# Supplemental methods: description of the four nutrient profiling systems

***Original FSA-NPS***(1)

The original FSA-NPS takes into account the nutritional composition for 100g of foods (or 100 mL of beverages), in unfavourable elements (i.e. energy, saturated fats, sugars, and sodium; leading to a total of A points) and favourable elements (i.e. proteins, fibres, and fruits, vegetables & nuts; leading to a total of C points).

**Food categories:**

The original FSA-NPS considers one single food category for all foods and beverages.

**Step 1:** **Calculation of A points**

Total A points = [points of energy] + [points of sat fat] + [points of total sugar] + [points of sodium]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Points*** | **Energy (kJ)** | **Saturated Fat (g)** | **Total Sugars (g)** | **Sodium (mg)** |
| 0 | ≤ 335 | ≤ 1 | ≤ 4.5 | ≤ 90 |
| 1 | > 335 | > 1 | > 4.5 | > 90 |
| 2 | > 670 | > 2 | > 9 | > 180 |
| 3 | > 1005 | > 3 | > 13.5 | > 270 |
| 4 | > 1340 | > 4 | > 18 | > 360 |
| 5 | > 1675 | > 5 | > 22.5 | > 450 |
| 6 | > 2010 | > 6 | > 27 | > 540 |
| 7 | > 2345 | > 7 | > 31 | > 630 |
| 8 | > 2680 | > 8 | > 36 | > 720 |
| 9 | > 3015 | > 9 | > 40 | > 810 |
| 10 | > 3350 | > 10 | > 45 | > 900 |

**Step 2: Calculation of C points**

Total C points = [points of fruits, vegetables & nuts] + [points of fibre] + [points of protein]

|  |  |  |  |
| --- | --- | --- | --- |
| ***Points*** | **Fruits, Vegetables & nuts (%)** | **Fibre (g)** | **Protein (g)** |
| 0 | ≤ 40 | ≤ 0.9 | ≤ 1.6 |
| 1 | > 40 | > 0.9 | > 1.6 |
| 2 | > 60 | > 1.9 | > 3.2 |
| 3 | - | > 2.8 | > 4.8 |
| 4 | - | > 3.7 | > 6.4 |
| 5 | > 80 | > 4.7 | > 8.0 |

**Step 3: Calculation of the final score**

* If Total A points < 11 points, then FSA score = Total A points – Total C points
* If Total A points ≥ 11 points and [points of fruits, vegetables & nuts] = 5 then FSA score = Total A points – Total C points
* If Total A points ≥ 11 points and [points of fruits, vegetables & nuts] < 5 then FSA score = Total A points – [points of fruits, vegetables & nuts] - [points of fibre]

**NPSC**(2)

The NPSC has been adapted from the original FSA-NPS, taking into account the nutritional composition for 100g of foods (or 100 mL of beverages), in unfavourable elements (i.e. energy, saturated fats, sugars, and sodium; leading to a total of A points) and favourable elements (i.e. proteins, fibres, and fruits, vegetables & nuts; leading to a total of C points). Some modifications have been made on the food categories or the points’ allocations for some nutrients.

**Food categories:**

The NPSC considers three different food categories for the score calculation:

* Category C1: beverages
* Category C2: all foods not included in C1 or C3
* Category C3: cheeses and processed cheeses with >320mg calcium/100g, edible oil, edible oil spreads, margarine and butter

**Step 1: Calculation of A points**

Total A points = [points of energy] + [points of sat fat] + [points of total sugar] + [points of sodium]

* Categories C1 and C2: same grids as for the original FSA-NPS
* Category C3: Total A points for foods in this category were extended linearly to 11 points for energy, 30 points for saturated fat, and 30 points for sodium.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Points*** | **Energy (kJ)** | **Saturated Fat (g)** | **Total Sugars (g)** | **Sodium (mg)** |
| 0 | ≤ 335 | ≤ 1 | ≤ 5 | ≤ 90 |
| 1 | > 335 | > 1 | > 5 | > 90 |
| 2 | > 670 | > 2 | > 9 | > 180 |
| 3 | > 1005 | > 3 | > 13.5 | > 270 |
| 4 | > 1340 | > 4 | > 18 | > 360 |
| 5 | > 1675 | > 5 | > 22.5 | > 450 |
| 6 | > 2010 | > 6 | > 27 | > 540 |
| 7 | > 2345 | > 7 | > 31 | > 630 |
| 8 | > 2680 | > 8 | > 36 | > 720 |
| 9 | > 3015 | > 9 | > 40 | > 810 |
| 10 | > 3350 | > 10 | > 45 | > 900 |
| 11 | > 3685 | > 11 |  | > 990 |
| 12 |  | > 12 |  | > 1080 |
| 13 |  | > 13 |  | > 1170 |
| 14 |  | > 14 |  | > 1260 |
| 15 |  | > 15 |  | > 1350 |
| 16 |  | > 16 |  | > 1440 |
| 17 |  | > 17 |  | > 1530 |
| 18 |  | > 18 |  | > 1620 |
| 19 |  | > 19 |  | > 1710 |
| 20 |  | > 20 |  | > 1800 |
| 21 |  | > 21 |  | > 1890 |
| 22 |  | > 22 |  | > 1980 |
| 23 |  | > 23 |  | > 2070 |
| 24 |  | > 24 |  | > 2160 |
| 25 |  | > 25 |  | > 2250 |
| 26 |  | > 26 |  | > 2340 |
| 27 |  | > 27 |  | > 2430 |
| 28 |  | > 28 |  | > 2520 |
| 29 |  | > 29 |  | > 2610 |
| 30 |  | > 30 |  | > 2700 |

**Step 2:** **Calculation of C points**

Total C points = [points of fruits, vegetables & nuts] + [points of fibre] + [points of protein]

For the three food categories, the attribution of points for fruits, vegetables & nuts is modified as follows:

* The points can be scored for fruits, vegetables, nuts and legumes, including coconut, spices, herbs, fungi, seeds, algae and potatoes.
* When the content in fruits, vegetables & nuts is equal to 100%, 8 points are attributed instead of 5.
* A distinction is made if the food contains concentrated of non-concentrated fruits, vegetables & nuts.

|  |  |  |
| --- | --- | --- |
| ***Points*** | **Fruits, Vegetables & nuts (%)** | |
| Concentrated | Non-concentrated |
| 0 | < 25 | ≤ 40 |
| 1 | ≥ 25 | > 40 |
| 2 | ≥ 43 | > 60 |
| 5 | ≥ 67 | > 80 |
| 8 | = 100 | = 100 |

For foods from category C1 (beverages), fibres content is not taken into account.

**Step 3: Calculation of the final score**

The computation of the FSA score based on the NPSC is modified as follows:

* Category C1:
* If Total A points < 13 points, then FSA score = Total A points – [points of fruits, vegetables & nuts] - [points of protein]
* If Total A points ≥ 13 points and [points of fruits, vegetables & nuts] ≥ 5 then FSA score = Total A points – [points of fruits, vegetables & nuts] - [points of protein]
* If Total A points ≥ 13 points and [points of fruits, vegetables & nuts] < 5 then FSA score = Total A points – [points of fruits, vegetables & nuts]
* Categories C2 and C3:
* If Total A points < 13 points, then FSA score = Total A points – Total C points
* If Total A points ≥ 13 points and [points of fruits, vegetables & nuts] ≥ 5 then FSA score = Total A points – Total C points
* If Total A points ≥ 13 points and [points of fruits, vegetables & nuts] < 5 then FSA score = Total A points – [points of fruits, vegetables & nuts] - [points of fibre]

**HSR-NPS**(3)

The HSR-NPS, closed to the NPSC, takes into account the nutritional composition for 100g of foods (or 100 mL of beverages), in unfavourable elements (i.e. energy, saturated fats, sugars, and sodium; leading to a total of A points) and favourable elements (i.e. proteins, fibres, and fruits, vegetables & nuts; leading to a total of C points). Some modifications have been made on the food categories or the points’ allocations for some nutrients.

**Food categories:**

The HSR-NPS considers six different food categories for the score calculation:

* Category C1: beverages other than dairy beverages
* Category C1D: dairy beverages
* Category C2: all foods other than those from categories C1, C1D, C2D, C3 or C3D
* Category C2D: dairy foods other than those from categories C1D or C3D
* Category C3: edible oil, edible oil spreads, margarine and butter
* Category C3D: cheeses and processed cheeses with >320mg calcium/100g

**Step 1:** **Calculation of A points**

Total A points = [points of energy] + [points of sat fat] + [points of total sugar] + [points of sodium]

* Categories C1, C1D, C2, C2D: the grids based on the NPSC for points’ attribution regarding saturated fat, total sugars and sodium were modified as follows

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Points*** | **Energy (kJ)** | **Saturated Fat (g)** | **Total Sugars (g)** | **Sodium (mg)** |
| 0 | ≤ 335 | ≤ 1 | ≤ 5 | ≤ 90 |
| 1 | > 335 | > 1 | > 5 | > 90 |
| 2 | > 670 | > 2 | > 9 | > 180 |
| 3 | > 1005 | > 3 | > 13.5 | > 270 |
| 4 | > 1340 | > 4 | > 18 | > 360 |
| 5 | > 1675 | > 5 | > 22.5 | > 450 |
| 6 | > 2010 | > 6 | > 27 | > 540 |
| 7 | > 2345 | > 7 | > 31 | > 630 |
| 8 | > 2680 | > 8 | > 36 | > 720 |
| 9 | > 3015 | > 9 | > 40 | > 810 |
| 10 | > 3350 | > 10 | > 45 | > 900 |
| 11 | > 3685 | > 11.2 | > 49 | > 1005 |
| 12 |  | > 12.5 | > 54 | > 1121 |
| 13 |  | > 13.9 | > 58 | > 1251 |
| 14 |  | > 15.5 | > 63 | > 1397 |
| 15 |  | > 17.3 | > 67 | > 1559 |
| 16 |  | > 19.3 | > 72 | > 1740 |
| 17 |  | > 21.6 | > 76 | > 1942 |
| 18 |  | > 24.1 | > 81 | > 2168 |
| 19 |  | > 26.9 | > 85 | > 2420 |
| 20 |  | > 30.0 | > 90 | > 2701 |
| 21 |  | > 33.5 | > 94 | > 3015 |
| 22 |  | > 37.4 | > 99 | > 3365 |
| 23 |  | > 41.7 |  | > 3756 |
| 24 |  | > 46.6 |  | > 4192 |
| 25 |  | > 52.0 |  | > 4679 |
| 26 |  | > 58.0 |  | > 5223 |
| 27 |  | > 64.7 |  | > 5829 |
| 28 |  | > 72.3 |  | > 6506 |
| 29 |  | > 80.6 |  | > 7262 |
| 30 |  | > 90 |  | > 8106 |

* Categories C3 and C3D: the grids for points’ attribution regarding energy, saturated fat, total sugar and sodium were similar to the category C3 of the NPSC.

**Step 2:** **Calculation of C points**

Total C points = [points of fruits, vegetables & nuts] + [points of fibre] + [points of protein]

For all food categories, the food components taken into account to compute the points of fruits, vegetables & nuts are similar to the NPSC. However, the number of points is modified as follows:

|  |  |  |
| --- | --- | --- |
| ***Points*** | **Fruits, Vegetables & nuts (%)** | |
| Concentrated | Non-concentrated |
| 0 | < 25 | ≤ 40 |
| 1 | ≥ 25 | > 40 |
| 2 | ≥ 43 | > 60 |
| 3 | ≥ 52 | > 67 |
| 4 | ≥ 63 | > 75 |
| 5 | ≥ 67 | > 80 |
| 6 | ≥ 80 | > 90 |
| 7 | ≥ 90 | > 95 |
| 8 | = 100 | = 100 |

For all food categories, the grids for points’ attribution regarding proteins and fibres are modified as follows:

| ***Points*** | **Fibre (g)** | **Protein (g)** |
| --- | --- | --- |
| 0 | ≤ 0.9 | ≤ 1.6 |
| 1 | > 0.9 | > 1.6 |
| 2 | > 1.9 | ≥ 3.2 |
| 3 | > 2.8 | > 4.8 |
| 4 | > 3.7 | > 6.4 |
| 5 | > 4.7 | > 8.0 |
| 6 | > 5.4 | > 9.6 |
| 7 | > 6.3 | > 11.6 |
| 8 | > 7.3 | > 13.9 |
| 9 | > 8.4 | > 16.7 |
| 10 | > 9.7 | > 20.0 |
| 11 | > 11.2 | > 24.0 |
| 12 | > 13.0 | > 28.9 |
| 13 | > 15.0 | > 34.7 |
| 14 | > 17.3 | > 41.6 |
| 15 | > 20.0 | > 50.0 |

**Step 3: Calculation of the final score**

The computation of the FSA score based on the HSR-NPS for categories C1 and C1D is similar to the computation of FSA score for foods in category C1 in the NPSC. The computation of the FSA score for categories C2, C2D, C3 and C3D is similar to the computation of FSA score for foods in categories C2 and C3 in the NPSC.

**French HCSP-NPS**(4)

The HCSP-NPS has been adapted from the original FSA-NPS, taking into account the nutritional composition for 100g of foods (or 100 mL of beverages), in unfavourable elements (i.e. energy, saturated fats, sugars, and sodium; leading to a total of A points) and favourable elements (i.e. proteins, fibres, and fruits, vegetables & nuts; leading to a total of C points).

**Food categories:**

The HCSP-NPS considers four different food categories for the score calculation:

* Category C1: beverages
* Category C2: all foods not included in C1, C3 or C4
* Category C3: cheeses
* Category C4: fats

**Step 1: Calculation of A points**

Total A points = [points of energy] + [points of sat fat] + [points of total sugar] + [points of sodium]

* Category C1: for beverages, the grids for points’ attribution regarding energy and total sugars were modified. The attribution of points for sugars takes into account the presence of sweeteners, in which case the grid maintains the total sugar score to 1 (instead of 0).

|  |  |  |
| --- | --- | --- |
| ***Points*** | **Energy (kJ)** | **Total Sugar (g)** |
| 0 | ≤ 0 | ≤ 0 |
| 1 | ≤ 30 | ≤ 1.5 |
| 2 | ≤ 60 | ≤ 3 |
| 3 | ≤ 90 | ≤ 4.5 |
| 4 | ≤ 120 | ≤ 6 |
| 5 | ≤ 150 | ≤ 7.5 |
| 6 | ≤ 180 | ≤ 9 |
| 7 | ≤ 210 | ≤ 10.5 |
| 8 | ≤ 240 | ≤ 12 |
| 9 | ≤ 270 | ≤ 13.5 |
| 10 | > 270 | > 13.5 |

* Categories C2 and C3: same grids as for the original FSA-NPS
* Category C4: for fats, the saturated fat component was modified as follows:

|  |  |
| --- | --- |
| ***Points*** | **Ratio saturated fats / total fats** |
| 0 | < 10 |
| 1 | < 16 |
| 2 | < 22 |
| 3 | < 28 |
| 4 | < 34 |
| 5 | < 40 |
| 6 | < 46 |
| 7 | < 52 |
| 8 | < 58 |
| 9 | < 64 |
| 10 | ≥ 64 |

**Step 2:** **Calculation of C points**

Total C points = [points of fruits, vegetables & nuts] + [points of fibre] + [points of protein]

* Category C1: for beverages, the grid for points’ attribution for the fruits, vegetables & nuts component was modified as follows:

|  |  |
| --- | --- |
| ***Points*** | **Fruits, Vegetables & nuts (%)** |
| 0 | ≤ 40 |
| 2 | > 40 |
| 4 | > 60 |
| 10 | > 80 |

The grids for points’ attribution regarding favourable elements are similar to the original FSA-NPS for the categories C2, C3 and C4.

**Step 3: Calculation of the final score**

* Categories C1, C3 and C4: the computation of the FSA score is similar to the original FSA-NPS.
* Category C2: for cheeses, the score takes into account the protein content, whether the A score reaches 11 or not, i.e.: FSA score = Total A points – Total C points

**References**

1. Rayner M, Scarborough P & Lobstein T (2009) The UK Ofcom Nutrient Profiling Model - Defining ‘Healthy’ and ‘Unhealthy’ Food and Drinks for TV Advertising to Children. Available online: https://www.ndph.ox.ac.uk/cpnp/files/about/uk-ofcom-nutrient-profile-model.pdf (accessed on 10 August 2017). .

2. (2016) Australia New Zealand Food Standards Code - Schedule 5 - Nutrient profiling scoring method.

3. Guide for industry to the Health Star Rating Calculator (HSRC). Australian Government Department of Health.

4. Haut Conseil de la santé publique (2015) On information regarding the nutritional quality of foodstuffs.

# Supplemental Table 1. Description of the four dietary indexes and correlation between indices (NutriNet-Santé sample N=71,403)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Dietary indexes** | **Mean (SD)** | **Median** | **Minimum** | **Maximum** | **Spearman correlations coefficients for tertiles variables** | | |
| **NPSC-DI** | **HSR-DI** | **HCSP-DI** |
| Original FSA-DI | 6.95 (2.50) | 7.02 | -4.83 | 18.55 | 0.95 | 0.95 | 0.97 |
| NPSC-DI | 7.26 (2.91) | 7.37 | -7.36 | 22.03 | - | 0.99 | 0.90 |
| HSR-DI | 7.09 (3.33) | 7.21 | -11.77 | 22.38 | - | - | 0.91 |
| HCSP-DI | 6.66 (2.54) | 6.71 | -4.83 | 18.31 | - | - | - |

DI: Dietary Index; FSA: Food Standards Agency; HCSP: High Council for Public Health; HSR: Health Star Rating; NPSC: Nutrient Profiling System Criterion; SD: Standard Deviation

**Supplemental Table 2. Association between the four individual dietary indices and weight gain, adjusted for the proportion of ultra-processed food intake in the diet (NutriNet-Santé sample N=71,403)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Original Foods Standards Agency-Dietary Index** | | **NPSC-Dietary Index** | | **Health Star Rating-Dietary Index** | | **HCSP-Dietary Index** | |
| **β (95% CI)** | **P-value** | **β (95% CI)** | **P-value** | **β (95% CI)** | **P-value** | **β (95% CI)** | **P-value** |
| Tertile 2 (BMI difference at baseline with the reference – T1) | 0.38 (0.11-0.66) | 0.006 | 0.52 (0.25-0.58) | <0.0001 | 0.32 (0.05-0.60) | 0.02 | 0.60 (0.32-0.88) | <0.0001 |
| Tertile 3 (BMI difference at baseline with the reference – T1) | 0.13 (-0.17-0.44) | 0.4 | 0.29 (0.00-0.58) | 0.05 | -0.13 (-0.42-0.16) | 0.4 | 0.27 (-0.05-0.59) | 0.1 |
| Time (weight gain / year in the reference – T1) | 0.09 (0.07-0.10) | <0.0001 | 0.11 (0.09-0.12) | <0.0001 | 0.11 (0.09-0.12) | <0.0001 | 0.08 (0.06-0.09) | <0.0001 |
| Time\*tertile 2 (additional BMI gain / year compared to T1) | 0.05 (0.02-0.07) | 0.0001 | 0.05 (0.03-0.08) | <0.0001 | 0.05 (0.02-0.07) | <0.0001 | 0.06 (0.04-0.08) | <0.0001 |
| Time\*tertile 3 (additional BMI gain / year compared to T1) | 0.14 (0.12-0.16) | <0.0001 | 0.09 (0.06-0.11) | <0.0001 | 0.09 (0.07-0.11) | <0.0001 | 0.18 (0.16-0.20) | <0.0001 |

CI: Confidence Interval; HCSP: High Council for Public Health; NPSC: Nutrient Profiling System Criterion; T: Tertile

a Models were adjusted for age, sex, level of monthly income, educational level, marital status, physical activity, energy intake, alcohol intake, and season of dietary data collection. Analyses were computed overall, and by sex.

b Estimates β of parameters, corresponding to the modelling of log(BMI), were thus transformed as follows: β’=[Exponential(β)-1]\*100, interpreted as a variation of BMI in percentage.

**Supplemental Table 3. Prospective associations between the four individual dietary indices and overweight or obesity risk, adjusted for the proportion of ultra-processed food intake in the diet**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Original Foods Standards Agency-Dietary Index** | | | **NPSC-Dietary Index** | | | **Health Star Rating-Dietary Index** | | | **HCSP-Dietary Index** | | |
| **Cases / person-years** | **HR[95%CI]** | ***P-trend*** | **Cases / person-years** | **HR[95%CI]** | ***P-trend*** | **Cases / person-years** | **HR[95%CI]** | ***P-trend*** | **Cases / person-years** | **HR[95%CI]** | ***P-trend*** |
| **Overweight (NutriNet-Santé sample N=40,096)** | | | | | | | | | | | | |
| Continuous | 4488/199045 | 1.02 [1.00-1.03] | 0.03 | 4488/199045 | 1.01 [1.00-1.03] | 0.03 | 4488/199045 | 1.01 [1.00-1.02] | 0.06 | 4488/199045 | 1.02 [1.01-1.04] | 0.002 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Tertile 1 | 1335/68010 | 1 (ref) | 0.05 | 1327/67637 | 1 (ref) | 0.09 | 1345/67497 | 1 (ref) | 0.2 | 1296/68539 | 1 (ref) | 0.001 |
| Tertile 2 | 1505/67364 | 1.04 [0.96-1.12] |  | 1550/66578 | 1.09 [1.01-1.18] |  | 1536/66740 | 1.06 [0.99-1.14] |  | 1518/67607 | 1.09 [1.01-1.17] |  |
| Tertile 3 | 1648/63671 | 1.09 [1.00-1.18] |  | 1611/64830 | 1.08 [0.99-1.16] |  | 1607/64808 | 1.05 [0.97-1.14] |  | 1674/62899 | 1.16 [1.06-1.26] |  |
| **Obesity (NutriNet-Santé sample N=50,569)** | | | | | | | | | | | | |
| Continuous | 1582/269051 | 0.99 [0.97-1.01] | 0.4 | 1582/269051 | 1.00 [0.98-1.02] | 0.8 | 1582/269051 | 0.99 [0.97-1.01] | 0.3 | 1582/269051 | 0.99 [0.97-1.02] | 0.5 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Tertile 1 | 476/91288 | 1 (ref) | 0.3 | 474/90892 | 1 (ref) | 0.7 | 480/90767 | 1 (ref) | 0.3 | 470/91856 | 1 (ref) | 0.3 |
| Tertile 2 | 524/90962 | 0.95 [0.84-1.08] |  | 525/90346 | 0.98 [0.86-1.11] |  | 534/90316 | 0.98 [0.86-1.11] |  | 529/91305 | 0.97 [0.84-1.10] |  |
| Tertile 3 | 582/86802 | 0.92 [0.80-1.06] |  | 583/87813 | 0.98 [0.86-1.12] |  | 568/87968 | 0.93 [0.81-1.06] |  | 583/85890 | 0.92 [0.80-1.07] |  |

HR: Hazard Ratio; CI: Confidence Interval; HCSP: High Council for Public Health; NPSC: Nutrient Profiling System Criterion

a Models were adjusted for age (time-scale), sex, level of monthly income, educational level, physical activity, energy intake, alcohol intake, number of dietary records, and season of dietary data collection.