



## Food insecurity among Dutch food bank recipients

|                                 |   |
|---------------------------------|---|
| Journal:                        | <i>BMJ Open</i>   |
| Manuscript ID:                  | bmjopen-2013-004657   |
| Article Type:                   | Research  |
| Date Submitted by the Author:   | 10-Dec-2013   |
| Complete List of Authors:       | Neter, Judith; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences<br>Dijkstra, Coosje; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences<br>Visser, Marjolein; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences; VU University Medical Center, Department of Epidemiology and Biostatistics<br>Brouwer, Ingeborg; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences |
| <b>Primary Subject Heading</b>: | Public health   |
| Secondary Subject Heading:      | Epidemiology  |
| Keywords:                       | PUBLIC HEALTH, NUTRITION & DIETETICS, EPIDEMIOLOGY  |
|                                 |   |

SCHOLARONE™  
Manuscripts

only

## Food insecurity among Dutch food bank recipients

Judith E. Neter<sup>1</sup>, S. Coosje Dijkstra<sup>1</sup>, Marjolein Visser<sup>1,2</sup>, Ingeborg A. Brouwer<sup>1</sup>

<sup>1</sup> Department of Health Sciences and the EMGO<sup>+</sup> Institute for Health and Care Research, Faculty of Earth and Life Sciences, VU University Amsterdam, the Netherlands

<sup>2</sup> Department of Epidemiology and Biostatistics, VU University Medical Center, the Netherlands

### Corresponding author

Judith E. Neter

Tel: +31 (0)20 5986128

Fax: +31 (0)20 5986940

E-mail address: [judith.neter@vu.nl](mailto:judith.neter@vu.nl)

VU University Amsterdam

Faculty of Earth and Life Sciences

Department of Health Sciences

De Boelelaan 1085

1081 HV Amsterdam

The Netherlands

**Key words:** food insecurity, food assistance program, low-socioeconomic status, nutrition

**Word count:** 3,068

**Contributorship statement**

J.E.N., I.A.B. and M.V. designed the research. J.E.N. and S.C.D. conducted the research. J.E.N. performed the complete data analyses, writing of the first draft of the manuscript and revision of the manuscript. S.C.D., M.V. and I.A.B. had significant advice concerning interpretation of the results and critical review of the manuscript. J.E.N. had primary responsibility for final content. All authors were involved in the development of the manuscript and approved the final version.

**Source of financial support:** This project was funded by a grant from the Netherlands Organization for Health Research and Development (115100003). The Netherlands organization for Health Research and Development had no role in the design, analysis or writing of this article.

**Ethical statement:** This study was approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The Netherlands, as well as the national board of the Dutch Food Bank.

**Data sharing statement:** There is no additional data available

**Competing interest statement:** The authors declare no conflicts of interest

## 1 Abstract

2 Background: Food insecurity is an important problem in high-income Western countries.

3 However, objective prevalence data on food insecurity in Europe are scarce.

4 Methods: In this cross-sectional study among 251 Dutch food bank recipients from 11 food  
5 banks the prevalence of food insecurity and the independent associations of demographic,  
6 lifestyle and nutrition-related characteristics with low and very low food security were  
7 assessed with multinomial logistic regression analyses, adjusted for potential confounders.

8 Results: The prevalence of food insecurity was 73.3% (N=184), of which 49.5% (N=91)  
9 reported very low food security. Of the very low food secure participants 47.3% (N=43)  
10 reported they were ever hungry but did not eat because they could not afford enough food in  
11 the previous three months. Recipients living in a household without children (Odds Ratio  
12 (OR)):0.38 [95%CI:0.17-0.87]), recipients with higher satisfaction with overall food intake  
13 (OR:0.59 [95%CI:0.36-0.98]), and recipients with higher perceived healthiness of overall  
14 food intake (OR:0.44 [95%CI:0.25-0.78]) had lower odds on low food security. Furthermore,  
15 male recipients (OR:0.29 [95%CI:0.15-0.59]), recipients with higher satisfaction with overall  
16 food intake (OR:0.46 [95%CI:0.28-0.78]), and recipients with higher perceived healthiness of  
17 overall food intake (OR:0.37 [95%CI:0.21-0.66]) had lower odds on very low food security,  
18 while low educated recipients (OR:4.53 [95%CI:1.28-16.01]) had higher odds on very low  
19 food security.

20 Conclusion: Our study showed high prevalence rates of food insecurity among Dutch food  
21 bank recipients, and identified subgroups at increased risk of food insecurity. More research  
22 is urgently needed on the underlying determinants of food insecurity and the effectiveness of  
23 food assistance by food banks.

## Article summary

### *Strengths and limitations of the study*

- Our study among food bank recipients is the first study addressing food insecurity in the Netherlands.
- Data were collected from 251 food bank recipients from 11 food banks throughout the Netherlands.
- A unique aspect of this study is the identification of factors associated with food insecurity. In Europe, this has only been studied among low-income persons in the UK so far.
- A possible limitation of our study is its cross-sectional design which makes it impossible to draw any causal conclusions regarding the factors associated with food insecurity.
- We were not able to adjust for the number of items, nor for the total amount of calories in the food parcel because all food banks and parcels are unique. (e.g. different options for self-selection and/or the exchange of products).

## 24 Introduction

25 Even in high-income Western countries like the Netherlands, there are people who cannot  
26 afford sufficient nutritious food to eat. This food insecurity can be defined as the lack of  
27 availability of nutritionally adequate and safe foods, or the lack of ability to acquire  
28 acceptable foods in socially acceptable ways.[1] It has been associated with unfavorable food  
29 choices[2] and a less healthy diet. Food insecure people have a lower intake of fruit and  
30 vegetables[2-5] and a lower nutrient intake[5-8] leading to micronutrient deficiencies and  
31 malnutrition.[7, 9] Furthermore, food insecurity was shown to be associated with poorer  
32 health including poor oral health[10], overweight, diabetes, and heart disease, and  
33 consequently is a major public health issue.[11-17] Food insecurity is not only a problem in  
34 adults, but also in children and adolescents.[18-21] However, this study focused on adults  
35 only.

36 Only a small number of high-income Western countries report prevalence rates of  
37 food insecurity, varying between 5% and 25%[22-27]: 5.2% in Australia[26], 5.3% in South  
38 Korea[27], 7.7% in Canada[22], 15% in the United States[24], and 15.8% in New  
39 Zealand[23]. In Europe, food insecurity was only reported for low-income people in the  
40 United Kingdom, and was 25%.[25]

41 There are many public and private food assistance programs operating at national,  
42 state, and local levels to reduce food security and hunger in high-income countries. Accurate  
43 measurement of the existence of food security, understanding the factors related to food  
44 insecurity, and monitoring food assistance programs can help public health officials, policy  
45 makers, service providers, and the public at large to assess the growing needs for food  
46 assistance and the effectiveness of existing food assistance programs. Research can also help  
47 to identify subgroups within food bank recipients who are at higher risk of food  
48 insecurity[28].

1  
2  
3 49 Limited research has been performed on the prevalence of food insecurity and factors  
4  
5 50 associated with food insecurity in Europe. The present study aims, to determine the  
6  
7 51 prevalence of low and very low food security among Dutch food bank recipients, and to  
8  
9 52 identify potential factors associated with low and very low food security.  
10  
11  
12 53

## 14 **Methods**

15  
16 55 This cross-sectional study was part of the Dutch Food Bank study, which explores and  
17  
18 56 optimizes food choices and food patterns among Dutch food bank recipients. The study was  
19  
20 57 approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The  
21  
22 58 Netherlands, as well as the national board of the Dutch Food Bank.  
23  
24  
25 59

### 27 *Food Banks*

28  
29 61 For the present study, 11 out of approximately 135 Dutch food banks were selected, based on  
30  
31 62 factors including size, the frequency of providing food parcels, urbanization, region, and  
32  
33 63 willingness of the food bank to participate. The food banks selected were located in  
34  
35 64 Apeldoorn, Boxtel, Breda, Enschede, Groningen, Haarlem, Hilversum, Huizen, Rotterdam,  
36  
37 65 Wageningen, and Zeewolde.  
38  
39  
40 66

### 43 *Study population and data collection*

44  
45 68 The target population consisted of recipients of the Dutch Food Bank. Inclusion criteria for  
46  
47 69 participation were: 1) at least 18 years of age, 2) sufficiently fluent in Dutch to participate in  
48  
49 70 oral and written interviews, 3) recipient of a Dutch food bank for at least one month, 4) single  
50  
51 71 member per household, and 5) collect own food parcel at the food bank. Recipients were  
52  
53 72 recruited between October 2010 and March 2011 through promotional posters and  
54  
55 73 information letters. They could sign up for the study within two or three weeks after  
56  
57  
58  
59  
60

1  
2  
3 74 recruitment with an application form, telephone or e-mail. Participation was voluntary and  
4  
5 75 confidential. Of the approximately 1,200 food bank recipients who received an information  
6  
7 76 letter or might have seen our promotional poster at the food bank, 368 signed up, of which  
8  
9  
10 77 251 participated in the study. Of the 113 recipients who signed up for participation but  
11  
12 78 ultimately did not participate, we were able to contact 41 by telephone to complete a short  
13  
14 79 non-response questionnaire. Reasons for non-participation were: 1) not enough time (N=17),  
15  
16 80 2) did not pick up their food parcel (themselves) at the day of measurement (N=7), 3) missed  
17  
18 81 the researchers at the day of measurement (N=5), 4) did not realize the measurements were  
19  
20 82 on that specific day (N=4), and 5) other reasons (N=8). Measurement days were scheduled  
21  
22 83 between October 2010 and April 2011. Participants who completed the study received a gift  
23  
24 84 coupon of 5 Euros and a small incentive for participation.  
25  
26  
27  
28  
29

### 30 86 *Food security*

31  
32 87 To measure the food security status of the participants, trained interviewers used a translated  
33  
34 88 version of the 6-item US Department of Agriculture (USDA) Household Food Security  
35  
36 89 Survey Scale.[28] The original, validated[29] American questionnaire (Supplemental Table  
37  
38 90 1) was translated back and forth for this study. Coding was carried out in accordance with the  
39  
40 91 Guide to Measuring Household Food Security.[28] Food security status was defined and  
41  
42 92 classified according to the USDA guidelines: score 0 or 1 is food secure; score 2-4 is low  
43  
44 93 food security; score 5-6 is very low food security.[28]  
45  
46  
47  
48

### 49 95 *Explanatory variables*

50  
51  
52 96 Participants completed a self-administered general questionnaire, which consisted of the  
53  
54 97 following domains: socio-demographics, lifestyle factors, grocery shopping, food parcels,  
55  
56 98 food intake, and foods from the food parcels beyond the expiration date.  
57  
58  
59  
60



1  
2  
3 99 Socio-demographics included date of birth, sex, duration of being recipient of a Dutch  
4  
5 100 food bank household size, household composition, ethnicity, level of education, and paid  
6  
7 101 (part-time) job. For ethnicity, we created two-categories: Dutch and non-Dutch ancestry. A  
8  
9  
10 102 participant had a non-Dutch ancestry if the participant or at least one of the parents was born  
11  
12 103 outside the Netherlands. We created three levels of education: low (less than finished  
13  
14 104 elementary school), medium (elementary school), high (general intermediate, and lower  
15  
16 105 vocational education, university, college, higher vocational, general secondary, and  
17  
18 106 intermediate vocational education).

20  
21 107 Lifestyle factors included self-reported height and weight, current smoking, and  
22  
23 108 physical activity. Body mass index (BMI) was calculated as self-reported weight (kg) divided  
24  
25 109 by self-reported height (m<sup>2</sup>). BMI cut-off points of the WHO were used to define weight  
26  
27 110 status.[30] Physical activity was established by asking “How many days a week are you  
28  
29 111 moderately intense physically active for at least 30 minutes?”. Moderately intense physical  
30  
31 112 activity included sport activities, walking, cycling, gardening, and performing heavy  
32  
33 113 housework.

34  
35  
36 114 With regard to the domain grocery shopping, we asked “How much money do you  
37  
38 115 weekly spend on average on foods and drinks to supplement the food parcel?” This amount  
39  
40 116 of money was divided by the number of adults plus children in the household to create the  
41  
42 117 variable money spent on groceries per person per week. For the statistical analyses two  
43  
44 118 categories were created on the basis of the median; 0-29.99 Euros per person per week and  
45  
46 119 30-50 Euros per person per week.

47  
48  
49 120 Questions regarding food parcels included: “How satisfied are you usually with the  
50  
51 121 content of the food parcel?”, and “Do you usually use all foods from the food parcel?”.

52  
53  
54 122 Food-intake-related questions included “How satisfied are you with your current food  
55  
56 123 intake?”, and “How healthy is your current food intake?”. Self-efficacy was measured with  
57  
58  
59  
60

1  
2  
3 124 the question “How certain are you that you can eat healthily?”. The above mentioned  
4  
5 125 questions regarding satisfaction with the food parcels, and nutrition-related questions with  
6  
7 126 five answer categories were scored from -2 to +2, and were analyzed continuously.

8  
9  
10 127 Food parcels provided by the Dutch food banks may include many foods which are  
11  
12 128 nearby the expiration date. Questions on the use of foods beyond the expiration date therefore  
13  
14 129 included “Do you use perishable foods from the food parcel that are beyond the expiration  
15  
16 130 date?”, and “Do you use non-perishable foods from the food parcel that are beyond the  
17  
18 131 expiration date?”.

19  
20  
21 132

### 22 133 *Statistical analyses*

23  
24  
25 134 Statistical analyses were performed using PASW statistics (formerly SPSS statistics) for  
26  
27 135 Windows version 20.0 (Armonk, NY: IBM Corp, USA). Descriptive statistics were used to  
28  
29 136 summarize participants’ characteristics and to examine the level of food insecurity in the  
30  
31 137 study sample. Values in the text are mean  $\pm$  standard deviation (SD), frequency and relative  
32  
33 138 frequency. Sex differences in the prevalence of low and very low food security were tested  
34  
35 139 with Chi-square test. Multinomial logistic regression analysis was used to study the  
36  
37 140 association of demographic, lifestyle and nutrition-related characteristics with low and very  
38  
39 141 low food security. The dependent variable level of food security consisted of three categories:  
40  
41 142 food secure, food insecure with low food security and food insecure with very low food  
42  
43 143 security. For each independent variable the categories low and very low food security were  
44  
45 144 compared with the food secure category; the reference group. Both univariate and  
46  
47 145 multivariate analyses were performed. We adjusted for confounding effects by including the  
48  
49 146 variables age, sex, and level of education in the model. Crude and adjusted odds ratios (ORs)  
50  
51 147 are presented with their 95% confidence interval (CI). We tested for interaction with age, sex,  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 148 and level of education in multivariate analyses. Two-tailed *P*-values of <0.05 were  
4  
5 149 considered significant.  
6

7 150

## 9 151 **Results**

10  
11 152 In total, 251 Dutch food bank recipients participated in the study, of whom 37.1% males and  
12  
13 153 62.9% females (Table 1). Mean age of the total study sample was  $46.3 \pm 10.6$  years. Most of  
14  
15 154 the participants were recipient of the food bank for >12 months. The majority of the  
16  
17 155 participants was of Dutch origin, had a medium level of education, and did not currently have  
18  
19 156 a (part-time) paid job. Furthermore, mean BMI of the population was  $27.3 \pm 6.3$  kg/m<sup>2</sup>, and  
20  
21 157 56.8% was either overweight or obese. Smokers were much more prevalent than non-  
22  
23 158 smokers.  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 1: Characteristics of 251 Dutch Food Bank recipients measured in 2010/2011<sup>1,2</sup>

| Characteristics                                      |             |
|--|-------------|
| Age, <i>yrs</i>                                      | 46.3 ± 10.6 |
| Sex  |             |
| Male   | 93 (37.1)   |
| Female   | 158 (62.9)  |
| Duration of being recipient                          |             |
| 0 - 6 months   | 91 (36.3)   |
| 6 - 12 months  | 63 (25.1)   |
| >12 months   | 97 (38.6)   |
| Household size                                       |             |
| 1 person   | 102 (40.6)  |
| 2 - 4 persons  | 108 (43.0)  |
| ≥ 5 persons  | 41 (16.3)   |
| Household composition                                |             |
| Single parent household                              | 59 (23.6)   |
| Household without children                           | 127 (50.8)  |
| Multiple household with children                     | 64 (25.6)   |
| Ethnicity  |             |
| Dutch  | 178 (71.8)  |
| Non-Dutch ancestry                                   | 70 (28.2)   |
| Educational level                                    |             |
| Low  | 34 (13.6)   |
| Medium   | 131 (52.4)  |
| High   | 85 (34.0)   |
| Current paid (part-time) job                         |             |
| No   | 218 (86.9)  |
| Yes  | 33 (13.1)   |
| Body mass index, <i>kg/m<sup>2</sup></i>             | 27.3 ± 6.3  |
| Weight status  |             |
| Underweight; BMI <18.5 <i>kg/m<sup>2</sup></i>       | 8 (3.3)     |
| Normal Weight; BMI 18 - 24.9 <i>kg/m<sup>2</sup></i> | 98 (40.0)   |
| Overweight; BMI 25 - 29.9 <i>kg/m<sup>2</sup></i>    | 70 (28.6)   |
| Obese; BMI ≥30 <i>kg/m<sup>2</sup></i>               | 69 (28.2)   |
| Current smoking                                      |             |
| No   |             |

|  |                 |
|--|-----------------|
| Yes  | 105 (41.8)      |
| Physically active $\geq$ 30 min/day                | 146 (58.2)      |
| 0 - 2 days/week                                    |                 |
| 3 - 5 days/week                                    | 70 (27.9)       |
| 6 - 7 days/week                                    | 80 (31.9)       |
| Money spent on groceries                           | 101 (40.2)      |
| 0 - 29.99 Euros per person per week                |                 |
| 30 - 50 Euros per person per week                  | 200 (81.6)      |
| Satisfaction with food parcel                      | 45 (18.4)       |
| (Range -2 to +2)                                   | 0.88 $\pm$ 0.83 |
| Satisfaction with overall food intake              |                 |
| (Range -2 to +2)                                   | 0.69 $\pm$ 0.73 |
| Perceived healthiness of overall food intake       |                 |
| (Range -2 to +2)                                   | 0.62 $\pm$ 0.68 |
| Self-efficacy of eating healthy                    |                 |
| (Range -2 to +2)                                   | 0.75 $\pm$ 0.82 |
| Use of all products from food parcel               |                 |
| Never  |                 |
| Sometimes  | 9 (3.6)         |
| Always   | 143 (57.0)      |
| Use of perishable foods beyond expiration date     | 99 (39.4)       |
| Never  |                 |
| Sometimes  | 57 (22.7)       |
| Always   | 154 (61.4)      |
| Use of non-perishable foods beyond expiration date | 40 (15.9)       |
| Never  |                 |
| Sometimes  | 34 (13.5)       |
| Always   | 158 (62.9)      |
|  | 59 (23.5)       |

<sup>1</sup>Total N was 251. For age, household composition, educational level, self-efficacy of eating healthy N was 250, for ethnicity N was 248, and for BMI, weight status and money spent on groceries in Euros per person per week N was 245

<sup>2</sup> Values are presented as mean  $\pm$  SD, frequency and relative frequency.

1  
2  
3 159 The prevalence of food insecurity was 73.3% (N=184), of which 49.5% (N=91) with  
4  
5 160 very low food security (Figure 1). Very low food security was significantly more prevalent in  
6  
7 161 women than men (43.7% vs. 23.7%; P=0.001). Of the very low food secure participants  
8  
9 162 47.3% (N=43) reported that they were ever hungry but did not eat because they could not  
10  
11 163 afford enough food in the previous three months. This percentage was substantially lower  
12  
13 164 among low food secure participants (3.2%, N=3). Univariate analyses regarding associations  
14  
15 165 of demographic and lifestyle characteristics with low or very low food security compared  
16  
17 166 with food security showed that men were less likely than women to have very low food  
18  
19 167 security (OR:0.31 [95%CI:0.16-0.61]). Participants with a low level of education were more  
20  
21 168 likely to have very low food security as compared to participants with a high level of  
22  
23 169 education (OR:3.90 [95%CI:1.14-13.37]). In contrast to household size, household  
24  
25 170 composition was associated with food insecurity. Households without children were less  
26  
27 171 likely to have low food security as compared with multiple households with children  
28  
29 172 (OR:0.43 [95%CI:0.20-0.91]). Duration of being recipient of a Dutch food bank, employment  
30  
31 173 status, ethnicity, BMI, weight status, current smoking status, and level of physical activity  
32  
33 174 were not associated with food insecurity.

34  
35  
36  
37  
38 175 Univariate analyses regarding associations of nutrition-related characteristics with low  
39  
40 176 or very low food security compared with food security, showed that participants who were  
41  
42 177 more satisfied with their overall food intake were less likely to have low food security  
43  
44 178 (OR:0.59 [95%CI:0.36-0.96]) or very low food security (OR:0.45 [95%CI:0.27-0.73])  
45  
46 179 compared to their counterparts. Participants who perceived their overall food intake to be  
47  
48 180 more healthy were less likely to have low food security (OR:0.46 [95%CI:0.27-0.70]) or very  
49  
50 181 low food security (OR:0.38 [95%CI:0.22-0.66]) compared to participants who perceived their  
51  
52 182 overall food intake less healthy. Participants who were more certain of a healthy food intake  
53  
54 183 were less likely to have very low food security (OR:0.66 [95%CI:0.44-0.98]) compared to  
55  
56  
57  
58  
59  
60

1  
2  
3 184 participants who were less certain of a healthy food intake. Satisfaction with the food parcel  
4  
5 185 was borderline significant; participants who were more satisfied with the food parcel tended  
6  
7 186 to have less very low food security compared to participants who were less satisfied with the  
8  
9  
10 187 food parcel (OR:0.67 [95%CI:0.45-1.01]). No associations were found between the total  
11  
12 188 amount of money spent on groceries per person per week, the extent to which products of the  
13  
14 189 food parcel were used, the extent to which the use of perishable and non-perishable foods  
15  
16 190 were used beyond the expiration date, and food insecurity.

17  
18  
19 191 Table 2a and 2b show multivariate associations of demographic, lifestyle, and  
20  
21 192 nutrition-related characteristics with low or very low food security compared with food  
22  
23 193 security. After adjustment for age, sex and level of education the observed univariate  
24  
25 194 associations remained statistically significant with one exception: self-efficacy of eating  
26  
27 195 healthy was no longer associated with low food security.

28  
29  
30 196 Significant interaction was present between ethnicity and level of education  
31  
32 197 (P=0.041), between satisfaction with overall food intake and level of education (P=0.026),  
33  
34 198 and between use of non-perishable foods beyond the expiration date and level of education  
35  
36 199 (P=0.043), in their associations with low food security. Stratified analyses showed that  
37  
38 200 participants with a high level of education who were more satisfied with their overall food  
39  
40 201 intake were less likely to have low food security compared to their counterparts (OR:0.33  
41  
42 202 [95%CI:0.13-0.85]).

43  
44  
45 203 Significant interaction was present between ethnicity and level of education (P=0.035)  
46  
47 204 and between use of perishable foods beyond the expiration date and level of education  
48  
49 205 (P=0.018), in their associations with very low food security. Stratified analyses showed that  
50  
51 206 participants of Dutch ancestry with a high level of education were less likely to have very low  
52  
53 207 food security compared to participants with a non-Dutch ancestry (OR:0.21 [95%CI:0.05-  
54  
55 208 0.95]). Furthermore, participants who sometimes used perishable foods beyond the expiration  
56  
57  
58  
59  
60

1  
2  
3 209 date with a medium level of education were more likely to have very low food security  
4  
5 210 compared to participants who always used perishable foods beyond the expiration date  
6  
7 211 (OR:4.82 [95%CI:1.22-19.14]). No other significant associations were observed in stratified  
8  
9  
10 212 analyses.  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only



Table 2a: Multivariate associations of demographic and lifestyle characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                           | N  | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|----|---|----|--|
| Age, yrs                               | 92 | 1.00 (0.97-1.03)                                    | 91 | 1.01 (0.98-1.05)   |
| Sex                                    |    |   |    |  |
| Male                                   | 37 | 0.60 (0.32-1.16)                                    | 22 | 0.29* (0.15-0.59)  |
| Female (Ref)                           | 56 | 1.00  | 69 | 1.00   |
| Duration of being recipient            |    |   |    |  |
| 0 - 6 months                           | 31 | 1.06 (0.50-2.25)                                    | 35 | 1.27 (0.59-2.70)   |
| 6 - 12 months                          | 28 | 1.34 (0.59-3.06)                                    | 19 | 0.88 (0.37-2.10)   |
| >12 months (Ref)                       | 34 | 1.00  | 37 | 1.00   |
| Household size                         |    |   |    |  |
| 1 person                               | 33 | 0.50 (0.18-1.35)                                    | 33 | 0.53 (0.19-1.50)   |
| 2 - 4 persons                          | 43 | 0.92 (0.34-2.52)                                    | 43 | 0.97 (0.34-2.74)   |
| ≥ 5 persons (Ref)                      | 17 | 1.00  | 15 | 1.00   |
| Household composition                  |    |   |    |  |
| Single parent household                | 20 | 0.62 (0.22-1.73)                                    | 28 | 1.40 (0.49-4.00)   |
| Household without children             | 41 | 0.38** (0.17-0.87)                                  | 44 | 0.72 (0.29-1.76)   |
| Multiple household with children (Ref) | 32 | 1.00  | 18 | 1.00   |
| Ethnicity                              |    |   |    |  |
| Dutch                                  | 68 | 1.05 (0.50-2.22)                                    | 62 | 0.72 (0.34-1.52)   |
| Non-Dutch ancestry (Ref)               | 24 | 1.00  | 29 | 1.00   |

|  |    |                  |    |                     |  |
|--|----|------------------|----|---------------------|--|
| Educational level                        |    |                  |    |                     |  |
| Low                                      | 15 | 2.79 (0.81-9.56) | 15 | 4.53** (1.28-16.01) |  |
| Medium                                   | 44 | 0.90 (0.45-1.78) | 51 | 1.29 (0.63-2.66)    |  |
| High (Ref)                               | 34 | 1.00             | 25 | 1.00                |  |
| Current paid (part-time) job             |    |                  |    |                     |  |
| No                                       | 81 | 1.45 (0.58-3.60) | 81 | 1.53 (0.59-4.01)    |  |
| Yes (Ref)                                | 12 | 1.00             | 10 | 1.00                |  |
| Body mass index, <i>kg/m<sup>2</sup></i> |    |                  |    |                     |  |
| Weight status                            |    |                  |    |                     |  |
| Underweight                              | 2  | 0.83 (0.10-6.87) | 4  | 1.33 (0.20-8.84)    |  |
| Normal weight                            | 42 | 1.96 (0.83-4.63) | 34 | 1.34 (0.57-3.12)    |  |
| Overweight                               | 27 | 1.39 (0.57-3.39) | 20 | 0.89 (0.36-2.19)    |  |
| Obese (Ref)                              | 21 | 1.00             | 30 | 1.00                |  |
| Current smoking                          |    |                  |    |                     |  |
| No                                       | 40 | 0.93 (0.48-1.83) | 36 | 0.69 (0.34-1.38)    |  |
| Yes (Ref)                                | 53 | 1.00             | 55 | 1.00                |  |
| Physical active $\geq$ 30 min/day        |    |                  |    |                     |  |
| 0 - 2 days/week                          | 20 | 0.91 (0.40-2.09) | 34 | 1.98 (0.88-4.45)    |  |
| 3 - 5 days/week                          | 33 | 1.17 (0.55-2.47) | 25 | 1.18 (0.53-2.64)    |  |
| 6 - 7 days/week (Ref)                    | 40 | 1.00             | 32 | 1.00                |  |

<sup>1</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

Table 2b: Multivariate associations of nutrition-related characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                                       | N  | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|----|---|----|--|
| Money spent on groceries                           |    |   |    |  |
| 0 - 29.99 Euros per person per week                | 78 | 1.29 (0.55-3.07)                                    | 70 | 0.82 (0.35-1.90)   |
| 30 - 50 Euros per person per week (Ref)            | 14 | 1.00  | 19 | 1.00   |
| Satisfaction with food parcel                      | 93 | 0.71 (0.46-1.08)                                    | 91 | 0.65 (0.43-1.01)   |
| Satisfaction with overall food intake              | 93 | 0.59** (0.36-0.98)                                  | 91 | 0.46* (0.28-0.78)  |
| Perceived healthiness of overall food intake       | 93 | 0.44* (0.25-0.78)                                   | 91 | 0.37* (0.21-0.66)  |
| Self-efficacy of eating healthy                    | 92 | 0.72 (0.48-1.09)                                    | 91 | 0.66 (0.43-1.01)   |
| Use of all products from parcel                    |    |   |    |  |
| Never  | 4  | 1.55 (0.26-9.33)                                    | 3  | 0.86 (0.13-5.69)   |
| Sometimes  | 58 | 1.37 (0.69-2.69)                                    | 48 | 0.89 (0.45-1.76)   |
| Always (Ref)                                       | 31 | 1.00  | 28 | 1.00   |
| Use of perishable foods beyond expiration date     |    |   |    |  |
| Never  | 17 | 0.83 (0.29-2.40)                                    | 26 | 2.00 (0.68-5.92)   |
| Sometimes  | 59 | 1.05 (0.43-2.57)                                    | 53 | 1.77 (0.67-4.69)   |
| Always (Ref)                                       | 17 | 1.00  | 12 | 1.00   |
| Use of non-perishable foods beyond expiration date |    |   |    |  |
| Never  | 13 | 1.18 (0.37-3.76)                                    | 13 | 1.08 (0.33-3.51)   |
| Sometimes  | 57 | 0.87 (0.39-1.94)                                    | 56 | 0.93 (0.41-2.11)   |
| Always (Ref)                                       | 23 | 1.00  | 22 | 1.00   |

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

<sup>1</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

For peer review only

1  
2  
3 214 **Discussion**  
4

5 215 Our study among food bank recipients is the first study addressing food insecurity in the  
6  
7 216 Netherlands and showed that 73.3% of the Dutch food bank recipients is food insecure of  
8  
9 217 which 49.5% with very low food security. Furthermore, the presence of food insecurity was  
10  
11 218 associated with female sex, low level of education, households with children, low satisfaction  
12  
13 219 with overall food intake, low perceived healthiness of overall food intake and low self-  
14  
15 220 efficacy of eating healthy.  
16  
17

18 221 The prevalence of food insecurity in our study was much higher than previously  
19  
20 222 reported national prevalence data from other high-income Western but non-European  
21  
22 223 countries.[22-24, 26-27] Comparison with the only European figure available shows that the  
23  
24 224 prevalence of food insecurity was almost three times higher in our food bank population  
25  
26 225 (73%) than in a study among low income persons in the UK (25%).[25] However, we  
27  
28 226 examined Dutch food bank recipients: a very specific group of low-income people.  
29  
30 227 Compared to prevalence data of food insecurity from the US and South Korea, based on  
31  
32 228 people who make use of any type of public food assistance, our prevalence was also higher.  
33  
34 229 The reported prevalences in these studies were: 26.1% in food assistance program users[27]  
35  
36 230 and 36.4% in public assistance users.[31] Compared to prevalence data of food insecurity  
37  
38 231 from the US among food stamp program users, 66%[32] and 71%[33], and food pantry users  
39  
40 232 76%[34] our prevalence is comparable. However, the proportion of very low food secure  
41  
42 233 participants who reported that they were hungry but did not eat because they could not afford  
43  
44 234 enough food was somewhat higher in our study than in a comparable study in the US[34]  
45  
46 235 (47.3% vs. 40.1%).  
47  
48  
49  
50

51 236 A unique aspect of this study is the identification of factors associated with food  
52  
53 237 insecurity. In Europe, this has only been studied among low-income persons in the UK so far.  
54  
55 238 Our observed sex difference in the prevalence of food insecurity agreed with previous  
56  
57  
58  
59  
60

1  
2  
3 239 studies[23, 27, 35], and could be explained by the fact that women may be the first to  
4  
5 240 compromise their diet in an unhealthy way, to protect their children and partner when the  
6  
7 241 family faces threats to their food supply.[35-36]  
8

9  
10 242 Consistent with previous studies conducted outside Europe, we found that food  
11  
12 243 insecurity was associated with a lower level of education.[27, 33, 37] Unlike previous  
13  
14 244 studies, however, we found no association between food insecurity and employment  
15  
16 245 status[27, 33, 37], ethnicity[23-24, 31, 33, 38], and household size[7, 13, 31]. Possible  
17  
18 246 explanations for these differences are that only 13.1% of the population had a paid (part-time)  
19  
20 247 job, and the majority (71.8%) of our population was of Dutch origin. However, stratified  
21  
22 248 analysis showed that Dutch participants with a high level of education were less likely to  
23  
24 249 have low food security. Although we did not find a significant association with household  
25  
26 250 size, we did find a significant association with household composition. As in previous  
27  
28 251 studies[12, 24, 31, 33] households with children were more likely to have higher odds on low  
29  
30 252 food security than households without children. Adult caregivers may sacrifice their own diet  
31  
32 253 to avoid that their children will experience hunger.[39] Previous studies showed that weight  
33  
34 254 is negatively associated with food insecurity, but only in women.[13, 40-42] In contrast to  
35  
36 255 previous studies and our expectations, weight status was not associated with food insecurity.  
37  
38 256 In our study, weight status was based on self-reported height and weight, and therefore may  
39  
40 257 have been biased. A study by Ver ploeg et al.[43] reported that overweight women who  
41  
42 258 received food stamp benefits were less likely to recognize they were overweight than eligible  
43  
44 259 nonparticipants.  
45  
46  
47  
48

49 260 Overall, Dutch food bank recipients included in our study had a more unhealthy  
50  
51 261 lifestyle compared with the general Dutch population. The proportion of smokers was more  
52  
53 262 than twice as high, 58% vs. 25%[44], as was the prevalence of obesity, 28% vs. 13.5%.[45]  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 263 A possible limitation of our study is its cross-sectional design which makes it  
4  
5 264 impossible to draw any causal conclusions regarding the factors associated with food  
6  
7 265 insecurity. Possible reverse associations might have occurred between characteristics  
8  
9 266 associated with food insecurity variables which are not determinants of food insecurity (e.g.  
10  
11 267 weight status, smoking status, satisfaction with the food parcel). Therefore, these results  
12  
13  
14 268 should be interpreted with caution. Second, we were not able to adjust for the number of  
15  
16 269 items, nor for the total amount of calories in the food parcel because all food banks and  
17  
18 270 parcels are unique. (e.g. different options for self-selection and/or the exchange of products).  
19  
20  
21 271 Last, although the USDA Household Food Security Survey Scale is validated for use in low-  
22  
23 272 SES persons in general, it has not yet been validated in food bank users. Therefore, we can  
24  
25 273 not rule out that bias or misclassification might have occurred.

26  
27 274 In the US there is a small but growing body of evidence showing that the  
28  
29 275 Supplemental Nutrition Assistance Program reduces the prevalence of food insecurity.[46-48]  
30  
31 276 The high levels of household food insecurity among Dutch food bank recipients, and the  
32  
33 277 number of people who qualify for food assistance surpassed the supply raise the question  
34  
35 278 whether food banks are able to supply the right quantity of foods.

36  
37  
38 279 In conclusion, this paper shows that the prevalence of food insecurity is high among  
39  
40 280 Dutch food bank recipients and that specific subgroups are more vulnerable for food  
41  
42 281 insecurity. More research is urgently needed on the underlying determinants of food  
43  
44 282 insecurity and on the effectiveness of food assistance by food banks.  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Acknowledgements**

The authors would like to thank all food banks that participated for their cooperation, all food bank recipients for their participation, and all research assistants, MSc and BSc interns for their help in collecting data.

For peer review only



## References

1. Anderson S. Core indicators of nutritional state for difficult-to-sample populations. *J Nutr* 1990;**120**:1559-600.
2. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *J Nutr* 2001;**131**:2670-6.
3. Duffy P, Zizza C, Jacoby J, et al. Diet quality is low among female food pantry clients in Eastern Alabama. *J Nutr Educ Behav* 2009;**41**:414-9.
4. Kendall A, Olson CM, Frongillo EA. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 1996;**96**:1019-24; quiz 1025-6.
5. Robaina KA, Martin KS. Food insecurity, poor diet quality, and obesity among food pantry participants in Hartford, CT. *J Nutr Educ Behav* 2013;**45**:159-164.
6. Dixon LB, Winkleby MA, Radimer KL. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third National Health and Nutrition Examination Survey, 1988-1994. *J Nutr* 2001;**131**:1232-46.
7. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr* 2008;**138**:604-12.
8. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *Am J Public Health* 1997;**87**:1956-61.
9. Bell M, Wilbur L, Smith C. Nutritional status of persons using a local emergency food system program in middle America. *J Am Diet Assoc* 1998;**98**:1031-3.
10. Muirhead V, Quinonez C, Figueiredo R, et al. Oral health disparities and food insecurity in working poor Canadians. *Community Dent Oral Epidemiol* 2009;**37**:294-304.
11. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr* 2010;**140**:304-10.
12. Che J, Chen J. Food insecurity in Canadian households. *Health Rep* 2001;**12**:11-22.
13. Townsend MS, Peerson J, Love B, et al. Food insecurity is positively related to overweight in women. *J Nutr* 2001;**131**:1738-45.
14. Vozoris NT, Tarasuk VS. Household food insufficiency is associated with poorer health. *J Nutr* 2003;**133**:120-6.
15. Laraia BA. Food insecurity and chronic disease. *Adv Nutr* 2013;**4**:203-12.
16. Hampton T. Food insecurity harms health, well-being of millions in the United States. *JAMA* 2007;**298**:1851-3.

17. Holben DH, Pheley AM. Diabetes risk and obesity in food-insecure households in rural Appalachian Ohio. *Prev Chronic Dis* 2006;**3**:A82.
18. Cook JT, Frank DA, Levenson SM, et al. Child food insecurity increases risks posed by household food insecurity to young children's health. *J Nutr* 2006;**136**:1073-6.
19. Eicher-Miller HA, Mason AC, Weaver CM, et al. Food insecurity is associated with iron deficiency anemia in US adolescents. *Am J Clin Nutr* 2009;**90**:1358-71.
20. Gundersen C, Kreider B. Bounding the effects of food insecurity on children's health outcomes. *J Health Econ* 2009;**28**:971-83.
21. Kirkpatrick SI, McIntyre L, Potestio ML. Child hunger and long-term adverse consequences for health. *Arch Pediatr Adolesc Med* 2010;**164**:754-62.
22. Household food insecurity, 2007–2008. Canadian Community Health Survey [date accessed 2013 February 5th]; Available from: <http://www.statcan.gc.ca/pub/82-625-x/2010001/article/11162-eng.htm>.
23. Carter KN, Lanumata T, Kruse K, et al. What are the determinants of food insecurity in New Zealand and does this differ for males and females? *Aust N Z J Public Health* 2010;**34**:602-8.
24. Coleman-Jensen A, Nord M, Andrews M, et al. Household Food Security in the United States in 2011. U.S. Department of Agriculture, Economic Research Center; September 2012. ERR-141.
25. Nelson M, Erens B, Bates B, et al. Low Income Diet and Nutrition Survey London: The Stationery Office; 2007. N5616225 c1 07/07.
26. Rychetnik L, Webb K, Story L, et al. Food Security Options Paper: A food security planning framework: A menu of options for policy and planning interventions. 2003.
27. Kim K, Kim MK, Shin YJ, et al. Factors related to household food insecurity in the Republic of Korea. *Public Health Nutr* 2011;**14**:1080-7.
28. Bickel G, Nord M, Price C, et al. Guide to Measuring Household Food Security, Revised 2000 Washington DC: USDA: 2000.
29. Blumberg SJ, Bialostosky K, Hamilton WL, et al. The effectiveness of a short form of the Household Food Security Scale. *Am J Public Health* 1999;**89**:1231-4.
30. World Health Organisation (WHO) Expert Committee. Physical status: the use and interpretation of anthropometry. Geneva: WHO: 1995.
31. Furness BW, Simon PA, Wold CM, et al. Prevalence and predictors of food insecurity among low-income households in Los Angeles County. *Public Health Nutr* 2004;**7**:791-4.

- 1
- 2
- 3 32. Oberholser CA, Tuttle CR. Assessment of household food security among food stamp
- 4 recipient families in Maryland. *Am J Public Health* 2004;**94**:790-5.
- 5
- 6 33. Kaiser L, Baumrind N, Dumbauld S. Who is food-insecure in California? Findings
- 7 from the California Women's Health Survey, 2004. *Public Health Nutr* 2007;**10**:574-
- 8 81.
- 9
- 10 34. Mabli J, Cojen R, Potter F, et al. Hunger in America 2010: National report prepared
- 11 for feeding America. Princeton: Mathematica Policy Research Institute; 2010. 06251-
- 12 600.
- 13
- 14 35. Martin MA, Lippert AM. Feeding her children, but risking her health: the intersection
- 15 of gender, household food insecurity and obesity. *Soc Sci Med* 2012;**74**:1754-64.
- 16
- 17 36. McIntyre L, Glanville NT, Raine KD, et al. Do low-income lone mothers compromise
- 18 their nutrition to feed their children? *CMAJ* 2003;**168**:686-91.
- 19
- 20 37. Foley W, Ward P, Carter P, et al. An ecological analysis of factors associated with
- 21 food insecurity in South Australia, 2002-7. *Public Health Nutr* 2010;**13**:215-21.
- 22
- 23 38. Mello JA, Gans KM, Risica PM, et al. How is food insecurity associated with dietary
- 24 behaviors? An analysis with low-income, ethnically diverse participants in a nutrition
- 25 intervention study. *J Am Diet Assoc* 2010;**110**:1906-11.
- 26
- 27 39. Radimer KL, Olson CM, Greene JC, et al. Understanding hunger and developing
- 28 indicators to assess it in women and children. *J Nutr Educ* 1992;**24**:36S-45S.
- 29
- 30 40. Adams EJ, Grummer-Strawn L, Chavez G. Food insecurity is associated with
- 31 increased risk of obesity in California women. *J Nutr* 2003;**133**:1070-4.
- 32
- 33 41. Gooding HC, Walls CE, Richmond TK. Food insecurity and increased BMI in young
- 34 adult women. *Obesity* 2012;**20**:1896-901.
- 35
- 36 42. Jilcott SB, Wall-Bassett ED, Burke SC, et al. Associations between food insecurity,
- 37 supplemental nutrition assistance program (SNAP) benefits, and body mass index
- 38 among adult females. *J Am Diet Assoc* 2011;**111**:1741-5.
- 39
- 40 43. Ver Ploeg ML, Chang HH, Lin BH. Over, under, or about right: misperceptions of
- 41 body weight among food stamp participants. *Obesity* 2008;**16**:2120-5.
- 42
- 43 44. Kerncijfers roken in Nederland 2011. Een overzicht van recente Nederlandse
- 44 basisgegevens over rookgedrag. Den Haag: Stivoro; 2012.
- 45
- 46 45. Visscher TLS, Van Bakel AM, Zantinge EM. Overgewicht samengevat. In:
- 47 *Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid*.
- 48 Bilthoven: 2012.
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1  
2  
3 46. Gundersen C. Food insecurity is an ongoing national concern. *Adv Nutr* 2013;**4**:36-  
4 41.  
5  
6 47. Eicher-Miller HA, Mason AC, Abbott AR, McCabe GP, Boushey CJ. The effect of  
7 Food Stamp Nutrition Education on the food insecurity of low-income women  
8 participants. *J Nutr Educ Behav* 2009;**41**:161-8.  
9  
10  
11 48. Nord M. How much does the Supplemental Nutrition Assistance Program alleviate  
12 food insecurity? Evidence from recent programme leavers. *Public Health Nutr*  
13 2012;**15**:811-7.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **Figure legend**  
4  
5  
6

7 Figure 1: Prevalence of food insecurity in 93 male and 158 female Dutch food bank  
8 recipients, stratified by sex.  
9

10 \* Food insecurity with hunger is different from men,  $P=0.001$  (Chi-square test).  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

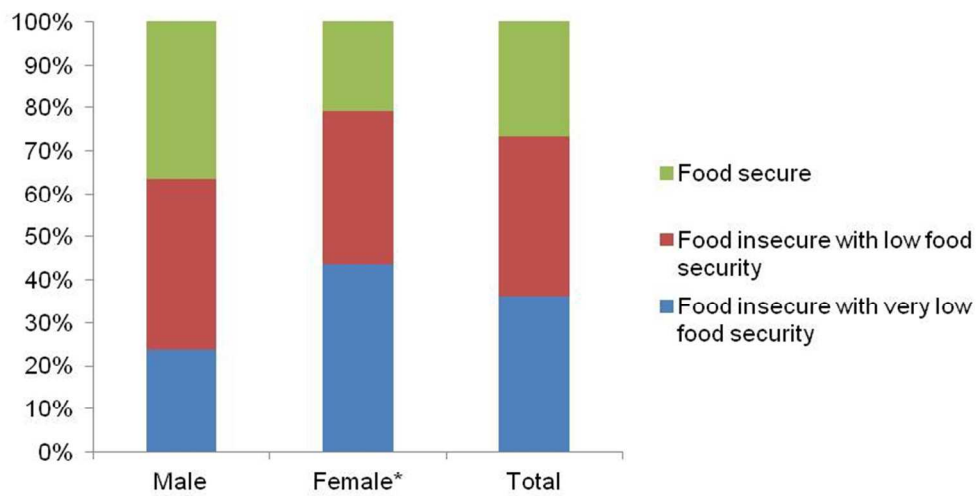


Figure 1: Prevalence of food insecurity in 93 male and 158 female Dutch food bank recipients, stratified by sex.

\* Food insecurity with hunger is different from men,  $P=0.001$  (Chi-square test).

148x76mm (150 x 150 DPI)

## Web only file

### Supplemental Table 1: 6-Item Subset (Short Form) of the 3-month Food Security Questionnaire

---

LEAD: These next questions are about the food eaten in your household in the last 3 months and whether you were able to afford the food you need.

I'm going to read you two statements that people have made about their food situation. Please tell me whether the statement was **OFTEN**, **SOMETIMES**, or **NEVER** true for (you/you and the other members of your household) in the last 3 months.

1. The first statement is, "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 3 months? (Possible answers: **often true**, **sometimes true**, never true)

2. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 3 months? (Possible answers: **often true**, **sometimes true**, never true)

3. In the last 3 months, since (date 3 months ago) did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

3a.[Ask only if Q3 = YES] How often did this happen -- almost every week, some weeks but not every week, or in only 1 or 2 weeks in the past three months? Almost every week, some weeks but not every week, 1 or 2 weeks in the past three months, don't know/refusal (Possible answers: **almost every week**, **some weeks but not every week**, **in 1 or 2 weeks in the past three months**)

4. In the last 3 months, did you ever eat less than you felt you should because there wasn't enough money to buy food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

5. In the last 3 months, were you ever hungry but didn't eat because you couldn't afford enough food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

---

Affirmative answers are typed with **bold** font

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

|                              | Item No | Recommendation   |
|------------------------------|---------|--|
| <b>Title and abstract</b>    | 1       | (a) Indicate the study's design with a commonly used term in the title or the abstract <b>p3</b><br>(b) Provide in the abstract an informative and balanced summary of what was done and what was found <b>p3</b>  |
| <b>Introduction</b>          |         |  |
| Background/rationale         | 2       | Explain the scientific background and rationale for the investigation being reported <b>p5/6</b>   |
| Objectives                   | 3       | State specific objectives, including any prespecified hypotheses <b>p6</b>   |
| <b>Methods</b>               |         |  |
| Study design                 | 4       | Present key elements of study design early in the paper <b>p6</b>  |
| Setting                      | 5       | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection <b>p6/7</b>  |
| Participants                 | 6       | (a) Give the eligibility criteria, and the sources and methods of selection of participants <b>p6/7</b>  |
| Variables                    | 7       | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable <b>p7-9</b>   |
| Data sources/<br>measurement | 8*      | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group <b>p7-9</b>   |
| Bias                         | 9       | Describe any efforts to address potential sources of bias <b>p7</b>  |
| Study size                   | 10      | Explain how the study size was arrived at <b>p7</b>  |
| Quantitative variables       | 11      | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why <b>p8/9</b>   |
| Statistical methods          | 12      | (a) Describe all statistical methods, including those used to control for confounding <b>p9/10</b><br>(b) Describe any methods used to examine subgroups and interactions <b>p9/10</b><br>(c) Explain how missing data were addressed <b>not applicable</b><br>(d) If applicable, describe analytical methods taking account of sampling strategy <b>not applicable</b><br>(e) Describe any sensitivity analyses <b>not applicable</b> |
| <b>Results</b>               |         |  |
| Participants                 | 13*     | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed <b>p7/11</b><br>(b) Give reasons for non-participation at each stage <b>p7</b><br>(c) Consider use of a flow diagram <b>not applicable</b>   |
| Descriptive data             | 14*     | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders <b>p11/12</b><br>(b) Indicate number of participants with missing data for each variable of interest <b>p12</b>   |
| Outcome data                 | 15*     | Report numbers of outcome events or summary measures <b>p13</b>  |
| Main results                 | 16      | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included <b>p13/14, 16-18</b>  |



|                          |    |  |
|--------------------------|----|--|
|                          |    | (b) Report category boundaries when continuous variables were categorized <b>p11/12</b>  |
|                          |    | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period <b>not applicable</b>   |
| Other analyses           | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses <b>p14/15</b>   |
| <b>Discussion</b>        |    |  |
| Key results              | 18 | Summarise key results with reference to study objectives <b>p20</b>  |
| Limitations              | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias <b>p22</b>                    |
| Interpretation           | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence <b>p20/21</b> |
| Generalisability         | 21 | Discuss the generalisability (external validity) of the study results <b>p22</b>   |
| <b>Other information</b> |    |  |
| Funding                  | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based <b>p23</b>                 |

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Food insecurity among Dutch food bank recipients - a cross-sectional study

|                                 |   |
|---------------------------------|---|
| Journal:                        | <i>BMJ Open</i>   |
| Manuscript ID:                  | bmjopen-2013-004657.R1  |
| Article Type:                   | Research  |
| Date Submitted by the Author:   | 16-Apr-2014   |
| Complete List of Authors:       | Neter, Judith; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences<br>Dijkstra, Coosje; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences<br>Visser, Marjolein; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences; VU University Medical Center, Department of Epidemiology and Biostatistics<br>Brouwer, Ingeborg; VU University Amsterdam, Department of Health Sciences and the EMGO+ Institute for Health and Care Research, Faculty of Earth and Life Sciences |
| <b>Primary Subject Heading</b>: | Public health   |
| Secondary Subject Heading:      | Epidemiology  |
| Keywords:                       | PUBLIC HEALTH, NUTRITION & DIETETICS, EPIDEMIOLOGY  |
|                                 |   |

SCHOLARONE™  
Manuscripts

1  
2  
3 **Food insecurity among Dutch food bank recipients - a cross-sectional study**  
4  
5  
6

7  
8 Judith E. Neter<sup>1</sup>, S. Coosje Dijkstra<sup>1</sup>, Marjolein Visser<sup>1,2</sup>, Ingeborg A. Brouwer<sup>1</sup>  
9  
10

11  
12 <sup>1</sup> Department of Health Sciences and the EMGO Institute for Health and Care Research, Faculty  
13 of Earth and Life Sciences, VU University Amsterdam, the Netherlands  
14

15  
16 <sup>2</sup> Department of Epidemiology and Biostatistics, VU University Medical Center, the Netherlands  
17  
18  
19

20  
21  
22 **Corresponding author**  
23

24 Judith E. Neter

25  
26 Tel: +31 (0)20 5986128  
27

28  
29 Fax: +31 (0)20 5986940  
30

31 E-mail address: [judith.neter@vu.nl](mailto:judith.neter@vu.nl)  
32  
33

34  
35  
36 VU University Amsterdam  
37

38 Faculty of Earth and Life Sciences  
39

40 Department of Health Sciences  
41

42 De Boelelaan 1085  
43

44 1081 HV Amsterdam  
45  
46

47 The Netherlands  
48  
49

50  
51  
52 **Key words:** food insecurity, food assistance program, low-socioeconomic status, nutrition  
53  
54

55  
56  
57 **Word count:** 3,579  
58  
59  
60

## 1 Abstract

2 Objective: To determine the prevalence of (very) low food security among Dutch food bank  
3 recipients, and to identify potential demographic, lifestyle and nutrition-related factors  
4 associated with (very) low food security.

5 Setting: Eleven out of 135 Dutch food banks were selected throughout the Netherlands.

6 Participants: Two-hundred-fifty-one Dutch food bank recipients participated in the study (93  
7 males and 158 females). Inclusion criteria for participation were: 1) at least 18 years of age,  
8 2) sufficiently fluent in Dutch to participate in oral and written interviews, 3) recipient of a  
9 Dutch food bank for at least one month, and 4) collect own food parcel at the food bank. A  
10 single member per household was included.

11 Primary outcome: Level of food security.

12 Results: The prevalence of food insecurity was 72.9% (N=183), of which 40.4% (N=74)  
13 reported very low food security. Of the very low food secure participants, 56.8% (N=42)  
14 reported they were ever hungry but did not eat because they could not afford enough food in  
15 the previous three months. Adjusted multinomial logistic regression analyses showed that  
16 households without children were less likely to experience low food security (Odds Ratio  
17 (OR):0.39 [95%CI:0.18-0.88]) and male recipients (OR:0.24 [95%CI:0.11-0.51]) were less  
18 likely to experience very low food security, while low educated recipients (OR:5.05  
19 [95%CI:1.37-18.61]) were more likely to experience very low food security. Furthermore,  
20 recipients with high satisfaction with overall food intake (OR:0.46 [95%CI:0.27-0.78]), high  
21 perceived healthiness of overall food intake (OR:0.34 [95%CI:0.19-0.62]) or high self-  
22 efficacy of eating healthy (OR:0.62 [95%CI:0.40-0.96]) were less likely to experience very  
23 low food security.

24 Conclusion: Our study showed high prevalence rates of food insecurity among Dutch food  
25 bank recipients, and identified subgroups at increased risk of food insecurity. More research

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

26 is urgently needed on the underlying determinants of food insecurity and the effectiveness of  
27 food assistance by food banks.

For peer review only

## Article summary

### *Strengths and limitations of the study*

- Our study among food bank recipients is the first study addressing food insecurity in the Netherlands.
- Data were collected from 251 food bank recipients from 11 food banks throughout the Netherlands.
- A unique aspect of this study is the identification of demographic, lifestyle and nutrition-related factors associated with food insecurity. In Europe, this has only been studied among low-income persons in the UK so far.
- A possible limitation of our study is its cross-sectional design which makes it impossible to draw any causal conclusions regarding the factors associated with food insecurity.
- We were not able to adjust for the number of items, nor for the total amount of calories in the food parcel because all food banks and parcels are unique. (e.g. different options for self-selection and/or the exchange of products).
- Of the 368 recipients who signed up 251 recipients (68.2%) participated in our study. This and the selection of 11 out of 135 food banks may have led to selection bias.

## 28 Introduction

29 Even in high-income Western countries like the Netherlands, there are people who cannot  
30 afford sufficient nutritious food to eat. Food insecurity can be defined as the lack of  
31 availability of nutritionally adequate and safe foods, or the lack of ability to acquire  
32 acceptable foods in socially acceptable ways.[1] It has been associated with unfavorable food  
33 choices[2] and a less healthy diet. Food insecure people have a lower intake of fruit and  
34 vegetables[2-5] and a lower nutrient intake[5-8] which consequently may lead to  
35 micronutrient deficiencies and malnutrition.[7 9] Furthermore, food insecurity was shown to  
36 be associated with poorer health including poor oral health[10], overweight, diabetes, and  
37 heart disease, and consequently is a major public health issue.[11-17] Food insecurity is not  
38 only a problem in adults, but also in children and adolescents.[18-21] However, this study  
39 focused on adults only.

40 Only a small number of high-income Western countries report prevalence rates of  
41 food insecurity, varying between 5% and 25%[22-27]: 5.2% in Australia[26], 5.3% in South  
42 Korea[27], 7.7% in Canada[22], 15% in the United States[24], and 15.8% in New  
43 Zealand[23]. In Europe, food insecurity was only reported for low-income people in the  
44 United Kingdom, and was 25%.[25]

45 Of the more than 7 million Dutch households in 2012, 664 thousand households  
46 (9.4%) were living below the low-income threshold. These 664 thousand households  
47 comprise over 1.3 million individuals (8.4% of the Dutch population). Moreover, over 811  
48 thousand individuals had an income that was even below the basic needs variant of the low-  
49 income threshold. This lowest-needs variant relates to costs incurred by a single person for  
50 purchasing goods which are regarded as (virtually) unavoidable in the Netherlands, such as  
51 food, clothing, housing and personal care.[28]

1  
2  
3 52 The Dutch Food Bank aims to provide food parcels that supplement the normal diet  
4  
5 53 for 2-3 days. Individuals living alone with a monthly disposable income <180 Euros qualify  
6  
7 54 for food assistance as do families with a monthly disposable income of <180 Euros with the  
8  
9 55 additional income allowance of 60 Euros per adult and 50 Euros per child (<18 years of age).  
10  
11 56 In 2013, the food banks weekly provided over 35 thousand food parcels and thereby  
12  
13 57 supported approximately 85 thousand individuals in the Netherlands.[29]

14  
15  
16 58 There are many public and private food assistance programs operating at national,  
17  
18 59 state, and local levels to reduce food security and hunger in high-income countries. Accurate  
19  
20 60 measurement of the existence of food security, understanding the factors related to food  
21  
22 61 insecurity, and monitoring food assistance programs can help public health officials, policy  
23  
24 62 makers, service providers, and the public at large to assess the growing needs for food  
25  
26 63 assistance and the effectiveness of existing food assistance programs. Research can also help  
27  
28 64 to identify subgroups within food bank recipients who are food secure or at higher risk of low  
29  
30 65 or very low food security[30].  
31  
32

33  
34 66 Limited research has been performed on the prevalence of food insecurity and factors  
35  
36 67 associated with food insecurity in Europe. The present study aims, to determine the  
37  
38 68 prevalence of low and very low food security among Dutch food bank recipients, and to  
39  
40 69 identify potential demographic, lifestyle and nutrition-related factors associated with low and  
41  
42 70 very low food security.  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 71 **Methods**  
4

5 72 This cross-sectional study was part of the Dutch Food Bank study, which explores and  
6  
7 73 optimizes food choices and food patterns among Dutch food bank recipients. The study was  
8  
9 74 approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The  
10  
11 75 Netherlands, as well as the national board of the Dutch Food Bank.  
12  
13

14 76

15  
16 77 *Food Banks*  
17

18 78 Based on a search on the website of the Dutch Food Bank, e-mails, phone calls and food bank  
19  
20 79 visits 11 out of approximately 135 Dutch food banks were selected for the present study,  
21  
22 80 based on factors including size, the frequency of providing food parcels, urbanization, region,  
23  
24 81 and willingness of the food bank to participate. The food banks selected were located in  
25  
26 82 Apeldoorn (N=29), Boxtel (N=11), Breda (N=42), Enschede (N=71), Groningen (N=17),  
27  
28 83 Haarlem (N=6), Hilversum (N=16), Huizen (N=14), Rotterdam (N=28), Wageningen (N=12),  
29  
30 84 and Zeewolde (N=5).  
31  
32

33 85

34  
35  
36 86 *Study population and data collection*  
37

38 87 The target population consisted of recipients of the 11 selected Dutch food banks. Inclusion  
39  
40 88 criteria for participation were: 1) at least 18 years of age, 2) sufficiently fluent in Dutch to  
41  
42 89 participate in oral and written interviews, 3) recipient of a Dutch food bank for at least one  
43  
44 90 month, 4) single member per household, and 5) collect own food parcel at the food bank.  
45  
46 91 Recipients were recruited between October 2010 and March 2011 through promotional  
47  
48 92 posters and information letters. They could sign up for the study within two or three weeks  
49  
50 93 after recruitment with an application form, telephone or e-mail. Participation was voluntary  
51  
52 94 and confidential. Of the approximately 1,200 food bank recipients who received an  
53  
54 95 information letter or might have seen our promotional poster at the food bank, 368 signed up,  
55  
56  
57  
58  
59  
60

1  
2  
3 96 of which 251 (68.2%) participated in the study. Of the 113 recipients who signed up for  
4  
5 97 participation but ultimately did not participate, we were able to contact 41 by telephone to  
6  
7 98 complete a short non-response questionnaire. Reasons for non-participation were: 1) not  
8  
9 99 enough time (N=17), 2) did not pick up their food parcel (themselves) at the day of  
10  
11 100 measurement (N=7), 3) missed the researchers at the day of measurement (N=5), 4) did not  
12  
13 101 realize the measurements were on that specific day (N=4), and 5) other reasons (N=8).  
14  
15 102 Measurement days were scheduled between October 2010 and April 2011. Participants who  
16  
17 103 completed the study received a gift coupon of 5 Euros and a small incentive for participation.  
18  
19  
20  
21  
22

### 23 105 *Food security*

24  
25 106 To measure the food security status of the participants, trained interviewers used a translated  
26  
27 107 version of the 6-item US Department of Agriculture (USDA) Household Food Security  
28  
29 108 Survey Scale.[30] The original, validated[31] American questionnaire (Supplemental Table  
30  
31 109 1) was translated and back-translated for this study. Coding was carried out in accordance  
32  
33 110 with the Guide to Measuring Household Food Security.[30] Food security status was defined  
34  
35 111 and classified according to the USDA guidelines: score 0 or 1 is food secure; score 2-4 is low  
36  
37 112 food security; score 5-6 is very low food security.[30]  
38  
39  
40  
41  
42

### 43 114 *Explanatory variables*

44  
45 115 The selection of explanatory variables was based on common sense and literature. Literature  
46  
47 116 showed that sex[23 27 32], level of education[27 33 34], employment status[27 33 34],  
48  
49 117 ethnicity[23 24 34-36], household size[7 13 35], household composition[12 24 34 35] and  
50  
51 118 weight status[13 37-39] were associated with food insecurity and therefore included in this  
52  
53 119 study. Physical activity was included because it may influence the energy-balance and  
54  
55 120 consequently food security status. Smoking and money spent on grocery shopping were  
56  
57  
58  
59  
60

1  
2  
3 121 included because they may influence food purchases and consequently food security status.  
4  
5 122 Furthermore, satisfaction with the food parcel, satisfaction with overall food intake, perceived  
6  
7 123 healthiness of food intake, self-efficacy of eating healthy and the use of products from the  
8  
9  
10 124 food parcel may influence the variety, quality and quantity of food intake and consequently  
11  
12 125 food security status.

13  
14 126 Participants completed a self-administered general questionnaire, which consisted of  
15  
16 127 the following domains: socio-demographics, lifestyle factors, grocery shopping, food parcels,  
17  
18 128 food intake, and foods from the food parcels beyond the expiration date.

19  
20  
21 129 Socio-demographics included date of birth, sex, duration of being recipient of a Dutch  
22  
23 130 food bank household size, household composition, ethnicity, level of education, and paid job.  
24  
25 131 For ethnicity, we created two-categories: Dutch and non-Dutch ancestry. A participant had a  
26  
27 132 non-Dutch ancestry if the participant or at least one of the parents was born outside the  
28  
29 133 Netherlands. We created three levels of education: low (less than finished elementary school),  
30  
31 134 medium (elementary school), high (general intermediate, and lower vocational education,  
32  
33 135 university, college, higher vocational, general secondary, and intermediate vocational  
34  
35 136 education).

36  
37  
38 137 Lifestyle factors included self-reported height and weight, current smoking, and  
39  
40 138 physical activity. Body mass index (BMI) was calculated as self-reported weight (kg) divided  
41  
42 139 by self-reported height (m<sup>2</sup>). BMI cut-off points of the WHO were used to define weight  
43  
44 140 status.[40] Physical activity was established by asking “How many days a week are you  
45  
46 141 physically active with moderate intensity for at least 30 minutes?”. Moderately intense  
47  
48 142 physical activity included sport activities, walking, cycling, gardening, and performing heavy  
49  
50 143 housework.

51  
52  
53 144 With regard to the domain grocery shopping, we asked “How much money do you  
54  
55 145 weekly spend on average on foods and drinks to supplement the food parcel?” This amount  
56  
57  
58  
59  
60

1  
2  
3 146 of money was divided by the number of adults plus children in the household to create the  
4  
5 147 variable money spent on groceries per person per week. For the statistical analyses two  
6  
7 148 categories were created on the basis of the median; 0-29.99 Euros per person per week and  
8  
9 149 30-50 Euros per person per week.

10  
11 150 Questions regarding food parcels included: “How satisfied are you usually with the  
12  
13 151 content of the food parcel?” (categories: not satisfied at all, not satisfied, neutral, satisfied,  
14  
15 152 very satisfied), and “Do you usually use all foods from the food parcel?” (categories: never,  
16  
17 153 sometimes, always).

18  
19  
20 154 Food-intake-related questions included “How satisfied are you with your current food  
21  
22 155 intake?” (categories: not satisfied at all, not satisfied, neutral, satisfied, completely satisfied),  
23  
24 156 and “How healthy is your current food intake?” (not healthy at all, not healthy, neutral,  
25  
26 157 healthy, very healthy). Self-efficacy was measured with the question “How certain are you  
27  
28 158 that you can eat healthily?” (not certain at all, not certain, neutral, certain, very certain). The  
29  
30 159 above mentioned questions regarding satisfaction with the food parcels, and nutrition-related  
31  
32 160 questions with five answer categories were scored from -2 to +2, and were analyzed  
33  
34 161 continuously.

35  
36  
37 162 Food parcels provided by the Dutch food banks consist of donated foods only and  
38  
39 163 often include foods which are close to the expiration date. Questions on the use of foods  
40  
41 164 beyond the expiration date therefore included “Do you use perishable foods from the food  
42  
43 165 parcel that are beyond the expiration date?”, and “Do you use non-perishable foods from the  
44  
45 166 food parcel that are beyond the expiration date?” (categories: never, sometimes, always).

46  
47  
48  
49 167

#### 50 51 52 168 *Statistical analyses*

53  
54 169 Statistical analyses were performed using PASW statistics (formerly SPSS statistics) for  
55  
56 170 Windows version 20.0 (Armonk, NY: IBM Corp, USA). Descriptive statistics were used to  
57  
58  
59  
60

1  
2  
3 171 summarize participants' characteristics and to examine the level of food insecurity in the  
4  
5 172 study sample. Values in the text are mean  $\pm$  standard deviation (SD), frequency or relative  
6  
7 173 frequency. Sex differences in the prevalence of low and very low food security were tested  
8  
9  
10 174 with Chi-square test. Multinomial logistic regression analysis was used to study the  
11  
12 175 association of demographic, lifestyle and nutrition-related characteristics with low and very  
13  
14 176 low food security. The dependent variable level of food security consisted of three categories:  
15  
16 177 food secure, low food secure and very low food secure. For each independent variable the  
17  
18 178 categories low and very low food security were compared with the food secure category; the  
19  
20  
21 179 reference group. Both univariate and multivariate analyses were performed. We adjusted for  
22  
23 180 confounding effects by including the variables age, sex, and level of education in the model.  
24  
25 181 Crude and adjusted odds ratios (ORs) are presented with their 95% confidence interval (CI).  
26  
27 182 The variables age, sex, duration of being recipient, household size, household composition,  
28  
29 183 level of education and money spent on groceries were tested for interaction with age, sex, and  
30  
31 184 level of education in multivariate analyses. Two-tailed *P*-values of  $<0.05$  were considered  
32  
33  
34 185 significant.

35  
36 18637  
38 187 **Results**

39  
40 188 In total, 251 Dutch food bank recipients participated in the study, of whom 37.1% were males  
41  
42 189 and 62.9% females (Table 1). Mean age of the total study sample was  $46.3 \pm 10.6$  years. Most  
43  
44 190 of the participants were recipients of the food bank for  $>12$  months. The majority of the  
45  
46 191 participants was of Dutch origin, had a medium level of education, and did not currently have  
47  
48 192 a paid job. Furthermore, mean BMI of the population was  $27.3 \pm 6.3$  kg/m<sup>2</sup>, and 56.8% was  
49  
50 193 either overweight or obese. Smokers were much more prevalent than non-smokers.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 1: Characteristics of 251 Dutch Food Bank recipients measured in 2010/2011<sup>1</sup>

| Characteristics                                |                          |
|--|--------------------------|
| Age, yrs                                       | 46.3 ± 10.6 <sup>2</sup> |
| Sex  |                          |
| Male   | 93 (37.1)                |
| Female   | 158 (62.9)               |
| Duration of being recipient                    |                          |
| 0 - 6 months                                   | 91 (36.3)                |
| 6 - 12 months                                  | 63 (25.1)                |
| >12 months                                     | 97 (38.6)                |
| Household size                                 |                          |
| 1 person                                       | 102 (40.6)               |
| 2 - 4 persons                                  | 108 (43.0)               |
| ≥ 5 persons                                    | 41 (16.3)                |
| Household composition                          |                          |
| Single parent household                        | 59 (23.6)                |
| Household without children                     | 127 (50.8)               |
| Multiple household with children               | 64 (25.6)                |
| Ethnicity                                      |                          |
| Dutch  | 178 (71.8)               |
| Non-Dutch ancestry                             | 70 (28.2)                |
| Educational level                              |                          |
| Low  | 34 (13.6)                |
| Medium   | 131 (52.4)               |
| High   | 85 (34.0)                |
| Current paid job                               |                          |
| No   | 218 (86.9)               |
| Yes  | 33 (13.1)                |
| Body mass index, kg/m <sup>2</sup>             | 27.3 ± 6.3               |
| Weight status                                  |                          |
| Underweight; BMI <18.5 kg/m <sup>2</sup>       | 8 (3.3)                  |
| Normal Weight; BMI 18 - 24.9 kg/m <sup>2</sup> | 98 (40.0)                |
| Overweight; BMI 25 - 29.9 kg/m <sup>2</sup>    | 70 (28.6)                |
| Obese; BMI ≥30 kg/m <sup>2</sup>               | 69 (28.2)                |
| Current smoking                                |                          |
| No   | 105 (41.8)               |

|    |  |                 |
|----|--|-----------------|
| 1  |  |                 |
| 2  |  |                 |
| 3  | Yes  | 146 (58.2)      |
| 4  | Physically active $\geq$ 30 min/day                |                 |
| 5  |  |                 |
| 6  | 0 - 2 days/week                                    | 70 (27.9)       |
| 7  | 3 - 5 days/week                                    | 80 (31.9)       |
| 8  |  |                 |
| 9  | 6 - 7 days/week                                    | 101 (40.2)      |
| 10 |  |                 |
| 11 | Money spent on groceries                           |                 |
| 12 | 0 - 29.99 Euros per person per week                | 200 (81.6)      |
| 13 |  |                 |
| 14 | 30 - 50 Euros per person per week                  | 45 (18.4)       |
| 15 | Satisfaction with food parcel                      | 0.88 $\pm$ 0.83 |
| 16 |  |                 |
| 17 | (Range -2 to +2)                                   |                 |
| 18 | Satisfaction with overall food intake              | 0.69 $\pm$ 0.73 |
| 19 |  |                 |
| 20 | (Range -2 to +2)                                   |                 |
| 21 | Perceived healthiness of overall food intake       | 0.62 $\pm$ 0.68 |
| 22 |  |                 |
| 23 | (Range -2 to +2)                                   |                 |
| 24 | Self-efficacy of eating healthy                    | 0.75 $\pm$ 0.82 |
| 25 |  |                 |
| 26 | (Range -2 to +2)                                   |                 |
| 27 | Use of all products from food parcel               |                 |
| 28 |  |                 |
| 29 | Never  | 9 (3.6)         |
| 30 | Sometimes  | 143 (57.0)      |
| 31 |  |                 |
| 32 | Always   | 99 (39.4)       |
| 33 |  |                 |
| 34 | Use of perishable foods beyond expiration date     |                 |
| 35 | Never  | 57 (22.7)       |
| 36 | Sometimes  | 154 (61.4)      |
| 37 |  |                 |
| 38 | Always   | 40 (15.9)       |
| 39 |  |                 |
| 40 | Use of non-perishable foods beyond expiration date |                 |
| 41 | Never  | 34 (13.5)       |
| 42 | Sometimes  | 158 (62.9)      |
| 43 |  |                 |
| 44 | Always   | 59 (23.5)       |
| 45 |  |                 |

<sup>1</sup>Total N was 251. For age, household composition, educational level, self-efficacy of eating healthy N was 250, for ethnicity N was 248, and for BMI, weight status and money spent on groceries in Euros per person per week N was 245

<sup>2</sup> Values are presented as mean  $\pm$  SD, frequency or relative frequency.

1  
2  
3 194 Of the sample 84.9% (N=213) responded affirmatively to at least one item on our  
4  
5 195 food security scale. Of those, 14% (N=30) affirmed only one item and were therefore  
6  
7 196 classified as marginally food secure. The prevalence of food insecurity was 72.9% (N=183),  
8  
9 197 of which 40.4% (N=74) with very low food security (Figure 1). Very low food security was  
10  
11 198 significantly more prevalent in women than men (37.3% vs. 16.1%; P=0.001). Of the very  
12  
13 199 low food secure participants 56.8% (N=42) reported that they were ever hungry but did not  
14  
15 200 eat because they could not afford enough food in the previous three months. This was the  
16  
17 201 most extreme category of the survey instrument. This percentage was substantially lower  
18  
19 202 among low food secure participants (3.7%, N=4). Univariate analyses regarding associations  
20  
21 203 of demographic as well as lifestyle characteristics with low or very low food security  
22  
23 204 compared with food security showed that men were less likely than women to experience  
24  
25 205 very low food security (OR:0.25[95%CI:0.12-0.53]). Participants with a low level of  
26  
27 206 education were more likely to experience very low food security as compared to participants  
28  
29 207 with a high level of education (OR:4.23 [95%CI:1.20-14.94]). In contrast to household size,  
30  
31 208 household composition was associated with food insecurity. Households without children  
32  
33 209 were less likely to experience low food security as compared with multiple households with  
34  
35 210 children (OR:0.45 [95%CI:0.22-0.94]). Duration of being recipient of a Dutch food bank,  
36  
37 211 employment status, ethnicity, BMI, weight status, current smoking status, and level of  
38  
39 212 physical activity were not associated with food insecurity.  
40  
41  
42  
43  
44

45 213 Univariate analyses regarding associations of nutrition-related characteristics with  
46  
47 214 food security status, showed that participants who were more satisfied with their overall food  
48  
49 215 intake were less likely to experience low food security (OR:0.56 [95%CI:0.35-0.90]) or very  
50  
51 216 low food security (OR:0.45 [95%CI:0.27-0.74]) compared to their counterparts. Participants  
52  
53 217 who perceived their overall food intake to be more healthy were less likely to experience low  
54  
55 218 food security (OR:0.46 [95%CI:0.27-0.78]) or very low food security (OR:0.35 [95%CI:0.20-  
56  
57  
58  
59  
60



1  
2  
3 219 0.62]) compared to participants who perceived their overall food intake to be less healthy.  
4  
5 220 Participants who were more certain of a healthy food intake were less likely to experience  
6  
7 221 very low food security (OR:0.62 [95%CI:0.41-0.96]) compared to participants who were less  
8  
9 222 certain of a healthy food intake. Satisfaction with the food parcel was borderline significant;  
10  
11 223 participants who were more satisfied with the food parcel tended to experience less low food  
12  
13 224 security compared to participants who were less satisfied with the food parcel (OR:0.68  
14  
15 225 [95%CI:0.46-1.01]). No associations were found between the total amount of money spent on  
16  
17 226 groceries per person per week, the extent to which products of the food parcel were used, the  
18  
19 227 extent to which the use of perishable and non-perishable foods were used beyond the  
20  
21 228 expiration date, and food insecurity.

22  
23  
24  
25 229 Table 2a and 2b show multivariate associations of demographic, lifestyle, and  
26  
27 230 nutrition-related characteristics with low or very low food security compared with food  
28  
29 231 security. After adjustment for age, sex and level of education the observed univariate  
30  
31 232 associations remained statistically significant. Furthermore, multivariate analysis showed that  
32  
33 233 participants who were more satisfied with the food parcel were less likely to experience low  
34  
35 234 food security compared to participants who were less satisfied (OR:0.66 [95%CI:0.44-0.99]) .

36  
37  
38 235 Significant interaction was present between duration of being recipient and age  
39  
40 236 (P=0.029) in its association with low food security. Older participants who are recipient of  
41  
42 237 the food bank for a shorter period of time seemed to be less likely to experience low food  
43  
44 238 security compared to their counterparts. Furthermore, significant interaction was present  
45  
46 239 between household size and age (P=0.040) in its association with very low food security.  
47  
48 240 Older participants with smaller household sizes seemed to be less likely to experience very  
49  
50 241 low food security compared to participants with larger household sizes.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 2a: Multivariate associations of demographic and lifestyle characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                           | N   | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|-----|---|----|--|
| Age, yrs                               | 108 | 1.00 (0.97-1.03)                                    | 74 | 1.01 (0.98-1.05)   |
| Sex                                    |     |   |    |  |
| Male                                   | 44  | 0.64 (0.34-1.19)                                    | 15 | 0.24* (0.11-0.51)  |
| Female (Ref)                           | 65  | 1.00  | 59 | 1.00   |
| Duration of being recipient            |     |   |    |  |
| 0 - 6 months                           | 38  | 1.12 (0.54-2.30)                                    | 28 | 1.40 (0.63-3.10)   |
| 6 - 12 months                          | 30  | 1.26 (0.56-2.80)                                    | 17 | 1.06 (0.43-2.61)   |
| >12 months (Ref)                       | 41  | 1.00  | 29 | 1.00   |
| Household size                         |     |   |    |  |
| 1 person                               | 39  | 0.51 (0.19-1.36)                                    | 27 | 0.50 (0.17-1.49)   |
| 2 - 4 persons                          | 51  | 0.94 (0.35-2.49)                                    | 34 | 0.81 (0.28-2.39)   |
| ≥ 5 persons (Ref)                      | 19  | 1.00  | 13 | 1.00   |
| Household composition                  |     |   |    |  |
| Single parent household                | 22  | 0.55 (0.20-1.47)                                    | 25 | 1.52 (0.51-4.50)   |
| Household without children             | 50  | 0.39** (0.18-0.88)                                  | 35 | 0.78 (0.30-2.06)   |
| Multiple household with children (Ref) | 37  | 1.00  | 13 | 1.00   |
| Ethnicity                              |     |   |    |  |
| Dutch                                  | 81  | 1.07 (0.52-2.21)                                    | 48 | 0.60 (0.27-1.30)   |
| Non-Dutch ancestry (Ref)               | 27  | 1.00  | 26 | 1.00   |

|  |    |                  |    |                     |
|--|----|------------------|----|---------------------|
| Educational level                        |    |                  |    |                     |
| Low                                      | 17 | 2.80 (0.83-9.39) | 13 | 5.05** (1.37-18.61) |
| Medium                                   | 53 | 0.91 (0.47-1.77) | 41 | 1.25 (0.58-2.67)    |
| High (Ref)                               | 39 | 1.00             | 20 | 1.00                |
| Current paid job                         |    |                  |    |                     |
| No                                       | 95 | 1.40 (0.58-3.38) | 66 | 1.52 (0.54-4.22)    |
| Yes (Ref)                                | 14 | 1.00             | 8  | 1.00                |
| Body mass index, <i>kg/m<sup>2</sup></i> |    |                  |    |                     |
| Weight status                            |    |                  |    |                     |
| Underweight                              | 2  | 0.72 (0.09-5.90) | 4  | 1.54 (0.23-10.37)   |
| Normal weight                            | 47 | 1.75 (0.77-4.01) | 28 | 1.22 (0.51-2.93)    |
| Overweight                               | 33 | 1.39 (0.59-3.27) | 14 | 0.73 (0.28-1.91)    |
| Obese (Ref)                              | 25 | 1.00             | 26 | 1.00                |
| Current smoking                          |    |                  |    |                     |
| No                                       | 44 | 0.86 (0.45-1.64) | 32 | 0.82 (0.40-1.69)    |
| Yes (Ref)                                | 65 | 1.00             | 42 | 1.00                |
| Physical active $\geq$ 30 min/day        |    |                  |    |                     |
| 0 - 2 days/week                          | 24 | 0.96 (0.43-2.12) | 30 | 2.21 (0.95-5.14)    |
| 3 - 5 days/week                          | 39 | 1.15 (0.56-2.35) | 18 | 0.98 (0.42-2.32)    |
| 6 - 7 days/week (Ref)                    | 46 | 1.00             | 26 | 1.00                |

<sup>†</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

Table 2b: Multivariate associations of nutrition-related characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                                       | N   | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|-----|---|----|--|
| Money spent on groceries                           |     |   |    |  |
| 0 - 29.99 Euros per person per week                | 92  | 1.47 (0.64-3.34)                                    | 56 | 0.82 (0.34-1.96)   |
| 30 - 50 Euros per person per week (Ref)            | 16  | 1.00  | 16 | 1.00   |
| Satisfaction with food parcel                      | 109 | 0.66** (0.44-0.99)                                  | 74 | 0.71 (0.45-1.12)   |
| Satisfaction with overall food intake              | 109 | 0.56** (0.34-0.92)                                  | 74 | 0.46* (0.27-0.78)  |
| Perceived healthiness of overall food intake       | 109 | 0.44* (0.26-0.77)                                   | 74 | 0.34* (0.19-0.62)  |
| Self-efficacy of eating healthy                    | 108 | 0.74 (0.49-1.10)                                    | 74 | 0.62** (0.40-0.96)                                       |
| Use of all products from parcel                    |     |   |    |  |
| Never  | 4   | 1.29 (0.22-7.72)                                    | 3  | 1.01 (0.15-6.80)   |
| Sometimes  | 68  | 1.29 (0.67-2.48)                                    | 37 | 0.79 (0.38-1.61)   |
| Always (Ref)                                       | 37  | 1.00  | 34 | 1.00   |
| Use of perishable foods beyond expiration date     |     |   |    |  |
| Never  | 22  | 0.95 (0.34-2.61)                                    | 20 | 1.57 (0.51-4.78)   |
| Sometimes  | 69  | 1.17 (0.48-2.82)                                    | 43 | 1.61 (0.59-4.39)   |
| Always (Ref)                                       | 18  | 1.00  | 11 | 1.00   |
| Use of non-perishable foods beyond expiration date |     |   |    |  |
| Never  | 17  | 1.22 (0.41-3.64)                                    | 8  | 0.61 (0.18-2.11)   |
| Sometimes  | 67  | 0.94 (0.43-2.05)                                    | 46 | 0.86 (0.37-1.99)   |
| Always (Ref)                                       | 25  | 1.00  | 20 | 1.00   |

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

<sup>1</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

For peer review only

1  
2  
3 242 **Discussion**  
4

5 243 Our study among food bank recipients is the first study addressing food insecurity in the  
6  
7 244 Netherlands and showed that 72.9% of the Dutch food bank recipients is food insecure of  
8  
9 245 which 40.4% with very low food security. Furthermore, the presence of food insecurity was  
10  
11 246 associated with female sex, low level of education, households with children, low satisfaction  
12  
13 247 with the food parcel, low satisfaction with overall food intake, low perceived healthiness of  
14  
15 248 overall food intake and low self-efficacy of eating healthy.  
16  
17

18 249 To indicate the severity of food insecurity in our study sample we compared our  
19  
20 250 prevalence rates with available national prevalence rates and other charitable food assistance  
21  
22 251 populations. The last group consists of people who depend on food assistance programs  
23  
24 252 regarding their food intake and therefore are not able to choose what they eat. We examined  
25  
26 253 Dutch food bank recipients - a very specific group of low-income people - and one should  
27  
28 254 therefore compare the prevalence rates of food insecurity with other samples with caution.  
29  
30 255 Furthermore, in contrary to the US, in the Netherlands we do not have publicly-run  
31  
32 256 entitlement programs.  
33  
34  
35

36 257 The prevalence of food insecurity in our study was much higher than previously  
37  
38 258 reported national prevalence data from other high-income Western but non-European  
39  
40 259 countries.[22-24 26 27] Comparison with the only European figure available shows that the  
41  
42 260 prevalence of food insecurity was almost three times higher in our food bank population  
43  
44 261 (73%) than in a study among low income persons in the UK (25%).[25] Compared to  
45  
46 262 prevalence data of food insecurity from the US and South Korea, based on people who make  
47  
48 263 use of any type of public food assistance, our prevalence was also higher. The reported  
49  
50 264 prevalences in these studies were: 26.1% in food assistance program users[27] and 36.4% in  
51  
52 265 public assistance users[35]. Possible explanations for this difference are the differences in  
53  
54 266 time-period where the food security question refers to, in the year food insecurity was  
55  
56  
57  
58  
59  
60

1  
2  
3 267 measured and in the measurement instruments that were used. Compared to prevalence data  
4  
5 268 of food insecurity from the US among food stamp program users (66%[41] and 71%[34])  
6  
7 269 and food pantry users (76%[42] and 84%[5]) our prevalence is comparable. However, the  
8  
9 270 proportion of very low food secure participants who reported that they were hungry but did  
10  
11 271 not eat because they could not afford enough food was somewhat higher in our study than in  
12  
13 272 a comparable study in the US[42] (56.8% vs. 40.1%).

14  
15  
16 273 A unique aspect of this study is the identification of demographic, lifestyle and  
17  
18 274 nutrition-related factors associated with food insecurity. In Europe, this has only been studied  
19  
20 275 among low-income persons in the UK so far. Our observed sex difference in the prevalence  
21  
22 276 of food insecurity is consistent with previous studies[23 27 32], and could be explained by  
23  
24 277 the fact that women may be the first to compromise their diet in an unhealthy way, to protect  
25  
26 278 their children and partner when the family faces threats to their food supply.[32 43]

27  
28  
29 279 Consistent with previous studies conducted outside Europe, we found that food  
30  
31 280 insecurity was associated with a lower level of education.[27 33 34] Unlike previous studies,  
32  
33 281 however, we found no association between food insecurity and employment status[27 33 34],  
34  
35 282 ethnicity[23 24 34-36], and household size[7 13 35]. Possible explanations for these  
36  
37 283 differences are that only 13.1% of the population had a paid job, and the majority (71.8%) of  
38  
39 284 our population was of Dutch origin. Although we did not find a significant association with  
40  
41 285 household size, we did find a significant association with household composition. As in  
42  
43 286 previous studies[12 24 34 35] households with children were more likely to experience low  
44  
45 287 food security than households without children. Adult caregivers may sacrifice their own diet  
46  
47 288 to avoid that their children will experience hunger.[44] Previous studies showed that weight  
48  
49 289 is positively associated with food insecurity, but only in women.[13 37-39] In contrast to  
50  
51 290 previous studies and our expectations, weight status was not associated with food insecurity.  
52  
53 291 In our study, weight status was based on self-reported height and weight, and therefore may  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 292 have been biased. A study by Ver ploeg et al.[45] reported that overweight women who  
4  
5 293 received food stamp benefits were less likely to recognize they were overweight than eligible  
6  
7 294 nonparticipants.  
8

9  
10 295 Overall, Dutch food bank recipients included in our study had a more unhealthy  
11  
12 296 lifestyle compared with the general Dutch population. The proportion of smokers was more  
13  
14 297 than twice as high, 58% vs. 25%[46], as was the prevalence of obesity, 28% vs. 13.5%.[47]  
15

16 298 A possible limitation of our study is its cross-sectional design which makes it  
17  
18 299 impossible to draw any causal conclusions regarding the factors associated with food  
19  
20 300 insecurity. Possible reverse associations might have occurred between characteristics  
21  
22 301 associated with food insecurity variables which are not determinants of food insecurity (e.g.  
23  
24 302 weight status, smoking status, satisfaction with the food parcel). Therefore, these results  
25  
26 303 should be interpreted with caution. Second, we were not able to adjust for the number of  
27  
28 304 items, nor for the total amount of calories in the food parcel because all food banks and  
29  
30 305 parcels are unique. (e.g. different options for self-selection and/or the exchange of products).  
31  
32 306 Third, of the 368 recipients who signed up 251 recipients (68.2%) participated in our study.  
33  
34 307 This and the selection of 11 out of 135 food banks may have led to selection bias. Last,  
35  
36 308 although the USDA Household Food Security Survey Scale is validated for use in low-SES  
37  
38 309 persons in general, it has not yet been validated in food bank users. Therefore, we can not  
39  
40 310 rule out that bias or misclassification might have occurred.  
41  
42  
43  
44

45 311 In the US there is a small but growing body of evidence showing that the  
46  
47 312 Supplemental Nutrition Assistance Program reduces the prevalence of food insecurity.[48-50]  
48  
49 313 The high levels of household food insecurity among Dutch food bank recipients, and the  
50  
51 314 number of people who qualify for food assistance surpassed the supply, raising the question  
52  
53 315 of whether food banks are able to supply the right quantity or nutritional quality of foods.  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 316 In conclusion, this paper shows that the prevalence of food insecurity is high among  
4  
5 317 Dutch food bank recipients and that specific subgroups are more vulnerable for food  
6  
7 318 insecurity. More research is urgently needed on the underlying determinants of food  
8  
9  
10 319 insecurity and on the effectiveness of food assistance by food banks.  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

## Acknowledgements

The authors would like to thank all food banks that participated for their cooperation, all food bank recipients for their participation, and all research assistants, MSc and BSc interns for their help in collecting data.

**Source of financial support:** This project was funded by a grant from the Netherlands Organization for Health Research and Development (115100003). The Netherlands organization for Health Research and Development had no role in the design, analysis or writing of this article.

## Contributorship statement

J.E.N., I.A.B. and M.V. designed the study. J.E.N. and S.C.D. conducted the data collection. J.E.N. performed the complete data analyses and drafted the manuscript. S.C.D., M.V. and I.A.B. gave significant advice concerning the interpretation of the results and critical review of the manuscript for intellectual content. J.E.N. had primary responsibility for its final content. All authors were involved in the development of the manuscript and approved the final version.

**Ethical statement:** This study was approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The Netherlands, as well as the national board of the Dutch Food Bank.

**Data sharing statement:** No additional data available

**Competing interest statement:** The authors declare no conflicts of interest

## References

1. Anderson S. Core indicators of nutritional state for difficult-to-sample populations. *J Nutr* 1990;120:1559-600.
2. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *J Nutr* 2001;131(10):2670-6.
3. Duffy P, Zizza C, Jacoby J, et al. Diet quality is low among female food pantry clients in Eastern Alabama. *J Nutr Educ Behav* 2009;41(6):414-9 doi: 10.1016/j.jneb.2008.09.002published Online First: Epub Date]].
4. Kendall A, Olson CM, Frongillo EA. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 1996;96(10):1019-24; quiz 25-6.
5. Robaina KA, Martin KS. Food insecurity, poor diet quality, and obesity among food pantry participants in Hartford, CT. *J Nutr Educ Behav* 2013;45:159-64 doi: 10.1016/j.jneb.2012.07.001published Online First: Epub Date]].
6. Dixon LB, Winkleby MA, Radimer KL. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third National Health and Nutrition Examination Survey, 1988-1994. *J Nutr* 2001;131(4):1232-46.
7. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr* 2008;138(3):604-12.
8. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *Am J Public Health* 1997;87(12):1956-61.
9. Bell M, Wilbur L, Smith C. Nutritional status of persons using a local emergency food system program in middle America. *J Am Diet Assoc* 1998;98(9):1031-3 doi: 10.1016/s0002-8223(98)00237-5published Online First: Epub Date]].
10. Muirhead V, Quinonez C, Figueiredo R, et al. Oral health disparities and food insecurity in working poor Canadians. *Community Dent Oral Epidemiol* 2009;37(4):294-304 doi: 10.1111/j.1600-0528.2009.00479.xpublished Online First: Epub Date]].
11. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr* 2010;140(2):304-10 doi: 10.3945/jn.109.112573published Online First: Epub Date]].
12. Che J, Chen J. Food insecurity in Canadian households. *Health reports / Statistics Canada, Canadian Centre for Health*. 2001;12(4):11-22.
13. Townsend MS, Peerson J, Love B, et al. Food insecurity is positively related to overweight in women. *J Nutr* 2001;131(6):1738-45.

- 1  
2  
3 14. Vozoris NT, Tarasuk VS. Household food insufficiency is associated with poorer health.  
4 J Nutr 2003;133(1):120-6.  
5
- 6 15. Laraia BA. Food insecurity and chronic disease. Adv Nutr 2013;4(2):203-12 doi:  
7 10.3945/an.112.003277published Online First: Epub Date]].  
8
- 9 16. Hampton T. Food insecurity harms health, well-being of millions in the United States.  
10 JAMA 2007;298(16):1851-3 doi: 10.1001/jama.298.16.1851published Online First:  
11 Epub Date]].  
12
- 13 17. Holben DH, Pheley AM. Diabetes risk and obesity in food-insecure households in rural  
14 Appalachian Ohio. Prev Chronic Dis 2006;3(3):A82.  
15
- 16 18. Cook JT, Frank DA, Levenson SM, et al. Child food insecurity increases risks posed by  
17 household food insecurity to young children's health. J Nutr 2006;136(4):1073-6.  
18
- 19 19. Eicher-Miller HA, Mason AC, Weaver CM, et al. Food insecurity is associated with iron  
20 deficiency anemia in US adolescents. Am J Clin Nutr 2009;90(5):1358-71 doi:  
21 10.3945/ajcn.2009.27886published Online First: Epub Date]].  
22
- 23 20. Gundersen C, Kreider B. Bounding the effects of food insecurity on children's health  
24 outcomes. J Health Econ 2009;28(5):971-83 doi:  
25 10.1016/j.jhealeco.2009.06.012published Online First: Epub Date]].  
26
- 27 21. Kirkpatrick SI, McIntyre L, Potestio ML. Child hunger and long-term adverse  
28 consequences for health. Arch Pediatr Adolesc Med 2010;164(8):754-62 doi:  
29 10.1001/archpediatrics.2010.117published Online First: Epub Date]].  
30
- 31 22. Household food insecurity, 2007–2008. Canadian Community Health Survey [date  
32 accessed 2013 February 5th]; Available from: [http://www.statcan.gc.ca/pub/82-625-](http://www.statcan.gc.ca/pub/82-625-x/2010001/article/11162-eng.htm)  
33 [x/2010001/article/11162-eng.htm](http://www.statcan.gc.ca/pub/82-625-x/2010001/article/11162-eng.htm).  
34
- 35 23. Carter KN, Lanumata T, Kruse K, et al. What are the determinants of food insecurity in  
36 New Zealand and does this differ for males and females? Aust N Z J Public Health  
37 2010;34(6):602-8 doi: 10.1111/j.1753-6405.2010.00615.xpublished Online First: Epub  
38 Date]].  
39
- 40 24. Coleman-Jensen A, Nord M, Andrews M, et al. Household Food Security in the United  
41 States in 2011. U.S. Department of Agriculture, Economic Research Center; September  
42 2012. ERR-141.  
43
- 44 25. Nelson M, Erens B, Bates B, et al. Low Income Diet and Nutrition Survey London: The  
45 Stationery Office; 2007. N5616225 c1 07/07.  
46
- 47 26. Rychetnik L, Webb K, Story L, et al. Food Security Options Paper: A food security  
48 planning framework: A menu of options for policy and planning interventions. 2003.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1
- 2
- 3 27. Kim K, Kim MK, Shin YJ, et al. Factors related to household food insecurity in the
- 4 Republic of Korea. *Public Health Nutr* 2011;14(6):1080-7
- 5
- 6 28. Armoedesignalement 2013. Den Haag: Centraal Bureau voor de Statistiek | Sociaal en
- 7 Cultureel Planbureau, 2013.
- 8
- 9 29. Feiten en Cijfers Voedselbanken Nederland: Voedselbanken Nederland, 2014.
- 10
- 11 30. Bickel G, Nord M, Price C, et al. Guide to Measuring Household Food Security,
- 12 Revised 2000 Washington DC: USDA: 2000.
- 13
- 14 31. Blumberg SJ, Bialostosky K, Hamilton WL, et al. The effectiveness of a short form of
- 15 the Household Food Security Scale. *Am J Public Health* 1999;89(8):1231-4.
- 16
- 17 32. Martin MA, Lippert AM. Feeding her children, but risking her health: the intersection of
- 18 gender, household food insecurity and obesity. *Soc Sci Med* 2012;74(11):1754-64 doi:
- 19 10.1016/j.socscimed.2011.11.013published Online First: Epub Date]].
- 20
- 21 33. Foley W, Ward P, Carter P, et al. An ecological analysis of factors associated with food
- 22 insecurity in South Australia, 2002-7. *Public Health Nutr* 2010;13(2):215-21 doi:
- 23 10.1017/s1368980009990747published Online First: Epub Date]].
- 24
- 25 34. Kaiser L, Baumrind N, Dumbauld S. Who is food-insecure in California? Findings from
- 26 the California Women's Health Survey, 2004. *Public Health Nutr* 2007;10(6):574-81 doi:
- 27 10.1017/s1368980007382542published Online First: Epub Date]].
- 28
- 29 35. Furness BW, Simon PA, Wold CM, et al. Prevalence and predictors of food insecurity
- 30 among low-income households in Los Angeles County. *Public Health Nutr*
- 31 2004;7(6):791-4.
- 32
- 33 36. Mello JA, Gans KM, Risica PM, et al. How is food insecurity associated with dietary
- 34 behaviors? An analysis with low-income, ethnically diverse participants in a nutrition
- 35 intervention study. *J Am Diet Assoc* 2010;110(12):1906-11.
- 36
- 37 37. Adams EJ, Grummer-Strawn L, Chavez G. Food insecurity is associated with increased
- 38 risk of obesity in California women. *J Nutr* 2003;133(4):1070-4.
- 39
- 40 38. Gooding HC, Walls CE, Richmond TK. Food insecurity and increased BMI in young
- 41 adult women. *Obesity (Silver Spring, Md)* 2012;20(9):1896-901 doi:
- 42 10.1038/oby.2011.233published Online First: Epub Date]].
- 43
- 44 39. Jilcott SB, Wall-Bassett ED, Burke SC, et al. Associations between food insecurity,
- 45 supplemental nutrition assistance program (SNAP) benefits, and body mass index among
- 46 adult females. *J Am Diet Assoc* 2011;111(11):1741-5 doi:
- 47 10.1016/j.jada.2011.08.004published Online First: Epub Date]].
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
- 2
- 3 40. World Health Organisation (WHO) Expert Committee. Physical status: the use and
- 4 interpretation of anthropometry. Technical Report Series Geneva: WHO, 1995.
- 5
- 6 41. Oberholser CA, Tuttle CR. Assessment of household food security among food stamp
- 7 recipient families in Maryland. *Am J Public Health* 2004;94(5):790-5.
- 8
- 9 42. Mabli J, Cojen R, Potter F, et al. Hunger in America 2010: National report prepared for
- 10 feeding America. Princeton: Mathematica Policy Research Institute; 2010. 06251-600.
- 11
- 12 43. McIntyre L, Glanville NT, Raine KD, et al. Do low-income lone mothers compromise
- 13 their nutrition to feed their children? *CMAJ* 2003;168(6):686-91.
- 14
- 15 44. Radimer KL, Olson CM, Greene JC, et al. Understanding hunger and developing
- 16 indicators to assess it in women and children. *J Nutr Educ* 1992;24(1):36S-45S.
- 17
- 18 45. Ver Ploeg ML, Chang HH, Lin BH. Over, under, or about right: misperceptions of body
- 19 weight among food stamp participants. *Obesity* 2008;16(9):2120-5
- 20
- 21 46. Kerncijfers roken in Nederland 2011. Een overzicht van recente Nederlandse
- 22 basisgegevens over rookgedrag. Den Haag: STIVORO, 2012.
- 23
- 24 47. Visscher TLS, Bakel AM van, Zantinge EM. Overgewicht samengevat. In:
- 25 *Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid*.
- 26 Bilthoven: RIVM, 2012.
- 27
- 28 48. Gundersen C. Food insecurity is an ongoing national concern. *Adv Nutr* 2013;4(1):36-41
- 29 doi: 10.3945/an.112.003244published Online First: Epub Date]].
- 30
- 31 49. Eicher-Miller HA, Mason AC, Abbott AR, et al. The effect of Food Stamp Nutrition
- 32 Education on the food insecurity of low-income women participants *J Nutr Educ Behav*
- 33 2009;41(3):161-8 doi: 10.1016/j.jneb.2008.06.004published Online First: Epub Date]].
- 34
- 35 50. Nord M. How much does the Supplemental Nutrition Assistance Program alleviate food
- 36 insecurity? Evidence from recent programme leavers. *Public Health Nutr*
- 37 2012;15(5):811-7 doi: 10.1017/s1368980011002709published Online First: Epub Date]].
- 38
- 39
- 40
- 41
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

1  
2  
3 **Figure legend**  
4  
5

6 Figure 1: Prevalence of food insecurity in 93 male and 158 female Dutch food bank  
7 recipients, stratified by sex.  
8

9 \* Food insecurity with hunger is different from men,  $P=0.001$  (Chi-square test).  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

1  
2  
3  
4  
5  
6  
7  
8  
9 **Food insecurity among Dutch food bank recipients - a cross-sectional study**

10  
11  
12 Judith E. Neter<sup>1</sup>, S. Coosje Dijkstra<sup>1</sup>, Marjolein Visser<sup>1,2</sup>, Ingeborg A. Brouwer<sup>1</sup>

13  
14  
15  
16 <sup>1</sup> Department of Health Sciences and the EMGO Institute for Health and Care Research, Faculty  
17 of Earth and Life Sciences, VU University Amsterdam, the Netherlands

18  
19 <sup>2</sup> Department of Epidemiology and Biostatistics, VU University Medical Center, the Netherlands

20  
21  
22  
23 **Corresponding author**

24  
25 Judith E. Neter

26  
27 Tel: +31 (0)20 5986128

28  
29 Fax: +31 (0)20 5986940

30  
31 E-mail address: [judith.neter@vu.nl](mailto:judith.neter@vu.nl)

32  
33  
34  
35 VU University Amsterdam

36  
37 Faculty of Earth and Life Sciences

38  
39 Department of Health Sciences

40  
41 De Boelelaan 1085

42  
43 1081 HV Amsterdam

44  
45 The Netherlands

46  
47  
48 **Key words:** food insecurity, food assistance program, low-socioeconomic status, nutrition

49  
50  
51  
52 **Word count:** 3,579



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Contributorship statement**

J.E.N., I.A.B. and M.V. designed the study. J.E.N. and S.C.D. conducted the data collection. J.E.N. performed the complete data analyses and drafted the manuscript. S.C.D., M.V. and I.A.B. gave significant advice concerning the interpretation of the results and critical review of the manuscript for intellectual content. J.E.N. had primary responsibility for its final content. All authors were involved in the development of the manuscript and approved the final version.

**Source of financial support:** This project was funded by a grant from the Netherlands Organization for Health Research and Development (115100003). The Netherlands organization for Health Research and Development had no role in the design, analysis or writing of this article.

**Ethical statement:** This study was approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The Netherlands, as well as the national board of the Dutch Food Bank.

**Data sharing statement:** There is no additional data available

**Competing interest statement:** The authors declare no conflicts of interest

## Abstract

**Objective:** To determine the prevalence of (very) low food security among Dutch food bank recipients, and to identify potential demographic, lifestyle and nutrition-related factors associated with (very) low food security.

**Setting:** Eleven out of 135 Dutch food banks were selected throughout the Netherlands.

**Participants:** Two-hundred-fifty-one Dutch food bank recipients participated in the study (93 males and 158 females). Inclusion criteria for participation were: 1) at least 18 years of age, 2) sufficiently fluent in Dutch to participate in oral and written interviews, 3) recipient of a Dutch food bank for at least one month, and 4) collect own food parcel at the food bank. A single member per household was included.

**Primary outcome:** Level of food security.

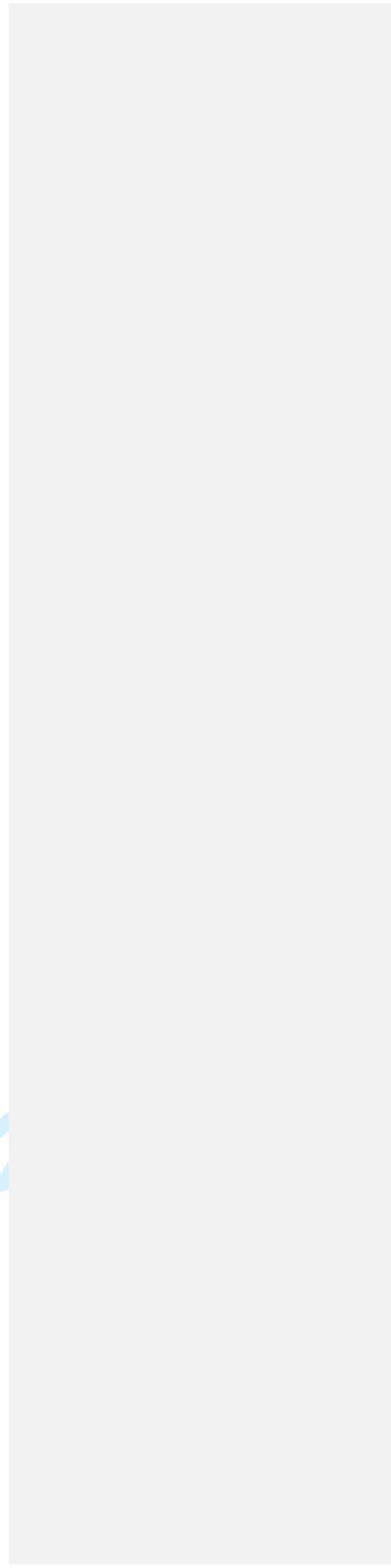
**Results:** The prevalence of food insecurity was 72.9% (N=183), of which 40.4% (N=74) reported very low food security. Of the very low food secure participants, 56.8% (N=42) reported they were ever hungry but did not eat because they could not afford enough food in the previous three months. Adjusted multinomial logistic regression analyses showed that households without children were less likely to experience low food security (Odds Ratio (OR):0.39 [95%CI:0.18-0.88]) and male recipients (OR:0.24 [95%CI:0.11-0.51]) were less likely to experience very low food security, while low educated recipients (OR:5.05 [95%CI:1.37-18.61]) were more likely to experience very low food security. Furthermore, recipients with high satisfaction with overall food intake (OR:0.46 [95%CI:0.27-0.78]), high perceived healthiness of overall food intake (OR:0.34 [95%CI:0.19-0.62]) or high self-efficacy of eating healthy (OR:0.62 [95%CI:0.40-0.96]) were less likely to experience very low food security.

**Conclusion:** Our study showed high prevalence rates of food insecurity among Dutch food bank recipients, and identified subgroups at increased risk of food insecurity. More research

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

26 is urgently needed on the underlying determinants of food insecurity and the effectiveness of  
27 food assistance by food banks.

For peer review only



1  
2  
3  
4  
5  
6  
7 **Article summary**  
8  
9

10 *Strengths and limitations of the study*  
11

- 12 • Our study among food bank recipients is the first study addressing food insecurity in the  
13 Netherlands.  
14
- 15 • Data were collected from 251 food bank recipients from 11 food banks throughout the  
16 Netherlands.  
17
- 18 • A unique aspect of this study is the identification of demographic, lifestyle and nutrition-  
19 related factors associated with food insecurity. In Europe, this has only been studied  
20 among low-income persons in the UK so far.  
21
- 22 • A possible limitation of our study is its cross-sectional design which makes it impossible  
23 to draw any causal conclusions regarding the factors associated with food insecurity.  
24
- 25 • We were not able to adjust for the number of items, nor for the total amount of calories  
26 in the food parcel because all food banks and parcels are unique. (e.g. different options  
27 for self-selection and/or the exchange of products).  
28
- 29 • Of the 368 recipients who signed up 251 recipients (68.2%) participated in our study.  
30 This and the selection of 11 out of 135 food banks may have led to selection bias.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 28 Introduction

29 Even in high-income Western countries like the Netherlands, there are people who cannot  
30 afford sufficient nutritious food to eat. Food insecurity can be defined as the lack of  
31 availability of nutritionally adequate and safe foods, or the lack of ability to acquire  
32 acceptable foods in socially acceptable ways.[1] It has been associated with unfavorable food  
33 choices[2] and a less healthy diet. Food insecure people have a lower intake of fruit and  
34 vegetables[2-5] and a lower nutrient intake[5-8] which consequently may lead to  
35 micronutrient deficiencies and malnutrition.[7 9] Furthermore, food insecurity was shown to  
36 be associated with poorer health including poor oral health[10], overweight, diabetes, and  
37 heart disease, and consequently is a major public health issue.[11-17] Food insecurity is not  
38 only a problem in adults, but also in children and adolescents.[18-21] However, this study  
39 focused on adults only.

40 Only a small number of high-income Western countries report prevalence rates of  
41 food insecurity, varying between 5% and 25%[22-27]: 5.2% in Australia[26], 5.3% in South  
42 Korea[27], 7.7% in Canada[22], 15% in the United States[24], and 15.8% in New  
43 Zealand[23]. In Europe, food insecurity was only reported for low-income people in the  
44 United Kingdom, and was 25%.[25]

45 Of the more than 7 million Dutch households in 2012, 664 thousand households  
46 (9.4%) were living below the low-income threshold. These 664 thousand households  
47 comprise over 1.3 million individuals (8.4% of the Dutch population). Moreover, over 811  
48 thousand individuals had an income that was even below the basic needs variant of the low-  
49 income threshold. This lowest-needs variant relates to costs incurred by a single person for  
50 purchasing goods which are regarded as (virtually) unavoidable in the Netherlands, such as  
51 food, clothing, housing and personal care.[28]

1  
2  
3  
4  
5  
6  
7 52 The Dutch Food Bank aims to provide food parcels that supplement the normal diet  
8  
9 53 for 2-3 days. Individuals living alone with a monthly disposable income <180 Euros qualify  
10  
11 54 for food assistance as do families with a monthly disposable income of <180 Euros with the  
12  
13 55 additional income allowance of 60 Euros per adult and 50 Euros per child (<18 years of age).  
14  
15 56 In 2013, the food banks weekly provided over 35 thousand food parcels and thereby  
16  
17 57 supported approximately 85 thousand individuals in the Netherlands.[29]

18  
19 58 There are many public and private food assistance programs operating at national,  
20  
21 59 state, and local levels to reduce food security and hunger in high-income countries. Accurate  
22  
23 60 measurement of the existence of food security, understanding the factors related to food  
24  
25 61 insecurity, and monitoring food assistance programs can help public health officials, policy  
26  
27 62 makers, service providers, and the public at large to assess the growing needs for food  
28  
29 63 assistance and the effectiveness of existing food assistance programs. Research can also help  
30  
31 64 to identify subgroups within food bank recipients who are food secure or at higher risk of low  
32  
33 65 or very low food security[30].

34  
35 66 Limited research has been performed on the prevalence of food insecurity and factors  
36  
37 67 associated with food insecurity in Europe. The present study aims, to determine the  
38  
39 68 prevalence of low and very low food security among Dutch food bank recipients, and to  
40  
41 69 identify potential demographic, lifestyle and nutrition-related factors associated with low and  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60 70 very low food security.

**Comment [j1]: Comment [MOU3]:**  
Somewhere early on the authors should mention the 3 levels of food security reported in the article based on the 6-item questionnaire: food secure, low food security and very low food security.

1  
2  
3  
4  
5  
6  
71 **Methods**

8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

72 This cross-sectional study was part of the Dutch Food Bank study, which explores and  
73 optimizes food choices and food patterns among Dutch food bank recipients. The study was  
74 approved by the Medical Ethical Committee of the VU Medical Center in Amsterdam, The  
75 Netherlands, as well as the national board of the Dutch Food Bank.

76  
77 *Food Banks*

78 Based on a search on the website of the Dutch Food Bank, e-mails, phone calls and food bank  
79 visits 11 out of approximately 135 Dutch food banks were selected for the present study,  
80 based on factors including size, the frequency of providing food parcels, urbanization, region,  
81 and willingness of the food bank to participate. The food banks selected were located in  
82 Apeldoorn (N=29), Boxtel (N=11), Breda (N=42), Enschede (N=71), Groningen (N=17),  
83 Haarlem (N=6), Hilversum (N=16), Huizen (N=14), Rotterdam (N=28), Wageningen (N=12),  
84 and Zeewolde (N=5).

85  
86 *Study population and data collection*

87 The target population consisted of recipients of the 11 selected Dutch food banks. Inclusion  
88 criteria for participation were: 1) at least 18 years of age, 2) sufficiently fluent in Dutch to  
89 participate in oral and written interviews, 3) recipient of a Dutch food bank for at least one  
90 month, 4) single member per household, and 5) collect own food parcel at the food bank.  
91 Recipients were recruited between October 2010 and March 2011 through promotional  
92 posters and information letters. They could sign up for the study within two or three weeks  
93 after recruitment with an application form, telephone or e-mail. Participation was voluntary  
94 and confidential. Of the approximately 1,200 food bank recipients who received an  
95 information letter or might have seen our promotional poster at the food bank, 368 signed up,

**Comment [j2]: Comment [MOU4]:** Can you describe the overall population of food banks in the Netherlands? Is there a central clearinghouse that collects information on all the food banks? For example, in the US there are regional food banks that distribute food to and collect information about smaller food pantries. How did you gather this information on factors? Please describe more information

1  
2  
3  
4  
5  
6  
7 96 of which 251 (68.2%) participated in the study. Of the 113 recipients who signed up for  
8  
9 97 participation but ultimately did not participate, we were able to contact 41 by telephone to  
10  
11 98 complete a short non-response questionnaire. Reasons for non-participation were: 1) not  
12  
13 99 enough time (N=17), 2) did not pick up their food parcel (themselves) at the day of  
14  
15 100 measurement (N=7), 3) missed the researchers at the day of measurement (N=5), 4) did not  
16  
17 101 realize the measurements were on that specific day (N=4), and 5) other reasons (N=8).  
18  
19 102 Measurement days were scheduled between October 2010 and April 2011. Participants who  
20  
21 103 completed the study received a gift coupon of 5 Euros and a small incentive for participation.  
22  
23 104

#### 24 105 *Food security*

25  
26 106 To measure the food security status of the participants, trained interviewers used a translated  
27  
28 107 version of the 6-item US Department of Agriculture (USDA) Household Food Security  
29  
30 108 Survey Scale.[30] The original, validated[31] American questionnaire (Supplemental Table  
31  
32 109 1) was translated and back-translated for this study. Coding was carried out in accordance  
33  
34 110 with the Guide to Measuring Household Food Security.[30] Food security status was defined  
35  
36 111 and classified according to the USDA guidelines: score 0 or 1 is food secure; score 2-4 is low  
37  
38 112 food security; score 5-6 is very low food security.[30]  
39  
40 113

#### 41 114 *Explanatory variables*

42  
43 115 The selection of explanatory variables was based on common sense and literature. Literature  
44  
45 116 showed that sex[23 27 32], level of education[27 33 34], employment status[27 33 34],  
46  
47 117 ethnicity[23 24 34-36], household size[7 13 35], household composition[12 24 34 35] and  
48  
49 118 weight status[13 37-39] were associated with food insecurity and therefore included in this  
50  
51 119 study. Physical activity was included because it may influence the energy-balance and  
52  
53 120 consequently food security status. Smoking and money spent on grocery shopping were  
54  
55  
56  
57  
58  
59  
60



1  
2  
3  
4  
5  
6  
7 121 included because they may influence food purchases and consequently food security status.  
8  
9 122 Furthermore, satisfaction with the food parcel, satisfaction with overall food intake, perceived  
10 123 healthiness of food intake, self-efficacy of eating healthy and the use of products from the  
11  
12 124 food parcel may influence the variety, quality and quantity of food intake and consequently  
13  
14 125 food security status.

15  
16 126 Participants completed a self-administered general questionnaire, which consisted of  
17  
18 127 the following domains: socio-demographics, lifestyle factors, grocery shopping, food parcels,  
19  
20 128 food intake, and foods from the food parcels beyond the expiration date.

21  
22 129 Socio-demographics included date of birth, sex, duration of being recipient of a Dutch  
23  
24 130 food bank household size, household composition, ethnicity, level of education, and paid job.  
25  
26 131 For ethnicity, we created two-categories: Dutch and non-Dutch ancestry. A participant had a  
27  
28 132 non-Dutch ancestry if the participant or at least one of the parents was born outside the  
29  
30 133 Netherlands. We created three levels of education: low (less than finished elementary school),  
31  
32 134 medium (elementary school), high (general intermediate, and lower vocational education,  
33  
34 135 university, college, higher vocational, general secondary, and intermediate vocational  
35  
36 136 education).

37  
38 137 Lifestyle factors included self-reported height and weight, current smoking, and  
39  
40 138 physical activity. Body mass index (BMI) was calculated as self-reported weight (kg) divided  
41  
42 139 by self-reported height (m<sup>2</sup>). BMI cut-off points of the WHO were used to define weight  
43  
44 140 status.[40] Physical activity was established by asking “How many days a week are you  
45  
46 141 physically active with moderate intensity for at least 30 minutes?”. Moderately intense  
47  
48 142 physical activity included sport activities, walking, cycling, gardening, and performing heavy  
49  
50 143 housework.

51 144 With regard to the domain grocery shopping, we asked “How much money do you  
52  
53 145 weekly spend on average on foods and drinks to supplement the food parcel?” This amount

**Comment [J3]:** Comment [MOU5]: This is unclear: did you differentiate between full-time and part-time employment? Mentioned several times throughout document

1  
2  
3  
4  
5  
6  
7 146 of money was divided by the number of adults plus children in the household to create the  
8  
9 147 variable money spent on groceries per person per week. For the statistical analyses two  
10  
11 148 categories were created on the basis of the median; 0-29.99 Euros per person per week and  
12  
13 149 30-50 Euros per person per week.

14  
15 150 Questions regarding food parcels included: “How satisfied are you usually with the  
16  
17 151 content of the food parcel?” (categories: not satisfied at all, not satisfied, neutral, satisfied,  
18  
19 152 very satisfied), and “Do you usually use all foods from the food parcel?” (categories: never,  
20  
21 153 sometimes, always).

22 154 Food-intake-related questions included “How satisfied are you with your current food  
23  
24 155 intake?” (categories: not satisfied at all, not satisfied, neutral, satisfied, completely satisfied),  
25  
26 156 and “How healthy is your current food intake?” (not healthy at all, not healthy, neutral,  
27  
28 157 healthy, very healthy). Self-efficacy was measured with the question “How certain are you  
29  
30 158 that you can eat healthily?” (not certain at all, not certain, neutral, certain, very certain). The  
31  
32 159 above mentioned questions regarding satisfaction with the food parcels, and nutrition-related  
33  
34 160 questions with five answer categories were scored from -2 to +2, and were analyzed  
35  
36 161 continuously.

37 162 Food parcels provided by the Dutch food banks consist of donated foods only and  
38  
39 163 often include foods which are close to the expiration date. Questions on the use of foods  
40  
41 164 beyond the expiration date therefore included “Do you use perishable foods from the food  
42  
43 165 parcel that are beyond the expiration date?”, and “Do you use non-perishable foods from the  
44  
45 166 food parcel that are beyond the expiration date?” (categories: never, sometimes, always).

47 167

#### 48 168 *Statistical analyses*

50  
51 169 Statistical analyses were performed using PASW statistics (formerly SPSS statistics) for  
52  
53 170 Windows version 20.0 (Armonk, NY: IBM Corp, USA). Descriptive statistics were used to

**Comment [J4]:** Comment [MOU6]: For future research, you may want to ask: how often do you receive a food parcel? How many days does the food usually last?

1  
2  
3  
4  
5  
6  
7 171 summarize participants' characteristics and to examine the level of food insecurity in the  
8  
9 172 study sample. Values in the text are mean  $\pm$  standard deviation (SD), frequency or relative  
10  
11 173 frequency. Sex differences in the prevalence of low and very low food security were tested  
12  
13 174 with Chi-square test. Multinomial logistic regression analysis was used to study the  
14  
15 175 association of demographic, lifestyle and nutrition-related characteristics with low and very  
16  
17 176 low food security. The dependent variable level of food security consisted of three categories:  
18  
19 177 food secure, low food secure and very low food secure. For each independent variable the  
20  
21 178 categories low and very low food security were compared with the food secure category; the  
22  
23 179 reference group. Both univariate and multivariate analyses were performed. We adjusted for  
24  
25 180 confounding effects by including the variables age, sex, and level of education in the model.  
26  
27 181 Crude and adjusted odds ratios (ORs) are presented with their 95% confidence interval (CI).  
28  
29 182 The variables age, sex, duration of being recipient, household size, household composition,  
30  
31 183 level of education and money spent on groceries were tested for interaction with age, sex, and  
32  
33 184 level of education in multivariate analyses. Two-tailed *P*-values of  $<0.05$  were considered  
34  
35 185 significant.

## 37 187 Results

38  
39 188 In total, 251 Dutch food bank recipients participated in the study, of whom 37.1% were males  
40  
41 189 and 62.9% females (Table 1). Mean age of the total study sample was  $46.3 \pm 10.6$  years. Most  
42  
43 190 of the participants were recipients of the food bank for  $>12$  months. The majority of the  
44  
45 191 participants was of Dutch origin, had a medium level of education, and did not currently have  
46  
47 192 a paid job. Furthermore, mean BMI of the population was  $27.3 \pm 6.3$  kg/m<sup>2</sup>, and 56.8% was  
48  
49 193 either overweight or obese. Smokers were much more prevalent than non-smokers.

Comment [J5]: For Table 1, please include Mean +/- SD in the Heading.

Table 1: Characteristics of 251 Dutch Food Bank recipients measured in 2010/2011

| Characteristics                                |                          |
|--|--------------------------|
| Age, yrs                                       | 46.3 ± 10.6 <sup>a</sup> |
| Sex  |                          |
| Male   | 93 (37.1)                |
| Female   | 158 (62.9)               |
| Duration of being recipient                    |                          |
| 0 - 6 months                                   | 91 (36.3)                |
| 6 - 12 months                                  | 63 (25.1)                |
| >12 months                                     | 97 (38.6)                |
| Household size                                 |                          |
| 1 person                                       | 102 (40.6)               |
| 2 - 4 persons                                  | 108 (43.0)               |
| ≥ 5 persons                                    | 41 (16.3)                |
| Household composition                          |                          |
| Single parent household                        | 59 (23.6)                |
| Household without children                     | 127 (50.8)               |
| Multiple household with children               | 64 (25.6)                |
| Ethnicity                                      |                          |
| Dutch  | 178 (71.8)               |
| Non-Dutch ancestry                             | 70 (28.2)                |
| Educational level                              |                          |
| Low  | 34 (13.6)                |
| Medium   | 131 (52.4)               |
| High   | 85 (34.0)                |
| Current paid job                               |                          |
| No   | 218 (86.9)               |
| Yes  | 33 (13.1)                |
| Body mass index, kg/m <sup>2</sup>             | 27.3 ± 6.3               |
| Weight status                                  |                          |
| Underweight; BMI <18.5 kg/m <sup>2</sup>       | 8 (3.3)                  |
| Normal Weight; BMI 18 - 24.9 kg/m <sup>2</sup> | 98 (40.0)                |
| Overweight; BMI 25 - 29.9 kg/m <sup>2</sup>    | 70 (28.6)                |
| Obese; BMI ≥30 kg/m <sup>2</sup>               | 69 (28.2)                |
| Current smoking                                |                          |
| No   | 105 (41.8)               |

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

|  |                 |
|--|-----------------|
| Yes  | 146 (58.2)      |
| Physically active $\geq$ 30 min/day                |                 |
| 0 - 2 days/week                                    | 70 (27.9)       |
| 3 - 5 days/week                                    | 80 (31.9)       |
| 6 - 7 days/week                                    | 101 (40.2)      |
| Money spent on groceries                           |                 |
| 0 - 29.99 Euros per person per week                | 200 (81.6)      |
| 30 - 50 Euros per person per week                  | 45 (18.4)       |
| Satisfaction with food parcel                      | 0.88 $\pm$ 0.83 |
| (Range -2 to +2)                                   |                 |
| Satisfaction with overall food intake              | 0.69 $\pm$ 0.73 |
| (Range -2 to +2)                                   |                 |
| Perceived healthiness of overall food intake       | 0.62 $\pm$ 0.68 |
| (Range -2 to +2)                                   |                 |
| Self-efficacy of eating healthy                    | 0.75 $\pm$ 0.82 |
| (Range -2 to +2)                                   |                 |
| Use of all products from food parcel               |                 |
| Never  | 9 (3.6)         |
| Sometimes  | 143 (57.0)      |
| Always   | 99 (39.4)       |
| Use of perishable foods beyond expiration date     |                 |
| Never  | 57 (22.7)       |
| Sometimes  | 154 (61.4)      |
| Always   | 40 (15.9)       |
| Use of non-perishable foods beyond expiration date |                 |
| Never  | 34 (13.5)       |
| Sometimes  | 158 (62.9)      |
| Always   | 59 (23.5)       |

<sup>1</sup>Total N was 251. For age, household composition, educational level, self-efficacy of eating healthy N was 250, for ethnicity N was 248, and for BMI, weight status and money spent on groceries in Euros per person per week N was 245

<sup>2</sup> Values are presented as mean  $\pm$  SD, frequency or relative frequency.

1  
2  
3  
4  
5  
6  
7 194 Of the sample 84.9% (N=213) responded affirmatively to at least one item on our  
8  
9 195 food security scale. Of those, 14% (N=30) affirmed only one item and were therefore  
10  
11 196 classified as marginally food secure. The prevalence of food insecurity was 72.9% (N=183),  
12  
13 197 of which 40.4% (N=74) with very low food security (Figure 1). Very low food security was  
14  
15 198 significantly more prevalent in women than men (37.3% vs. 16.1%; P=0.001). Of the very  
16  
17 199 low food secure participants 56.8% (N=42) reported that they were ever hungry but did not  
18  
19 200 eat because they could not afford enough food in the previous three months. This was the  
20  
21 201 most extreme category of the survey instrument. This percentage was substantially lower  
22  
23 202 among low food secure participants (3.7%, N=4). Univariate analyses regarding associations  
24  
25 203 of demographic as well as lifestyle characteristics with low or very low food security  
26  
27 204 compared with food security showed that men were less likely than women to experience  
28  
29 205 very low food security (OR:0.25[95%CI:0.12-0.53]). Participants with a low level of  
30  
31 206 education were more likely to experience very low food security as compared to participants  
32  
33 207 with a high level of education (OR:4.23 [95%CI:1.20-14.94]). In contrast to household size,  
34  
35 208 household composition was associated with food insecurity. Households without children  
36  
37 209 were less likely to experience low food security as compared with multiple households with  
38  
39 210 children (OR:0.45 [95%CI:0.22-0.94]). Duration of being recipient of a Dutch food bank,  
40  
41 211 employment status, ethnicity, BMI, weight status, current smoking status, and level of  
42  
43 212 physical activity were not associated with food insecurity.

44  
45 213 Univariate analyses regarding associations of nutrition-related characteristics with  
46  
47 214 food security status, showed that participants who were more satisfied with their overall food  
48  
49 215 intake were less likely to experience low food security (OR:0.56 [95%CI:0.35-0.90]) or very  
50  
51 216 low food security (OR:0.45 [95%CI:0.27-0.74]) compared to their counterparts. Participants  
52  
53 217 who perceived their overall food intake to be more healthy were less likely to experience low  
54  
55 218 food security (OR:0.46 [95%CI:0.27-0.78]) or very low food security (OR:0.35 [95%CI:0.20-

**Comment [J6]: Comment [MOU7]:** This would be bivariate analyses.

**Comment [J7]: Comment [MOU8]:**  
Throughout this section, I would change "have" very low food security to "experience" very low... OR to be categorized as very low food secure.

**Comment [J8]:** Could you create a Table with the Bivariate Results? You could then summarize the major findings and report all the data in the Table.

1  
2  
3  
4  
5  
6  
7 219 0.62]) compared to participants who perceived their overall food intake to be less healthy.  
8  
9 220 Participants who were more certain of a healthy food intake were less likely to experience  
10  
11 221 very low food security (OR:0.62 [95%CI:0.41-0.96]) compared to participants who were less  
12  
13 222 certain of a healthy food intake. Satisfaction with the food parcel was borderline significant;  
14  
15 223 participants who were more satisfied with the food parcel tended to experience less low food  
16  
17 224 security compared to participants who were less satisfied with the food parcel (OR:0.68  
18  
19 225 [95%CI:0.46-1.01]). No associations were found between the total amount of money spent on  
20  
21 226 groceries per person per week, the extent to which products of the food parcel were used, the  
22  
23 227 extent to which the use of perishable and non-perishable foods were used beyond the  
24  
25 228 expiration date, and food insecurity.

26 229 Table 2a and 2b show multivariate associations of demographic, lifestyle, and  
27  
28 230 nutrition-related characteristics with low or very low food security compared with food  
29  
30 231 security. After adjustment for age, sex and level of education the observed univariate  
31  
32 232 associations remained statistically significant. Furthermore, multivariate analysis showed that  
33  
34 233 participants who were more satisfied with the food parcel were less likely to experience low  
35  
36 234 food security compared to participants who were less satisfied (OR:0.66 [95%CI:0.44-0.99]).

37 235 Significant interaction was present between duration of being recipient and age  
38  
39 236 (P=0.029) in its association with low food security. Older participants who are recipient of  
40  
41 237 the food bank for a shorter period of time seemed to be less likely to experience low food  
42  
43 238 security compared to their counterparts. Furthermore, significant interaction was present  
44  
45 239 between household size and age (P=0.040) in its association with very low food security.  
46  
47 240 Older participants with smaller household sizes seemed to be less likely to experience very  
48  
49 241 low food security compared to participants with larger household sizes.

Comment [j9]: Comment [MOU9]: For these two paragraphs, I would report the main regression model first, then list the significant interactions.

Table 2a: Multivariate associations of demographic and lifestyle characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                           | N   | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|-----|---|----|--|
| Age, yrs                               | 108 | 1.00 (0.97-1.03)                                    | 74 | 1.01 (0.98-1.05)   |
| Sex                                    |     |   |    |  |
| Male                                   | 44  | 0.64 (0.34-1.19)                                    | 15 | 0.24* (0.11-0.51)  |
| Female (Ref)                           | 65  | 1.00  | 59 | 1.00   |
| Duration of being recipient            |     |   |    |  |
| 0 - 6 months                           | 38  | 1.12 (0.54-2.30)                                    | 28 | 1.40 (0.63-3.10)   |
| 6 - 12 months                          | 30  | 1.26 (0.56-2.80)                                    | 17 | 1.06 (0.43-2.61)   |
| >12 months (Ref)                       | 41  | 1.00  | 29 | 1.00   |
| Household size                         |     |   |    |  |
| 1 person                               | 39  | 0.51 (0.19-1.36)                                    | 27 | 0.50 (0.17-1.49)   |
| 2 - 4 persons                          | 51  | 0.94 (0.35-2.49)                                    | 34 | 0.81 (0.28-2.39)   |
| ≥ 5 persons (Ref)                      | 19  | 1.00  | 13 | 1.00   |
| Household composition                  |     |   |    |  |
| Single parent household                | 22  | 0.55 (0.20-1.47)                                    | 25 | 1.52 (0.51-4.50)   |
| Household without children             | 50  | 0.39** (0.18-0.88)                                  | 35 | 0.78 (0.30-2.06)   |
| Multiple household with children (Ref) | 37  | 1.00  | 13 | 1.00   |
| Ethnicity                              |     |   |    |  |
| Dutch                                  | 81  | 1.07 (0.52-2.21)                                    | 48 | 0.60 (0.27-1.30)   |
| Non-Dutch ancestry (Ref)               | 27  | 1.00  | 26 | 1.00   |



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

|                                    |    |                  |    |                     |
|------------------------------------|----|------------------|----|---------------------|
| Educational level                  |    |                  |    |                     |
| Low                                | 17 | 2.80 (0.83-9.39) | 13 | 5.05** (1.37-18.61) |
| Medium                             | 53 | 0.91 (0.47-1.77) | 41 | 1.25 (0.58-2.67)    |
| High (Ref)                         | 39 | 1.00             | 20 | 1.00                |
| Current paid job                   |    |                  |    |                     |
| No                                 | 95 | 1.40 (0.58-3.38) | 66 | 1.52 (0.54-4.22)    |
| Yes (Ref)                          | 14 | 1.00             | 8  | 1.00                |
| Body mass index, kg/m <sup>2</sup> |    |                  |    |                     |
| Weight status                      |    |                  |    |                     |
| Underweight                        | 2  | 0.72 (0.09-5.90) | 4  | 1.54 (0.23-10.37)   |
| Normal weight                      | 47 | 1.75 (0.77-4.01) | 28 | 1.22 (0.51-2.93)    |
| Overweight                         | 33 | 1.39 (0.59-3.27) | 14 | 0.73 (0.28-1.91)    |
| Obese (Ref)                        | 25 | 1.00             | 26 | 1.00                |
| Current smoking                    |    |                  |    |                     |
| No                                 | 44 | 0.86 (0.45-1.64) | 32 | 0.82 (0.40-1.69)    |
| Yes (Ref)                          | 65 | 1.00             | 42 | 1.00                |
| Physical active ≥ 30 min/day       |    |                  |    |                     |
| 0 - 2 days/week                    | 24 | 0.96 (0.43-2.12) | 30 | 2.21 (0.95-5.14)    |
| 3 - 5 days/week                    | 39 | 1.15 (0.56-2.35) | 18 | 0.98 (0.42-2.32)    |
| 6 - 7 days/week (Ref)              | 46 | 1.00             | 26 | 1.00                |

<sup>1</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

Table 2b: Multivariate associations of nutrition-related characteristics with low and very low food security compared with food security, in 251 Dutch food bank recipients<sup>1</sup>

| Determinants                                       | N   | Low food security versus food security, OR (95% CI) | N  | Very low food security versus food security, OR (95% CI) |
|--|-----|---|----|--|
| Money spent on groceries                           |     |   |    |  |
| 0 - 29.99 Euros per person per week                | 92  | 1.47 (0.64-3.34)                                    | 56 | 0.82 (0.34-1.96)   |
| 30 - 50 Euros per person per week (Ref)            | 16  | 1.00  | 16 | 1.00   |
| Satisfaction with food parcel                      | 109 | 0.66** (0.44-0.99)                                  | 74 | 0.71 (0.45-1.12)   |
| Satisfaction with overall food intake              | 109 | 0.56** (0.34-0.92)                                  | 74 | 0.46* (0.27-0.78)  |
| Perceived healthiness of overall food intake       | 109 | 0.44* (0.26-0.77)                                   | 74 | 0.34* (0.19-0.62)  |
| Self-efficacy of eating healthy                    | 108 | 0.74 (0.49-1.10)                                    | 74 | 0.62** (0.40-0.96)                                       |
| Use of all products from parcel                    |     |   |    |  |
| Never  | 4   | 1.29 (0.22-7.72)                                    | 3  | 1.01 (0.15-6.80)   |
| Sometimes  | 68  | 1.29 (0.67-2.48)                                    | 37 | 0.79 (0.38-1.61)   |
| Always (Ref)                                       | 37  | 1.00  | 34 | 1.00   |
| Use of perishable foods beyond expiration date     |     |   |    |  |
| Never  | 22  | 0.95 (0.34-2.61)                                    | 20 | 1.57 (0.51-4.78)   |
| Sometimes  | 69  | 1.17 (0.48-2.82)                                    | 43 | 1.61 (0.59-4.39)   |
| Always (Ref)                                       | 18  | 1.00  | 11 | 1.00   |
| Use of non-perishable foods beyond expiration date |     |   |    |  |
| Never  | 17  | 1.22 (0.41-3.64)                                    | 8  | 0.61 (0.18-2.11)   |
| Sometimes  | 67  | 0.94 (0.43-2.05)                                    | 46 | 0.86 (0.37-1.99)   |
| Always (Ref)                                       | 25  | 1.00  | 20 | 1.00   |

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

<sup>1</sup> Adjusted for age, sex and educational level

\* P < 0.01

\*\* P < 0.05

For peer review only

1  
2  
3  
4  
5  
6  
7 242 **Discussion**

8 243 Our study among food bank recipients is the first study addressing food insecurity in the  
9  
10 244 Netherlands and showed that 72.9% of the Dutch food bank recipients is food insecure of  
11  
12 245 which 40.4% with very low food security. Furthermore, the presence of food insecurity was  
13  
14 246 associated with female sex, low level of education, households with children, low satisfaction  
15  
16 247 with the food parcel, low satisfaction with overall food intake, low perceived healthiness of  
17  
18 248 overall food intake and low self-efficacy of eating healthy.

19  
20 249 To indicate the severity of food insecurity in our study sample we compared our  
21  
22 250 prevalence rates with available national prevalence rates and other charitable food assistance  
23  
24 251 populations. The last group consists of people who depend on food assistance programs  
25  
26 252 regarding their food intake and therefore are not able to choose what they eat. We examined  
27  
28 253 Dutch food bank recipients - a very specific group of low-income people - and one should  
29  
30 254 therefore compare the prevalence rates of food insecurity with other samples with caution.  
31  
32 255 Furthermore, in contrary to the US, in the Netherlands we do not have publicly-run  
33  
34 256 entitlement programs.

35 257 The prevalence of food insecurity in our study was much higher than previously  
36  
37 258 reported national prevalence data from other high-income Western but non-European  
38  
39 259 countries.[22-24 26 27] Comparison with the only European figure available shows that the  
40  
41 260 prevalence of food insecurity was almost three times higher in our food bank population  
42  
43 261 (73%) than in a study among low income persons in the UK (25%).[25] Compared to  
44  
45 262 prevalence data of food insecurity from the US and South Korea, based on people who make  
46  
47 263 use of any type of public food assistance, our prevalence was also higher. The reported  
48  
49 264 prevalences in these studies were: 26.1% in food assistance program users[27] and 36.4% in  
50  
51 265 public assistance users[35]. Possible explanations for this difference are the differences in  
52  
53 266 time-period where the food security question refers to, in the year food insecurity was  
54

1  
2  
3  
4  
5  
6  
7 267 measured and in the measurement instruments that were used. Compared to prevalence data  
8  
9 268 of food insecurity from the US among food stamp program users (66%[41] and 71%[34])  
10  
11 269 and food pantry users (76%[42] and 84%[5]) our prevalence is comparable. However, the  
12  
13 270 proportion of very low food secure participants who reported that they were hungry but did  
14  
15 271 not eat because they could not afford enough food was somewhat higher in our study than in  
16  
17 272 a comparable study in the US[42] (56.8% vs. 40.1%).

18 273 A unique aspect of this study is the identification of demographic, lifestyle and  
19  
20 274 nutrition-related factors associated with food insecurity. In Europe, this has only been studied  
21  
22 275 among low-income persons in the UK so far. Our observed sex difference in the prevalence  
23  
24 276 of food insecurity is consistent with previous studies[23 27 32], and could be explained by  
25  
26 277 the fact that women may be the first to compromise their diet in an unhealthy way, to protect  
27  
28 278 their children and partner when the family faces threats to their food supply.[32 43]

29  
30 279 Consistent with previous studies conducted outside Europe, we found that food  
31  
32 280 insecurity was associated with a lower level of education.[27 33 34] Unlike previous studies,  
33  
34 281 however, we found no association between food insecurity and employment status[27 33 34],  
35  
36 282 ethnicity[23 24 34-36], and household size[7 13 35]. Possible explanations for these  
37  
38 283 differences are that only 13.1% of the population had a paid job, and the majority (71.8%) of  
39  
40 284 our population was of Dutch origin. Although we did not find a significant association with  
41  
42 285 household size, we did find a significant association with household composition. As in  
43  
44 286 previous studies[12 24 34 35] households with children were more likely to experience low  
45  
46 287 food security than households without children. Adult caregivers may sacrifice their own diet  
47  
48 288 to avoid that their children will experience hunger.[44] Previous studies showed that weight  
49  
50 289 is positively associated with food insecurity, but only in women.[13 37-39] In contrast to  
51  
52 290 previous studies and our expectations, weight status was not associated with food insecurity.  
53  
54 291 In our study, weight status was based on self-reported height and weight, and therefore may

1  
2  
3  
4  
5  
6  
7 292 have been biased. A study by Ver ploeg et al.[45] reported that overweight women who  
8  
9 293 received food stamp benefits were less likely to recognize they were overweight than eligible  
10  
11 294 nonparticipants.

12 295 Overall, Dutch food bank recipients included in our study had a more unhealthy  
13  
14 296 lifestyle compared with the general Dutch population. The proportion of smokers was more  
15  
16 297 than twice as high, 58% vs. 25%[46], as was the prevalence of obesity, 28% vs. 13.5%.[47]

17  
18 298 A possible limitation of our study is its cross-sectional design which makes it  
19  
20 299 impossible to draw any causal conclusions regarding the factors associated with food  
21  
22 300 insecurity. Possible reverse associations might have occurred between characteristics  
23  
24 301 associated with food insecurity variables which are not determinants of food insecurity (e.g.  
25  
26 302 weight status, smoking status, satisfaction with the food parcel). Therefore, these results  
27  
28 303 should be interpreted with caution. Second, we were not able to adjust for the number of  
29  
30 304 items, nor for the total amount of calories in the food parcel because all food banks and  
31  
32 305 parcels are unique. (e.g. different options for self-selection and/or the exchange of products).

33 306 **Third, of the 368 recipients who signed up 251 recipients (68.2%) participated in our study.**

34 307 **This and the selection of 11 out of 135 food banks may have led to selection bias.** Last,  
35  
36 308 although the USDA Household Food Security Survey Scale is validated for use in low-SES  
37  
38 309 persons in general, it has not yet been validated in food bank users. Therefore, we can not  
39  
40 310 rule out that bias or misclassification might have **occurred**.

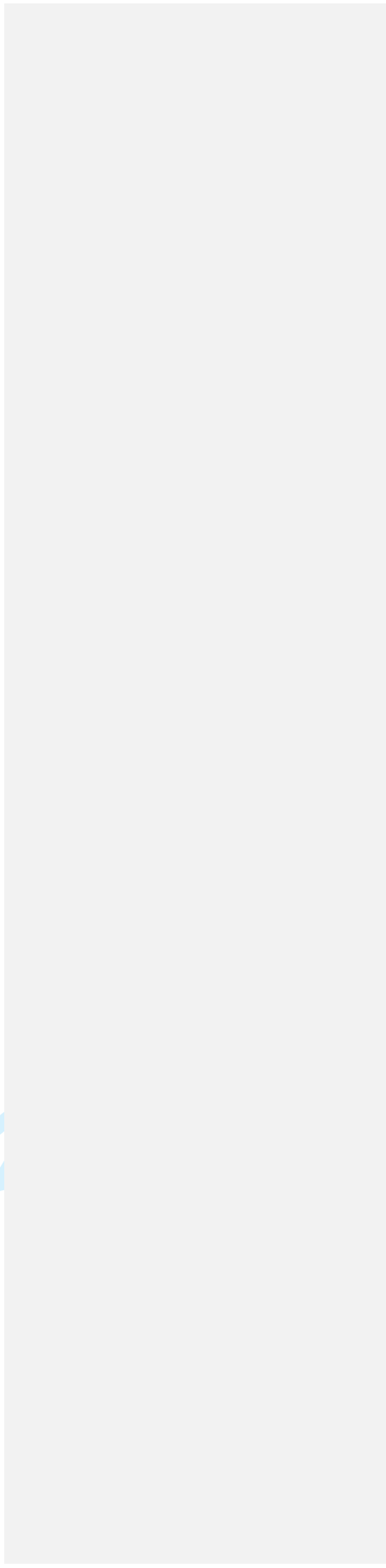
41  
42  
43 311 In the US there is a small but growing body of evidence showing that the  
44  
45 312 Supplemental Nutrition Assistance Program reduces the prevalence of food insecurity.[48-50]  
46  
47 313 The high levels of household food insecurity among Dutch food bank recipients, and the  
48  
49 314 number of people who qualify for food assistance surpassed the supply, **raising** the question  
50  
51 315 **of** whether food banks are able to supply the right quantity **or nutritional quality** of foods.

**Comment [J10]:** Include the response rate and selection of 11 food banks which may create selection bias.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

316 In conclusion, this paper shows that the prevalence of food insecurity is high among  
317 Dutch food bank recipients and that specific subgroups are more vulnerable for food  
318 insecurity. More research is urgently needed on the underlying determinants of food  
319 insecurity and on the effectiveness of food assistance by food banks.

For peer review only



### Acknowledgements

The authors would like to thank all food banks that participated for their cooperation, all food bank recipients for their participation, and all research assistants, MSc and BSc interns for their help in collecting data.

For peer review only



## References

1. Anderson S. Core indicators of nutritional state for difficult-to-sample populations. *J Nutr* 1990;120:1559-600.
2. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *J Nutr* 2001;131(10):2670-6.
3. Duffy P, Zizza C, Jacoby J, et al. Diet quality is low among female food pantry clients in Eastern Alabama. *J Nutr Educ Behav* 2009;41(6):414-9 doi: 10.1016/j.jneb.2008.09.002published Online First: Epub Date]].
4. Kendall A, Olson CM, Frongillo EA. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 1996;96(10):1019-24; quiz 25-6.
5. Robaina KA, Martin KS. Food insecurity, poor diet quality, and obesity among food pantry participants in Hartford, CT. *J Nutr Educ Behav* 2013;45:159-64 doi: 10.1016/j.jneb.2012.07.001published Online First: Epub Date]].
6. Dixon LB, Winkleby MA, Radimer KL. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third National Health and Nutrition Examination Survey, 1988-1994. *J Nutr* 2001;131(4):1232-46.
7. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr* 2008;138(3):604-12.
8. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *Am J Public Health* 1997;87(12):1956-61.
9. Bell M, Wilbur L, Smith C. Nutritional status of persons using a local emergency food system program in middle America. *J Am Diet Assoc* 1998;98(9):1031-3 doi: 10.1016/s0002-8223(98)00237-5published Online First: Epub Date]].
10. Muirhead V, Quinonez C, Figueiredo R, et al. Oral health disparities and food insecurity in working poor Canadians. *Community Dent Oral Epidemiol* 2009;37(4):294-304 doi: 10.1111/j.1600-0528.2009.00479.xpublished Online First: Epub Date]].
11. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr* 2010;140(2):304-10 doi: 10.3945/jn.109.112573published Online First: Epub Date]].
12. Che J, Chen J. Food insecurity in Canadian households. *Health reports / Statistics Canada, Canadian Centre for Health*. 2001;12(4):11-22.
13. Townsend MS, Peerson J, Love B, et al. Food insecurity is positively related to overweight in women. *J Nutr* 2001;131(6):1738-45.

14. Vozoris NT, Tarasuk VS. Household food insufficiency is associated with poorer health. *J Nutr* 2003;133(1):120-6.
15. Laraia BA. Food insecurity and chronic disease. *Adv Nutr* 2013;4(2):203-12 doi: 10.3945/an.112.003277published Online First: Epub Date]].
16. Hampton T. Food insecurity harms health, well-being of millions in the United States. *JAMA* 2007;298(16):1851-3 doi: 10.1001/jama.298.16.1851published Online First: Epub Date]].
17. Holben DH, Pheley AM. Diabetes risk and obesity in food-insecure households in rural Appalachian Ohio. *Prev Chronic Dis* 2006;3(3):A82.
18. Cook JT, Frank DA, Levenson SM, et al. Child food insecurity increases risks posed by household food insecurity to young children's health. *J Nutr* 2006;136(4):1073-6.
19. Eicher-Miller HA, Mason AC, Weaver CM, et al. Food insecurity is associated with iron deficiency anemia in US adolescents. *Am J Clin Nutr* 2009;90(5):1358-71 doi: 10.3945/ajcn.2009.27886published Online First: Epub Date]].
20. Gundersen C, Kreider B. Bounding the effects of food insecurity on children's health outcomes. *J Health Econ* 2009;28(5):971-83 doi: 10.1016/j.jhealeco.2009.06.012published Online First: Epub Date]].
21. Kirkpatrick SI, McIntyre L, Potestio ML. Child hunger and long-term adverse consequences for health. *Arch Pediatr Adolesc Med* 2010;164(8):754-62 doi: 10.1001/archpediatrics.2010.117published Online First: Epub Date]].
22. Household food insecurity, 2007–2008. Canadian Community Health Survey [date accessed 2013 February 5th]; Available from: <http://www.statcan.gc.ca/pub/82-625-x/2010001/article/111162-eng.htm>.
23. Carter KN, Lanumata T, Kruse K, et al. What are the determinants of food insecurity in New Zealand and does this differ for males and females? *Aust N Z J Public Health* 2010;34(6):602-8 doi: 10.1111/j.1753-6405.2010.00615.xpublished Online First: Epub Date]].
24. Coleman-Jensen A, Nord M, Andrews M, et al. Household Food Security in the United States in 2011. U.S. Department of Agriculture, Economic Research Center; September 2012. ERR-141.
25. Nelson M, Erens B, Bates B, et al. Low Income Diet and Nutrition Survey London: The Stationery Office; 2007. N5616225 c1 07/07.
26. Rychetnik L, Webb K, Story L, et al. Food Security Options Paper: A food security planning framework: A menu of options for policy and planning interventions. 2003.

- 1
- 2
- 3
- 4
- 5
- 6
- 7 27. Kim K, Kim MK, Shin YJ, et al. Factors related to household food insecurity in the
- 8 Republic of Korea. *Public Health Nutr* 2011;14(6):1080-7
- 9
- 10 28. Armoedesignalement 2013. Den Haag: Centraal Bureau voor de Statistiek | Sociaal en
- 11 Cultureel Planbureau, 2013.
- 12
- 13 29. Feiten en Cijfers Voedselbanken Nederland: Voedselbanken Nederland, 2014.
- 14
- 15 30. Bickel G, Nord M, Price C, et al. Guide to Measuring Household Food Security,
- 16 Revised 2000 Washington DC: USDA: 2000.
- 17
- 18 31. Blumberg SJ, Bialostosky K, Hamilton WL, et al. The effectiveness of a short form of
- 19 the Household Food Security Scale. *Am J Public Health* 1999;89(8):1231-4.
- 20
- 21 32. Martin MA, Lippert AM. Feeding her children, but risking her health: the intersection of
- 22 gender, household food insecurity and obesity. *Soc Sci Med* 2012;74(11):1754-64 doi:
- 23 10.1016/j.socscimed.2011.11.013published Online First: Epub Date]].
- 24
- 25 33. Foley W, Ward P, Carter P, et al. An ecological analysis of factors associated with food
- 26 insecurity in South Australia, 2002-7. *Public Health Nutr* 2010;13(2):215-21 doi:
- 27 10.1017/s1368980009990747published Online First: Epub Date]].
- 28
- 29 34. Kaiser L, Baumrind N, Dumbauld S. Who is food-insecure in California? Findings from
- 30 the California Women's Health Survey, 2004. *Public Health Nutr* 2007;10(6):574-81 doi:
- 31 10.1017/s1368980007382542published Online First: Epub Date]].
- 32
- 33 35. Furness BW, Simon PA, Wold CM, et al. Prevalence and predictors of food insecurity
- 34 among low-income households in Los Angeles County. *Public Health Nutr*
- 35 2004;7(6):791-4.
- 36
- 37 36. Mello JA, Gans KM, Risica PM, et al. How is food insecurity associated with dietary
- 38 behaviors? An analysis with low-income, ethnically diverse participants in a nutrition
- 39 intervention study. *J Am Diet Assoc* 2010;110(12):1906-11.
- 40
- 41 37. Adams EJ, Grummer-Strawn L, Chavez G. Food insecurity is associated with increased
- 42 risk of obesity in California women. *J Nutr* 2003;133(4):1070-4.
- 43
- 44 38. Gooding HC, Walls CE, Richmond TK. Food insecurity and increased BMI in young
- 45 adult women. *Obesity (Silver Spring, Md)* 2012;20(9):1896-901 doi:
- 46 10.1038/oby.2011.233published Online First: Epub Date]].
- 47
- 48 39. Jilcott SB, Wall-Bassett ED, Burke SC, et al. Associations between food insecurity,
- 49 supplemental nutrition assistance program (SNAP) benefits, and body mass index among
- 50 adult females. *J Am Diet Assoc* 2011;111(11):1741-5 doi:
- 51 10.1016/j.jada.2011.08.004published Online First: Epub Date]].
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
- 2
- 3
- 4
- 5
- 6
- 7 40. World Health Organisation (WHO) Expert Committee. Physical status: the use and
- 8 interpretation of anthropometry. Technical Report Series Geneva: WHO, 1995.
- 9
- 10 41. Oberholser CA, Tuttle CR. Assessment of household food security among food stamp
- 11 recipient families in Maryland. *Am J Public Health* 2004;94(5):790-5.
- 12
- 13 42. Mabli J, Cojen R, Potter F, et al. Hunger in America 2010: National report prepared for
- 14 feeding America. Princeton: Mathematica Policy Research Institute; 2010. 06251-600.
- 15
- 16 43. McIntyre L, Glanville NT, Raine KD, et al. Do low-income lone mothers compromise
- 17 their nutrition to feed their children? *CMAJ* 2003;168(6):686-91.
- 18
- 19 44. Radimer KL, Olson CM, Greene JC, et al. Understanding hunger and developing
- 20 indicators to assess it in women and children. *J Nutr Educ* 1992;24(1):36S-45S.
- 21
- 22 45. Ver Ploeg ML, Chang HH, Lin BH. Over, under, or about right: misperceptions of body
- 23 weight among food stamp participants. *Obesity* 2008;16(9):2120-5
- 24
- 25 46. Kerncijfers roken in Nederland 2011. Een overzicht van recente Nederlandse
- 26 basisgegevens over rookgedrag. Den Haag: STIVORO, 2012.
- 27
- 28 47. Visscher TLS, Bakel AM van, Zantinge EM. Overgewicht samengevat. In:
- 29 Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid.
- 30 Bilthoven: RIVM, 2012.
- 31
- 32 48. Gundersen C. Food insecurity is an ongoing national concern. *Adv Nutr* 2013;4(1):36-41
- 33 doi: 10.3945/an.112.003244published Online First: Epub Date]].
- 34
- 35 49. Eicher-Miller HA, Mason AC, Abbott AR, et al. The effect of Food Stamp Nutrition
- 36 Education on the food insecurity of low-income women participants *J Nutr Educ Behav*
- 37 2009;41(3):161-8 doi: 10.1016/j.jneb.2008.06.004published Online First: Epub Date]].
- 38
- 39 50. Nord M. How much does the Supplemental Nutrition Assistance Program alleviate food
- 40 insecurity? Evidence from recent programme leavers. *Public Health Nutr*
- 41 2012;15(5):811-7 doi: 10.1017/s1368980011002709published Online First: Epub Date]].
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

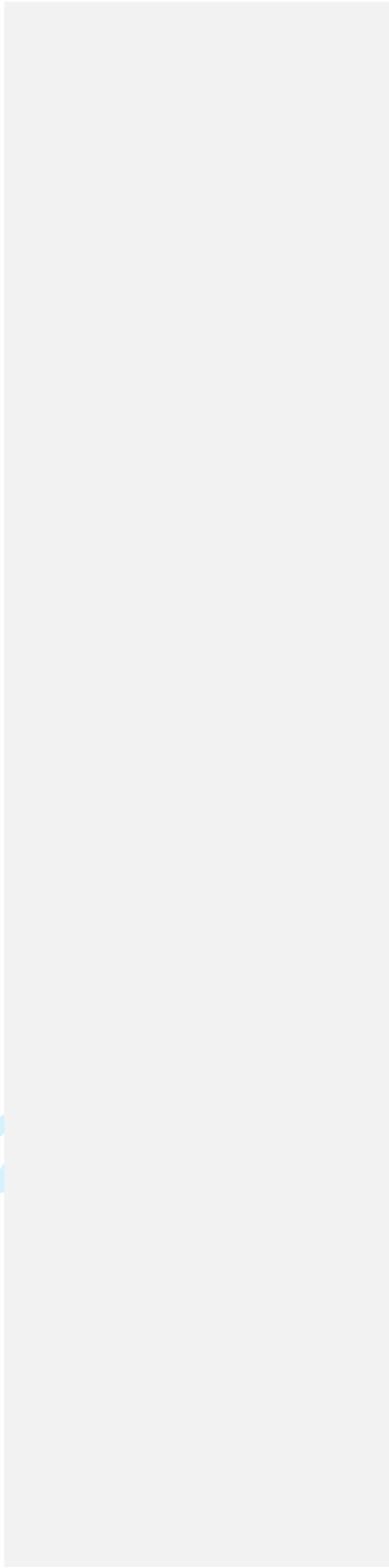
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Figure legend**

Figure 1: Prevalence of food insecurity in 93 male and 158 female Dutch food bank recipients, stratified by sex.

\* Food insecurity with hunger is different from men,  $P=0.001$  (Chi-square test).

For peer review only



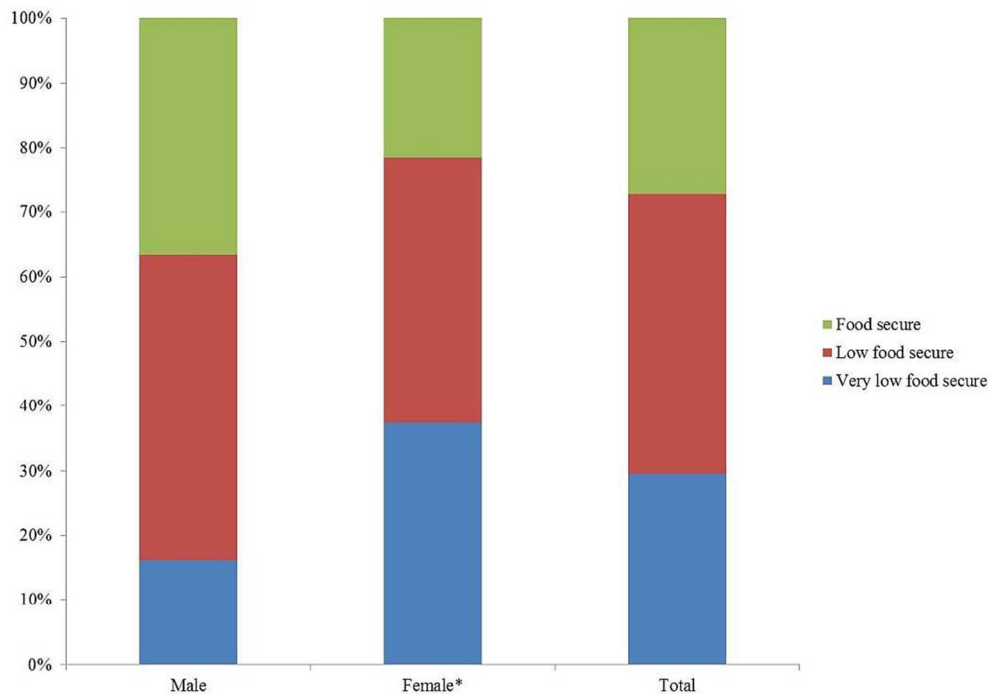


Figure 1: Prevalence of food insecurity in 93 male and 158 female Dutch food bank recipients, stratified by sex.

\* Food insecurity with hunger is different from men, P=0.001 (Chi-square test).

90x63mm (300 x 300 DPI)

ew only

**Web only file**

## Supplemental Table 1: 6-Item Subset (Short Form) of the 3-month Food Security Questionnaire

---

LEAD: These next questions are about the food eaten in your household in the last 3 months and whether you were able to afford the food you need.

I'm going to read you two statements that people have made about their food situation. Please tell me whether the statement was **OFTEN**, **SOMETIMES**, or **NEVER** true for (you/you and the other members of your household) in the last 3 months.

1. The first statement is, "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 3 months? (Possible answers: **often true**, **sometimes true**, never true)

2. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 3 months? (Possible answers: **often true**, **sometimes true**, never true)

3. In the last 3 months, since (date 3 months ago) did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

3a.[Ask only if Q3 = YES] How often did this happen -- almost every week, some weeks but not every week, or in only 1 or 2 weeks in the past three months? Almost every week, some weeks but not every week, 1 or 2 weeks in the past three months, don't know/refusal (Possible answers: **almost every week**, **some weeks but not every week**, in 1 or 2 weeks in the past three months)

4. In the last 3 months, did you ever eat less than you felt you should because there wasn't enough money to buy food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

5. In the last 3 months, were you ever hungry but didn't eat because you couldn't afford enough food? Yes, no, don't know/refusal (Possible answers: **yes**, no)

---

Affirmative answers are typed with **bold** font

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

|                              | Item No | Recommendation   |
|------------------------------|---------|--|
| <b>Title and abstract</b>    | 1       | (a) Indicate the study's design with a commonly used term in the title or the abstract <b>p1/3</b><br>(b) Provide in the abstract an informative and balanced summary of what was done and what was found <b>p3</b>  |
| <b>Introduction</b>          |         |  |
| Background/rationale         | 2       | Explain the scientific background and rationale for the investigation being reported <b>p6/7</b>   |
| Objectives                   | 3       | State specific objectives, including any prespecified hypotheses <b>p7</b>   |
| <b>Methods</b>               |         |  |
| Study design                 | 4       | Present key elements of study design early in the paper <b>p8</b>  |
| Setting                      | 5       | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection <b>p8/9</b>  |
| Participants                 | 6       | (a) Give the eligibility criteria, and the sources and methods of selection of participants <b>p8/9</b>  |
| Variables                    | 7       | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable <b>p9-12</b>  |
| Data sources/<br>measurement | 8*      | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group <b>p9-11</b>  |
| Bias                         | 9       | Describe any efforts to address potential sources of bias <b>p12</b>   |
| Study size                   | 10      | Explain how the study size was arrived at <b>p8/9</b>  |
| Quantitative variables       | 11      | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why <b>p9-11</b>  |
| Statistical methods          | 12      | (a) Describe all statistical methods, including those used to control for confounding <b>p11/12</b><br>(b) Describe any methods used to examine subgroups and interactions <b>p11/12</b><br>(c) Explain how missing data were addressed <b>not applicable</b><br>(d) If applicable, describe analytical methods taking account of sampling strategy <b>not applicable</b><br>(e) Describe any sensitivity analyses <b>not applicable</b> |
| <b>Results</b>               |         |  |
| Participants                 | 13*     | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed <b>p8/9/12</b><br>(b) Give reasons for non-participation at each stage <b>p8/9</b><br>(c) Consider use of a flow diagram <b>not applicable</b>   |
| Descriptive data             | 14*     | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders <b>p13/14</b><br>(b) Indicate number of participants with missing data for each variable of interest <b>p14</b>   |
| Outcome data                 | 15*     | Report numbers of outcome events or summary measures <b>p14</b>  |
| Main results                 | 16      | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included <b>p15/16, 17-19</b>  |



|                          |    |  |
|--------------------------|----|--|
|                          |    | (b) Report category boundaries when continuous variables were categorized <b>p13/14</b>  |
|                          |    | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period <b>not applicable</b>   |
| Other analyses           | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses <b>p16</b>  |
| <b>Discussion</b>        |    |  |
| Key results              | 18 | Summarise key results with reference to study objectives <b>p21</b>  |
| Limitations              | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias <b>p23</b>                    |
| Interpretation           | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence <b>p21-23</b> |
| Generalisability         | 21 | Discuss the generalisability (external validity) of the study results <b>p21</b>   |
| <b>Other information</b> |    |  |
| Funding                  | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based <b>p2</b>                  |

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).