Supplementary Material

**Supplemental Method 1.** Selection of nutrients and reference values to calculate the SecDiet score.

**Nutrients included:**

Vitamin A: Vitamin A is essential to ensure normal vision, growth and development. The main outcome related to vitamin A deficiency is xerophtalmia, which in the most extreme case can lead to irreversible blindness. IOM and EFSA have set their recommendations based on the intake necessary to ensure adequate stores(1–3). Only the WHO has defined a minimum daily intake necessary to prevent xerophtalmia, in the absence of clinical or subclinical infection, without ensuring liver storage. This mean requirement has been estimated as 300µg RE/day for men and 270µg/day for women(4). These reference values were used as the deficiency threshold (DT) for vitamin A, with a CV of 15%.

Thiamin: Thiamin is an essential vitamin because of its role as a coenzyme in the metabolism of carbohydrates and branched-chain amino acids. Thiamin deficiency manifests itself in the form of beriberi disease or as Wernicke-Korsakoff syndrome. Reference values are mainly based on erythrocyte transketolase activity, which is used as a marker of thiamin status(1–3,5). However, these reference values do not involve the onset of deficiency symptoms, so we defined an estimated deficiency threshold (eDT). This eDT was calculated as the intake covering the requirements of 2.5% of the population and is therefore estimated as . The EFSA has set the EAR at 0.3mg/1000kcal/day and the RDA at 0.4mg/1000kcal/day with a CV of 20%(1). The eDT is therefore set at 0.18mg/1000kcal/day. This threshold is quite consistent with studies that observed clinical signs of deficiency at intakes below 0.2 mg/1000kcal, as reported by the NCM(5).

Riboflavin: Riboflavin is a precursor of coenzymes that acts in numerous oxidation-reduction reactions in metabolic pathways and energy production. The clinical signs of riboflavin deficiency, ariboflavinosis, are nonspecific, and can take different forms such as a sore throat, cheilosis, angular stomatitis, etc. An adequate riboflavin intake has been determined using different indicators such as urinary riboflavin excretion, erythrocyte glutathione reductase activity coefficient or plasma riboflavin(2–5). The EFSA used the inflection point of the urinary riboflavin excretion curve, which is a sign of body saturation, and set the EAR at 1.3 mg/day and the RDA at 1.6 mg/day with a CV of 10%(1). In the same way as for thiamin, reference values were not set at the onset of clinical signs of deficiency and an eDT was calculated and set at 1.0 mg/day using EFSA reference values.

Niacin: Niacin is a precursor of the coenzymes involved in the metabolism of glucose, amino acids and fatty acids. Pellagra is the disease that appears in case of niacin deficiency. Niacin requirements are estimated using the urinary excretion of niacin metabolites and are expressed as niacin equivalent to take account of the conversion of tryptophan into niacin(2,3,5). The EFSA based its reference values using depletion-repletion studies and set the EAR at 1.3 mg NE/MJ (5.5 mg NE/1000kcal), based on the rationale that this intake is sufficient to prevent depletion and maintain niacin body stores. Assuming a CV of 10%, the RDA was set at 1.6 mg NE/MJ (6.6 mg NE/1000kcal). The EFSA also noted that there were no signs of niacin deficiency with intakes of at least 1 mg/NE/MJ (4.4 mg NE/1000kcal) for a minimal daily energy intake of 8.4 MJ/day (2000kcal/day)(1). Since the reference values were not based on the appearance of clinical signs of deficiency, an eDT was estimated, based on the EFSA reference values, and set at 1.0 mg/NE/MJ (4.35 mg/1000kcal), which is in line with the minimum intake indicated by EFSA and NCM(1,5).

Folate: Folate acts as a coenzyme in the metabolism of nucleic and amino acids and is also fundamental for the normal functioning of the methionine cycle. The main clinical sign of folate deficiency in adults is megaloblastic anaemia. In pregnant women, folate intakes need to be increased to reduce risk of neural tube defects. The requirements for folate are based on the minimum amounts needed to maintain adequate levels of biomarkers such as serum or erythrocyte folates or plasma homocysteine(1,2,4). Since the reference values were not based on the appearance of clinical signs of deficiency, an eDT was estimated based on the EFSA reference values. The EFSA has set an EAR of 250 µg/day and a RDA of 330 µg/day with a CV of 15%, based on a depletion-repletion study(1). The eDT was therefore set at 175 µg/day.

Vitamin B12: Vitamin B12 plays an essential role in normal blood formation and neurological function. It acts as a coenzyme in the reaction that converts homocysteine to methionine and is also implicated in the metabolism of fatty acids and amino acids. The earliest symptom of vitamin B12 deficiency is similar to that of folate deficiency and takes the form of megaloblastic anaemia, but additional neurological dysfunction may eventually occur. The requirements for vitamin B12 are based on evaluating several biomarkers of vitamin B12 status(1–3). The NNR determined that the lowest dietary intake needed to prevent anaemia is 1 µg/day(5) and this value was selected as the threshold for the calculation of the SecDiet, with a CV of 15%.

Vitamin C: Vitamin C acts as an enzyme cofactor and antioxidant. The clinical form of vitamin C deficiency is scurvy and occurs with a body pool lower than 300 mg and a plasma ascorbate concentration lower than 11 µmol/L. Scurvy can be prevented by an intake of 10 mg/day of vitamin C(1,2,4). This value was selected as the threshold for the calculation of the SecDiet with a CV of 10% (CV assumed by the EFSA(1)).

Iodine: Iodine is an essential component for the synthesis of thyroid hormones which are crucial for numerous physiological functions (growth, development of neurological and cognitive functions, protein synthesis, etc.). The consequence of iodine deficiency is impaired thyroid function that may lead to thyroid hypertrophy resulting in goitre, mental retardation or cretinism. Iodine requirements are mainly based on thyroid iodine accumulation and turnover(1–3). The EFSA has defined an Adequate Intake based on the prevalence of goitre. A European epidemiological study found that the lowest prevalence of goitre was observed with a urinary iodine concentration above 100 µg/L, which corresponds to an iodine intake at around 150 µg/day. An Adequate Intake of 150 µg/day was thus defined for adults(1). The Adequate Intake was taken as the deficiency threshold, with a CV of 20%. However, it appears that this threshold overestimated the risk of iodine deficiency so, using the national prevalence of goitre (which is approximately 10% in France(6)), we readjusted the estimation of the risk of deficiency (by dividing the deficiency threshold by an adequate factor of 1.5) in order to obtain a probability of adequacy of 0.9 in the French national representative survey INCA3. The recalibrated DT was therefore set at 100 µg/day with a CV of 20%.

Selenium: Selenium, via selenoproteins, plays a role, among others, in the metabolism of thyroid hormones and in the defences against oxidative stress. Selenium requirements are defined as the intake needed to maximize the activity of plasma selenoprotein glutathione peroxidase(2,3). Selenium deficiency leads to Keshan disease, which was first observed in Chinese regions where soil selenium concentrations are low. Epidemiological studies were used to establish a population basal requirement for selenium and concluded that Keshan disease was not present in regions where the mean intake of selenium for adults was higher than 19.1 µg/day for males and 13.3 µg/day for females. These thresholds were adapted to use a standard reference body weight of 65 kg for men and 55kg for women. The population minimum intake of selenium defined by the FAO is therefore 21 µg/day for males and 16 µg/day for females(4,7), and this was taken as the reference for the SecDiet with a CV of 15%.

Iron: Most of the body’s iron reserves are found in hemoglobin and muscle myoglobin and contribute to oxygen transport. Iron deficiency causes anaemia, which is the most common nutritional deficiency worldwide, and corresponds to low haemoglobin concentrations. Iron deficiency can also lead to depleted stores when serum ferritin concentrations are low. Iron intake requirements are based on the modelling of obligatory losses while taking account of iron absorption(1,2). Although the requirements are not based on iron deficiency, we considered that those based on obligatory losses were adequate to define the deficiency threshold. We therefore considered the Anses recommendations that are based on the modeling of obligatory losses but applied to bioavailable iron. For men and non-menstruating women, an EAR of 6 mg/d, RDA of 11 mg/d and CV of 40% defined by Anses were therefore used for iron(3). Assuming iron absorption of 16%, the EAR and RDA correspond respectively to 0.95 mg/day and 1.74 mg/day of bioavailable iron. The deficiency threshold was therefore set at 1.74 mg/d of bioavailable iron, with a CV of 40%. For menstruating women, the distribution of their requirements is not normal and was modelled using a lognormal function by adding basal iron losses (normally distributed) to menstrual losses (exponentially distributed, λ=ln(2)/0.28) with a Monte-Carlo simulation on 1000 individuals in the same way as the calculation of the PANDiet(8). Since the combination of basal and menstrual losses followed a lognormal distribution, it was considered that the logarithm of physiological requirements followed a normal distribution (µ=0.18, σ=0.34). As for iodine, the threshold used overestimated the risk of iron deficiency, so based on the prevalence of anaemia in the French population (2% among men and 5.1% among women(9)) we readjusted it by dividing by a factor of 2.5 for men and non-menstruating women and 2.8 for menstruating women in order to obtain a probability of adequacy of 0.98 for men and 0.95 for women in the French national representative survey INCA3. The corrected DT was set at 0.70 mg/day with a CV of 40% for men and non-menstruating women. For menstruating women, the DT was set at 0.83 mg/day.

Bioavailable iron was estimated using a mathematical model. Nonhaeme iron absorption is dependent on individual concentration of serum ferritin and on dietary factors such as vitamin C, meat, fish and poultry, tea, phytate and calcium intakes. Haeme iron absorption is only dependent on serum ferritin levels. The following equation was used to calculate nonhaeme iron absorption(10):

For haeme iron absorption, the following equation was used (11):

where SF is serum ferritin (mg/L), C is vitamin C (mg), MFP is meat, fish, and poultry (g), T is tea (number of cups), P is phytate (mg), Ca is calcium (mg), and NH is nonhaeme iron (mg).

Because no data were available on the serum ferritin status of individuals, the serum ferritin level was set at 15 mg/L corresponding to the cut-off value for low ferritin stores. However, this hypothesis overestimates the absorption, since iron absorption is maximal at low ferritin stores.

Zinc: Zinc is essential for growth and development and has a catalytic role in various enzymatic processes. There are no specific clinical signs of deficiency in adults but skin lesions, diarrhoea, alopecia, impaired immune system may appear. In children, growth retardation is the main clinical sign. A vegetarian diet may lead to low zinc status because of the high content in plant-based foods of phytates that reduce zinc absorption. There are no adequate biomarkers for zinc status from which to derive requirements. Zinc requirements were thus estimated using a factorial approach considering physiological requirements, by estimating total daily losses and zinc absorption(1,2,4,12). We estimated the deficiency threshold for bioavailable zinc from estimates of obligatory losses. For men, urinary and sweat losses, integumental losses and losses in semen are estimated respectively at 0.63 mg/d, 0.54 mg/d and 0.1 mg/d. For women, urinary and sweat losses, integumental losses and menstrual losses are estimated respectively at 0.44 mg/d, 0.46 mg/d and 0.1 mg/d(5,13). Losses from the intestine could not be precisely determined because they depend on the quantity of zinc absorbed, and this was estimated to be 0.3 mg/d. It was therefore considered that total endogenous losses reached 1.6 mg/d for men and 1.3 mg/d for women and these two values were retained to define the deficiency threshold, with a CV of 15%.

The following mathematical model was used to calculate bioavailable zinc from dietary zinc and phytate intakes(14) :

TAZ: total absorbed zinc (mmol), TDZ: total dietary zinc (mmol) and TDP: total dietary phytate (mmol).

Calcium: Calcium is an essential and structural component of the skeleton and more than 99 percent of total body calcium is present in the bones and teeth. When intakes are inadequate, calcium is resorbed from the skeleton in order to maintain normal circulating concentrations, making it difficult to estimate calcium nutritional status and requirements. On the long term, this resorption reduces bone mineral density and chronic calcium deficiency can lead to osteopenia and osteoporosis and an increased risk of fractures. Calcium requirements are difficult to estimate because of calcium homeostasis and the absence of short-term clinical manifestations of calcium deficiency. Health agencies have therefore based their requirements on balanced studies(1,2,12). Over the long term, it is assumed that intake should not be lower than 500 mg/d for adults to maintain a consistent balance(5,12) and several meta-analyses have concluded that there was no significant association between calcium intake and fracture risk with a calcium intake higher than 500 mg/d(15–17). This value of 500 mg/d was retained for our study to define the deficiency threshold, with a CV of 15%.

**Nutrients not included:**

Pantothenic acid: Pantothenic acid is widely found in foods and isolated pantothenic acid deficiency has almost never been observed, except under experimental conditions(2,4,12).

Vitamin B6: Vitamin B6 is frequently found in foods and vitamin B6 deficiency is extremely rare; it has only been observed during depletion with very low level of vitamin B6 or in association with other B-vitamin deficiencies(2,4,12).

Vitamin B8: No deficiency has been observed in healthy humans under normal conditions but only in individuals receiving total parenteral nutrition without biotin or those consuming raw egg whites over a long period(2,4,12).

Vitamin D: Vitamin D deficiency can occur in the form of rickets in children and osteomalacia in adults. Despite its fundamental role in human metabolism, vitamin D was not considered for the calculation of the SecDiet because it can be synthesized endogenously in adequate quantities through exposure to the sun and the requirements are generally determined based on low sun exposure(1,3,12). It would therefore be inaccurate to evaluate the risk of vitamin D deficiency by only considering food intake, so it was not included in the SecDiet.

Vitamin E: Vitamin E deficiency is very rare and has only been observed in individuals with medical conditions that alter its absorption or metabolism. Vitamin E deficiency due to a low intake has never been described in healthy individuals(2,4,5).

Vitamin K: Vitamin K plays a role in blood coagulation. Vitamin K deficiency can be found in infants that are exclusively breast-fed and can cause bleeding, but has not been observed in adults, except when a pathology interferes with absorption of the vitamin(2,4,12).

Copper: Copper deficiency is rare in humans and has only been observed in patients receiving prolonged total parenteral nutrition, in the case of genetic mutations affecting copper metabolism(1,2) or in patients who have undergone bariatric surgery(18).

Manganese: Clinical signs of manganese deficiency have not been clearly described in humans and it has only been observed in few cases of patients receiving parenteral nutrition(1,2,12).

Phosphorus: Phosphorus is widespread in foods. Phosphorus deficiency is unlikely to be caused by an inadequate phosphorus intake, but only in the event of metabolic disorders or in patients receiving parenteral nutrition(1,2,12).

Potassium: Potassium is found in all foods and potassium deficiency is not caused by an inadequate potassium intake but can be caused by increased potassium losses (diarrhea, vomiting, abuse of laxatives and diuretics)(1,12).

Sodium: Sodium deficiency is rare in healthy adults. Nowadays there are more concerns about excess intakes rather than insufficient intakes(2,12,19).

Magnesium: Magnesium deficiency may be observed in some diseases or with chronic alcoholism, or in the case of a low magnesium intake combined with important losses (prolonged diarrhea, excessive urinary magnesium losses) but otherwise overt deficiency is not common in healthy adults(2,4,12).

Chromium: There is insufficient scientific evidence of how essential chromium is in humans; chromium deficiency has only been observed in patients receiving total parenteral nutrition without chromium supplementation(1,2).

Fluoride: Fluoride plays an important role in the prevention of caries and an insufficient fluoride intake increases the risk of dental caries. However, fluoride is not considered as an essential nutrient(1,2).

Molybdenum: Molybdenum deficiency has not been observed in healthy humans(1,2).

**Supplemental Method 2.** The PANDiet score is expressed as the average of an adequacy subscore (AS – accounting for 27 nutrients) and a moderation subscore (MS – accounting for six nutrients, plus 12 potential penalty values). DHA and EPA+DHA are weighted by a factor of 1/2 as DHA is present twice. Niacin equivalents were calculated as the sum of dietary niacin and 1/60 dietary tryptophan. The upper reference value for sugars excludes lactose. The tolerable upper intake limit for vitamin A concerns retinol only. Version 3.1 of the PANDiet is based on the dietary reference intake from the 2016 Anses opinion(3) and the overall construction of the score has been described elsewhere(20,21).

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| PANDiet score |
| Average of Adequacy and Moderation subscores |
|  |  |  |  |  |  |  |  |  |
| Adequacy subscore |  | Moderation subscore |
| Nutrient | Reference value (/day) | Variability | Source |  | Nutrient | Reference value (/day) | Variability | Source |
| Protein | 0.66 or 0.8 g/kg bw | 12.5% | (22,23) |  | Protein | 2.2 g/kg bw | 12.5% | (3) |
| LA | 3.08% EIEA | 15% | (24) |  | Total fat | 44% EIEA | 5% | (3) |
| ALA | 0.769% EIEA | 15% | (24) |  | SFA | 12% EIEA | 15% | (3) |
| DHA | 0.192 g | 15% | (24) |  | Carbohydrates | 60.5% EIEA | 5% | (3) |
| EPA + DHA | 0.385 g | 15% | (24) |  | Sugars | 100 g | 15% | (3) |
| Fibre | 23 g | 15% | (3) |  | Sodium | 3482 or 2618 mg | 40% | (3) |
| Vitamin A | 570 or 490 µg | 15% | (3) |  |  |  |  |  |
| Thiamin | 0.3 mg/1000 kcal | 20% | (1) |  | Tolerable Upper Intake Limits | Source |
| Riboflavin | 1.3 mg | 10% | (1) |  | Vitamin A | 3000 µg | (3) |
| Niacin | 5.44 mg NE/1000kcal | 10% | (3) |  | Niacin | 900 mg | (3) |
| Pantothenic acid | 3.62 or 2.94 mg | 30% | (3) |  | Vitamin B6 | 25 mg | (3) |
| Vitamin B-6 | 1.5 or 1.3 mg | 10% | (25) |  | Folate | 1170 µg | (3) |
| Folate | 250 µg | 15% | (3) |  | Vitamin D | 100 µg | (3) |
| Vitamin B-12 | 3.33 µg | 10% | (3) |  | Vitamin E | 300 mg | (3) |
| Vitamin C | 90 mg | 10% | (3) |  | Calcium | 2500 mg | (3) |
| Vitamin D | 10 µg | 25% | (3) |  | Copper | 10 mg | (3) |
| Vitamin E | 5.8 or 5.5 mg | 40% | (3) |  | Iodine | 600 µg | (3) |
| Calcium | 860 (<= 24 y.o) or 750 (>24 y.o.) | 15% or 13% | (3) |  | Dissociable magnesium | 250 mg | (3) |
| Copper | 1.0 or 0.8 mg | 15% | (3) |  | Selenium | 300 µg | (3) |
| Iodine | 107 µg | 20% | (3) |  | Zinc | 25 mg | (3) |
| Bioavailable iron | See Supplemental Method 1 | (3) |  |  |  |  |
| Magnesium | 5 mg/kg bw | 15% | (3) |  |  |  |  |  |
|  |  |  |  |  |
| Manganese | 1.56 or 1.39 mg | 40% | (3) |  |  |  |  |  |
| Phosphorus | Calcium (mmol) / 1.65c.f. phosphorus section in de Gavelle et al. (8) | 7.5% + CV Calcium (mg) | (1) |  |  |  |  |  |
| Potassium | 2692 mg | 15%  | (1) |  |  |  |  |  |
| Selenium | 54 µg | 15% | (3) |  |  |  |  |  |
|  |  |  |  |  |
| Bioavailable zinc | 0.642 + 0.038 b.w. | 10% | (3) |  |  |  |  |  |
| bw, body weight; LA, linoleic acid; EIEA, energy intake excluding alcohol; ALA, alpha-linolenic acid; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; NE, niacin equivalent; CV, coefficient of variation; SFA, saturated fatty acids. |

**Supplemental Table 1:** Spearman rank correlation coefficients (r) between the SecDiet score and its probabilities of adequacy, the PANDiet score and total energy intake in the French adult population, INCA3, n=1,774.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | SecDiet score | Calcium | Zinc | Iron | Selenium | Iodine | Vitamin C | Vitamin B12 | Folate | Niacin | Riboflavin | Thiamin | Vitamin A |
| Probabilities of adequacy |
| *Vitamin A* | 0.68†(0.65, 0.70) \*\*  | 0.43 (0.39, 0.47) \*\* | 0.31 (0.27, 0.35) \*\* | 0.21 (0.17, 0.26) \*\* | 0.26 (0.21, 0.30) \*\* | 0.40 (0.36, 0.44) \*\* | 0.24 (0.19, 0.28) \*\* | 0.27 (0.23, 0.32) \*\* | 0.48 (0.44, 0.51) \*\* | 0.07 (0.03, 0.12) \* | 0.44 (0.40, 0.48) \*\* | 0.10 (0.05, 0.14) \*\* | 1 |
| *Thiamin* | 0.17 (0.13, 0.22) \*\* | 0.13 (0.08, 0.17) \*\* | 0.08 (0.03, 0.12) \* | 0.11 (0.06, 0.15) \*\* | 0.09 (0.04, 0.14) \* | 0.15 (0.11, 0.20) \*\* | 0.15 (0.10, 0.19) \*\* | 0.06 (0.01, 0.11) \* | 0.16 (0.12, 0.21) \*\* | 0.18 (0.13, 0.23) \*\* | 0.16 (0.12, 0.21) \*\* | 1 |  |
| *Riboflavin* | 0.74 (0.71, 0.76) \*\* | 0.64 (0.61, 0.66) \*\* | 0.52 (0.48, 0.55) \*\* | 0.42 (0.38, 0.45) \*\* | 0.38 (0.34, 0.42) \*\* | 0.61 (0.58, 0.64) \*\* | 0.29 (0.25, 0.33) \*\* | 0.46 (0.42, 0.49) \*\* | 0.56 (0.53, 0.59) \*\* | 0.17 (0.12, 0.21) \*\* | 1 |  |  |
| *Niacin* | 0.20 (0.16, 0.25) \*\* | 0.14 (0.09, 0.18) \*\* | 0.14 (0.09, 0.19) \*\* | 0.20 (0.15, 0.24) \*\* | 0.09 (0.05, 0.14) \*\* | 0.17 (0.13, 0.22) \*\* | 0.11 (0.07, 0.16) \*\* | 0.12 (0.07, 0.16) \*\* | 0.15 (0.10, 0.19) \*\* | 1 |  |  |  |
| *Folate* | 0.70 (0.68, 0.73) \*\* | 0.49 (0.45, 0.52) \*\* | 0.37 (0.33, 0.41) \*\* | 0.40 (0.36, 0.44) \*\* | 0.37 (0.32, 0.40) \*\* | 0.53 (0.49, 0.56) \*\* | 0.43 (0.39, 0.46) \*\* | 0.31 (0.27, 0.35) \*\* | 1 |  |  |  |  |
| *Vitamin B12* | 0.51 (0.48, 0.55) \*\* | 0.38 (0.34, 0.42) \*\* | 0.48 (0.44, 0.51) \*\* | 0.33 (0.28, 0.37) \*\* | 0.28 (0.24, 0.32) \*\* | 0.36 (0.32, 0.40) \*\* | 0.14 (0.09, 0.18) \*\* | 1 |  |  |  |  |  |
| *Vitamin C* | 0.42 (0.38, 0.46) \*\* | 0.24 (0.20, 0.28) \*\* | 0.21 (0.17, 0.25) \*\* | 0.30 (0.26, 0.34) \*\* | 0.24 (0.19, 0.28) \*\* | 0.25 (0.21, 0.29) \*\* | 1 |  |  |  |  |  |  |
| *Iodine* | 0.78 (0.76, 0.79) \*\* | 0.58 (0.55, 0.61) \*\* | 0.40 (0.36, 0.44) \*\* | 0.38 (0.34, 0.42) \*\* | 0.38 (0.34, 0.42) \*\* | 1 |  |  |  |  |  |  |  |
| *Selenium* | 0.41 (0.37, 0.45) \*\* | 0.35 (0.31, 0.39) \*\* | 0.27 (0.22, 0.31) \*\* | 0.21 (0.16, 0.25) \*\* | 1 |  |  |  |  |  |  |  |  |
| *Iron* | 0.51 (0.48, 0.55) \*\* | 0.30 (0.26, 0.34) \*\* | 0.51 (0.47, 0.54) \*\* | 1 |  |  |  |  |  |  |  |  |  |
| *Zinc* | 0.54 (0.50, 0.57) \*\* | 0.49 (0.45, 0.52) \*\* | 1 |  |  |  |  |  |  |  |  |  |  |
| *Calcium* | 0.70 (0.68, 0.73) \*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| Total energy intake | 0.44 (0.40, 0.47) \*\* |  |  |  |  |  |  |  |  |  |  |  |  |
| PANDiet score | 0.50 (0.46, 0.53) \*\* |  |  |  |  |  |  |  |  |  |  |  |  |
| † Spearman rank correlation coefficient with 95% confidence interval. \*, P<0.05; \*\*, P<0.001 |

**Supplemental Table 2:** The SecDiet score and its probabilities of adequacy according to monthly income per household unit in the French adult population from the INCA3 survey, n=1,774

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|  | Monthly income per household unit (€) |
|  | >1850 € (n=607) | 1340-1850 € (n=402) | 900-1340 € (n=355) | <900 € (n=281) | Not available (n=129) |  |
|  | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.94 | 0.07 | 0.93 | 0.08 | 0.92 | 0.10 | 0.91 | 0.11 | 0.93 | 0.07 | 0.002 |
| MedianQ1-Q3 | 0.97 0.93-0.99 | 0.96 0.91-0.99 | 0.96\* 0.89-0.99 | 0.95\*0.87-0.99 | 0.96\*0.89-0.99 |
| PANDiet (0-100) | 64.96 | 4.83 | 64.60 | 5.85 | 64.08 | 6.00 | 64.05 | 7.33 | 63.63 | 5.41 | 0.058 |
| MedianQ1-Q3 | 65.0961.70-68.17 | 64.4560.95-68.71 | 64.8159.96-68.27 | 64.1459.60-68.72 | 63.9058.58-66.78 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.92 | 0.14 | 0.91 | 0.15 | 0.90 | 0.19 | 0.84 | 0.27 | 0.91 | 0.15 | - |
|  Thiamin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.00 | - |
|  Riboflavin | 0.96 | 0.10 | 0.95 | 0.12 | 0.93 | 0.16 | 0.93 | 0.14 | 0.94 | 0.08 | - |
|  Niacin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.00 | 1.00 | 0.02 | 1.00 | 0.00 | - |
|  Folate | 0.96 | 0.10 | 0.95 | 0.10 | 0.92 | 0.17 | 0.94 | 0.13 | 0.92 | 0.14 | - |
|  Vitamin B12 | 0.98 | 0.04 | 0.97 | 0.06 | 0.97 | 0.06 | 0.97 | 0.06 | 0.97 | 0.04 | - |
|  Vitamin C | 0.98 | 0.05 | 0.97 | 0.05 | 0.97 | 0.05 | 0.97 | 0.06 | 0.97 | 0.05 | - |
|  Iodine | 0.91 | 0.15 | 0.90 | 0.15 | 0.90 | 0.16 | 0.89 | 0.18 | 0.92 | 0.11 | - |
|  Selenium | 0.99 | 0.02 | 0.99 | 0.02 | 0.99 | 0.03 | 0.99 | 0.03 | 0.99 | 0.03 | - |
|  Iron | 0.97 | 0.05 | 0.96 | 0.08 | 0.96 | 0.07 | 0.96 | 0.08 | 0.97 | 0.04 | - |
|  Zinc | 0.99 | 0.04 | 0.99 | 0.06 | 0.98 | 0.05 | 0.98 | 0.06 | 0.99 | 0.04 | - |
|  Calcium | 0.96 | 0.09 | 0.95 | 0.12 | 0.94 | 0.15 | 0.9 | 0.21 | 0.92 | 0.13 | - |
| \* Significantly different from the reference (“>1850 €”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

**Supplemental Table 3:** The SecDiet score and its probabilities of adequacy according to monthly income per household unit in the French adult population from the NutriNet-Santé study, n=104,382.

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| --- | --- |
|  | Monthly income per household unit (€) |
|  | >3700 € (n=9938) | 2700 - 3700 € (n=14 382) | 2300 - 2700 € (n=9129) | 1800 - 2300 € (n=14 986) | 1200 - 1800 € (n=25 632) | 900 - 1200 € (n=6740) | <900 € (n=11277) | Not available (n=12297) |  |
|  | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.97 | 0.05 | 0.97 | 0.05 | 0.97 | 0.05 | 0.96 | 0.06 | 0.96 | 0.06 | 0.95 | 0.07 | 0.94 | 0.08 | 0.95 | 0.07 | <0.001 |
| MedianQ1-Q3 | 0.990.97-1.00 | 0.990.96-1.00 | 0.98\*0.96-1.00 | 0.98\*0.96-1.00 | 0.98\*0.95-0.99 | 0.98\*0.94-0.99 | 0.97\*0.91-0.99 | 0.98\*0.94-0.99 |
| PANDiet (0-100) | 62.50 | 6.96 | 61.99 | 7.00 | 61.52 | 7.03 | 61.26 | 7.24 | 60.31 | 7.14 | 59.47 | 7.14 | 59.31 | 7.55 | 60.94 | 7.49 | <0.001 |
| MedianQ1-Q3 | 61.9957.54-67.02 | 61.36\*57.04-66.47 | 60.86\*56.64-65.97 | 60.60\*56.25-65.83 | 59.73\*55.36-64.76 | 58.82\*54.41-63.83 | 58.64\*53.99-63.99 | 60.39\*55.75-65.71 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.99 | 0.05 | 0.99 | 0.05 | 0.98 | 0.05 | 0.98 | 0.05 | 0.98 | 0.06 | 0.98 | 0.06 | 0.97 | 0.09 | 0.98 | 0.07 | - |
|  Thiamin | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | - |
|  Riboflavin | 0.98 | 0.09 | 0.98 | 0.10 | 0.97 | 0.10 | 0.97 | 0.11 | 0.96 | 0.12 | 0.95 | 0.14 | 0.93 | 0.17 | 0.95 | 0.15 | - |
|  Niacin | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.02 | 1.00 | 0.03 | 1.00 | 0.03 | 1.00 | 0.03 | - |
|  Folate | 0.98 | 0.07 | 0.98 | 0.07 | 0.98 | 0.08 | 0.97 | 0.09 | 0.97 | 0.11 | 0.95 | 0.13 | 0.94 | 0.15 | 0.96 | 0.12 | - |
|  Vitamin B12 | 0.98 | 0.06 | 0.98 | 0.06 | 0.98 | 0.06 | 0.98 | 0.07 | 0.98 | 0.07 | 0.98 | 0.07 | 0.97 | 0.11 | 0.97 | 0.09 | - |
|  Vitamin C | 1.00 | 0.02 | 0.99 | 0.03 | 0.99 | 0.03 | 0.99 | 0.03 | 0.99 | 0.03 | 0.99 | 0.04 | 0.98 | 0.05 | 0.99 | 0.04 | - |
|  Iodine | 0.90 | 0.16 | 0.89 | 0.17 | 0.88 | 0.18 | 0.88 | 0.19 | 0.86 | 0.20 | 0.84 | 0.22 | 0.81 | 0.25 | 0.84 | 0.22 | - |
|  Selenium | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.01 | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.03 | 1.00 | 0.02 | - |
|  Iron | 0.99 | 0.03 | 0.99 | 0.03 | 0.99 | 0.04 | 0.99 | 0.04 | 0.99 | 0.04 | 0.99 | 0.05 | 0.98 | 0.06 | 0.99 | 0.05 | - |
|  Zinc | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.02 | 1.00 | 0.03 | 1.00 | 0.03 | 0.99 | 0.03 | 1.00 | 0.03 | - |
|  Calcium | 0.98 | 0.08 | 0.98 | 0.09 | 0.98 | 0.09 | 0.97 | 0.09 | 0.97 | 0.11 | 0.96 | 0.12 | 0.94 | 0.14 | 0.96 | 0.12 | - |
| \* Significantly different from the reference (“>3700€”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

**Supplemental Table 4:** The SecDiet score and its probabilities of adequacy according to professional situation in the French adult population from the INCA3 survey, n=1,774

|  |  |
| --- | --- |
|  | Professional situation |
|  | Other occupations (n=1600) | Unemployed people (n=112) | Students (n=62) |  |
|  | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.93 | 0.09 | 0.91 | 0.09 | 0.92 | 0.11 | <0.001 |
| MedianQ1-Q3 | 0.970.91-0.99 | 0.93\*0.86-0.98 | 0.950.88-0.99 |
| PANDiet (0-100) | 64.66 | 5.63 | 62.72 | 7.24 | 63.11 | 6.49 | <0.001 |
| MedianQ1-Q3 | 64.9260.89-68.74 | 61.06\*59.06-66.92 | 64.36\*59.43-67.72 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.90 | 0.17 | 0.87 | 0.19 | 0.83 | 0.31 | - |
|  Thiamin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | - |
|  Riboflavin | 0.94 | 0.12 | 0.94 | 0.10 | 0.92 | 0.14 | - |
|  Niacin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.00 | - |
|  Folate | 0.95 | 0.12 | 0.90 | 0.18 | 0.92 | 0.17 | - |
|  Vitamin B12 | 0.97 | 0.06 | 0.98 | 0.04 | 0.98 | 0.04 | - |
|  Vitamin C | 0.97 | 0.05 | 0.97 | 0.05 | 0.97 | 0.07 | - |
|  Iodine | 0.90 | 0.15 | 0.88 | 0.16 | 0.90 | 0.19 | - |
|  Selenium | 0.99 | 0.02 | 0.99 | 0.03 | 1.00 | 0.02 | - |
|  Iron | 0.96 | 0.07 | 0.96 | 0.06 | 0.98 | 0.04 | - |
|  Zinc | 0.98 | 0.05 | 0.99 | 0.03 | 0.99 | 0.02 | - |
|  Calcium | 0.94 | 0.12 | 0.89 | 0.24 | 0.92 | 0.20 | - |
| \* Significantly different from the reference (“Others occupations”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

**Supplemental Table 5:** The SecDiet score and its probabilities of adequacy according to professional situation in the French adult population from the NutriNet-Santé study, n=104,382.

|  |  |
| --- | --- |
|  | Professional situation |
|  | Other occupations (n=89 238) | Unemployed people (n=6371) | Students (n=8773) |  |
|  | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.96 | 0.06 | 0.94 | 0.08 | 0.93 | 0.08 | <0.001 |
| MedianQ1-Q3 | 0.980.95-0.99 | 0.97\*0.93-0.99 | 0.97\*0.91-0.99 |
| PANDiet (0-100) | 61.18 | 7.20 | 59.62 | 7.49 | 59.05 | 7.33 | <0.001 |
| MedianQ1-Q3 | 60.5856.15-65.75 | 59.05\*54.34-64.27 | 58.39\*53.95-63.36 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.98 | 0.06 | 0.98 | 0.07 | 0.97 | 0.09 | - |
|  Thiamin | 1.00 | 0.00 | 1.00 | 0.01 | 1.00 | 0.00 | - |
|  Riboflavin | 0.97 | 0.11 | 0.95 | 0.15 | 0.92 | 0.18 | - |
|  Niacin | 1.00 | 0.02 | 1.00 | 0.03 | 1.00 | 0.03 | - |
|  Folate | 0.97 | 0.10 | 0.95 | 0.14 | 0.94 | 0.15 | - |
|  Vitamin B12 | 0.98 | 0.07 | 0.97 | 0.11 | 0.97 | 0.10 | - |
|  Vitamin C | 0.99 | 0.03 | 0.99 | 0.05 | 0.99 | 0.04 | - |
|  Iodine | 0.87 | 0.19 | 0.83 | 0.23 | 0.8 | 0.25 | - |
|  Selenium | 1.00 | 0.02 | 1.00 | 0.03 | 1.00 | 0.03 | - |
|  Iron | 0.99 | 0.04 | 0.98 | 0.05 | 0.98 | 0.06 | - |
|  Zinc | 1.00 | 0.02 | 1.00 | 0.03 | 0.99 | 0.04 | - |
|  Calcium | 0.97 | 0.10 | 0.95 | 0.13 | 0.95 | 0.14 | - |
| \* Significantly different from the reference (“Others occupations”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |
|  |  |  |  |  |  |  |  |

**Supplemental Table 6:** The SecDiet score and its probabilities of adequacy according to perception of financial situation in the French adult population from the INCA3 survey, n=1,774

|  |  |  |
| --- | --- | --- |
|  | Perception of financial situation |  |
|  | Financially comfortable (n=298) | It's okay (n=663) | It's tight (n=195) | Manageable if careful (n=496) | Hard to make ends meet (n=102) | Can't manage without debts (n=19) | Refusal to answer (n=1) |  |
|  | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.94 | 0.08 | 0.94 | 0.06 | 0.92 | 0.09 | 0.92 | 0.10 | 0.89 | 0.14 | 0.85 | 0.14 | 0.96 | . | <0.001 |
| MedianQ1-Q3 | 0.970.92-0.99 | 0.970.92-0.99 | 0.960.89-0.99 | 0.960.89-0.99 | 0.93\*0.86-0.97 | 0.95\*0.81-0.97 | 0.96- |
| PANDiet (0-100) | 65.31 | 5.19 | 64.56 | 5.40 | 64.26 | 5.18 | 64.09 | 6.23 | 63.55 | 8.00 | 63.36 | 7.55 | 54.25 | . | <0.001 |
| MedianQ1-Q3 | 65.1661.45-68.90 | 64.9060.27-68.62 | 64.196.116-67.68 | 64.8460.06-68.27 | 63.12\*59.16-67.53 | 62.0554.71-72.00 | 54.25- |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.92 | 0.17 | 0.92 | 0.14 | 0.86 | 0.23 | 0.89 | 0.18 | 0.82 | 0.27 | 0.82 | 0.18 | 0.96 | . | - |
|  Thiamin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | 0.99 | 0.01 | 1.00 | . | - |
|  Riboflavin | 0.95 | 0.10 | 0.96 | 0.08 | 0.92 | 0.14 | 0.93 | 0.14 | 0.90 | 0.20 | 0.86 | 0.22 | 0.98 | . | - |
|  Niacin | 1.00 | 0.01 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.02 | 1.00 | 0.01 | 1.00 | 0.00 | 1.00 | . | - |
|  Folate | 0.94 | 0.14 | 0.96 | 0.08 | 0.95 | 0.09 | 0.93 | 0.14 | 0.90 | 0.22 | 0.84 | 0.18 | 0.95 | . | - |
|  Vitamin B12 | 0.97 | 0.06 | 0.98 | 0.04 | 0.97 | 0.05 | 0.97 | 0.06 | 0.96 | 0.08 | 0.94 | 0.11 | 1.00 | . | - |
|  Vitamin C | 0.98 | 0.04 | 0.98 | 0.04 | 0.98 | 0.04 | 0.97 | 0.06 | 0.95 | 0.07 | 0.91 | 0.19 | 0.96 | . | - |
|  Iodine | 0.90 | 0.18 | 0.91 | 0.14 | 0.91 | 0.13 | 0.90 | 0.15 | 0.87 | 0.20 | 0.80 | 0.19 | 0.96 | . | - |
|  Selenium | 0.99 | 0.01 | 0.99 | 0.02 | 0.99 | 0.02 | 0.99 | 0.02 | 0.98 | 0.04 | 0.98 | 0.03 | 1.00 | . | - |
|  Iron | 0.97 | 0.05 | 0.97 | 0.04 | 0.96 | 0.06 | 0.96 | 0.08 | 0.94 | 0.12 | 0.91 | 0.16 | 0.99 | . | - |
|  Zinc | 0.99 | 0.04 | 0.99 | 0.03 | 0.98 | 0.06 | 0.98 | 0.06 | 0.97 | 0.07 | 0.91 | 0.17 | 1.00 | . | - |
|  Calcium | 0.97 | 0.07 | 0.95 | 0.09 | 0.89 | 0.21 | 0.93 | 0.15 | 0.89 | 0.22 | 0.87 | 0.19 | 0.97 | . | - |
| \* Significantly different from the reference (“Financially comfortable €”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

**Supplemental Table 7:** The SecDiet score and its probabilities of adequacy according to food insufficiency status in the French adult population from the INCA3 survey, n=1,774

|  |  |
| --- | --- |
|  | Food insufficiency status |
|  | Food sufficiency (n=1512) | Qualitative food insufficiency (n=227) | Quantitative food sufficiency (n=35) |  |
|  | Mean | SD | Mean | SD | Mean | SD | *P*† |
| SecDiet (0-1) | 0.93 | 0.08 | 0.90 | 0.11 | 0.91 | 0.10 | <0.001 |
| MedianQ1-Q3 | 0.970.91-0.99 | 0.95\*0.87-0.98 | 0.95\*0.88-0.96 |
| PANDiet (0-100) | 64.67 | 5.71 | 63.37 | 6.13 | 61.51 | 6.08 | <0.001 |
| MedianQ1-Q3 | 64.9260.95-68.63 | 62.59\*59.23-67.96 | 61.43\*56.87-66.84 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.90 | 0.17 | 0.84 | 0.24 | 0.90 | 0.14 | - |
|  Thiamin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | - |
|  Riboflavin | 0.95 | 0.12 | 0.91 | 0.17 | 0.93 | 0.12 | - |
|  Niacin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.00 | - |
|  Folate | 0.94 | 0.12 | 0.92 | 0.16 | 0.93 | 0.17 | - |
|  Vitamin B12 | 0.97 | 0.05 | 0.96 | 0.07 | 0.97 | 0.05 | - |
|  Vitamin C | 0.98 | 0.05 | 0.97 | 0.05 | 0.92 | 0.15 | - |
|  Iodine | 0.90 | 0.15 | 0.89 | 0.15 | 0.89 | 0.18 | - |
|  Selenium | 0.99 | 0.02 | 0.99 | 0.03 | 1.00 | 0.02 | - |
|  Iron | 0.97 | 0.06 | 0.95 | 0.11 | 0.94 | 0.11 | - |
|  Zinc | 0.99 | 0.05 | 0.98 | 0.07 | 0.98 | 0.07 | - |
|  Calcium | 0.94 | 0.12 | 0.90 | 0.21 | 0.94 | 0.12 | - |
| \* Significantly different from the reference (“Food sufficiency”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

**Supplemental Table 8:** The SecDiet score and its probabilities of adequacy according to food security status in the French adult population from the INCA3 survey, n=1,774.

|  |  |
| --- | --- |
|  | Food security status |
|  | Food security (n=1654) | Moderate food insecurity (n=73) | Severe food insecurity (n=47) |  |
|  | Mean | SD | Mean | SD | Mean | SD | *P*1 |
| SecDiet (0-1) | 0.93 | 0.08 | 0.89 | 0.13 | 0.89 | 0.10 | <0.001 |
| MedianQ1-Q3 | 0.970.91-0.99 | 0.94\*0.82-0.99 | 0.89\*0.88-0.95 |
| PANDiet (0-100) | 64.53 | 5.73 | 63.07 | 6.00 | 62.72 | 7.28 | 0.002 |
| MedianQ1-Q3 | 64.8460.61-68.58 | 61.93\*58.58-67.69 | 60.7857.30-67.02 |
| Probabilities of adequacy for SecDiet (0-1) |
|  Vitamin A | 0.90 | 0.18 | 0.84 | 0.24 | 0.81 | 0.19 | - |
|  Thiamin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | - |
|  Riboflavin | 0.95 | 0.12 | 0.90 | 0.17 | 0.91 | 0.12 | - |
|  Niacin | 1.00 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 | - |
|  Folate | 0.94 | 0.12 | 0.89 | 0.22 | 0.91 | 0.15 | - |
|  Vitamin B12 | 0.97 | 0.05 | 0.96 | 0.06 | 0.98 | 0.05 | - |
|  Vitamin C | 0.97 | 0.05 | 0.96 | 0.05 | 0.95 | 0.13 | - |
|  Iodine | 0.90 | 0.15 | 0.88 | 0.16 | 0.88 | 0.17 | - |
|  Selenium | 0.99 | 0.02 | 0.98 | 0.05 | 0.99 | 0.02 | - |
|  Iron | 0.97 | 0.06 | 0.93 | 0.11 | 0.95 | 0.11 | - |
|  Zinc | 0.99 | 0.05 | 0.97 | 0.05 | 0.97 | 0.11 | - |
|  Calcium | 0.94 | 0.14 | 0.92 | 0.15 | 0.91 | 0.13 | - |
| \* Significantly different from the reference (“Food security”), assessed by Dwass-Steel-Critchlow-Fligner (DSCF) test for pairwise multiple comparisons; significant at P<0.05.† P for Kruskal-Wallis non-parametric test. |

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