesser G, Gingrich A, et al.: Measuring eating motives in older adults with and without functional impairments with The Eating Motivation Survey (TEMS). Appetite 2019; 137: 1–20.*
2. *Renner B, Sproesser G, Strohbach S, Schupp HT: Why we eat what we eat. The Eating Motivation Survey (TEMS). Appetite 2012; 59(1): 117–28.*
3. *Atallah N, Adjibade M, Lelong H, et al.: How healthy lifestyle factors at midlife relate to healthy aging. Nutrients 2018; 10(7): 854–64.*
4. *Hengeveld LM, Wijnhoven HAH, Olthof MR, et al.: Prospective associations of poor diet quality with long-term incidence of protein-energy malnutrition in community-dwelling older adults: the Health, Aging, and Body Composition (Health ABC) Study. Am J Clin Nutr 2018; 107(2): 155–64.*
5. *Mendonça N, Granic A, Mathers JC, et al.: Prevalence and determinants of low protein intake in very old adults: insights from the Newcastle 85+ Study. Eur J Nutr 2018; 57(8): 2713–22.*
6. *Volkert D, Kreuel K, Heseker H, Stehle P: Energy and nutrient intake of young-old, old-old and very-old elderly in Germany. Eur J Clin Nutr 2004; 58(8): 1190–200.*
7. *Naughton P, McCarthy SN, McCarthy MB: The creation of a healthy eating motivation score and its association with food choice and physical activity in a cross sectional sample of Irish adults. Int J Behav Nutr Phys Act 2015; 12(1): 74–84.*
8. *Hearty AP, McCarthy SN, Kearney JM, Gibney MJ: Relationship between attitudes towards healthy eating and*

dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. Appetite 2007; 48(1): 1–11.

9. *Rempe HM, Sproesser G, Hannink A, et al: The relationship between healthy eating motivation and protein intake in community-dwelling older adults with varying functional status. Nutrients 2020; 12(3): 662.*
10. *Dijkstra SC, Neter JE, Brouwer IA, Huisman M, Visser M: Adherence to dietary guidelines for fruit, vegetables and fish among older dutch adults; the role of education, income and job prestige. J Nutr Health Aging 2014; 18(2): 115–21.*
11. *Brandl B, Skurk T, Rennekamp R, et al.: A phenotyping platform to characterize healthy individuals across four stages of life – the enable study. Front Nutr 2020; 7: 582387.*
12. *Deutsche Gesellschaft für Ernährung e. V: Vollwertig essen und trinken nach den 10 Regeln der DGE. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/10-regeln-der-dge/ (last accessed on 10 January 2022).*
13. *Nöthlings U, Hoffmann K, Bergmann MM, Boeing H: Fitting portion sizes in a self-administered food frequency questionnaire. J Nutr 2007; 137(12): 2781–6.*
14. *Freese J, Feller S, Harttig U, et al.: Development and evaluation of a short 24-h food list as part of a blended dietary assessment strategy in large-scale cohort studies. Eur J Clin Nutr 2014; 68(3): 324–9.*
15. *Mitry P, Wawro N, Six-Merker J, et al.: Usual dietary intake estimation based on a combination of repeated 24-h food lists and a food frequency questionnaire in the KORA FF4 cross-sectional study. Front Nutr 2019; 6: 145.*
16. *Volkert D, Kreuel K, Stehle P: Ernährung ab 65. Teil 1: Einstellungen älterer Menschen zu Gesundheit und Ernährung. Ernährungs Umschau 2002; 49: 428–33.*
17. *Divine RL, Lepisto L: Analysis of the healthy lifestyle consumer. J Consum Mark 2005; 22(5): 275–83.*
18. *Kiesswetter E, Sieber CC, Volkert D: Protein intake in older people: Why, how much and how? Z Gerontol Geriatr 2020; 53(4): 285–9.*
19. *Doma KM, Farrell EL, Leith-Bailey ER, Soucier VD, Duncan AM: Motivators, barriers and other factors related to bean consumption in older adults. J Nutr Gerontol Geriatr 2019; 38(4): 397–413.*
20. *Wolters M, Volkert D, Streicher M, et al.: Prevalence of malnutrition using harmonized definitions in older adults from different settings – a MaNuEL study. Clin Nutr 2019; 38(5): 2389–98.*
21. *Steptoe A, Pollard TM, Wardle J: Development of a measure of the motives underlying the selection of food: the food choice questionnaire. Appetite 1995; 25(3): 267–84.*
22. *Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F: Gender differences in food choice: the contribution of health beliefs and dieting. Ann Behav Med 2004; 27(2): 107–16.*
23. *Doma KM, Farrell EL, Leith-Bailey ER, Soucier VD, Duncan AM: Older adults' awareness and knowledge of beans in relation to their nutrient content and role in chronic disease risk. Nutrients 2019; 11(11): 2680.*
24. *Subar AF, Freedman LS, Tooze JA, et al.: Addressing current criticism regarding the value of self-report dietary data. J Nutr 2015; 145(12): 2639–45.*