



PORTION SIZES OF FOOD ITEMS AMONG ELDER SUBJECTS IN THE GENERAL POPULATION. A METHODOLOGICAL DIETARY STUDY FROM MALMÖ, SWEDEN

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Abstract: *Objectives:* To describe portion size for different food items included in food frequency questionnaire in the Good Aging in Skåne study (GÅS), in an elderly population in Malmö, Sweden in relation to an increased age. *Design:* Self-reported intake of portion size among older volunteers. *Setting:* General population from the city of Malmö, Sweden. *Participants:* 106 men and women in three age groups (60-69, 70-79 and 80-91 years) from the general population participated in the study. *Measurements:* The participants were interviewed regarding their consumption of regular food items in meals and snack meals and beverages. They estimated their portion sizes of 71 different food items. *Results:* Portion sizes for the eight food items; red and white wine, soft drinks, crisp bread, chocolate, salted nuts, stewed fruit and low fat hard cheese differed between the three male age groups with the oldest men reporting the lowest intake. Among women, only three food items differed namely; oil-based dressing, soup and medium strong beer. Generally the oldest women reported the lowest intake. *Conclusion:* There were few differences in portion sizes regarding an increased age, from 60 to 90 years of age, for both genders. There is in reality no need to considerate portion size for more than a few food items when using dietary assessment methods such as FFQ in nutritional epidemiology, and reduction factors are presented for these food items.

Key words: Portion sizes, elderly, dietary assessment methods, food items, epidemiology.

Introduction

Among older persons, from ages 65 and over, a dietary assessment method that is easy to use is a prerequisite for participating in dietary studies, as well as to achieve valid and reliable data. Most commonly used methods are therefore; food frequency questionnaire (FFQ) (1, 2), diet history (3-5), different recall methods (2, 6) or food diaries (7) with estimated diaries (8) or weighed records (9). Also a combination of methods has been used to increase the validity of data (10-13).

All dietary assessment methods have advantages and disadvantages. One method that is quite burdensome and afflicted with difficulties for an elderly person is weighed food record (14). Food frequency questionnaire is easy to use in larger populations and among elderly persons, as it is less burdensome than other dietary assessment methods (14). Therefore it has been commonly used even though it only shows the frequency

of food items, and not portion size. Consequently the most commonly used dietary assessment methods among elderly are depending on estimating the portion size. The portion size must be determined as this knowledge is crucial to achieve appropriate energy and nutrient intake (15, 16).

Among older persons both energy intake and meal frequency has been shown to decrease with an increased age, (3, 17) as well as food intake (18). In addition, the distribution of energy in different meals can change (9). One reason to a decrease in food intake in old age, are decreased snacking (19).

However, there is lack of sufficient knowledge regarding portion sizes among older persons, foremost in the higher ages, i.e. 80 years and older. Studies that compare specific portion sizes in different ages of elderly have not been found, to our knowledge. If this profound knowledge is missing, there is a potential risk of introducing bias due to age. This is especially important using methods where the portion sizes not are registered, such as FFQ.

The present study will be focussing on describing estimated portion sizes for elderly persons from the general population, in different age groups in Malmö, a municipality in southern Sweden. These data will later on

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be used in combination with data from a large sequential longitudinal cohort study on elderly called Good Aging in Skåne study (GÅS), which are a part of the Swedish National study on Aging and Care (SNAC) (20, 21). The overall purpose of the GÅS study is to study future needs of care and how the society can meet these needs. It is an ongoing longitudinal study that includes men and women in 9 age cohorts: 60, 66, 72, 78, 81, 84, 87, 90 and 93 years, invited after randomisation from municipality registers, with re-examination every third year (sixth year for subjects up to 72 years of age) and including dietary habits and dietary intake assessed by a FFQ. The aims of the GÅS study are to describe normal aging, predictors of disorders and the natural course for subjects suffering from chronic disorders from clinical, biological and societal perspectives.

The aim of this study was to describe portion size for different food items included in the food frequency questionnaire used in the Good Aging in Skåne study (GÅS), in an elderly population in the city of Malmö, in relation to an increased age.

Material and methods

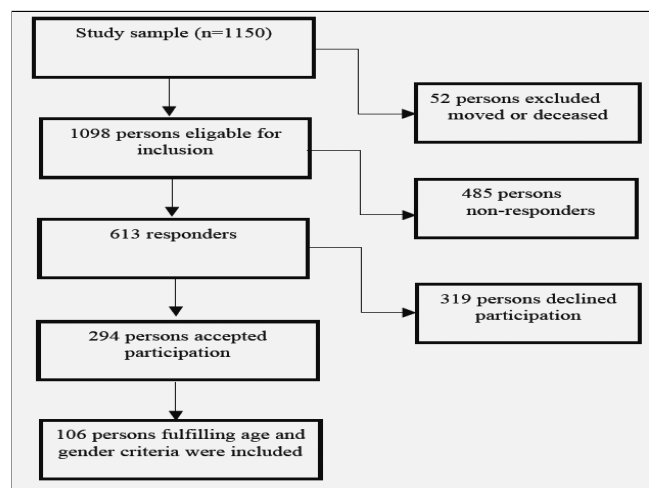
Sample population

A random sample of 1150 elderly persons living in the city of Malmö, one of the three largest cities in Sweden, from different ages (60, 66, 72-73, 77-78, 81-82, 84-91 years) were selected using the National Municipality Registry and were invited to participate in the study, Figure 1. Participation was voluntary. Of these 52 persons had moved or was deceased. Of the remaining 1098 persons, 613 answered the invitation. Of these a total of 319 declined participation (138 men and 181 women). Of these declining, 44 answers came from relatives or trustees that mentioned reasons such as suffering from severe illness, living at a nursing home or hospitalization. Five persons rejected for other reasons.

Consequently, a total of 294 persons (157 men and 137 women) accepted to participate in the study, which means a participation rate of 27%. The aim was to get between 17 and 20 persons in each three age and gender groups. The age groups were chosen to be the same as in the GÅS study, as validation data from this study will be used in further analysis together with data from the GÅS study. The 294 persons willing to participate was consecutively contacted by letter or telephone and booked for an interview at a geriatric research unit until the specific age and gender groups were complete. A total of 106 persons, 54 women and 52 men, were included and interviewed of whom five older women were fragile and therefore interviewed by a dietician (JE) at home. It was difficult to recruit women in the oldest group (80-91 years); therefore 8 women participating in the GÅS-

project, previously also a random sample, were contacted for participation in this study. Seven of these accepted and were interviewed.

Figure 1
Flow chart over study sample



Interview regarding portion sizes

An interview regarding how much the elderly person consumes of regular food items and beverages to meals and snack meals were performed. The aim was to get an estimation of the portion sizes of 71 different food items and for a few foods the variation after season. The food frequency questionnaire (FFQ) covering 98 questions used in the GÅS-study (20, 21) was used as base for the food items and beverages included. This included mostly food items and beverages that are consumed for breakfast, snack meals and minor meals, but also a few main meals. The interviews were performed by two nutritionist students from June to August in 2008, except for fifteen interviews performed by a dietician (JE) during August to November, including the five home visits. The interviews took from about 30 to 60 minutes and required no preparations for the elderly person.

Estimation of portion sizes

To estimate the portion size a book-let with pictures from the Malmö Diet and Cancer project was used (22). The booklet was used in a validated modified diet history and an extensive FFQ in the ages 50 to 69 years, in both men and women (10, 11). The estimation of some portion sizes were also done in household measures (for example liquids, dairy products, sauce), in pieces (for example cookies, crackers, wafers, buns, sandwiches, sugar lumps, fruit, pancakes and waffles as well as and toppings like meats and salami) or in grams (for example candy, chocolate bars, nuts). When food items were estimated in pieces for example a cookie, an apple, a banana, a piece of

chocolate, standard portion sizes were used according to the Swedish National food administration (23, 24).

For food items where the intake often varies during the seasons, i.e. fruits, berries and ice cream, the variation during the year were also registered. The seasons that were used were spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January, February). The participants were asked to estimate the intake of food items and beverages each time they consumed, for example how many sandwiches were consumed at each occasion.

Statistical methods

The 106 older persons participating were divided in groups after sex and age, i.e. three age groups 60-69 years or youngest group, 70-79 years or middle group and 80-91 years or oldest group, for both men and women.

For each group a mean value was calculated for the intake of different food items and beverages, i.e. the amount that was consumed each day it was consumed. Portion sizes for 71 different food items and beverages were asked for in the interview; however 67 were included in the statistical analysis, as the consumption for some food items was very low, i.e. less than 5 grams and with only single persons reporting to consume them. Food items excluded were popcorn, boiling-coffee, gruel and margarine to sandwich. A few individuals reported consuming some food items very rare, these were included if the amount was given, to increase the validity of the estimation. Persons reported not consuming a food item or not estimated any amount was not included in the calculation. Food items that 5 or fewer individuals reported to consume were excluded from the tables; these were butter to sandwich, potato dumplings, yoghurt/kefir (men) and medium fat soured milk (women).

Foods items with similar content were aggregated into 18 groups, to get a higher number of persons consuming each food group and to increase the power. The groups were merged with the intention to be the same as presented in "Riksmaten", a large Swedish nationwide survey (25), but due to different ways of calculation direct comparisons were not possible.

Comparisons between the groups of men and women were performed with the Mann-Whitney U-test. Comparisons between the three age groups were performed with the Kruskal-Wallis test. This non-parametric test was chosen as the groups were small and uneven. Comparisons were made on a group level between men and women, and between the age groups (60-69, 70-79 and 80-91 years). In cases where a statistical significant difference ($p < 0.05$) was found, further analyses between two age groups were performed with the Mann-Whitney U-test.

Statistical power analysis was performed for food items without statistical significance between groups according to the Kruskal-Wallis test.

Food items where the seasonal variation was asked about was berries, apples/pears/peaches, orange/mandarin/grapefruit, banana and ice cream. The calculation was made as a difference of the highest portion minus the lowest to get a difference when actual.

The SPSS version 18.0 was used for all statistical calculations.

Results

The portion sizes of different food items among men and women in the three age groups (60-69, 70-79 and 80-91 years) are presented in table 1 and 2, respectively. Most persons reported intake of fruits and berries, coffee, wholemeal bread, crisp bread, water, marmalade and jam. Many of the women reported a high intake of crème fraîche for cooking, soups, sauce and pickled herring. Among the men also many reported to consume soups, sauce and pickled herring as well as brown beans and pea soup. Table 3 and 4 shows the portion size of aggregated food items (i.e. food items with a similar content) for men and women, respectively.

Portion sizes among men and women

The group of men reported statistical significant higher ($p < 0.05$) intakes of 16 food items and beverages compared to the group of women. These were: bregott (a mixture of butter and rapeseed oil) on sandwich, butter on bread and for cooking, medium fat hard cheese 28%, porridge from oat, graham, rye or barley, medium-fat soured milk, brown beans, pea soup, soup, pizza, pickled herring, rose hip soup, stewed fruit and alcoholic beverages such as light beer, strong beer and spirits. For aggregated food items men reported only higher intake of fat on sandwich ($p = 0.016$) and beer ($p = 0.001$).

Portion sizes in different age groups for men

Statistical significant differences between men in the three age groups are showed in table 1. There was a difference for eight food items; red and white wine, soft drinks, crisp bread, chocolate, salted nuts, stewed fruit and low fat hard cheese.

Men in the youngest age group reported significantly higher intake of white wine ($p = 0.010$) and red wine ($p = 0.037$) compared to the middle group. The youngest men reported significantly higher intake of crisp bread ($p = 0.029$), chocolate ($p = 0.026$), salted nuts ($p = 0.017$), stewed fruit ($p = 0.028$), white wine ($p = 0.005$), red wine ($p = 0.010$) and soft drinks ($p = 0.022$) compared to the oldest group. The middle group had significantly higher intake of crisp bread ($p = 0.014$), low fat hard cheese

**Table 1**

Average consumption of food items in grams per occasion, and per cent (%) male consumers. Consumption is based only on the number (n) of men reporting that food item

| Food items and beverages (gram/occasion) | Men 60-91 years (52) | | | Men 60-69 years (18) | | | Men 70-79 years (17) | | | Men 80-91 years (17) | | |
|--|----------------------|----|----|----------------------|----|-----|----------------------|----|----|----------------------|----|-----|
| | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % |
| "Bregott" (a mixture of butter and rapeseed oil) to sandwich | 17±12 | 14 | 27 | 23±18 | 5 | 28 | 17±6 | 2 | 12 | 13±6 | 7 | 41 |
| Low fat margarine to sandwich | 13±8 | 28 | 54 | 12±6 | 8 | 44 | 13±11 | 11 | 65 | 15±6 | 9 | 53 |
| Butter for cooking | 24±12 | 16 | 31 | 22±13 | 7 | 39 | 18±4 | 5 | 29 | 35±10 | 4 | 24 |
| Margarine for cooking | 20±10 | 32 | 62 | 19±11 | 11 | 61 | 20±9 | 10 | 59 | 21±10 | 11 | 65 |
| Oil for cooking | 13±9 | 28 | 54 | 16±13 | 11 | 61 | 12±6 | 9 | 53 | 11±3 | 8 | 47 |
| Oil based dressing | 14±10 | 22 | 42 | 17±12 | 10 | 56 | 12±8 | 8 | 47 | 9±5 | 4 | 24 |
| Cream (as an accessory) | 49±32 | 29 | 56 | 55±41 | 10 | 56 | 45±33 | 8 | 47 | 47±23 | 11 | 65 |
| Crème fraîche and cream for cooking | 61±51 | 36 | 69 | 71±45 | 14 | 78 | 42±30 | 12 | 71 | 69±73 | 10 | 59 |
| Sour cream | 89±94 | 17 | 33 | 116±119 | 9 | 50 | 43±16 | 3 | 18 | 67±56 | 5 | 29 |
| White bread, loaf | 56±34 | 25 | 48 | 62±51 | 8 | 44 | 58±29 | 6 | 35 | 50±21 | 11 | 65 |
| Wholemeal bread (soft) | 67±40 | 45 | 87 | 66±14 | 17 | 94 | 73±45 | 16 | 94 | 59±40 | 12 | 71 |
| Crisp bread | 24±15* | 43 | 83 | 27±14 | 14 | 78 | 28±15 | 13 | 76 | 19±16 | 16 | 94 |
| Thin flat unleavened bread | 31±17 | 12 | 23 | 31±22 | 5 | 28 | 33±15 | 5 | 29 | 28±13 | 2 | 12 |
| Crisp rolls, crackers | 30±20 | 32 | 62 | 34±15 | 7 | 39 | 31±29 | 12 | 71 | 26±10 | 13 | 76 |
| Full fat cheese, soft dessert cheese | 70±47 | 34 | 65 | 85±67 | 13 | 72 | 62±15 | 10 | 59 | 59±36 | 11 | 65 |
| Medium fat hard cheese 28% | 37±24 | 32 | 62 | 34±31 | 12 | 67 | 40±15 | 11 | 65 | 36±26 | 9 | 53 |
| Low fat hard cheese 10-17% | 25±14* | 16 | 31 | 21±5 | 5 | 28 | 43±17 | 4 | 24 | 17±8 | 7 | 41 |
| Soft cheese, soft whey cheese | 20±13 | 11 | 21 | 23±5 | 4 | 22 | 20±19 | 5 | 29 | 15±7 | 2 | 12 |
| Salami-type sausage (for bread) | 24±17 | 24 | 46 | 20±9 | 10 | 56 | 26±12 | 8 | 47 | 28±31 | 6 | 35 |
| Ham and meat (for bread) | 39±47 | 29 | 56 | 56±62 | 12 | 67 | 24±8 | 7 | 41 | 29±37 | 10 | 59 |
| Liver paste | 26±38 | 33 | 63 | 39±58 | 13 | 72 | 15±6 | 9 | 53 | 21±13 | 11 | 65 |
| Marmalade, jam | 15±11 | 36 | 69 | 17±11 | 9 | 50 | 12±10 | 11 | 65 | 17±11 | 16 | 94 |
| Porridge from oats, graham, rye or barley | 339±72 | 22 | 42 | 310±74 | 5 | 28 | 378±44 | 9 | 53 | 313±83 | 8 | 47 |
| Porridge from semolina, rice | 275±118 | 16 | 31 | 300±141 | 6 | 33 | 367±58 | 3 | 18 | 214±90 | 7 | 41 |
| Low fat milk 0,5% | 205±118 | 15 | 29 | 222±149 | 7 | 39 | 252±41 | 5 | 29 | 88±31 | 3 | 18 |
| Low fat soured milk 0,5% | 308±127 | 6 | 12 | 250 | 1 | 6 | 315±181 | 3 | 18 | 325±106 | 2 | 12 |
| Medium fat milk 1,5% | 201±55 | 20 | 38 | 198±46 | 7 | 39 | 201±36 | 7 | 41 | 205±86 | 6 | 35 |
| Medium fat soured milk 1,5% | 258±139 | 10 | 19 | 175±0 | 2 | 11 | 326±175 | 5 | 29 | 200±43 | 3 | 18 |
| Rich fat milk 3% | 211±105 | 14 | 27 | 210±139 | 5 | 28 | 193±80 | 3 | 18 | 221±102 | 6 | 35 |
| Rich fat soured milk 3% | 274±122 | 11 | 21 | 242±138 | 3 | 17 | 313±179 | 3 | 18 | 270±101 | 5 | 29 |
| Low fat yogurt, and healthy yogurt | 150±57 | 10 | 19 | 153±72 | 6 | 33 | 160±13 | 3 | 18 | 104 | 1 | 6 |
| High fibre cereals, muesli | 28±15 | 21 | 40 | 22±14 | 6 | 33 | 38±10 | 6 | 35 | 24±14 | 9 | 53 |
| Cornflakes, cereals, etc | 23±11 | 13 | 25 | 24±11 | 5 | 28 | 25±17 | 4 | 24 | 19±6 | 4 | 24 |
| Brown beans, pea soup | 317±160 | 45 | 87 | 350±206 | 17 | 94 | 256±81 | 13 | 76 | 333±146 | 15 | 88 |
| Soup (not pea soup) | 310±105 | 41 | 79 | 279±101 | 14 | 78 | 321±139 | 13 | 76 | 332±64 | 14 | 82 |
| Pancake, waffles | 205±127 | 35 | 67 | 206±115 | 12 | 67 | 198±150 | 10 | 59 | 209±129 | 13 | 76 |
| Pizza | 265±89 | 23 | 44 | 242±85 | 9 | 50 | 278±93 | 9 | 53 | 285±99 | 5 | 29 |
| Sauce to meat and fish | 78±47 | 45 | 87 | 88±59 | 15 | 83 | 88±44 | 13 | 76 | 62±35 | 17 | 100 |
| Pickled herring | 73±32 | 43 | 83 | 72±27 | 17 | 94 | 79±47 | 12 | 71 | 70±21 | 14 | 82 |
| Sweets, candy (not chocolate) | 97±71 | 13 | 25 | 128±70 | 8 | 44 | 85±22 | 2 | 12 | 21±11 | 3 | 18 |
| Chocolate | 50±50* | 38 | 73 | 68±54 | 10 | 56 | 46±27 | 14 | 82 | 40±62 | 14 | 82 |
| Sugar, honey | 10±12 | 34 | 65 | 14±21 | 8 | 44 | 8±4 | 14 | 82 | 9±9 | 12 | 71 |
| Cakes and tarts | 109±43 | 26 | 50 | 115±40 | 9 | 50 | 118±49 | 8 | 47 | 97±43 | 9 | 53 |
| Pastry pieces, such as Mazarin | 54±13 | 14 | 27 | 60±22 | 5 | 28 | 50 | 3 | 18 | 50±0 | 6 | 35 |
| Buns, bun rings | 47±22 | 36 | 69 | 54±16 | 12 | 67 | 45±29 | 11 | 65 | 41±20 | 13 | 76 |
| Sponge cake, jam swiss roll | 36±15 | 29 | 56 | 44±23 | 9 | 50 | 30±0 | 9 | 53 | 34±9 | 11 | 65 |
| Crisps | 76±64 | 7 | 13 | 150±71 | 2 | 11 | 46±39 | 4 | 24 | 50 | 1 | 6 |
| Salted nuts | 36±25* | 29 | 56 | 49±36 | 10 | 56 | 38±13 | 10 | 59 | 19±11 | 9 | 53 |
| Rose hip soup, fruit soup | 216±102 | 28 | 54 | 218±131 | 7 | 39 | 193±121 | 7 | 41 | 227±80 | 14 | 82 |
| Stewed fruit | 192±79* | 15 | 29 | 230±67 | 5 | 28 | 231±80 | 4 | 24 | 133±56 | 6 | 35 |
| Fruit drink | 200±52 | 19 | 37 | 199±71 | 8 | 44 | 233±30 | 4 | 24 | 183±28 | 7 | 41 |
| Soft drinks | 268±100* | 11 | 21 | 319±58 | 6 | 33 | 270±68 | 3 | 18 | 109±80 | 2 | 12 |
| Juice | 196±61 | 36 | 69 | 206±64 | 11 | 61 | 186±58 | 13 | 76 | 198±66 | 12 | 71 |
| Coffee (brewed) | 214±103 | 49 | 94 | 226±99 | 18 | 100 | 207±65 | 14 | 82 | 206±133 | 17 | 100 |
| Tea | 225±79 | 28 | 54 | 208±20 | 6 | 33 | 229±62 | 12 | 71 | 230±116 | 10 | 59 |
| Light beer | 350±98 | 21 | 40 | 349±80 | 7 | 39 | 380±160 | 5 | 29 | 334±76 | 9 | 53 |
| Medium strong beer | 404±206 | 25 | 48 | 518±266 | 10 | 56 | 317±105 | 7 | 41 | 337±119 | 8 | 47 |
| Strong-beer | 543±486 | 22 | 42 | 536±492 | 11 | 61 | 629±625 | 7 | 41 | 413±165 | 4 | 24 |
| White wine | 261±88* | 34 | 65 | 319±73 | 14 | 78 | 236±67 | 11 | 65 | 199±83 | 9 | 53 |
| Red wine | 262±101* | 39 | 75 | 323±70 | 13 | 72 | 250±74 | 12 | 71 | 217±121 | 14 | 82 |
| Spirits | 66±42 | 35 | 67 | 80±48 | 12 | 67 | 73±48 | 11 | 65 | 46±21 | 12 | 71 |
| Water, mineral water | 239±87 | 49 | 94 | 227±49 | 16 | 89 | 264±116 | 16 | 94 | 227±83 | 17 | 100 |
| Mushrooms (raw) | 140±156 | 12 | 23 | 125±106 | 2 | 11 | 70±36 | 6 | 35 | 253±237 | 4 | 24 |
| Mushrooms (prepared) | 35±23 | 26 | 50 | 39±25 | 12 | 67 | 35±24 | 7 | 41 | 29±20 | 7 | 41 |

* p-value <0.05, according to Kruskal-Wallis between three groups.



Table 2

Average consumption of food items in grams per occasion, and per cent (%) female consumers. Consumption is based only on the number of women reporting that food item

| 91 years (18) Food items and beverages (gram/occasion) | Women 60-91 years (54) | | | | Women 60-69 years (17) | | | Women 70-79 years (19) | | | Women 80- | |
|--|------------------------|----|----|---------|------------------------|-----|---------|------------------------|-----|---------|-----------|-----|
| | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % |
| "Bregott" (a mixture of butter and rapeseed oil) to sandwich | 9±5 | 22 | 41 | 7±3 | 9 | 53 | 8±5 | 5 | 26 | 11±7 | 8 | 44 |
| Low fat margarine to sandwich | 11±8 | 29 | 54 | 8±4 | 8 | 47 | 10±10 | 13 | 68 | 14±11 | 8 | 44 |
| Butter for cooking | 14±10 | 22 | 41 | 25±19 | 4 | 24 | 10±4 | 9 | 47 | 12±7 | 9 | 50 |
| Margarine for cooking | 18±14 | 36 | 67 | 17±19 | 13 | 76 | 18±11 | 13 | 68 | 19±9 | 10 | 56 |
| Oil for cooking | 11±6 | 33 | 61 | 11±5 | 12 | 71 | 11±7 | 11 | 58 | 12±6 | 10 | 56 |
| Oil based dressing | 14±10* | 25 | 46 | 9±5 | 9 | 53 | 21±11 | 9 | 47 | 12±10 | 7 | 39 |
| Cream (as an accessory) | 50±29 | 34 | 63 | 50±28 | 10 | 59 | 44±19 | 9 | 47 | 54±36 | 15 | 83 |
| Crème fraîche and cream for cooking | 51±28 | 43 | 80 | 59±30 | 15 | 88 | 46±26 | 18 | 95 | 49±30 | 10 | 56 |
| Sour cream | 100±79 | 24 | 44 | 96±46 | 7 | 41 | 98±97 | 8 | 42 | 104±90 | 9 | 50 |
| White bread, loaf | 45±26 | 27 | 50 | 46±31 | 9 | 53 | 46±20 | 7 | 37 | 44±23 | 11 | 61 |
| Wholemeal bread (soft) | 52±28 | 53 | 98 | 51±24 | 17 | 100 | 46±23 | 18 | 95 | 57±37 | 18 | 100 |
| Crisp bread | 19±8 | 39 | 72 | 21±11 | 14 | 82 | 18±6 | 14 | 74 | 17±7 | 11 | 61 |
| Thin flat unleavened bread | 27±13 | 13 | 24 | 37±17 | 4 | 24 | 25±11 | 3 | 16 | 21±9 | 6 | 33 |
| Crisp rolls, crackers | 30±16 | 37 | 69 | 33±17 | 10 | 59 | 23±10 | 13 | 68 | 34±18 | 14 | 78 |
| Full fat cheese, soft dessert cheese | 62±40 | 44 | 81 | 76±55 | 15 | 88 | 53±25 | 15 | 79 | 58±34 | 14 | 78 |
| Medium fat hard cheese 28% | 25±12 | 45 | 83 | 31±15 | 13 | 76 | 22±9 | 15 | 79 | 23±11 | 17 | 94 |
| Low fat hard cheese 10-17% | 26±12 | 18 | 33 | 23±10 | 7 | 41 | 23±11 | 7 | 37 | 38±13 | 4 | 22 |
| Soft cheese, soft whey cheese | 18±8 | 21 | 39 | 22±10 | 6 | 35 | 16±7 | 8 | 42 | 18±7 | 7 | 39 |
| Salami-type sausage (for bread) | 24±13 | 27 | 50 | 29±17 | 9 | 53 | 15±5 | 6 | 32 | 24±11 | 12 | 67 |
| Ham and meat (for bread) | 25±14 | 37 | 69 | 24±13 | 13 | 76 | 28±18 | 12 | 63 | 23±13 | 12 | 67 |
| Liver paste | 15±10 | 39 | 72 | 18±13 | 15 | 88 | 13±5 | 13 | 68 | 15±9 | 11 | 61 |
| Marmalade, jam | 13±10 | 43 | 80 | 16±13 | 15 | 88 | 9±4 | 13 | 68 | 15±10 | 15 | 83 |
| Porridge from oats, graham, rye or barley | 238±64 | 30 | 56 | 225±54 | 10 | 59 | 260±84 | 10 | 53 | 228±49 | 10 | 56 |
| Porridge from semolina, rice | 271±83 | 26 | 48 | 263±74 | 8 | 47 | 263±74 | 8 | 42 | 285±100 | 10 | 56 |
| Low fat milk 0,5% | 189±111 | 14 | 26 | 195±103 | 8 | 47 | 208±147 | 4 | 21 | 129±112 | 2 | 11 |
| Low fat soured milk 0,5% | 192±29 | 9 | 17 | 182±37 | 2 | 12 | 203±31 | 5 | 26 | 175±0 | 2 | 11 |
| Medium fat milk 1,5% | 180±139 | 20 | 37 | 238±148 | 4 | 24 | 212±173 | 8 | 42 | 119±77 | 8 | 44 |
| Rich fat milk 3% | 150±89 | 15 | 28 | 165±43 | 5 | 29 | 145±137 | 4 | 21 | 141±96 | 6 | 33 |
| Rich fat soured milk 3% | 207±68 | 16 | 30 | 225±43 | 3 | 18 | 239±100 | 4 | 21 | 186±59 | 9 | 50 |
| Low fat yogurt, healthy yogurt | 179±58 | 12 | 22 | 185±53 | 6 | 35 | 171±85 | 4 | 21 | 175±0 | 2 | 11 |
| Yogurt, kefir | 167±39 | 19 | 35 | 192±37 | 5 | 29 | 164±42 | 9 | 47 | 146±28 | 5 | 28 |
| High fibre cereals, muesli | 21±13 | 19 | 35 | 21±12 | 10 | 59 | 13±3 | 5 | 26 | 32±15 | 4 | 22 |
| Cornflakes, cereals, etc | 17±9 | 16 | 30 | 19±14 | 4 | 24 | 14±4 | 8 | 42 | 22±11 | 4 | 22 |
| Brown beans, pea soup | 221±91 | 31 | 57 | 247±80 | 8 | 47 | 208±90 | 10 | 53 | 216±102 | 13 | 72 |
| Soup (not pea soup) | 240±94* | 46 | 85 | 279±94 | 17 | 100 | 238±78 | 14 | 74 | 198±95 | 15 | 83 |
| Pancake, waffles | 167±100 | 38 | 70 | 180±102 | 14 | 82 | 187±131 | 9 | 47 | 141±76 | 15 | 83 |
| Pizza | 198±83 | 30 | 56 | 223±86 | 12 | 71 | 209±87 | 11 | 58 | 140±46 | 7 | 39 |
| Sauce to meat and fish | 72±53 | 48 | 89 | 83±52 | 14 | 82 | 72±66 | 17 | 89 | 63±41 | 17 | 94 |
| Pickled herring | 57±23 | 43 | 80 | 54±22 | 13 | 76 | 55±24 | 14 | 74 | 62±24 | 16 | 89 |
| Sweets, candy (not chocolate) | 79±53 | 18 | 33 | 101±55 | 6 | 35 | 87±63 | 6 | 32 | 48±29 | 6 | 33 |
| Chocolate | 36±28 | 48 | 89 | 36±23 | 15 | 88 | 41±28 | 19 | 100 | 28±32 | 14 | 78 |
| Sugar, honey | 10±7 | 32 | 59 | 11±7 | 12 | 71 | 12±8 | 11 | 58 | 7±4 | 9 | 50 |
| Cakes and tarts | 93±34 | 34 | 63 | 89±40 | 8 | 47 | 83±25 | 12 | 63 | 104±36 | 14 | 78 |
| Pastry pieces such as Mazarin | 53±11 | 23 | 43 | 50±0 | 4 | 24 | 61±20 | 7 | 37 | 50±0 | 12 | 67 |
| Buns, bun rings | 48±23 | 40 | 74 | 42±16 | 14 | 82 | 53±34 | 13 | 68 | 48±16 | 13 | 72 |
| Sponge cake, jam sviss roll | 32±8 | 29 | 54 | 30±0 | 9 | 53 | 30±0 | 6 | 32 | 33±12 | 14 | 78 |
| Crisps | 53±48 | 12 | 22 | 65±39 | 6 | 35 | 59±63 | 4 | 21 | 6±2 | 2 | 11 |
| Salted nuts | 33±15 | 20 | 37 | 30±12 | 9 | 53 | 31±10 | 7 | 37 | 44±27 | 4 | 22 |
| Rose hip soup, fruit soup | 165±57 | 27 | 50 | 181±38 | 4 | 24 | 189±75 | 9 | 47 | 145±43 | 14 | 78 |
| Stewed fruit | 125±48 | 17 | 31 | 131±52 | 4 | 24 | 121±46 | 6 | 32 | 125±56 | 7 | 39 |
| Fruit drink | 211±47 | 20 | 37 | 211±69 | 7 | 41 | 219±35 | 9 | 47 | 191±28 | 4 | 22 |
| Soft drinks | 332±106 | 6 | 11 | 276±96 | 2 | 12 | 390±184 | 2 | 11 | 330±0 | 2 | 11 |
| Juice | 199±74 | 35 | 65 | 206±108 | 13 | 76 | 193±52 | 12 | 63 | 197±41 | 10 | 56 |
| Coffee (brewed) | 211±91 | 50 | 93 | 238±124 | 17 | 100 | 197±49 | 16 | 84 | 197±82 | 17 | 94 |
| Tea | 216±59 | 39 | 72 | 214±23 | 11 | 65 | 198±16 | 13 | 68 | 233±90 | 15 | 83 |
| Light beer | 250±79 | 24 | 44 | 257±82 | 6 | 35 | 238±75 | 6 | 32 | 253±86 | 12 | 67 |
| Medium strong beer | 327±102* | 11 | 20 | 387±88 | 6 | 35 | 258±79 | 4 | 21 | 250 | 1 | 6 |
| Strong-beer | 305±93 | 8 | 15 | 340±123 | 4 | 24 | 277±46 | 3 | 16 | 250 | 1 | 6 |
| White wine | 223±82 | 45 | 83 | 261±94 | 14 | 82 | 220±79 | 16 | 84 | 192±61 | 15 | 83 |
| Red wine | 220±86 | 40 | 74 | 250±96 | 14 | 82 | 227±91 | 14 | 74 | 177±47 | 12 | 67 |
| Spirits | 47±37 | 14 | 26 | 64±45 | 7 | 41 | 30±14 | 4 | 21 | 30±26 | 3 | 17 |
| Water, mineral water | 238±87 | 52 | 96 | 242±48 | 17 | 100 | 259±124 | 17 | 89 | 213±70 | 18 | 100 |
| Mushrooms (raw) | 121±65 | 16 | 30 | 117±33 | 4 | 24 | 144±82 | 8 | 42 | 81±28 | 4 | 22 |
| Mushrooms (prepared) | 31±16 | 26 | 48 | 28±11 | 11 | 65 | 24±9 | 5 | 26 | 37±21 | 10 | 56 |

* p-value <0.05, according to Kruskal-Wallis between three groups.



($p=0.025$), chocolate ($p=0.046$) and salted nuts ($p=0.005$) compared to the oldest group. Only two aggregated food groups, wine ($p=0.004$) and cream/sour cream/crème fraîche ($p=0.016$), differed among men in the age groups (table 3). The youngest group had significantly higher intake of wine compared to the middle group ($p=0.049$) and the oldest group ($p=0.002$). For cream/sour cream/crème fraîche the youngest group had significantly higher intake compared to the middle group ($p=0.005$) and the oldest group ($p=0.048$).

Portion sizes in different age groups for women

Only three food items differed statistically significant among the three groups of women; oil-based dressing, soup and medium strong beer, see table 2. The youngest group reported significantly higher intake of medium strong beer ($p=0.042$), but however lower intake of oil-based dressing ($p=0.010$) compared to the middle group. The youngest group also had significantly higher intake of soup ($p=0.019$) compared to the oldest group. For aggregated food groups there were statistical significant differences among the age groups (table 4) for cereals/muesli ($p=0.007$), beer ($p=0.026$) and wine ($p=0.010$). The women in the middle group had significantly lower intake of cereals/muesli than the women in the oldest group ($p=0.001$). The youngest group had significantly higher intake of beer compared to the oldest group ($p=0.010$). The youngest group had significantly higher intake of wine compared both to the

middle group ($p=0.021$) and the oldest group ($p=0.003$).

Power analysis

Statistical power analysis showed that with an 80% power and a p -level of 0.05 could a difference for the food items bread and buns/cookies/cakes of $>35g$ and $>43g$ daily be detected for men and women respectively. Corresponding differences for both gender for fruits and berries was $>75g$ and for food items milk products/soured milk/yoghurt and porridge about $>100g$, range 86 to 110, for both men and women, respectively.

Food items with seasonal variation

Food items where the seasonal variation was asked about is shown in table 5. There were no statistical significant differences between the groups of men and women and among the women according to age. Among the men there were differences in portion sizes for orange/mandarin/grapefruit as the youngest group had significantly higher intake ($p=0.043$) and for ice cream as the oldest group had a significantly lower intake ($p=0.029$). For the oldest men and women, respectively the standard deviation was 0 for the group orange/mandarin/grapefruit as well as with banana for the middle group of men and the youngest group of women. This could be explained by that if reporting to

Table 3

Average consumption of aggregated food items in grams per occasion, and per cent (%) male consumers. Consumption is based only on the number (n) of men reporting that food item

| Food item (gram/occasion) | Men 60-91 years (52) | | | Men 60-69 years (18) | | | Men 70-79 years (17) | | | Men 80-91 years (17) | | |
|-------------------------------------|----------------------|----|-----|----------------------|----|-----|----------------------|----|-----|----------------------|----|-----|
| | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % |
| Fat on sandwich | 18±15 | 39 | 75 | 21±17 | 13 | 72 | 16±14 | 11 | 65 | 18±14 | 15 | 88 |
| Cooking fats | 36±22 | 47 | 90 | 42±28 | 17 | 94 | 29±16 | 17 | 100 | 38±20 | 13 | 76 |
| Cream, sour cream and crème fraîche | 116±94* | 44 | 85 | 162±96 | 16 | 89 | 71±39 | 14 | 82 | 110±111 | 14 | 82 |
| Bread | 130±69 | 52 | 100 | 132±63 | 18 | 100 | 143±82 | 17 | 100 | 115±60 | 17 | 100 |
| Cheese | 87±63 | 48 | 92 | 101±84 | 17 | 94 | 89±43 | 15 | 88 | 70±52 | 16 | 94 |
| Fruit and berries | 423±108 | 52 | 100 | 458±96 | 18 | 100 | 373±112 | 17 | 100 | 436±105 | 17 | 100 |
| Buns, cookies and cakes | 144±94 | 44 | 85 | 170±125 | 14 | 78 | 123±80 | 15 | 88 | 139±70 | 15 | 88 |
| Stewed fruit and fruit soups | 270±153 | 33 | 63 | 334±243 | 8 | 44 | 228±127 | 10 | 59 | 265±101 | 15 | 88 |
| Sweets, candy, sugar and chocolate | 74±90 | 47 | 90 | 121±129 | 15 | 83 | 58±41 | 16 | 94 | 46±66 | 6 | 94 |
| Coffee, tea and water | 548±209 | 52 | 100 | 498±143 | 18 | 100 | 581±251 | 17 | 100 | 568±224 | 17 | 100 |
| Milk products, soured milk, yoghurt | 433±396 | 45 | 87 | 384±214 | 17 | 94 | 573±663 | 13 | 76 | 368±196 | 15 | 88 |
| Cereals and muesli | 29±18 | 30 | 58 | 28±17 | 9 | 50 | 37±23 | 9 | 53 | 24±12 | 12 | 71 |
| Porridge, gruel | 422±244 | 29 | 56 | 372±251 | 9 | 50 | 544±288 | 9 | 53 | 354±175 | 11 | 65 |
| Nuts, crisps and popcorn | 52±58 | 30 | 58 | 79±87 | 10 | 56 | 56±37 | 10 | 59 | 23±14 | 10 | 59 |
| Beer | 607±337 | 43 | 83 | 741±402 | 16 | 89 | 543±302 | 13 | 76 | 503±233 | 14 | 82 |
| Wine | 461±209* | 43 | 83 | 578±177 | 15 | 83 | 442±182 | 13 | 76 | 335±202 | 15 | 88 |
| Juice and soft drinks | 337±206 | 41 | 79 | 445±278 | 13 | 72 | 320±177 | 13 | 76 | 258±103 | 15 | 88 |
| Mushrooms | 69±100 | 38 | 73 | 52±49 | 14 | 78 | 51±34 | 13 | 76 | 111±173 | 11 | 65 |

* p -value <0.05 , according to Kruskal-Wallis between three groups. Data presented are based on consumption per eating event/occasion.



Table 4

Average consumption of aggregated food items in grams per occasion, and per cent (%) of female consumers. Consumption is based only on the number (n) of women reporting that food item

| Food item (gram/occasion) | Women 60-91 years (54) | | | Women 60-69 years (17) | | | Women 70-79 years (19) | | | Women 80-91 years (18) | | |
|-------------------------------------|------------------------|----|-----|------------------------|----|-----|------------------------|----|-----|------------------------|----|-----|
| | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % |
| Fat on sandwich | 12±8 | 48 | 89 | 10±5 | 14 | 82 | 11±8 | 17 | 89 | 14±9 | 17 | 94 |
| Cooking fats | 32±25 | 52 | 96 | 32±36 | 17 | 100 | 33±18 | 19 | 100 | 32±19 | 16 | 89 |
| Cream, sour cream and crème fraîche | 124±95 | 51 | 94 | 137±101 | 15 | 88 | 112±98 | 18 | 95 | 124±91 | 18 | 100 |
| Bread | 116±61 | 53 | 98 | 121±59 | 17 | 100 | 99±63 | 18 | 95 | 128±64 | 18 | 100 |
| Cheese | 87±47 | 54 | 100 | 107±63 | 17 | 100 | 75±38 | 19 | 100 | 82±35 | 18 | 100 |
| Fruit and berries | 449±118 | 54 | 100 | 422±89 | 17 | 100 | 442±111 | 19 | 100 | 484±144 | 18 | 100 |
| Buns, cookies and cakes | 150±77 | 48 | 89 | 118±70 | 15 | 88 | 153±81 | 15 | 79 | 174±74 | 18 | 100 |
| Stewed fruit and fruit soups | 205±83 | 32 | 59 | 208±52 | 6 | 35 | 243±98 | 10 | 53 | 181±77 | 16 | 89 |
| Sweets, candy, sugar and chocolate | 67±63 | 52 | 96 | 80±68 | 16 | 94 | 75±74 | 19 | 100 | 44±37 | 17 | 94 |
| Coffee, tea and water | 586±186 | 54 | 100 | 618±149 | 17 | 100 | 549±199 | 19 | 100 | 594±206 | 18 | 100 |
| Milk products, soured milk, yogurt | 374±218 | 52 | 96 | 414±230 | 16 | 94 | 403±269 | 19 | 100 | 303±112 | 17 | 94 |
| Cereals and muesli | 23±16* | 30 | 56 | 26±20 | 11 | 65 | 14±6 | 13 | 68 | 36±12 | 6 | 33 |
| Porridge, gruel | 368±178 | 40 | 74 | 335±111 | 13 | 76 | 417±217 | 12 | 63 | 358±194 | 15 | 83 |
| Nuts, crisps and popcorn | 55±47 | 24 | 44 | 61±46 | 11 | 65 | 64±60 | 7 | 37 | 31±28 | 6 | 33 |
| Beer | 420±259* | 29 | 54 | 590±316 | 9 | 53 | 411±201 | 8 | 42 | 303±194 | 12 | 67 |
| Wine | 439±173* | 48 | 89 | 564±212 | 14 | 82 | 425±165 | 19 | 100 | 359±86 | 15 | 83 |
| Juice and soft drinks | 329±186 | 40 | 74 | 314±175 | 15 | 88 | 361±213 | 14 | 74 | 308±173 | 11 | 61 |
| Mushrooms | 65±61 | 42 | 78 | 52±44 | 15 | 88 | 98±87 | 13 | 68 | 49±30 | 14 | 78 |

* p-value <0.05, according to Kruskal-Wallis between three groups; Data presented are based on consumption per eating event/occasion.

Table 5

Average consumption of food items with seasonal variation in grams per occasion, and per cent (%) of individuals reporting to consume them. Consumption is based only on the number (n) of individuals reporting that food item

| Food item (gram/occasion) | Berries, fresh or frozen | | | Apples, pears, peaches | | | Oranges, mandarin, grapefruit | | | Banana | | | Ice cream | | |
|---------------------------|--------------------------|----|-----|------------------------|----|-----|-------------------------------|----|-----|---------|----|----|-----------|----|-----|
| Age group (years) | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % | mean±sd | n | % |
| Men 60-91 y (52) | 146±79 | 46 | 88 | 123±9 | 50 | 96 | 104±13 | 44 | 85 | 105±38 | 43 | 78 | 86±53 | 48 | 92 |
| Men 60-69 y (18) | 151±106 | 16 | 89 | 124±5 | 18 | 100 | 109±14* | 16 | 89 | 115±55 | 16 | 89 | 99±55 | 16 | 89 |
| Men 70-79 y (17) | 130±48 | 14 | 82 | 121±16 | 16 | 94 | 102±8 | 12 | 71 | 105±0 | 13 | 76 | 99±63 | 17 | 100 |
| Men 80-91 y (17) | 156±71 | 16 | 94 | 125±0 | 16 | 94 | 100±15 | 16 | 94 | 101±15 | 14 | 76 | 58±22* | 15 | 88 |
| Women 60-91 y (54) | 144±88 | 51 | 94 | 131±39 | 54 | 100 | 104±21 | 48 | 89 | 102±13 | 48 | 89 | 74±45 | 46 | 85 |
| Women 60-69 y (17) | 132±29 | 15 | 88 | 121±15 | 17 | 100 | 103±3 | 15 | 88 | 105±0 | 15 | 88 | 75±56 | 15 | 88 |
| Women 70-79 y (19) | 127±56 | 18 | 95 | 145±63 | 19 | 100 | 108±31 | 15 | 79 | 102±13 | 17 | 89 | 82±50 | 14 | 74 |
| Women 80-91 y (18) | 170±133 | 18 | 100 | 125±0 | 18 | 100 | 101±19 | 18 | 100 | 98±18 | 16 | 89 | 67±28 | 17 | 94 |

* p-value = 0.043 and † p-value = 0.029, according to Kruskal-Wallis between three groups; A standard portion size was registered if only one food item was consumed. A standard deviation of 0 means that all persons in that group consumed only one food item, i.e. one fruit.

consume one fruit, the standard portion size was registered, which in these cases means that all persons in the actual group reported to consume only one fruit.

For berries and ice cream the portion sizes changed during the seasons for 11% (12 of 106) and 7% (8 of 106), respectively. For the other food items, i.e. apples/pears/peaches, orange/mandarin/grapefruit and banana all persons reported the same portion size over the seasons. Regarding the frequency, some persons changed their intake during the year. For berries 33% (35 of 106) did not change their frequency during the season. For the other food items the corresponding number was: apples/pears/peaches 92% (97 of 106), orange/mandarin/grapefruit 61% (65 of 106), banana

99% (105 of 106) and ice cream 76% (81 of 106).

Reduction of portion sizes

For those food items where the portion size was statistical significantly lower with increasing age, a reduction factor was calculated, table 6. For women, four food groups needs to be corrected, one food item; soup and three beverages; beer, wine (aggregated) and medium strong beer. The reduction factor for women aged 80-91 years ranged from 0.514 for beer to 0.853 for soup. For men, eleven food groups needs to be corrected, seven food items; chocolate, crisp bread, salted nuts,



stewed fruit, citrus fruit, ice cream and cream, and four beverages; soft drinks, white and red wine and wine (aggregated). The reduction factor for men aged 80-91 years ranged from 0.342 for soft drinks to 0.917 for citrus fruit.

The reduction factor was calculated as the intake in the youngest group (60-69 years) minus the intake of the significant age group divided with the intake in the youngest group. There was one exception, not shown in the table, for cereals/muesli where women in the middle group (70-79 years) had significantly lower intake compared to the oldest group, however not compared to the youngest age group.

Table 6

Reduction factor of portion size for food items were a difference between the age groups of men and women respectively, are present in relation to 60 to 69 years as a reference

| Food group/beverages | | 70-79 years | 80-91 years |
|----------------------|--------------------|-------------|-------------|
| Women | Medium strong beer | 0 | 0.667 |
| | Soup | 0 | 0.853 |
| | Beer (aggregated) | 0 | 0.514 |
| | Wine (aggregated) | 0.754 | 0.637 |
| Men | Chocolate | 0.677 | 0.588 |
| | Crisp bread | 0 | 0.704 |
| | Salted nuts | 0.776 | 0.388 |
| | Soft drinks | 0.846 | 0.342 |
| | Stewed fruit | 0 | 0.578 |
| | Wine white | 0.740 | 0.624 |
| | Wine red | 0.774 | 0.672 |
| | Citrus fruit | 0.936 | 0.917 |
| | Ice cream | 0 | 0.586 |
| | Cream (aggregated) | 0.438 | 0.679 |
| | Wine (aggregated) | 0.765 | 0.580 |

Discussion

This general population study presents new data on older persons portion sizes based on their self-reported intake. Men reported significantly larger portions than women of fifteen of 67 food items included in this study. These food items were mostly energy dense foods. In general, men report a higher intake of energy, and thus larger portion sizes than women (5, 7, 26).

Only minor differences in portion sizes regarding increasing age could be seen. For women four food items differed; soup and medium strong beer and for aggregated food groups; beer and wine. The range of reduction will be from about 15% to 50% between the portions in the 60:s and 80:s. Among men there were nine food items that differed; chocolate, crisp bread, salted nuts, stewed fruit, citrus fruit, ice cream, soft drinks and both red and white wine. For aggregated foods there were two differences; cream/sour cream/crème fraîche and wine. The range of reduction will be from almost one third to less than 10% between the portions in the 60:s

and 80:s. This means that there is only a few food items and beverages included in this study, where there is a need to correct for portion size according to age. This study has also showed that a dietary assessment method such as food frequency questionnaire (FFQ) can be used without register the portion size, as there were few differences according to an increased age. However, the reduction factor for some food items could be useful if accuracy is desirable using FFQ.

The food items and beverages where a decreased portion size regarding a higher age was found, were mostly food items and beverages consumed as snack meals. This is probably of minor importance for the total energy intake among both men and women. The major part of these food items is not consumed on a daily basis, and therefore presumable contributes to a minor part of the total energy intake throughout the day. Consequently, this is also of minor importance for the macronutrient intake. Among elderly it has been shown that snacks contributes to a lower amount of the total energy intake, compared to other age groups (27) and that the contribution of snacks to the total daily energy intake seems to decrease with increasing age (19). The differences for the age groups regarding intake of wine and beer, was in accordance to a large European study which showed that women drink less than men and also in later life women has a reduced consumption of alcohol (28).

Regarding portion sizes during the season, there were only minor differences. Only 11% and 7% respectively, reported different portion sizes during the season for berries and ice cream, whereas there were no differences for the other food items studied. Notable was that 76% and 39% respectively, reported to change their frequency of berries and oranges/mandarin/grapefruit during the season.

These data are based on self-reported intakes of older persons. The persons that participated were older persons living in their own homes, and they were randomly selected from a population register. All persons, except five women that had mobility problems, attended the unit for the interview. So far, no studies have concluded that healthy older persons provide less valid self-reports compared to younger persons (29, 30). On the contrary, older persons have been reporting stable and regular eating habits, and their food intake is part of their daily routine (12, 31). We also asked about portion size of the person's usual intake, not to remember from previous days that are common in dietary assessment. It has been shown that elderly are regular in their food pattern and therefore more easily remembers their food intake, and that they more easily reports their food intake and are more reliable than younger persons (31, 32). In a large European study, older persons compared to younger were less likely to underestimate their energy intake (33). It has also been shown that when recall is not an issue,



photographs is a useful method for estimating portion sizes (34), which strengthen our study.

It was difficult recruiting persons in the oldest age group as many of those no longer lived in their own homes or suffered from cognitive disorders such as dementia, as revealed in the answers from relatives and trustees. Earlier studies have shown that participation is low among older persons, especially among those 80 years and above (7, 35). It is also commonly known that persons participating in dietary studies often are healthier and more interested in foods than non-participating elderly. Also the most active or the very ill or disabled persons decline to participate in dietary studies (35). Persons interested in foods might more easily and more accurately estimate their portion sizes, thereby introducing a potential selection bias. Disabled subjects might have lower portion sizes and lower energy intakes, as they do not have the energy to participate. Since the purpose of this validation study was to evaluate whether or not correction of elder's portion sizes are needed in large scale epidemiological population studies, suffering from and sharing the same kind of selection patterns as this study, it seems reasonable and justifiable to generalise this portion size information to such studies.

Since the population was randomly selected from the elder general population we assume that the results of this study regarding portion sizes are applicable for elder. The catchment area in this study was a larger municipality in Sweden which reflects an urban area. It cannot be ruled out that dietary habits differ in rural areas. Furthermore, in the city of Malmö 18% of the persons 80 years and above are foreign born and this could be a source of selection bias if these persons were underrepresented in our study (36). This possibly limits generalisation of our results, however most of the foreign born older people in Malmö, migrated to Sweden more than 40 to 50 years ago. We therefore can assume that the differences in food pattern and dietary habits are diminished during the years. In Sweden, the proportion of foreign born older people is higher in urban areas such as big cities, than in rural areas. A phenomenon that is similar to larger cities in other European countries.

In Sweden it is traditional with prepared meals as well as sandwich meals including milk products (25). It is also typical with snack meals including coffee or tea (37, 38). However the food and meal pattern and food choice in northern Europe are different from the southern Europe (39). The food groups included in this study are representative for the typical Swedish dietary pattern, which means that the consumption of for example bread, spreads and cold cuts for sandwiches are frequent. The food groups chosen are almost the same as presented in other Swedish studies, both nationwide at all ages in the national survey "Riksmaten" (25) and among home-living Swedish elderly (4, 6, 10-13, 26). It is difficult to compare data between studies, since different dietary

assessment methods are used and the calculations of daily portion size are made differently. However, to evaluate dietary intake in relation to health there is a need for valid and reliable data. This is of importance for the dietary recommendations in the general population.

Limitations and consequences of results

This methodological study on portion sizes reported that elder subjects only had lower sizes for a limited number of food items like cream and alcoholic beverages. One reason could be low statistical power due to small sample size. Analyses of the type 2 error showed that true differences in the order of <35 g for food items like bread and cookies and about less than 100 g for food items like milk products and porridge might have been undetected. On the other hand, the absolute mean difference of bread intake for >80 year old men and women ranged from plus 7 g to minus 15 g compared to younger subjects aged 60 to 69 years. The corresponding difference of intake of porridge, a common meal for breakfast, between aged >80 years and younger subjects was between 10 to 18 g for women and men. There were only minor absolute differences between the age groups. This power corresponds to about half a glass of milk and one piece of bread which means that we can only detect differences that are larger than this. But for the total energy intake as well as assessment of macronutrients and micronutrients the importance of this source of error can be considered as low. The power analysis was based on main food groups, as was done to define differences from a public health point of view. Smaller differences than we can detect, probably have less effect on a group level. Consequently the differences we not have the power to detect probably have minor importance. Instead, when calculating nutrient intake, collinearity between food items could be a much larger problem on observed relative risk than variation in portion of elder subjects (40).

Thus, it seems that portion sizes for most of the common food items among the elder subjects do not differ in any significant way that could have any detrimental effects on calculation of intake of micro- or macronutrients of importance in nutritional epidemiology.

Conclusions

To conclude the findings of this study, there were few differences in portion size regarding an increased age from 60 to 90 years of age, for both genders in the general population. There is actually no need to considerate portion size for more than a few food items when using dietary assessment methods such as FFQ, and reduction factors are given for these food items. This means that the



frequency of intake is of greater importance for the energy and nutrient intake than the portion size, except for a few food items and beverages.

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