

Food Composition and Sustainability

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Abstract

Sustainable diets are diets with a low environmental impact that contribute to food and nutrition security and a healthy life for present and future generations. Currently, there are knowledge gaps that hinder the task of evaluating sustainable diets. Among these gaps, the lack of reliable global food composition data bases to determine whether diets have a nutritional and food profile in accordance with current recommendations is notable. Biodiversity is a significant element that is mentioned in the definition of sustainable diets. Certain indicators are needed for recognizing and explaining biodiversity, such as the nutritional composition of foods, i.e., the nutrient content and bioactive compounds in species, subspecies, cultivars and races, and food consumption identified in food surveys. The nutritional profile of certain foods varies according to the taxonomic classification below species and depends on the climate, geography and geochemistry, agricultural practices (e.g., the use of fertilizers), state of ripeness, growth stage, etc. Knowing the composition of traditional and local foods allows us to gain knowledge regarding our ecosystems, the value of their species and the within-species diversity. Considering the variation in the food composition in the diet of many communities, consumption of one plant variety over another can represent the difference between an inadequate or an adequate intake of one or more micronutrients or bioactive compounds by the population.

The lack of an open-source reliable database of food composition and food consumption of the global food supply is a challenge in the development of sustainable foods and food patterns.

Introduction

The FAO and Biodiversity International define “sustainable diets” as follows: “*Those diets with a low environmental impact that contribute to food and nutrition security and a 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, and safe and healthy, while optimizing natural and human resources*” (FAO/Biodiversity, 2012).

This definition implies that alimentary patterns are related to environmental sustainability, biodiversity maintenance and food safety, and a public health contribution. Currently, however, intensive agriculture, demographic pressure, progressive urbanization and changing lifestyles have modified food production and consumption, markedly affecting the healthiness of our diet.

According to an analysis performed by Johnson, et

al., (2014), human food consumption is affected by interrelated factors, including food availability, food accessibility, and food choice. These factors are also influenced by geography, demography, household incomes, socioeconomic status, urbanization, globalization, religion, culture and marketing and consumer attitude. Thus, we must consider the following different aspects to understand the concept of “sustainable diet”: agricultural, environmental, social, cultural and economic, as well as food consumption and its nutritional value.

There are knowledge gaps that hinder the task of evaluating a sustainable diet. Among these gaps, one I would like to emphasize is the lack reliable global food composition databases to determine whether diets have a nutritional and food profile in accordance with current recommendations.

The double nutritional and environmental pyramid developed by The Barilla Centre of Food and Nutrition (Barilla Center, 2010) notes, in a graphic representation similar to that of most food-based dietary guidelines, the contribution of

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different food sin nutritional and environmental levels. This double pyramid establishes an inverse relationship between the nutritional and environmental pyramids as follows: foods that ought to be consumed with low frequency and in smaller portions are placed at the top of the nutritional pyramid; inversely, they form the base of the environmental pyramid. Examples of such foods include red meat and processed and ultra-processed food. This scheme suggests that diets including plant-origin, low-processed, local and seasonal food are more sustainable and have less of an environmental impact than those including animal-origin, ultra-processed, non-local and non-seasonal (transport impact) food. Therefore, diverse authors have proposed the Mediterranean diet as an example of a sustainable diet because it includes a high intake of plant-origin, low-processed, local and seasonal food, and a low intake of animal-origin food. Moreover, the Mediterranean diet is a frugal diet (FAO/Bioversity, 2012; Trichopoulou, A., 2012; Dernini, et al., 2013).

Biodiversity and food composition

A significant element mentioned in the definition of sustainable diets is biodiversity, which is defined as follows: “The diversity of plants, animals and other organisms used for food, covering the genetic resources within species, between species and provided by ecosystems” (FAO, 2008; FAO, 2010). Certain indicators are needed for recognizing and explaining biodiversity. With this aim, the following two indicators have been developed: (FAO/Bioversity, 2012) nutritional composition, i.e., the nutrient content and bioactive compounds in species, subspecies, cultivars and races, and food consumption identified in a food survey (Johnston, et al., 2014) underused, wild and/or classified in a taxonomic level below subspecies (FAO/INFOODS, 2013).

Regarding food composition and biodiversity, there is an important knowledge gap about the influencing factors of the food content in many foods consumed in different regions worldwide, particularly in developing countries. The nutritional profiles of certain foods vary according to the taxonomic classification below species as follows: subspecies, varieties, cultivars, races. We also must consider that food composition, in terms of nutrients and bioactive compounds, depends on different factors, such as acclimate, geography and geochemistry, agricultural practices (e.g., the use of fertilizers), state of ripeness, growth stage, etc. For instance, rice cultivars could differ from each other in terms of essential nutrients for public health, such as iron, which varies between 0.7 and 6.4 mg/100g, among others. Other examples of these variations are found in sweet potatoes and bananas; their beta-carotene content ranges between 100 and 23100 mcg/100 g edible portion and < 1 to 8500 mcg/100 edible portion, respectively (Burlingame, et al., 2009 ; FAO/INFOODS, 2013). Another case is potato types that differ from each other in protein content between 0.85 and 4.2 g/100 g, a significant difference if we consider the potato as the main source of this macronutrient in some Latin American countries. Likewise, the content of total bioactive phenolic compounds ranges between 0.2 and 580 mg/100 g, and alpha-solanine, an antinutrient compound, varies between 0.001 and 47.2 mg/100g (Burlingame, et al., 2009).

In Spain, there are several examples of underused foods. The “colleja” (*Silene vulgaris*) is an edible herbaceous plant that grows wildly. Compared to other similar edible plants,

such as chard or spinach, the “colleja” is particularly rich in linolenic acid, a fatty acid of the n-3 series (García Gonzalo, et al., 2012). Another underused plant is the “tagarnina” (*Scolymus hispanicus*), which is widely consumed in southern and western Spain, although currently there is no information about its nutritional composition.

Through the Ark of Taste, the slow Food movement, in favor of traditional foods and biodiversity, has promoted an increase in cataloging and recovering of traditional foods in danger of disappearing around the world. In Spain, The Ark of Taste includes approximately 81 foods and traditional manufacturers (<https://slowfood.es/proyecto/arca-del-gusto/>). For instance, the “snowflake” potato is cultivated in Sierra Nevada (Granada, Spain) at an altitude of 2000 meters. This type of potato, originally from the Peruvian-Bolivian Andes, contains more starch but less sucrose, glucose and fructose than conventional potatoes sold in supermarkets.

We should emphasize that biodiversity; food production and food consumption are interrelated elements when evaluating the relationship between local products, nutrition, food safety and sustainability. In this context, traditional foods and food patterns play a key role (Trichopoulou, A., 2012).

Maintaining food traditions contributes to food safety because it encourages the cultivation of vegetables and raising animals that have particular nutritional features (because of their nutrient content and other bioactive compounds) a dare local and adapted to the environment. Moreover, food traditions are important for the development and economic sustainability of rural areas and their population. They also preserve biodiversity and enable the recovery of endangered varieties and species of food. The problem in determining the true role of traditional food sin the maintenance of biodiversity, sustainability and its relationship with a healthy food pattern is the lack of information about nutrients and bioactive compounds. In the last 15 years, FAO/INFOODS have made great progress addressing this lack of information. Their efforts resulted in the publication of the food composition database for biodiversity, published for the first time in 2010, which included 2401 foods. In the 2011, 2012 and 2013 database updates, the number of foods, nutrients and other components included in the databases increased. The 2.1 version from 2013 contains 6497 foods (FAO/INFOODS, 2013).

Traditional Foods

Knowing the composition of traditional and local foods allows us to gain knowledge regarding our ecosystems, the value of their species and the within-species diversity. Considering the variation in the food compositions in the diet of many communities, as mentioned earlier, consumption of one plant variety over another can represent the difference between an inadequate and an adequate intake of one or more micronutrients or bioactive compounds by the population. This leads us to recognize the importance of a better and broader knowledge base regarding the nutrient content of underused foods, wild foods or cultivars, which are a part of the dietary pattern of a community. This knowledge will help us promote local species and varieties as well as value and maintain the ecosystems that are producing them (Burlingame, B., 2009).

In 2005, the European Food Information Resource Network (Euro FIR) included a work package about traditional and ethnic food, among others (Trichopoulou, A., 2014). Traditional

food is an essential component in the dietary patterns of populations from a large number of regions and countries around the world. “Traditional food” has been defined as follows: “A food of a specific feature or features, which distinguish it clearly from other similar products in the same category in terms of the usage of “traditional ingredients” (raw materials or primary products) or “traditional composition” or “traditional type of production and/or processing method”. The “traditional” concept is understood as follows: “according to practices and specifications established prior to World War II” (Trichopoulou, A., 2007). In consideration of this definition, a compilation of 55 selected traditional foods from 13 European countries was published, which documented their traditional character and analyzed their energy and nutrient content with a common method. The compilation marked the beginning of knowledge about the nutritional profiles of traditional foods in each country and provided a methodological tool to continue the effort of recovering traditional foods in each country (Costa, et al., 2010).

This approach to the nutritional profiles of traditional foods has been continued by the AISBL Euro FIR with their project BaSe Food (Albuquerque, et al., 2013), in which an integrated approximation was made considering sustainability aspects, such as the specific features of local communities, traditional foods, vegetal resources and knowledge, and biodiversity preservation. In addition, one of the objectives of the project was to obtain information about the content of bioactive compounds and their possible connections to health and the development of sustainable diets.

Following these guidelines, the Spanish Database of Food Composition (BEDCA) (www.bedca.net), developed according to the Euro FIR standards, includes the composition of traditional foods, such as traditional cheeses from different regions of Spain, among others.

In 2010, the FAO affirmed “*countries, communities and cultures that maintain their own traditional food systems are better able to preserve food and recipes with the corresponding local biodiversity of cultivated varieties and autochthonous animal species. Furthermore, these communities have lower prevalence of chronic diseases associated with food. The Mediterranean diet is a clear example of this*” (Food and Agriculture Organization of the United Nations, 2011).

Nutritional composition data are a source for the successful promotion of traditional foods, the development and economic sustainability of rural areas, and the promotion of local biodiversity and sustainable diets by maintaining healthy dietary patterns.

Finally, the following points are compiled from the Las Palmas’ Decalogue about sustainable food in communities: choose and eat seasonal food in proximity; choose local products in local markets; consume preferably seasonal food; revalue traditional and local food and recipes; use terrestrial and aquatic biodiversity in a sustainable way to preserve it; and take interest in the sustainability and equality of agricultural, livestock and fishing procedures. For these key points, a deeper knowledge is needed about the nutrients and bioactive compounds of foods from our environment, underused foods and wild foods, with

nutritional profiles that are sometimes very different from those usually included in the food composition databases. This knowledge allows us to maintain environmentally and socioeconomically sustainable food patterns that stem biodiversity loss, contribute to food safety, are nutritionally adequate based on current recommendations, and enable us to have a healthy lifestyle.

As the quality of available data on bio diverse foods improves, we can use these data for research and the promotion of sustainable diets. A challenge in the development of sustainable foods and food patterns is the lack of an open-source reliable database of food composition and food consumption of the global food supply (Johnson, et al., 2014).

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