FOUNDATION LOUIS BONDUELLE

After a half century of European and North American diets tending towards convergence in their shares derived from plant-based sources, some of these countries are now entering a second dietary transition. Boosted by a growing interest in issues connected to sustainability, this new transition is characterized by an increase in the proportion of plant-based foods in diet.

Understanding the shifts in our behavior towards an increasingly plant-based diet

Europe - North America: an overview

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All human diets draw on plant-based food to a greater or lesser degree depending on peoples' resources and preferences, these latter being strongly influenced by ideology and culture. The proportion of plant-based food in the diet has shifted substantially over the course of the past 50 years; it will likely change just as markedly during the next 50 years.

At a time when prospective studies abound, all drawing attention to the challenge posed by the ever increasing number of mouths needing to be fed on a planet endowed with limited resources and faced with the consequences of climate change, many countries, among them Brazil and Canada, have recently updated their dietary recommendations to highlight the importance of consuming mostly plant-based products. Though, as yet, there are no commonly agreed recommendations at a European Union-wide level, the individual member countries are not immune to this growing trend. Belgium and France are notable cases in point, both having recently revised their nutritional policies in this direction.

The Louis Bonduelle Foundation presents this overview of consumption levels of plant-based foods in Europe (particularly in France and Russia) and North America, together with an analysis of the factors that currently appear to be influencing dietary behaviour in these regions. It concludes with an assessment of how diets are likely to look in the future.

From yesterday to today

The contrasting trends in Western countries' consumption of plant-based foods

DECREASE, STAGNATION OR GROWTH

Between 1963 and 2013, the most recent 50 year period for which comparable data are available, the plant-based component of the diet, calculated as a percentage of calorie intake, declined both in France and in Russia, see Figure 1. Across the Atlantic, where the plant-based component in the 1960s was much lower, we observe a different trend: stagnation in the United States and growth in Canada. In spite of these contrasting movements, Russia remained the country with the greatest plant-based component (46%) and the United States with the lowest (31%). But the gaps were narrowing. This convergence also applies to per capita consumption patterns for the sole category of fruits and vegetables: the countries where average consumption was highest in 1963 recorded stagnations or decreases (-5% in France), while those where average consumption was the lowest experienced the most growth (+ 102% in Russia).

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>> This is in all likelihood the mark of a dietary transition, consecutive in these countries to the lift-off of economic development and the industrialization of food production. Though this transition occurs at different times and at different speeds in different countries, it tends always to lead to a convergence in the core elements of food consumption (Claquin *et al.*, 2017). Now part of history for Europe and North America, this transition is currently taking effect in the emerging economies (China, Mexico, some parts of Northern Africa), as well as in many developing countries.

HAS A 2nd NUTRITIONAL TRANSITION BEGUN?

Some people are wondering at present whether a second dietary transition, one characterized by a move towards a markedly more plant-based diet, might be underway. If so, Canada would be a forerunner, having witnessed since 2013 an increase in the consumption in this category of food, especially of pulses as well as of fruits and vegetables. In France, the data from the last two national studies of individual food consumption (INCA) point in the same direction: the plant-based part (measured in terms of mass, not in energy as in FAO data) of the solid food diet increased from 47% in 2007 to 51% in 2015 (Afssa, 2009; Anses, 2017). As for the United States, gross consumption of fresh and ready-to-use vegetables has been stagnant for the past five years at around 117kg per capita per year, while for pulses the figure doubled over the same period, from approximately 2.3kg to 4.6kg per capita per year.

1. This plant share was calculated from FAO data by researchers from Oxford University and aggregated on the ourworldindata.org website. Note that in compiling this data, the categorization 'plant-based foods' covered only cereals, fruits, vegetables, roots, tubers and pulses; oilseeds (including vegetable fats), which are grouped with animal fats in FAO data, could not be integrated. Given that these latter are very calorific, this leads to an underestimate of around 15% in the plant-based contribution to total energy intake.

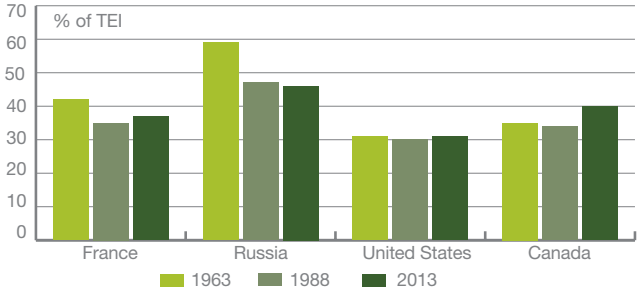


***Figure 1.** Contribution of major categories of plant foods to total diets in 1963, 1988 and 2013 in four western countries (as a % of total energy intake - TEI) FN1.*

Plant-based foods: What do we mean?

The range of different plant foods is very wide. Their immediate availability varies country by country, depending on agricultural production, connectivity with external markets and local eating habits:

- fruit and vegetables, whatever their form: fresh, dried, frozen, preserved, juiced;
- cereals (maize, rice, wheat, barley, sorghum, millet, oats, rye, *etc.*) and pseudo-cereals (quinoa, amaranth, buckwheat, *etc.*);
- roots and tubers: potato, cassava, sweet potato, yam, *etc.*;
- leguminous seeds (or pulses): red and white beans, faba beans, chickpeas, dried peas or split peas, lentils, *etc.*;
- oilseeds, be they actual seeds (soya, rapeseed, sunflower, oil palm, sesame, *etc.*) or fruits (nuts, hazelnuts, almonds, peanuts, *etc.*);
- and many others: algae, flowers and wild plants, herbs/ spices/ condiments, chocolate, hot drinks (coffee, tea, *etc.*), alcoholic beverages, sugar, *etc.*

Today The Western eater of 2020

INDIVIDUAL FACTORS

Certain individual factors would seem to encourage plant-based nutrition:

- **age**: in the United States, and likewise in France, among adults there is a positive correlation between age and the quantities of fruits and vegetables consumed (Lee-Kwan *et al.*, 2017, Anses, 2017);
- **household composition**: single women and couples without children appear to consume more vegetables than single men and families with children (Plessz *et al.*, 2010);
- **a healthy lifestyle** (not smoking, drinking alcohol in moderation, watching one's weight, regularly practicing a sport, *etc.*) (Agudo *et al.*, 2002; Pearson *et al.*, 2011).

Food preferences and tastes, which depend on a set of determinants related to childhood (whether breastfed or not, weening age and the extent of nutritional diversity immediately thereafter, *etc.*), also appear to be influential factors in the degree to which plant-based foods are selected in adulthood; recent papers have reported on the acquisition of a taste for vegetables (Guillaumie *et al.*, 2010, Appleton *et al.*, 2016) and a taste for meat, which can, in itself, serve as a barrier to switching to a more plant-based diet (Pohjolainen *et al.*, 2015; Sabate *et al.*, 2019).

A **lack of consumer information**, according to an Australian study, appears to be the main obstacle to switching to a more plant-based diet, and this regardless of sex, age or level of education (Lea *et al.*, 2006).

Regarding gender and income, a statistically convincing relationship with the consumption of plant-based foods has yet to be discerned:

- **regarding gender**: in Europe, the EPIC study reports significantly higher vegetable consumptions among men than women in some countries (Greece, Spain) and the opposite in others (Denmark, Sweden); this is also observed for fruit (Agudo *et al.*, 2002). In the United States, on the other hand, a CDC study indicates that women conform more than men to public health recommendations regarding both fruit consumption (15.1% *vs* 9.2%) and vegetables (10.9% *vs.* 7.6%) (Lee -Kwan *et al.*, 2017).
- **income**: some literature reviews conclude that people with the lowest incomes (or socio-economic status) consume the fewest fruits and vegetables (Kamphuis *et al.*, 2006, Giskes *et al.*, >>

>> 2010). However, a specific focus on vegetable consumption in Europe points to a more complicated relationship: a positive association with the level of education is reported in the Baltic and Scandinavian countries, though not in the Mediterranean countries (Prättälä *et al.*, 2009).

SOCIETAL FACTORS

Societal transformations together with evolving collective values are exerting a definite influence on the composition of Western diets (Hérault *et al.*, 2019):

- the **development of food communities** ('no'-diets, vegetarianism, fair-trade, local, organic, *etc.*) which, whatever their motives, accord plant-based foods a special place;
- **reductions in the time spent preparing and eating food**, which impedes the consumption of vegetables and pulses (Pohjolainen *et al.*, 2015), while encouraging that of starchy foods (easy to preserve and store, quick to transform into a meal) and meat (Milford *et al.*, 2019);
- the **feminization of societies**, which translates into increased demand for a healthy, natural and balanced diet, as well as, through a greater sensitivity to ecology and animal welfare, to a rise in vegetarianism and flexitarianism in most Western countries;
- **awareness of health and well-being**, with vegetable foods often appearing as the perfect "remedy";
- the **search for naturalness**, with most plant foods (fruits, vegetables, tubers, rice, quinoa, pulses, oleaginous fruits, seaweed, spices, *etc.*) logically coming into this definition since from harvest to the kitchen they do not undergo any substantial modification;
- the emergence of **new attitudes towards animals**, motivating purchases from production chains that are respectful of animal welfare; the development of total or partial eviction diets (vegan, raw vegan, vegetarian, flexitarian), and a revaluation of vegetable proteins (pulses, soya, cereals) and other protein alternatives (insects, yeasts) (Graça *et al.*, 2015).▮

2. Centers for Disease Control and Prevention.

Tomorrow Diets and production in the future

PROJECTED DEVELOPMENT OF GLOBAL DEMAND FOR VEGETABLE AND ANIMAL-SOURCED CALORIES

According to the Mond'Alim forecast (Claquin *et al.*, 2017), by 2050, world food demand is expected to increase by between 50 and 70%, driven in large part by population growth in Asia and sub-Saharan Africa. This increase in the demand for food is expected to be accompanied by a shift in the balance of world consumption, with Asia placing greater demand on animal-sourced calories in contrast to sub-Saharan Africa where emphasis is expected to be on vegetable sources (Figure 2).

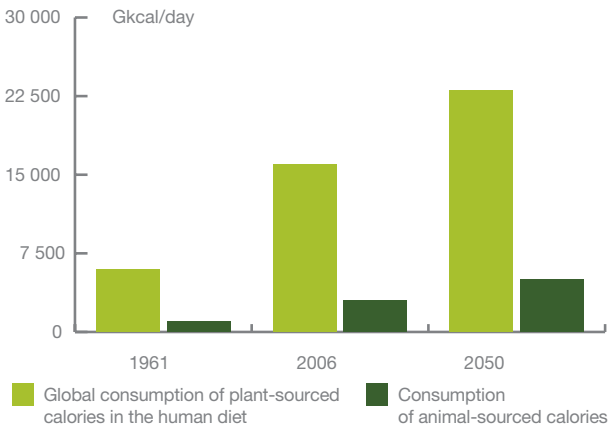


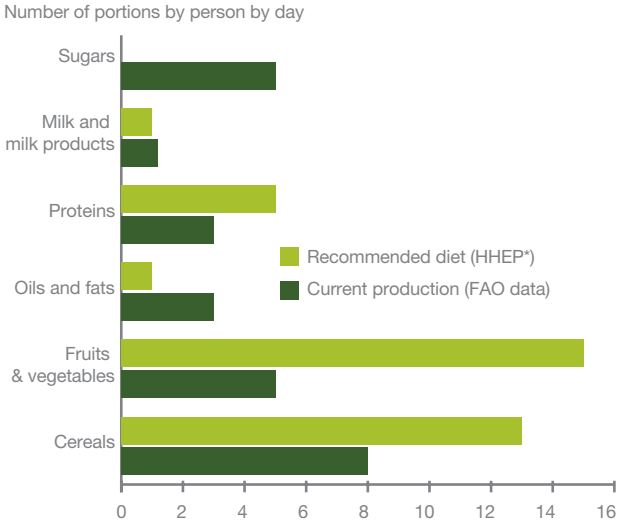
***Figure 2.** Global demand for plant and animal-sourced calories, past and future (Claquin* et al.*, 2017).*

TOWARDS HEALTHIER AND MORE SUSTAINABLE DIETS

Achieving a more sustainable diet - a concept that, as defined by the FAO, encompasses environmental and nutritional dimensions together with economic, social, cultural and health - is one of the main challenges of the 21st century. According to the prospective study undertaken by Agrimonde-Terra, to feed the 9.7 billion earthlings of 2050, it will be necessary first of all to rebalance diets to 2,750 - 3,000 kcal per day (loss and waste included), which approximates to 1,850 - 2,000 kcal per day in food actually consumed. Moreover, this would have to be achieved without significantly increasing the area under cultivation and by moderately increasing the area used for grazing at the expense of the forest (Le Mouël *et al.*, 2018). For Europe and North America, this implies: reducing meat consumption by around half (as a % of TEI) and making up the balance with fruits, vegetables and starches (cereals, pulses, potatoes). It is noteworthy that this scenario envisages an increase in meat consumption in certain areas, particularly in Africa.

REBALANCING PRODUCTION

But does current production match this ideal diet? Does it conform to nutritional recommendations and is it made up of more than 75% (by volume) of plant-based foods? No, is the answer of a Canadian team (Bahadur *et al.*, 2018): the world produces too much grain, fat and sugar, and not enough fruits and vegetables and, to a lesser extent, protein (Figure 3). There is a long way to go ... ▮



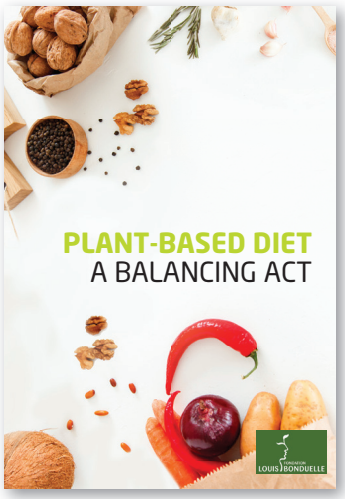
* Nutrition recommendations based on the Harvard Healthy Eating Plate (HHEP) created by experts from the Harvard School of Public Health.

Figure 3. Current world production and recommended consumption compared (Source: Bahadur et al.*, 2018).*

Conclusion

When we talk seriously about vegetable foods, many beliefs are revealed to be mistaken because dependent on the European or North American country to which we are attached, for example 21st century westerners do not always consume less plant-based food than their grandparents, women are not always more inclined towards fruits and vegetables than men. Hence it is through taking a wider perspective of the occasionally contrasting trends from one country to another that plant-based consumption patterns on each side of the Atlantic emerge as having been converging during the last 50 years. Societal transformations and modifications in certain collective values, shifts which go beyond the borders of the West (less time devoted to preparing and eating food, feminization of societies, concern for animal welfare, *etc.*), undoubtedly contribute to a convergence, even if all countries are not yet at the same stage of transformation. In all cases, human beings, and especially those in the advanced economies, will have in future to adopt an increasingly plant-based diet: prospective studies, adopting the base supposition that the food production of tomorrow will meet the planet's nutritional needs, point to a growing share of plant-based food in global calorific intake, all countries taken together.

For further information:



Plant-based diet
A balancing act
Monograph of the Louis Bonduelle Foundation, October 2019.

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FOUNDATION LOUIS BONDUELLE

« OUR GOALS AND BELIEFS: RESPECT THE EARTH, PROMOTE HEALTH AND VALUE CULTURE »

The Louis Bonduelle Foundation is interested in food in all its phases: from the management of agricultural resources and their economy, to the determinants of our eating habits through to the impact of diets on health.

OUR MISSION

- **Support the development of scientific knowledge of food**
- **Raise awareness of it**
- **Help apply it on the ground**

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A presence in seven countries

Benefiting from 15 years of existence and numerous partnerships, the Louis Bonduelle Foundation now has a presence in France, Italy, Belgium, the Netherlands, Canada, Spain, and Russia.