



Conference on ‘Sustainable food consumption’

Sustainable diets within sustainable food systems

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Sustainable diets and sustainable food systems are increasingly explored by diverse scientific disciplines. They are also recognised by the international community and called upon to orient action towards the eradication of hunger and malnutrition and the fulfilment of sustainable development goals. The aim of the present paper is to briefly consider some of the links between these two notions in order to facilitate the operationalisation of the concept of sustainable diet. The concept of sustainable diet was defined in 2010 combining two totally different perspectives: a nutrition perspective, focused on individuals, and a global sustainability perspective, in all its dimensions: environmental, economic and social. The nutrition perspective can be easily related to health outcomes. The global sustainability perspective is more difficult to analyse directly. We propose that it be measured as the contribution of a diet to the sustainability of food systems. Such an approach, covering the three dimensions of sustainability, enables identification of interactions and interrelations between food systems and diets. It provides opportunities to find levers of change towards sustainability. Diets are both the results and the drivers of food systems. The drivers of change for those variously involved, consumers and private individuals, are different, and can be triggered by different dimensions (health, environment, social and cultural). Combining different dimensions and reasons for change can help facilitate the transition to sustainable diets, recognising the food system’s specificities. The adoption of sustainable diets can be facilitated and enabled by food systems, and by appropriate policies and incentives.

Sustainable diets: Sustainable food systems: Sustainability: Food security and nutrition: Mediterranean diet

There is now wide recognition that the global food system, today, is not sustainable. There are more than two billion malnourished, almost 800 million undernourished, more than one billion overweight and obese. The majority of the poor and hungry are food producers. Food production and consumption are among the main drivers of environmental degradation, threatening its own resource base. A third of the food produced is lost or wasted. According to the FAO, global food demand is projected to increase by 60 % towards 2050 from 2007, driven by changing consumption patterns and population growth⁽¹⁾. Numerous studies show the role of food consumption patterns and of their evolution in the increase of non-

transmissible diseases. Numerous studies link food consumption patterns and their evolution to pressures on the environment. Many studies now point to synergies between more healthy diets and reduced environmental pressures, leading to the notion of sustainable diets, for healthy lives and healthy ecosystems.

Sustainable diets and sustainable food systems (SFS) are increasingly explored by diverse scientific disciplines^(2,3). They are also recognised by the international community and called upon to direct action towards the eradication of hunger and malnutrition and the fulfilment of sustainable development goals. The aim of the present paper is to briefly consider some of the links

Abbreviations: FSN, food security and nutrition; GHG, greenhouse gases; HLPE, High Level Panel of Experts on Food Security and Nutrition; SFS, sustainable food systems.

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between these two notions to pave ways for operationalising the concept of sustainable diets.

A series of international declarations and conferences have promoted SFS, and stressed their importance to ensure food security and nutrition. In 2012, the Secretary General of the United Nations launched, during the Conference on Sustainable Development, Rio + 20, the Zero Hunger Challenge, emphasising the central role of food security and nutrition (FSN) for sustainable development. The zero hunger challenge includes five objectives that complement each other: 100 % access to adequate food all year round; zero stunted children <2 years; all food systems are sustainable; 100 % increase in productivity; zero food loss. Two of these objectives could be qualified as results (eradication of hunger and of child malnutrition), two of them could be qualified as means, and integrate the three dimensions of sustainability, economic, social and environmental. The fifth and central one, all food systems are sustainable, is both a mean and a result, as well as a way to inscribe it in the long term.

In 2013, SFS were a topic of discussion in the Conference of FAO and the theme of World Food Day, with the slogan 'healthy people depend on healthy food systems'. The second International Conference on Nutrition, organised by FAO and WHO in November 2014, adopted the Rome Declaration on Nutrition⁽⁴⁾ that manifests a holistic approach, recognising 'that the root causes of and factors leading to malnutrition are complex and multidimensional', stressing the need to 'enhance SFS by developing coherent public policies from production to consumption'. The framework of action to guide the implementation of the declaration contains a specific list of recommended actions for SFS promoting healthy diets, even though many of the other recommended actions contribute to this objective.

The 2030 Agenda for Sustainable Development adopted by the General Assembly of the United Nations on 25 September 2015 reaffirms a commitment for a world where 'food is sufficient, safe, affordable and nutritious'⁽⁵⁾. Sustainable development goal 2 calls, by 2030, to 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture'. It is the first time that an international commitment is taken to eradicate hunger (rather than to reduce it). Interestingly, sustainable development goal 2 mentions also a means or directions to do so, 'promoting sustainable agriculture'. Sub goal 2.4 is to ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, help maintain ecosystems, and strengthen adaptation to climate change. However, it is to be noted that the sustainable development goals limited themselves to agricultural production systems, instead of referring to food systems. One has to refer to goal 12: 'Ensure sustainable production and consumption patterns' to go beyond production, with subgoal 12.3: setting a 50 % per capita target for the reduction of food losses and waste along the whole supply chain by 2030, being the only one specifically directed to food. Goal 12 also makes reference (subgoal 12.1) to the implementation of the 10-year framework of programme on sustainable

consumption and production patterns, under which are contained seven sectoral programmes, one being on SFS.

We thus adopt here a broader approach aiming to characterise the sustainability of diets within the sustainability of food systems. To do so first we analyse the relations between the two notions of SFS and sustainable diets. A brief description of the symptoms of the unsustainability of the food system, at global level, enables us to better characterise the issues at stake and the role of global diets. This leads to consideration of how sustainable diets could be the key to more SFS, starting from analysing what could be the characteristics of sustainable diets. The final section, building upon the relations and interactions between sustainable diets and food systems attempts to identify pathways for progress.

Sustainable food systems?

Food systems and diets

Diets and food systems are closely linked. However, the notion of food system is generally focused on food; we propose here to revisit the notion in relation to diets.

A diet is a selection of foods, eaten by an individual, chosen between those made available by the food system. Conversely the sum of diets creates the overall food demand that directs food systems. Diets are thus both a result and a driver of food systems. Therefore, approaching food systems by adopting the perspective of diets can bring operational insights to the issue of the evolution of food systems towards sustainability. Diet(s) can be a good entry point to see what can be done individually and collectively to improve food systems (and the margins of manoeuvre).

Hammond and Dubé⁽⁶⁾ proposed, as part of a systems framework for food and nutrition security, a definition of agrifood systems, focused on food production and linked to two other systems: the environmental system and the health and disease system; the interactions of the three systems determining outcomes on individuals.

Sobal *et al.*⁽⁷⁾ proposed an integrated conceptual model of the food and nutrition system emphasising a focus on nutrition and the links between food production, food consumption and nutritional health. It defines the food and nutrition system as 'the set of operations and processes involved in transforming raw materials into foods and transforming nutrients into health outcomes, all of which functions as a system within biophysical and sociocultural contexts.' It identifies three subsystems: the producer subsystem, the consumer subsystem and the nutrition subsystem, each flowing into the subsequent one. Focused on the linear relations between these three subsystems it is less comprehensive in its coverage of determinants of food systems, here described as part of biophysical and sociocultural contexts. It further identifies several systems that interact in many points with the food nutrition system. These systems, including the health care, economic, cultural, ecological, governmental, transportation systems, have their own specific orientations and interact with each other. This approach puts the consumer at the centre of

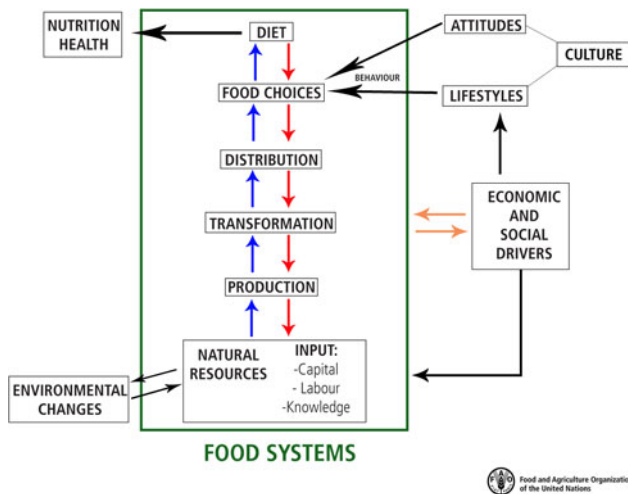


Fig. 1. (Colour online) Food systems and diets⁽⁸⁾.

the system, as an intermediate between food production and nutrition outcomes. It is thus particularly useful for the consideration of diets, within food systems.

More recently, building upon these and a range of other works^(9–12) the High Level Panel of Experts on Food Security and Nutrition (HLPE) proposed a comprehensive, descriptive definition:

‘A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes.’⁽¹³⁾

We propose to build upon the HLPE definition of food systems and to integrate the idea of linear exchanges between production and consumption, focusing on diets. In addition, we emphasise two dynamic domains interacting with food systems: environmental changes and social and economic drivers as well as two other domains interacting with individual food choices and diets: attitudes and lifestyles on one side, health on the other (see Fig. 1).

Notions and definitions of sustainable food systems and sustainable diets

We try here to delineate the relationships between diets and food systems, in order to be able to concretely assess the sustainability of diets, intended as their contribution to the sustainability of food systems and ultimately to food security and nutrition. The internationally agreed definition of food security dates from the 1996 World Food Summit: ‘Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life’⁽¹⁴⁾. This definition identifies four dimensions of food security: availability of food, accessibility (economical and physical), utilisation (the way it is used and absorbed) and stability of these three dimensions.

The HLPE, in line with the original broad approach of sustainability, has provided a definition of a SFS oriented by its capacity to ensure the positive outcomes of a food system: food security now and for future generations: ‘A sustainable food system is a food system that ensures food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition of future generations are not compromised.’⁽¹³⁾ The HLPE has thus formalised the link between the two concepts of FSN and of SFS: the basis is that there can be no FSN (short and long terms) without SFS. FSN for all, worldwide, and the conditions for their existence over time, could be what ultimately characterises SFS.

How do sustainable diets relate to SFS? First, a diet is a notion that is person-centred, it is the set of food, beverages and nutrients that are consumed by an individual or by a community of individuals during a certain period of time⁽¹⁵⁾. However, when the question is which diet to choose or to have, or what is an optimal diet, one has to bring in the picture elements that go beyond the diet *stricto-sensu*, both as impacted by the diet and as determining the space of potential choices of each individual: economic, social and cultural conditions and constraints.

As defined in 2010, sustainable diets are those diets with low environmental impacts, which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimising natural and human resources⁽¹⁶⁾.

Such a definition of sustainable diets, while embracing some of the elements of the food system, does not make direct reference to food systems. By introducing the SFS definition of the HLPE and how it relates to FSN, we deduct a relation between the definition of sustainable diets (with their double dimension of individual sustainability for health and of impact on global sustainability) and SFS:

‘A sustainable diet is a diet that contributes to the good nutritional status and long term good health of the individual/community, and that contributes to, and is enabled by, sustainable food systems, thus contributing to long term food security and nutrition.’

This has two important consequences to understand how sustainable diets relate to SFS: First, the two notions are very linked, which can help their common assessment. The strength of the contribution of the diet to the sustainability of the food system is what characterises the sustainability of the diet. Second, sustainable diets are both an objective and an essential mean, a key driver, to achieve the transformation of food systems, which is needed to achieve FSN.

The food system, at global level, currently, is not sustainable

From the above definition, the very function of food systems is to provide food security and nutrition. As shown

by current figures of hunger and malnutrition the global food system is not fulfilling its function. There is today a triple concern, often referred to as the triple burden of malnutrition, consisting first, of deficiencies in dietary energy intake (hunger defined by FAO as chronic undernourishment affecting 795 million persons according to the latest estimate⁽¹⁷⁾); second, of nutrient deficiencies, such as iron, iodine and vitamin A, which affect some two billion people in the world; and third, from overnutrition leading to overweight, estimated by WHO to involve 1.9 billion adults in 2014, and obesity, 600 million in 2014⁽¹⁸⁾. In addition, 42 million preschool children were suffering from overweight or obesity in 2013⁽¹⁸⁾. These different malnutrition challenges, which very often coexist in countries, can also overlap at individual level (for instance obesity can coexist with nutrient deficiencies), with correlated individual and public health challenges.

There are however differences in the way dietary patterns change across the world. Imamura and colleagues have characterised changes in dietary patterns nationally and regionally analysing information derived from individual-based national surveys⁽¹⁹⁾. Focusing on twenty dietary factors, they have modelled two different dietary patterns: one based on relatively high consumption of healthy items, another based on relatively low consumption of unhealthy items, as well as a third one integrating all items, and derived a score for each pattern. They note substantial heterogeneity between countries, including between neighbouring countries. Between 1990 and 2010 patterns based on more healthy items improved modestly while patterns based on unhealthy items worsened to a greater extent; these trends being weakly correlated. Trends vary significantly by national incomes, with improvements on healthy items in higher-income countries; global worsening on unhealthy items, particularly in middle-income countries, some improvements in high-income countries but they remain among the worst in the world. Importantly association between socioeconomic status and diet quality varies significantly for diet patterns based on unhealthy and healthy items.

Also, there are concerns about the scale of some major environmental impacts of food production. The production of food, including deforestation and other land-use changes linked to expansion of production, is responsible for 24 % of greenhouse gases (GHG) emissions⁽²⁰⁾. Agriculture accounts for 70 % of freshwater withdrawals globally, and in many places exceeding the renewable potential⁽²¹⁾. Pollution of soil and water is due to overuse of nitrogen and phosphorus fertilisers, and improper use of pesticides. Agriculture is also one major factor of biodiversity loss^(22,23), and at the same time agricultural biodiversity is decreasing: In the past 100 years, about 75 % of the genetic diversity of agricultural crops was lost⁽²⁴⁾, and today more than half global plant derived energy comes from only three crop species: wheat, rice and maize⁽²⁵⁾.

The food system is producing, globally, enough food but is unable to ensure food security and good nutrition in the world today. And strikingly it performs

proportionally worse to feed its own participants. The majority of the poor and undernourished people in the world are living in rural areas, depending on agricultural activities for their subsistence. This is why sustainability concerns for food systems expand in fact well beyond those of their inadequate environmental and natural resource use performance, questioning substantially their economic and social features.

Sustainability challenges for the future

According to FAO estimates⁽¹⁾, business as usual projections of food consumption, due to increased population and, to a more important extent, to worldwide dietary changes, is expected to grow by 60 % by 2050 compared with 2007. There are major differences between countries both in increase of food consumption and in changes in dietary patterns, but in the countries experiencing food consumption increase, patterns are generally changing towards more livestock products, vegetable oils and sugar. These three food groups together now provide 29 % of total dietary energy supply of the developing countries, a share up from 20 % three decades ago, and projected to rise to 35 % in 2030 (in industrialised countries the share has been about 48 % for several decades now).

Of particular significance is the projected increase of the global consumption of animal-sourced products. Such changes are expected to have a major environmental impact, mainly evaluated in terms of GHG emissions and land-use change⁽²⁶⁾. Some studies have described alternate scenarios. For instance Agrimonde⁽²⁷⁾ describes a baseline scenario, Agrimonde 0, with an increase of global demand of dietary energy of 83 %, and an abated scenario Agrimonde 1, where the increase is 28 %. This last scenario supposes radical changes in consumption patterns and behaviours and in worldwide distribution of food, including a decrease of 25 % of the per capita consumption in Organisation for Economic Co-operation and Development countries between 2000 and 2050, without any income reduction, and a slowdown in the increase of per capita consumption in emerging countries. Such a scenario would require radical changes in consumers' behaviours, reduction in waste, and implementation of efficient public policies to promote more balanced and healthy diets.

Another study⁽²⁸⁾ elaborates scenarios based on diets, differing mainly by the proportion of meat: 'western high meat', 'current trend', 'less meat' and 'fair-less meat'. It concludes that under the fair-less meat scenario it would probably be possible to feed the world with organic crops and an organic livestock system, with a very equitable distribution and an average daily intake of 11 715 kJ (2 800 kcal) per capita of which 20 % of protein is from animal origin. The western high meat diet, with 44 % of protein intake of animal origin would also probably be feasible, but only with a cropland expansion of 20 %, intensive crop production and intensive livestock production.

These challenges for the future, given today's unsatisfying performance of food systems, economically,

socially and environmentally, poses the question of the appropriate leverage points to improve the sustainability of food systems.

Is sustainable diet and consumption the key to reach sustainable food systems?

The very effectiveness of the concept of sustainable consumption and production is in fact grounded on the idea that to increase sustainability of systems, both production and consumption, supply and demand, have to be considered. There are production choices and there are consumption choices; increasing sustainability is a matter of both. To a certain extent, and still in many economies, consumption choices are bound to evolve in the, often restricted, product space which production offers. But in today's world, with a space of consumption choices increasingly wide, there are greater prospects for consumption to drive production, for consumption choices to orient the choices that producers make (which products, how they are made), or globally to direct production towards the products consumers want to buy. In that regard, there are increasing opportunities for more sustainable consumption patterns and choices to drive towards more sustainable production patterns.

Human and food systems dimensions of sustainable diets

Characterising sustainable diets requires first to distinguish between the two dimensions of the definition of sustainable diets (Fig. 2): on the one side, the nutrition and health dimension, assessed on persons, and on the other side the impact on the food system, and its sustainability, in all dimensions and measured at various levels. Assessing each dimension requires specific methodological approaches and tools.

The composition of the diet has two main categories of impacts: on the individuals consuming it and on the food system as a whole. The impacts on the individuals can be assessed by the nutritional characteristics of the foods consumed and/or, with a time lag, by the assessment of certain health characteristics known to be influenced by food consumption. The composition of the diet drives the demand for and production of specific foods, with environmental, economic and social impacts. Assessing the significance of specific dietary choices on sustainability of food system brings a series of challenges. Impacts can generally only be assessed using generic indicators and figures unless the origin of the products can be traced back and that there are means to better assess specific impacts in the area of origin and along the food value chain.

Looking at the nutrition dimension involves mainly individual-level indicators, but comes with its challenges. It impacts, and to a great extent determines, the nutrition status of the person. One main challenge for the assessment of nutrition and health impacts is how to make the link between the sum of individual diets, the global consumption of the population, and the health status of a population, at country level for example, given

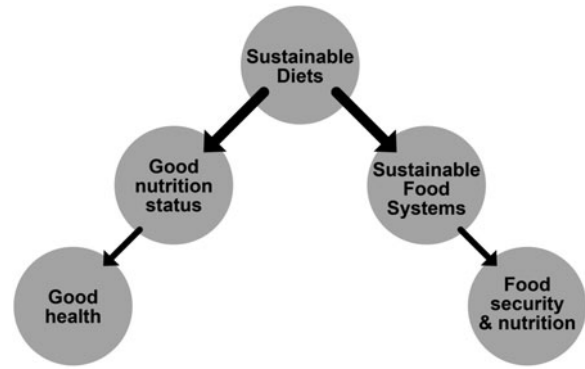


Fig. 2. Two dimensions of sustainable diets as a driver of changes at individual level and system level⁽²⁹⁾.

heterogeneity of consumption, especially in a time of changing diets.

The function of a diet is to ensure proper nutrition contributing to good health. There are numerous studies and often diverging views on optimal diets from a health perspective, and the aim of the present paper is not to review those studies. Some broad characteristics seem to be generally considered to be correlated with better health outcomes. For instance, a recent review of studies on health effects of diets, organised by types (low carbohydrates, low fat, low glycaemic, Mediterranean, mixed, Paleolithic and vegan) concluded with a broad aggregation of evidence in support of diets comprising preferentially minimally processed foods, and comprising mostly plants⁽³⁰⁾.

Diets that contribute to sustainable food systems

Most studies about the sustainability of diets focus only on environmental impacts, or combine them with health effects. Economic or social impacts of diets are generally not considered. Even environmental impacts are often reduced in some of them, specifically GHG emissions, land use or land-use change and water use. Impacts on water quality are much less mentioned and biodiversity is generally not taken into account or only through the proxy of land use, which does not enable proper consideration of agrobiodiversity nor of biodiversity in the field.

Environment. A number of studies have applied life cycle analysis to food products. A key issue here, from a diet perspective, is the functional unit used to make comparisons. These can be agricultural production methods, food production methods, food items, meals or diets. As noted by Heller, Keoleian and Willet in a critical review of life cycle analysis-based studies⁽³¹⁾, the ideal functional unit basis for diet comparisons should be nutritionally based. An increasing body of scientific literature analyses the parallels between the effects of diets on health and on the environment, using diets as the unit of comparison. One study adopting a global perspective and analysing the effects on health (type II diabetes, cancer, coronary mortality, all-cause mortality) and on the environment (GHG emissions and land-use change) of four diets (income dependent, Mediterranean, pescetarian



and vegetarian) concluded that current dietary trajectories are at the same time greatly increasing global incidences of type II diabetes, cancer and coronary mortality, and also causing significant increases of GHG emissions and contributing to land clearing. Alternative diets would have both health and environmental benefits⁽²⁶⁾. Gill *et al.*⁽³²⁾, focusing on the effects of the nutrition transition in emerging economies note that the impact on environment are significant and deserve proper consideration. Other studies^(33,34) analyse the environmental consequences of switching to more healthy diets or the consequences on health of switching to more environmentally friendly diets⁽³⁵⁾. Some studies analyse the environmental impacts of adopting diets respecting national dietary guidelines^(36,37). Most of them conclude that there are synergies between more healthy and more environmentally friendly diets. One German study⁽³⁸⁾ calculated that shifting to the official German dietary recommendations could reduce GHG emissions by 11 %, land use by 15 %, blue water use by 26 % and energy use by 7 %.

These global results are contradicted by another study⁽³⁷⁾ in the US context, finding that shifting to US dietary guidelines to support healthy weight would increase energy use by 38 %, blue water footprint by 10 % and GHG emissions by 6 %. This is mainly due to the increase of fruit and vegetables which, in the USA, have a high energy (and thus relatively high GHG) and blue water footprint. The authors conclude that differences in production systems can have a significant impact on results and that there can be trade-offs between more healthy and more environmentally sustainable diets.

Environmental impacts of a specific product can be very diverse depending on methods of production, conservation and transformation. They can also be very variable according to local conditions; particularly for impacts on water consumption and quality, biodiversity, etc. Therefore, strictly speaking, assessing the impacts of a diet would require to know where and how each of its components has been produced. Most environmental impacts are linked to production, mainly in agriculture. However, for perishable products in industrialised countries the impact on energy consumption and GHG emissions (including perfluorocarbores) of distribution, storage and consumption stages can be particularly important. With increased consumption of fresh or frozen perishable products the importance of these impacts is likely to grow.

At the global level, the environmental sustainability of an archetypal average global diet can initially be appraised by looking at how such a diet potentially impacts on the environmental sustainability of the food system, at least for some global common indicators. The need for a clarification of the relationships between diets and food systems emerges when trying to calculate concretely some of the indicators characterising the environmental impact of a diet at lower levels, such as the national level. Most of the diets are no longer determined by what is locally produced, as it was for traditional food systems⁽³⁹⁻⁴¹⁾. The connection between a diet and a geographic area has loosened with globalisation. Also, there is increasingly a disconnection between

the space of production and the space of consumption. And to a certain extent the very term Mediterranean diet is misleading. It is geographic, localised, by name, while it is in fact increasingly using imported products, including from outside the Mediterranean area. It can also be followed outside the Mediterranean region.

Impacts of a diet depend not only on its composition but on where and how each item has been produced, transformed, transported, stored and consumed. This is why when we want to assess environmental impacts of a diet concretely we immediately get lost in scopes, scales and data. The environmental impact of the sum of diets of a country is not the environmental impact of the national food production sector; there are exports and imports. In other words, what is assessed at consumption level is not the sustainability of a food system but the contribution of the diet to the sustainability of food systems. Unless there is total traceability of all products consumed, with for each of them total information on the specific impacts of their production, transformation, transport and conservation, impacts are assessed using available, often generic, figures, and in reality, most of the time, point-based estimates.

Economic and social significance. The economic and social significance of dietary choices brings back the issue of the importance of agriculture, food transformation, retail and food preparation (including catering) sectors in the national and local economies.

The livelihood of 2.5 billion people, living in rural areas, depend on agriculture⁽⁴²⁾ and growth in the agricultural sectors is more than three times more effective at reducing poverty than growth in other sectors⁽⁴³⁾. Women comprise, on average, 43 % of the agricultural labour force in developing countries, ranging from 20 % in Latin America to 50 % in Eastern Asia and sub-Saharan Africa⁽⁴²⁾.

The agricultural sectors and food chains are marked by a high diversity, often coexisting within the same geographical space, from very large-scale participants often better integrated with food chains and international trade, to more traditional, small-scale units. These different means of organisation often perform differently in relation to economic and social impacts, especially in relation to employment (including informal *v.* formal wage employment), working conditions, gender and especially women, job organisation and market power and repartition of the value added along the chain.

One of the main factors driving economic and social impacts of a specific diet (and also conditioning it) is food prices. Low price of food, especially of healthy food, condition the affordability of healthy diets. However, low prices reduce the income of producers, who constitute, worldwide, the majority of the hungry and malnourished. Low prices also risk reducing capacity and willingness to invest in agriculture, a condition for future food production. Social sustainability along the food chain also depends on the capacity for prices to be fairly remunerative for all participants involved. It is determined by the relative prices of foods, between themselves and as compared with income of consumers,

as well as the way by which they contribute to the income of the various participants along the food chain.

Assessing sustainable diets

Combining dimensions. The analysis of the relationships between the concept of sustainable diets, SFS on one side, and healthy diets on the other provides a framework that can help design a way forward to assess sustainable diets in concrete situations.

It could also help understand some of the conditions/drivers of sustainable diets, which could enable the design of actions towards more sustainable diets⁽⁴⁴⁾.

There is tension to manage between going towards the person, which is relevant for the ‘human health’ part of sustainable diets; *v.* going towards the system and integrating at broader scales, which is relevant for example for sociocultural indicators.

Applying the sustainable diets definition concretely to actual diets encounters several methodological challenges. It requires assessing the sustainability of an actual diet from two totally different perspectives: from a nutrition perspective, to assess the potential effect on the individual’s health, and from a broader sustainability perspective, to assess its impact on the sustainability of a food system, in all its dimensions: environmental, economic and social.

Therefore, taking these considerations altogether, we propose that indicators of sustainable diets could be those measuring the strength of the contribution of individual or collective dietary choices to the state of the food system (measured by indicators of the sustainability of food systems). A consequence is that the measurement of the sustainability of diets is by nature very multidimensional: it reflects the multidimensionality of the indicators of SFS, and how the different components/variables describing the diet can influence them.

This is conforming to a conception of sustainable diets as those diets which most strongly act to ‘shape’ the food system towards more sustainability, in its various dimensions, environmental, economic and social. A difficulty here is that in contrast to the increasing body of scientific literature that analyses the parallels between the effects of diets on health and on the environment, there are far fewer studies assessing the economic and social implications of dietary choices.

Combining scales. Finally, one critical issue is how to deal with the effect of spatial integration, from local to regional and global, when it comes to measuring the effect of one diet on one food system. With longer and longer food chains, expanding imports and exports, and increasing interconnection of food systems, diets are more likely to have remote impacts, which can be different from local impacts, and which will necessitate to a look at the food system at global scale. The example of meat consumption in Europe is a good one, as it drives a good part of the soyabean expansion in South America in order to provide feed. Another interesting example is the success of quinoa. Is the increase of quinoa consumption in developed countries really contributing to sustainable diets and how, given

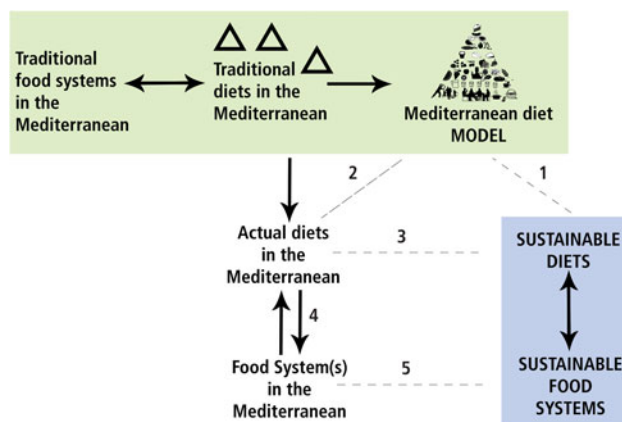


Fig. 3. (Colour online) From concepts to actual diets: the case of diets and food systems in the Mediterranean⁽²⁹⁾.

all the dimensions of sustainability of food systems we talked about, locally and remote?

The original discourse about sustainable diets was very much guided by an assumption that diets and food systems are linked, and in particular that they share the same spatial limits, with a broad equivalence between consumption and production spaces. Such an equivalence is true at global level (summing all the individual diets that compose it). It was to a great extent true in ‘traditional’ food systems very much linked to a specific ‘traditional’ diet, somehow homogenous, shared by a geographic community, and therefore sharing the same geographical limits as the food production area. To a certain extent this was true for the Mediterranean diet model, abstracted from traditional diets in the Mediterranean (see Fig. 3). This is why it can be considered as a case study of a sustainable diet (arrow 1). The work done in that respect aims to devise a methodological approach to consider actual diets in the Mediterranean in relation to the notion of a sustainable diet (arrow 3) using their relationship to the Mediterranean diet model (arrow 2) as a pathway. As shown above, to assess the environmental, economic and social dimensions would require looking specifically at the food system to which a diet is linked and to assess it from a SFS perspective (arrow 5). Finally, the main question of interest in any food system could be the relationships between the diet and the food system (arrows 4) and how these determine the sustainability of the diet (arrow 3) and of the food system as a whole (arrow 5). Understanding these relationships and their dynamics could also be key to understanding drivers of change, including potential means to improve the sustainability of diets and food systems.

This proximity of a diet to a food system, closely associated with a geographic area, is no more to be found for most modern diets. Furthermore, a diet within a particular ‘system’ is not the same for everybody; consumption within a food system is not homogeneously distributed. It is the sum of diets that creates global demand and thus determines impacts on food systems. This brings an additional difficulty to assess the impact of diets on food systems, and often a way to deal with this is to look at the



impact of average diets. However, from a nutrition and health perspective, the individual diets are important, rather than the average.

How to make progress towards sustainable diets?

What drives what? Food system constraints and enablers to sustainable diets

Many drivers of food consumption choices and to their expression are to be found within food systems. If we assume that sustainable diets are both an objective and a driver of SFS, understanding the drivers of food choices is of paramount importance to design ways to improve the sustainability of both diets and food systems. This leads to particular interest for two specific groups of parameters. The first covers economic, social and cultural parameters that, both inside and outside food systems, can drive food consumption choices. The second covers those relating to consumption choices that go beyond an interest in diet composition and take into account characteristics such as quality, origin and mode of production. Such choices can have various impacts on all dimensions of sustainability. Moreover, they can be the expression of attitudes that are also grounding some choices related to diet composition.

Sustainable diets are both constrained and enabled by the food system. The state of the food system determines the space of possible diets, and therefore determines the possibility to choose sustainable diets, given the available spectrum of consumption choices and incentives, and that these diets are available at the proper scale.

The food system is shaped by many drivers, its status being the result of different diets, environmental, economic and social issues at different levels from local to global, etc. First, it is shaped by the sum of all the diets. The existence of unsustainable diets, or their predominance and influence on the market, is in itself a constraint to the emergence of sustainable diets at scale. Currently we are rather, globally, in an un-virtuous circle, by which the evolution of diets, as shown above, are shaped by and contributing to a more and more unsustainable food system. This interrelation expands, today, spatially: in one location, say at country level, diets are diverse and one could say that several dietary patterns coexist. The food system is connected (and shaped by) a variety of diets. Together with the importance of imports, diets at one place are connected to food systems at other places. Second, the food system is also shaped by many other drivers, such as food production and distribution costs, energy and input prices, the cost of labour, agricultural policies, as well as the evolution of incomes with regard to the price of foods, etc.

Prices and affordability of diets

One of the first determinants of food consumption choices (and of their feasibility) is price. From a consumer perspective, and especially poor net food buyers, the lower food prices are, the better; it facilitates diversified and nutritious diets, and favours capacity to

spend on other basic needs. Conversely, low food prices can have direct negative environmental impacts by not discouraging food waste⁽⁴⁵⁾. They reduce investment capacity and thus economic sustainability. By driving the need for low production costs they also encourage low-cost practices that can be environmentally damaging and drive low income and wages for food producers and workers, with important social impacts.

Another difficulty results from the increasing discrepancy between prices of healthy *v.* non-healthy foods. This is particularly important as those with low income are more sensitive to prices and price change. A systematic review and meta-analysis covering ten countries found that healthier foods and diet patterns cost more than less healthy options, with the difference between much healthier and less healthy options being significant for low income families, but comparable with the societal cost of suboptimal diet quality, concluding that there would be room for public intervention⁽⁴⁶⁾.

This divide between the price of healthy *v.* unhealthy items tends to increase: in high income countries, the cost of the first category has risen more than the other during the past 30 years, and the same may apply in emerging economies, with prices of fruit and vegetables having risen more than most foods including energy dense processed foods⁽⁴⁷⁾. Price-driven substitutions from healthy to unhealthy food can be amplified in case of unhealthy foods becoming more affordable, when, as shown in the case of the USA, consumption of food away from home, soft drinks, juice and meats were more responsive to price changes than other foods⁽⁴⁸⁾. Conversely, this would also lead to possible higher effects on consumption of the taxation of such produce.

However, such findings do not necessarily mean that, systematically, healthier diets are always less accessible, such as in the case of the Mediterranean diet⁽⁴⁹⁾. Also, over time, some argue that income may become a weaker determinant of diets, giving thus broader scope for public policy to have a real influence in the future⁽⁵⁰⁾. This deserves to be discussed. On one side, it can suppress barriers to more healthy and sustainable diets if they were more expensive. Conversely, it could reduce the effectiveness of any attempt to integrate negative externalities, whether for health or sustainability reasons, in food prices.

The potentially ambivalent (and at least multiform) role of prices with regard to sustainability and food security calls for clarification, clearly separating food prices as an indicator of access at consumption level, from its use and interpretation inside the food system at large, which requires breaking down the final consumption price in various components to better envision its relationships with economic and social dimensions of sustainability. Such distinctions of level of impacts inside food systems are also particularly important to better understand, conversely, the potential impacts of changing diets, on the different stages of food systems, as it will impact prices and economic exchanges⁽⁵¹⁾.

Food prices should therefore also be analysed in terms of their impacts on sustainability, with different approaches for diets and for food production, for instance. The contribution of food prices to the various



dimensions of sustainability can thus be different when considering only diets or food systems as a whole, particularly when integrating a long-term perspective. Prices, however, are not the only parameter influencing food choices. Other parameters enter in line, such as education and consumer information.

Consumer information

Consumers, by their choices, in terms of type of products, quantity, quality (including production modes) direct production. Consumers are directed by the information made available to them. Producers can also anticipate consumer demand and its changes and pro-actively seek new markets.

Different parts of the food and nutrition systems have different foci, goals and units and this can make communication difficult between those involved⁽⁷⁾. Nutritionists organise the world according to nutrients, producers from a commodity perspective, and consumers from a taste perspective⁽⁷⁾. In that regard the decision to move from nutrient based to food based dietary guidelines has been key to increase their readability for consumers and thus their effectiveness.

Simple messages about healthy diets can be obscured by communication on various diets and products advocated by numerous participants⁽³⁰⁾.

Trends on dietary patterns towards more healthy items and towards more unhealthy items (see earlier) are not correlated which makes one wonder if it is not because these trends are driven by different policies and incentives, tendencies for increase of unhealthy items being driven by marketing and promotion of more healthy items by government policies⁽¹⁹⁾. There could also be reluctance from policy makers to propose changes that might have a negative effect on economic sectors⁽⁵⁰⁾.

Conversely, too simple messages can have detrimental impacts on nutrition. For instance, in the UK, meat and dairy products make a considerable contribution to the intakes of fourteen nutrients for which intake is below the lower reference level⁽⁵²⁾. Hence, a recommendation for reducing meat consumption would need to take into account the likely impacts on nutrient intake and propose a more holistic diet change to compensate for the induced changes.

Conclusion

How to operationalise changes or choices towards sustainable diets, combining arguments in the health and sustainability dimensions?

To trigger choices, there is a need to mobilise cultural, historical, geographical references and economic forces (including affordability). In fact, the introduction of sustainability criteria in the debate on healthy diets often acknowledges that the rationale for it is also to add one more reason to adopt them. It also needs to take into consideration convenience from the consumer perspective. Cumulating several dimensions can lead to cumulating positive externalities associated with a diet

change. In particular, social and economic dimensions can often more easily trigger change of some categories of participants. This could lead to envisage incentive schemes, internalising benefits, taking the full sustainability implications into account.

A richer definition of sustainable diets, such as the one proposed in the present paper, linking human health and the three dimensions of sustainability of food systems, can seem more complex but we argue that in fact it is less prone to possible errors potentially created by unidimensional criteria or approaches, and more adapted to the reality in which participants are working, and thus more operational. It needs more data, in all dimensions, environmental, social and economic, at the appropriate scale. It also needs to accept moving from an initial focus on win/win choices to accept informed choices acknowledging trade-offs. This could enable participants in the food system to successfully implement the three pathways identified by Tara Garnett⁽⁵³⁾: improve efficiency, restrain demand and improve governance.

In this discussion, what could be the role and use of dietary guidelines? Can this instrument be used to discuss sustainable diets? There is a competition between different discourses, typically the health discourse, and the sustainability discourse. We argue that it is important to have a place to enable the confrontation of priorities. Discussion on what are sustainable diets needs to be done with nutritionists, not only specialists of environment or sustainable development. Dietary guidelines, if well-conceived, and adapted to national situations and priorities can be a tool for food policies in general, to orient the behaviour of the different participants, given the multiplicity of objectives. Some countries have recently introduced explicitly sustainability as part of their dietary guidelines (for example, Brazil, Germany, Qatar, Sweden); it is however too early to draw conclusions about their implementation.

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Conflicts of Interest

None.

Authorship

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