



Supports the



ANNÉE INTERNATIONALE DES  
FRUITS ET DES LÉGUMES  
2021

## DIETARY GUIDELINES- ARE THEY IN LINE WITH A SUSTAINABLE DIET?

Food-based Dietary Guidelines are documents produced by policy makers that recommend how citizens should eat. Since the 1960s, Dietary Guidelines have become one of many dietary change tools in a food policy maker's tool-kit.

Tensions between health and sustainability in Dietary Guidelines have been discussed since the early 2010s.

Review of national healthy and sustainable dietary guidelines highlighted that health and sustainability that win-wins are possible, with diet shifts towards food based dietary guidelines shown to reduce greenhouse gas emissions (GHGE).

Over the last 3 years, our ability to analyse and quantify in detail sustainability impacts has grown considerably leading to a wider set of results. Ritchie et al. (2018) and Springmann et al. (2020) findings show that the majority current Guidelines are

incompatible with global GHG emissions targets. Part of the problem is that Dietary Guidelines are typically qualitative and do not contain recommendations as quantified measures. This leads to uncertainty in the calculation of environmental impacts.

In this issue of Global Fruit & Veg Newsletter, three papers are summarised that show how food based dietary guidelines could be more quantified, using dietary optimisation to provide national diets. These articles highlight that in the French (Kesse-Guyot *et al.*, 2020), Italian (Ferrari *et al.*, 2020), and Danish (Lassen *et al.*, 2020) contexts quantified dietary recommendations are possible and can lead to mutual win-wins.

**Christian Reynolds**

Centre for Food Policy  
City, University of London  
UNITED-KINGDOM



Editions available in:

English:

[www.aprifel.com](http://www.aprifel.com) / [www.freshfel.org](http://www.freshfel.org) / [www.kauppapuutarhaliitto.fi](http://www.kauppapuutarhaliitto.fi)  
[www.unitedfresh.co.nz](http://www.unitedfresh.co.nz) / [www.5amtag.ch](http://www.5amtag.ch) / [www.halfyourplate.ca](http://www.halfyourplate.ca)

French:

[www.aprifel.com](http://www.aprifel.com)

Spanish:

[www.5aldia.org](http://www.5aldia.org)



# Sustainability of the 2017 French food-based dietary recommendations: Results of the BioNutriNet project

Emmanuelle Kesse-Guyot

Sorbonne Paris Nord University, INSERM U1153, INRAE U1125, CNAM, Nutritional Epidemiology Research Team (EREN), Epidemiology and Statistics Research Center – University of Paris (CRESS), Bobigny, FRANCE

*Face to the environmental crisis and the role of food production<sup>1</sup>, some countries have now integrated the concept of sustainability into their food-based dietary recommendations (FBDG). The new French FBDG have been updated in 2017 by the Haut Conseil de la Santé Publique<sup>2</sup> and now promote to align nutritional and environmental objectives, in particular to increase plant-based food and to reduce pesticide exposure through plant-based diet. The objective of this study was therefore to assess the sustainability and health impacts of these FBDG using a multicriteria approach.*

## Environmental impact of diets at individual level was estimated

The study sample included 28,240 individuals from the NutriNet-Santé cohort (76% female, mean age = 50 y) completing a 264-items food frequency questionnaire distinguishing organic and non-organic foods. Consumption data were merged with data on environmental impact (greenhouse gas emissions, land occupation and energy demand), prices and pesticide contamination data in order to estimate the impact of diets at the individual level, while considering the farming practices of food production for each indicator. A previously validated dietary index reflecting the adherence to the 2017 FBDG (PNNS-GS2, Programme National Nutrition Santé – guidelines score, max score=14.25) was calculated<sup>3</sup>. The quintiles (Q) were calculated and compared for sustainable indicators (related to nutrition (using the PANDiet score reflecting the probability of adequacy to nutritional references), environment (using the pReCiPe score, a synthetic index summarizing the three individual environmental indicators accounting for

conflicts) and economy (cost of diets). The number of deaths prevented by following the FBDG were also assessed through the estimation of avoided deaths using a comparative risk model<sup>4</sup>. A comparative analysis with the performance of the former 2001 FBDG was conducted.

## Higher adherence to the French dietary guidelines is associated with lower environmental impacts

As expected, higher PNNS-GS2 was positively correlated with the PANDiet score. Higher PNNS-GS2 scores were associated with:

1. higher intakes of plant foods,
2. lower energy intakes,
3. higher diet costs ( $\Delta Q5$  vs. Q1 +0.91€/d),
4. lower environmental impacts ( $\Delta Q5$  vs. Q1 pReCiPe: -50%),
5. lower exposures to the pesticides studied, except those used organically, and
6. a reduction of about 35,000 avoided or delayed deaths, especially for ischemic heart diseases and cerebrovascular diseases.

The improvement of all these indicators with the level of adherence was more important for the 2017 recommendations than for the old ones (2001).

**These results suggest that the new FBDG were in line with the concept of sustainable diets, although a slight increase in cost occurred for higher adherence. If adopted by a large part of the general population, these FBDG could help prevent chronic diseases while reducing the environmental impacts related to food consumption.**



**Based on:** Kesse-Guyot, E., Chaltiel, D., Wang, J. et al. Sustainability analysis of French dietary guidelines using multiple criteria. *Nat Sustain*, 2020. 3, 377–385.

## References

1. Clark M et al. The Diet, Health, and Environment Trilemma. *Annual Review of Environment and Resources*. 2018;43(1):109–34.
2. Santé publique France - Santé publique France présente les nouvelles recommandations sur l'alimentation, l'activité physique et la sédentarité [Internet]. [cited 2019 Mar 1]. Available from: <https://www.santepubliquefrance.fr/Accueil-Presses/Tous-les-communiqués/Santé-publique-France-présente-les-nouvelles-recommandations-sur-l'alimentation-l-activité-physique-et-la-sédentarité>
3. Chaltiel D, et al. Programme National Nutrition Santé – guidelines score 2 (PNNS-GS2): development and validation of a diet quality score reflecting the 2017 French dietary guidelines. *British Journal of Nutrition*. 2019 Aug;122(3):331–42.
4. Kesse-Guyot E, et al. Sustainability analysis of French dietary guidelines using multiple criteria. *Nature Sustainability*. 2020 Mar 23;1–9.

# Could Dietary Goals and Climate Change Mitigation Be Achieved Through Optimized Diet? The experience of Modelling National Food Consumption Data in Italy

Marika Ferrari

Council for Agricultural Research and Economics - Research Center on Food and Nutrition, ITALY

*Dietary guidelines are the main tools for consumer advice and policy development to healthy food choices. In the past, they are based on the current evidence to reduce the risk of diet-health relationships and to translate dietary reference values for nutrient intake into food portions<sup>1</sup>. This approach neglects sustainability aspects that could have an indirect effect on human health and lifestyle as environmental, economic, and social implications. The integration of sustainability in all policies including dietary ones is essential to minimize mostly environmental challenges. Recently, mathematical methods and data processing are evolving as a powerful tool to optimize diet, nutritiously, economically, and environmentally<sup>2</sup> and on this approach the dietary guidelines developed in European countries are a step forward towards of sustainable diets and their promotion<sup>3,4</sup>.*

## Diet optimization and sustainability

Diet optimization is a mathematical approach that translate nutrient requirements into food choices while considering other food-related constraints, including, for example, diet cost, consumption habits, and environmental impact<sup>5</sup>. The model elaborates the optimal diet given an objective function and a set of constraints that are simultaneously achieved if the model provides a solution<sup>6</sup>. Most optimization studies have used nutrition and cost constraints in the analysis of dietary problems and solutions, and recently twelve studies applied ecological constraints reporting that the diets environmental impacts can be halved, staying within the existing nutritional constraints<sup>2</sup>. Only two studies were unique in combining three dimensions: nutrients, environmental impact in terms of greenhouses gas emissions (GHGEs), and cost. They demonstrate that using ecological and cost constrains would not resear in diets with a higher cost, but rather these diets could be even more affordable<sup>7</sup>.

## Reaching dietary goals and lower environmental impact – a case study

A national study was carried out to define a healthy and sustainable diet model with low GHGE, fulfilling dietary requirements, and considering current Italian food consumption patterns<sup>8</sup>. A duly designed database was developed, linking food nutritional composition and GHGE based on 921 food items consumed in Italy according to the last national food consumption survey (INRAN-SCAI 2005–2006). Linear programming as mathematical approach was used to develop new diet plans separately for

males and females, aged 18–60 years (n = 2,098 subjects), to minimize GHGE. The program is based on dietary goals and acceptability constraints as well as on 13 nutrient requirement constraints (Table 1) aiming to reach a healthy and acceptable diet for the Italian population. Diets optimized resulted with the reduction in CO<sub>2</sub>eq emissions on 43% for males and 50% for females. Linear programming was able to combine the choice of foods with higher nutritional characteristics with the choice of foods that have a lower GHGE.

The proposed optimized diets envisage a transition from a dietary model with high content of animal based foods (including meat and processed meat) to a diet rich in plant based foods such as fruit and vegetables (higher bound: 500 g/day), and especially legumes and cereals without changing the quantities of dairy products.

**TABLE 1 |** Nutritional constraints for daily intake compared with the mean observed diet (INRAN-SCAI 2005–2006) and the optimized diet from linear programming model for the adult male population, 18–60 years<sup>8</sup>.

	Established lower and upper bound	Observed diet	Optimized diet
<b>Nutritional</b>			
GHGE <sup>8</sup> (kgCO <sub>2</sub> e)		4.0	1.9
Energy (kcal/day)	2,400–2,460	2,406	2,400
Protein (g/day)	60–92	93.2	77.9
Total fat (% Energy)	24.5–30.8	36.0	30.5
SFA <sup>a</sup> (% Energy)	7.0–10.1	11.2	8.8
PUFA <sup>d</sup> (% Energy)	4.8–10.1	4.6	5.5
Cholesterol (mg/day)	250–300	334.0	250.0
Carbohydrates (% Energy)	46.8–65.7	47.5	60.2
Free + intrinsic sugar (% Energy)	10.4–16.3	13.2	14.0
Free sugar (% Energy)	4.2–5.5	7.9	5.5
Fiber (g/day)	24–26	19.5	26.0
Calcium (mg/day)	900–1,100	801.0	900.0
Iron (mg/day)	9–11	12.6	11.0
Zinc (mg/day)	11–13	12.7	11.0
Vitamin B <sub>12</sub> (µg/day)	2–3	6.7	2.6
Alcohol (g/day)	0	13.4	0.0
Fruit and vegetables (g/day)	400–500	423.0	500.0
Red meat (g/day)	10–30	73.0	10.0
Processed meat <sup>e</sup> (g/day)	0	36.0	0.0

**Based on:** Ferrari M et al. Could Dietary Goals and Climate Change Mitigation Be Achieved Through Optimized Diet? The Experience of Modeling the National Food Consumption Data in Italy. *Front. Nutr.*, 2020; 7:48.

## References

1. FAO/WHO: [https://www.who.int/nutrition/publications/nutrientrequirements/WHO\\_TRS\\_880/en/](https://www.who.int/nutrition/publications/nutrientrequirements/WHO_TRS_880/en/). 2010.
2. van Dooren C. *Front Nutr* 2018; 21:5:48
3. Brink E et al. *Public Health Nutrition* 2019; 22(13): 2419–2435
4. Gonzales Fischer C et al. *FAO and Oxford University* 2016
5. Gazan R et al. *Adv Nutr* 2018; 9: 602–616
6. Dantzig GB et al. *Linear Programming 2.Theory Extensions*.2003
7. van Dooren C et al. *Sustainability*.2015;7:12837.
8. Ferrari M et al. *Frontiers in Nutrition*. 2020: 7, 48.

# Development of a Danish Adapted healthy and sustainable plant-based diet

Anne D. Lassen

Division of Risk Assessment and Nutrition, National Food Institute, Technical University of Denmark, DENMARK

Healthy sustainable diets are defined as “dietary patterns that promote all dimensions of individuals’ health and wellbeing, have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable”<sup>1</sup>. Plant-based diets have been linked to both health benefits<sup>2,3,4</sup> and a lower climate impact<sup>5</sup>. However, plant-based diets may represent both healthy and unhealthy dietary practices<sup>6</sup>.

The EAT-Lancet Commission has proposed a global healthy reference diet that could help limit environmental changes. However, the scientific targets for this reference diet were based on extensive literature on foods, dietary patterns and health outcomes without taking into account national preferences and contexts (food culture, local food availability, nutrient content of foods, national dietary recommendations)<sup>7</sup>.

Denmark has two sets of official dietary recommendations:

- the Nordic Nutrition Recommendations (NNR) provide a basis for evaluating the intake of nutrients and planning diets,
- the Danish food-based dietary guidelines (FBDG) provide advice on foods and food groups which supply the required nutrients and promote overall health and prevent chronic diseases. The recommended consumption of fruit and vegetable is 600 g/day. Recently, a climate friendly FBDG has been launched in Denmark. The Danish Adapted healthy and sustainable plant-based diet has provided the basis for the climate friendly FBDG<sup>8</sup>.

This study aimed to develop a nationally adapted healthy plant-based diet based on the global EAT-Lancet reference diet. Two models were developed and nutritionally assessed:

- Model 1: evaluation of the original EAT-Lancet reference diet based on food availability using Danish food data;
- Model 2: modification of model 1 to reflect national food based dietary guidelines (FBDG) and current consumption pattern, for example by including processed food, discretionary foods and beverages in the diet and by increasing the amount of fruit and vegetables (incl. juice and excl. legumes) to 600 g, fish to 50 g, and dairy foods and cheese to 250 g and 20 g, respectively.

## Food group and macronutrient contents

The Danish adapted plant-based diet (Model 2) provides all amounts of foods within the possible ranges set by the EAT-Lancet Commission and the Danish FBDG.

The decrease in protein from meat was balanced by the high content of legumes and fish. In addition, the low content in specific amino acids is compensated by dietary mixtures of legumes and whole-grain, resulting in an adequate content of essential amino acids.

## Vitamin and mineral contents

The recommended nutrient density for vitamin E, B1, B2, B6, B12, C, niacin and folate were reached in Models 1 and 2. Concerning vitamin A, the recommended nutrient density was reached in Model 2 because a small amount of liver paste, margarine, blended spread and butter was included, reflecting the Danes’ preferences for fats and spreads. In addition, the red/orange vegetables provide vitamin A (beta carotene). Finally, the vitamin D content was higher in Model 2 compared to Model 1, as the amount of fish was increased in Model 2, but still well below the recommended nutrient density.

The recommended nutrient density for potassium, magnesium and phosphorus was reached in both models. However, the content of calcium, zinc, iodine and selenium is below the NNR in model 1.

After adapting the EAT-Lancet reference diet to the Danish FBDG and preferences (Model 2), the recommended nutrient density (6-65 years old) for calcium, iron, zinc and selenium was reached. However, guidelines should be made to eat plant-based foods rich in iron and zinc such as whole-grain products, legumes, nuts and seeds, and dark-green vegetables rich in iron with vitamin C which enhance effect of iron absorption.

Regarding children aged 2–5 years having an energy intake around half of 10 MJ, the content of calcium of the model 2 was found to be below the recommended intake. This indicates a need for a higher content of dairy products or other calcium rich food products to make the diet adequate for all individuals of this age group. Yet, FAO states that from an environmental point of view there is a need for a better understanding of the role and impact of dairy products in relation to health and sustainability.

## Main points to consider when adopting a more sustainable plant-based diet

Eat More of	Eat Adequate/ Moderate	Limit intake of
Vegetables, including dark green and red/orange vegetables	Fish and seafood (choose the most sustainable)	Red meat (particularly beef) and processed meat
Legumes	Milk (low-fat) and dairy products	Discretionary foods
Nuts and seeds	Vegetable oils	Salt
Fruits and berries	Poultry and eggs	Alcohol
Whole-grain products and potatoes	(Mushrooms)	Ultra-processed foods

Avoid over-consumption and minimize food waste

**Based on:** Lassen, A. D., Christensen, L. M., & Trolle, E. (2020). Development of a Danish Adapted Healthy Plant-Based Diet Based on the EAT-Lancet Reference Diet. *Nutrients*, 12(3), 738.

## References

1. WHO . Sustainable Healthy Diets—Guiding Principles. WHO; Geneva, Switzerland: 2019.
2. Madigan M., Karhu E. J. *Unexplored Med. Data.* 2018;3:9.
3. Qian F., et al. *JAMA Intern. Med.* 2019;179:1335–1344.
4. Satija A., Hu F.B. *Trends Cardiovasc. Med.* 2018;28:437–441.
5. Aleksandrowicz L., et al. *PLoS ONE.* 2016;11:1–16.
6. Satija A., et al. *J. Am. Coll. Cardiol.* 2017;70:411–422.
7. Willett W., et al. *Lancet.* 2019;393:447–492.
8. Danish Veterinary and Food Administration: The official dietary guidelines - Good for Health and Climate.