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FOOD NUTRITION QUALITY & ENVIRONMENTAL IMPACT

The European Commission is committed to achieving the United Nations 2030 Sustainable Development Goals (SDGs) and supporting their implementation by all players. Health and food-related goals are prominent in this global agenda and strengthening health and food systems is therefore key.

The articles in this issue make an important contribution to the evidence base needed to support all actors, in adopting healthy and sustainable diets.

The EU's comprehensive policies and legislation related to the safety of the food supply chain aim to protect plant, animal and human health as well as the environment, thereby improving efficiency of food production and reducing food waste. Through implementation of the Circular Economy Action Plan, further progress has been made to optimise resource use and ensure concrete measures are taken to help achieve the target of halving food waste by 2030 (SDG Target 12.3).

Given the importance of diet as a determinant of good health and the need to prevent death and disability from major nutrition-related chronic diseases, nutrition-sensitive agriculture and sustainable food production and consumption, in line with national dietary guidelines, are needed.

Through the Steering Group on Promotion and Prevention, the European Commission has made it a priority to identify, disseminate and transfer best practices in particular concerning SDG Targets 2.2 and 3.4. Interested stakeholders may join our efforts by submitting evaluated practices.

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Aprifel offices located at 4 rue de Trévise, 75009 Paris were impacted by the explosion that took place in Paris on Saturday, January 12, 2019, and are banned from access since then.

Aprifel team is currently hosted at 19 rue de la Pépinière, 75008 Paris.

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Need to produce more F&V and plant-based protein for human health and sustainable food systems

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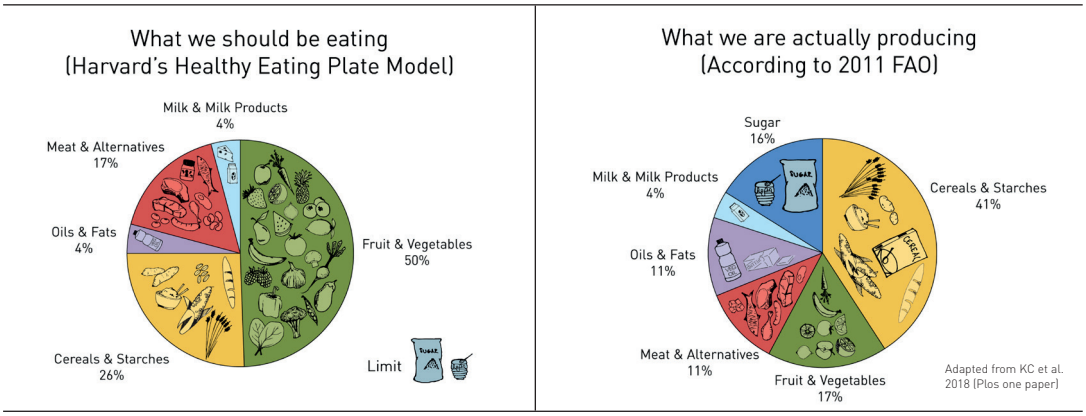
One day, when geography professor Evan Fraser and I were looking at a figure which showed the proportion of different food groups we need to eat as a healthy diet by Harvard Healthy Eating Plate (HHEP) model, a question came to mind: Is there any study about whether there is enough fruit and vegetables (F&V) produced to adopt the HHEP diet and what would be the environmental consequences of adopting such a diet?



Harvard Healthy Eating Plate guidelines: 50% of the plate should consist of F&V

HHEP advises that a dinner plate should consist of 50% of F&V, 25% of grains and the remaining 25% should be proteins, fats, and dairy. To answer our question, we started to explore what other nutritional guidelines across the globe are recommending for us to be healthy. Some of them, such as Food and Agricultural Organisation (FAO) and United States Department of Agriculture (USDA), recommend eating at least 2350 kilocalories/person/day. Other guidelines such as the Canadian Food Guide (CFG) also suggested the number of required servings of different food groups.

F&V production is much less than we should be eating

After seeing various nutrition recommendations, we were wondering what the global agricultural production or availability looks like. Production data is available in terms of mass or kilocalories. This brought another curiosity to mind; about how we calculate the number of servings of food needed to be eaten as per the HHEP and compare this with our current production. But, if we convert mass or kilocalories into the number of servings, would we have enough servings of each food group as per the HHEP recommendation? The answer is no.

In order to feed everyone according to the HHEP's guidelines, global agriculture would have to produce 15 servings of F&V per person per day. However, according to 2011 FAO data, just 5 servings were being produced. The calculation also shows a smaller shortfall in protein production, with 3 servings per person per day produced, compared to the 5 recommended by the HHEP. However, other food groups such as oil and fat, sugar, milk and grains, were being grossly overproduced.

Following this mismatch between overproduction of some food groups and underproduction of others, an immediate question came to mind: What would the land use and greenhouse gas impact be if we were to adopt the HHEP diet today and in the future? As we found out, the world's agriculture producers are not growing enough F&V to feed the global population a healthy diet. But we also found that we need to increase protein production too, and in that case, we would need extra land to use for agriculture to feed the growing population. If the agricultural industry immediately corrected its imbalances and shifted its production priorities to align with the HHEP, a new problem would emerge. It would free up 51 million hectares of arable land globally, but the total amount of land used for agriculture (includes pasture land as well) would jump by 407 million hectares. Greenhouse gas emissions would also rise as a result. Therefore growing more F&V should be accompanied by reduced reliance on livestock in order to keep the global food supply sustainable. The question can be raised again, how?

Best pathway: a significant increase in F&V production with a shift away from animal proteins

To explore the possibility in this context, we calculated the ratio of existing animal based protein to plant-based protein. Currently, globally, 84% of protein is from animal sources and only 16% protein is from plant sources. Then we explored the amount of the land used to produce this amount of animal and plant protein. At present, 103 million ha of arable land and 1092 million ha of pasture land is used for the production of 84% animal protein and about 36 million ha of arable land is used for the production of 16% plant protein. So adopting HHEP diet would not help to develop a sustainable food system. We cannot imagine an agro-ecosystem without animals in it, because animals play a role in cycling nutrients in the environment and preserving the quality of certain types of land. The best path forward would couple a significant increase in F&V production with a shift away from animal protein. In this context, we made a scenario analysis of required arable and pasture land for today and the future if we adopt 20% protein from animal sources and 80% protein from plant sources. We found that currently we would need 675 million ha of land and in 2050 we would need 813 million ha of land to produce the total protein servings which is even less than the amount of land that is currently being used for producing our proteins.

So in conclusion, if we want to move forward to feed the future, to be healthier without increasing the amount of land that agriculture uses, we both have to shift to a Harvard Healthy Eating Plate model and shift our protein consumption away from livestock-based to plant-based.

Based on: KC KB, Dias GM, Veeramani A, Swanton CJ, Fraser D, et al. (2018) When too much isn't enough: Does current food production meet global nutritional needs?. PLOS ONE 13(10): e0205683.

Dietary changes needed to improve diet sustainability across Europe

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Numerous studies have assessed the environmental impact of current diets or dietary shifts, most using greenhouse gas emission (GHGE) as an environmental indicator. These studies principally showed that meat and dairy are among the largest contributors to GHGE; whereas high intake of fruits, vegetables (F&V), and legumes/pulses/nuts consumption is associated with the lowest GHGE[1-3].

In this study, we aimed to identify the dietary changes needed to achieve a nutritionally adequate diet (i.e. which fulfill of a set of 32 nutrient recommendations) with lower GHGE across five European countries: Finland, France, Italy, Sweden and the UK.

Dietary data were derived from national food consumption surveys, including more than 1000 individuals by country (women and men/18-64 years). Average consumption, GHGE (gCO2eq) and nutritional composition of 151 food items (based on an adapted FoodEx* food classification) were estimated for each country and gender. Linear programming was used to design national and gender specific nutritionally adequate (fulfillment of a set of 32 nutrient recommendations) diets in three different scenarios:

Scenario 1: Departing the least from observed diet without applying GHGE reductions

Scenario 2: Minimizing the GHGE

Scenario 3: Departing the least from observed diet and applying a 30% GHGE reduction.

Energy content and GHGE in observed diets and after achieving nutrient recommendations

In the observed diets, across countries, energy content ranged from 1591 to 1888 kcal/day in women, and from 2109 to 2360 kcal/day in men. GHGE ranged from 3403 to 4321 g CO2 eq/day in women, and from 4636 to 5793 CO2 eq/day in men. Meat was the main contributor to GHGE in all observed diets except for Finnish women where it was dairy.

When nutrient recommendations were fulfilled (scenario 1) for women, GHGE increased in the modeled diets, except in the UK. For men, the same increase in GHGE was seen for all countries except Italy and Finland. For both genders, the majority of food-item quantities did not need to change, except for UK women who needed to change quantities for 53% of food items. Their food habits were associated with the lowest GHGE compared with other countries and gender, but they also had the most inadequate intakes of magnesium, vitamin E, vitamin C, folates, zinc, iron, calcium, potassium, and fiber.

GHGE decrease induce modifications in quantity of food item

Depending on country and gender, a decrease of 62-78% GHGE was theoretically achievable (scenario 2) but induced a modification in quantity of at least 99% of food items from observed diets. This has a strong risk of compromising the cultural acceptability of the diet.

Increased consumption of F&V and starchy foods is needed for a sustainable diet

Across Europe, dietary changes including lower consumption of fat, sugar and alcoholic beverages, along with increased consumption of F&V and starchy foods, were needed to reach a nutritionally adequate diet with a 30% reduction of GHGE (scenario 3). The study also found that there's a need for modifications in the type of animal-based products depending on the dietary habits of the populations. For example, in this scenario, contribution of dairy products to energy intakes is increased in Sweden and France for both men and women, but decreased in UK, Finland and Italy for women. In addition, energy intakes from fish is increased in France and Italy, but decreased in Finland.

This study highlights the importance to take into consideration environment, country, gender and social and cultural acceptability before setting nutritional goals to reach a nutritionally adequate diet with lower GHGE.



* FoodEx is a hierarchical system based on 20 main food categories that are further divided into subgroups up to a maximum of 4 levels. It builds on different food description and classification systems.

Based on: F. Vieux, M. Perignon, R. Gazan and N. Darmon. Dietary changes needed to improve diet sustainability: are they similar across Europe? European Journal of Clinical Nutrition 72, 951–960 (2018).

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Comparing environmental impacts and diet quality in individual diets

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An individual's food choices largely contribute to both their environmental impact[1] and their diet quality[2], but little is known about the relationship between the two[3]. We investigate how these food choices are influenced by an individual's dietary pattern preferences, gender, and culture, and how these shape someone's environmental impacts and their beneficial and discouraged nutrient intakes.

Relationship between Environmental Impacts and Nutrition

We compared the environmental impacts (for climate change, water scarcity footprint, and biodiversity loss) of the daily food intake of over 1400 individuals throughout Europe with their daily nutrient consumption based on data collected through the Food4Me study[4]. Though there was a wide range of eating patterns, nutrient intake, and impacts among individuals, countries and genders, in general it was found that there was good correlation between environmental impacts and kilocalorie intake, especially for climate change and water scarcity footprint (r^2 = 0.66 and 0.63, respectively). The relationship was less clear when comparing beneficial nutrient intake and environmental impacts (r^2 = 0.23 for climate change) – individuals consuming adequate amounts of beneficial nutrients daily had climate change impacts ranging from 4 to 20 $kgCO_2$ equivalents per day. Those with high beneficial nutrient intake and lower than average impacts (less than 6.1 $kgCO_2$ equivalents per day) tended to consume less meat, dairy, and sweets than others with high beneficial nutrient intakes. The relationship between climate change impacts and high intakes of discouraged nutrients (saturated fat, sugar, and sodium) and increased climate change impacts were correlated (r^2 = 0.54).

Variations in Dietary Patterns, Gender, and Country

We found that women, on average, had lower impacts per kilocalorie than their male counterparts, largely due to their considerably lower red meat consumption (which is associated with higher environmental impacts compared to other foods[5]) and higher fruit and vegetable consumption compared to men. However, men did have slightly higher beneficial nutrient intake compared to women, meaning they were more likely to meet the required beneficial nutrient recommendations. Vegetarians, while having lower than average impacts, did also have a tendency to consume inadequate beneficial nutrients. Diets in which no red meat was consumed had both lower than average impacts while also maintaining an average beneficial nutrient consumption. Differences between countries were large for both impacts and nutrient consumption, and a higher impact diet did not necessarily equal higher nutrient intake (as shown with Spanish subsets), as a higher nutrient intake diet did not mean statistically higher impacts (Irish subsets).

Best Practice Diets

Based on the eating patterns of the population investigated here, in order to achieve a good quality (which was a combination of adequate beneficial nutrient intake as well as low intakes of discouraged nutrients), low impact (in all three impact categories investigated) diet, intakes of meat, sweets, fats, and drinks should decrease (between 37 and 66%), and vegetable and cereal intakes should increase by 60% and 65%, respectively. Research showed that impact reductions are more limited, but still possible, in people already eating good quality diets (high beneficial nutrient intake and low harmful nutrient intake), and they had an average climate change impact of 5.1 $kgCO_2$ equivalents. Individuals with poor quality diets (high discouraged nutrient intake) tended to have higher impacts than average (8.6 $kgCO_2$ equivalents). Individuals with poor quality diets should focus on reducing their intakes of many food groups (meats, sweets, drinks, etc.), while also increasing their intakes of fruits, vegetables, and cereals. This would lead to not only a reduction in their impacts, despite an increased intake in some foods, but also lead to better quality diets.

Based on: Walker, C., Gibney, E., Hellweg, S. (2018). Comparison of Environmental Impact and Nutritional Quality among a European Sample Population – findings from the Food4Me study. Sci. Rep. 8, Article number: 2330

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