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Report

Nutrition indicator for biodiversity on food composition—A report on the progress of data availability

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ABSTRACT

FAO in collaboration with Bioversity International is leading the *Cross-cutting Initiative on Biodiversity for Food and Nutrition* which has been established to measure, investigate and promote biodiversity and nutrition. Nutritional indicators for biodiversity are needed to address the diversity of plants, animals and other organisms used for food, covering the genetic resources within species, between species and provided by ecosystems. The indicator for food composition aims to report the annual progress regarding availability of food compositional data for biodiversity from different data sources by counting the number of foods with sufficient detailed description of genus, species, subspecies and variety/cultivar/breed and with at least one component. Since the development of the nutrition indicator for biodiversity on food composition in 2007 more than 10 000 foods have been counted for the indicator. A 54% increase in data availability was measured from 2008 to 2009. Due to the mode of searching most data were located in scientific articles. Most available data were on variety/cultivar/breed level and were from Asia (3741) followed by America (2297), Africa (1773), Europe (1541) and Oceania (1032). This research supports the increasingly recognized importance of biodiversity for food composition. Nevertheless a wider spectrum of foods and components needs to be analysed in order to mainstream biodiversity into nutrition activities.

1. Introduction

A wealth of botanical and agricultural diversities exists. It is estimated that over 7000 plant species used for food can be found across the world (Bioversity International, 2009). However, during the last decades, a decline in mean species abundance of 30% has been reported (Nunes and Nijkamp, 2008). Only three crops, maize, wheat and rice, contribute to 43% of the global requirements for energy and to 39% of the global requirements for protein (FAOSTAT, 2010). This one-sidedness of agriculture contributes to a reduced consumption of other nutritionally rich species and varieties such as fruits and vegetables (Johns and Eyzaguirre, 2006). The global food and nutrition security becomes vulnerable when it is dependent on only a few number of species (Flyman and Afolayan, 2006). All the dimensions of food and nutrition security need to be addressed in interventions. Therefore, not only the quantity and energy contribution of foods are important to combat malnutrition but also their quality, i.e. their micronutrient content (Toledo and Burlingame, 2006). Vitamin A, iron and iodine deficiencies represent a serious global health problem (WHO, 2009b). Supplementation and fortification are common approaches to combat these deficiencies (Flyman and Afolayan, 2006). This ignores the fact that these three nutrients are simply markers for more extensive nutrient deficiencies and neglect the importance of a mixed diet including local varieties and underutilized foods. An alternative and more sustainable solution can be achieved by focusing on agro-biodiversity and food biodiversity (Johns and Eyzaguirre, 2007).

Food biodiversity is defined as the diversity of plants, animals and other organisms used for food, covering the genetic resources within species, between species and provided by ecosystems (FAO, 2010). The fact that nutrient content of food is significantly affected by the cultivar, variety or breed has lately become increasingly acknowledged and documented. In different varieties of the same species, the composition of macronutrients can vary by 10-fold and micronutrients by up to 1000-fold, representing the same variation as found between species (Burlingame et al., 2009; Davey et al., 2009; de Faria et al., 2009; Englberger et al., 2009; Talpur et al., 2009; Vieira et al., 2009). The intraspecies biodiversity has together with wild and underutilized foods a key role in global food and nutrition security (Nesbitt et al., 2010). Recent compositional studies show that locally available cultivars, varieties and wild underutilized foods are in many cases more nutrient-rich than similar commercially

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available foods, partly due to size of the food, water content and monoculture (Du et al., 2009; Giovanelli and Buratti, 2009). Nutrient content of cultivars/varieties/breeds should therefore be an important factor to consider in nutrition education and in agricultural research and strategies (Flyman and Afolayan, 2006; Toledo and Burlingame, 2006). Thus, biodiversity can contribute to achieving the Millenium Development Goals 1 and 7: ''Halve the proportion of people who suffer from hunger'' and ''Ensure environmental sustainability'' (UN, 2000).

Compositional data on food biodiversity are of importance not only for nutrition and health, but also for other areas. The concept of substantial equivalence ''embodies the idea that existing organisms used as food, or as a source of food, can be used as the basis for comparison when assessing the safety of human consumption of a food or food component that has been modified or is new.'' It involves a targeted analysis of the composition of genetically modified organisms (GMO) compared with their conventional counterparts. The major limitation of profiling is the need to accommodate the background of normal variation and to interpret the significance of any differences detected. Moreover, a broad spectrum of compositional data, covering the diverse varieties/cultivars/breeds, could identify existing organisms with high nutritional qualities and thus create an alternative to expensive research in GMO (Burlingame, 2004).

In addition, better knowledge of nutritional composition for unique species and varieties is essential for expansion of trade since many countries by legislation require accurate labelling of foods (Toledo and Burlingame, 2006).

Due to little attention to nutrient content among cultivars, varieties, breeds and underutilized foods, large gaps exist globally in food composition and food consumption data for these foods (Johns, 2003; FAO, 2010). In order to include this central aspect in nutrition programmes and interventions, food composition and food consumption investigations need to be enlarged to cover the existing biodiversity. These data should be gathered and disseminated to potential users e.g. through food composition databases and in food consumption reports. Only when the two elements, food composition and food consumption, are known, the contribution of biodiversity to better nutrition and health can be investigated and valued (FAO, 2008, 2010).

The *Cross-cutting Initiative on Biodiversity for Food and Nutrition* has been established to measure, investigate and promote biodiversity and nutrition. It is led by FAO (Food and Agriculture Organization of the United Nations) in collaboration with Bioversity International and other partners. One of its tasks was to establish nutrition indicators for biodiversity. The first indicator on food composition, to be referred to as the indicator within this article, was developed in 2007 at an Expert Consultation in Brazil (FAO, 2008). FAO will report, on a yearly basis until 2015, on the availability of food composition data for biodiversity. Data included for this purpose are foods with a taxonomic description below species level and wild and underutilized foods. More specifically, the indicator is a count of the number of foods fulfilling the criteria for biodiversity with at least one food component (Biodiversity Indicators Partnership, 2009; FAO, 2008). Another nutritional indicator for food biodiversity was developed in 2009, this time on food consumption. It will monitor the availability of food consumption data counting for biodiversity (FAO, 2010). The objective of the two nutrition indicators for biodiversity is to stimulate the production, collection and dissemination of food composition and consumption data taking biodiversity into account. In this way, the contribution of biodiversity to nutrition and health and other areas can be investigated and used to more accurately calculate nutrient intake estimations and dietary adequacy. Moreover, the indicators can be used as an advocacy tool to promote awareness of the importance of food biodiversity, including wild and underutilized foods. They will ultimately contribute to nutrition security, and the conservation and sustainable use of food biodiversity.

The aim of this article was to evaluate the trend of the indicator between 2008 and 2009 in terms of data availability, origin, location, food groups and components.

2. Materials and methods

2.1. The indicator

The indicator is a count of the number of foods with a satisfactory description on taxonomic rank below species with at least one value for a nutrient or a bioactive component. Exceptions exist for foods that are considered wild or underutilized, for which information on the species level is accepted. Indigenous foods were at first included for the indicator, but this term was excluded for the indicator in 2009, as it was often interpreted to incorporate common foods of local origin. As the term ''underutilized food'' is not well defined, it was decided in 2009 to only count those foods which are included in the specifically developed food list for this purpose: the 'reference list for underutilized foods for food biodiversity' which can be found on the INFOODS website (2010) http://www.fao.org/infoods/biodiversity/index_en.stm.

The indicator focuses on the genetic variety of foods while excluding other factors influencing the composition of foods such as environment, region, season, processing, feed and agricultural practices. Table 1 gives an overview of the criteria used for inclusion or exclusion of foods counting for the indicator.

2.2. Data sources

Data for the indicator were obtained through peer-reviewed articles, books, reports from e.g. research institutes, theses, conference presentations (including posters) and food composition databases. The search engines Scopus and Science Direct were used to obtain scientific articles. Electronically available search engines and non-electronic registries of universities were used to collect suitable theses. A targeted search for theses was conducted for Africa, Asia and South/Central America, whereas for Europe and Oceania the search was not as intensive. The search terms included food composition, composition, biodiversity, variety, cultivar, breed, wild food and underutilized species in different combinations. Specific searches were conducted for fruits, potatoes and milk. Reference lists of relevant papers were cross-checked and any suitable additional articles were included.

Data were also obtained through the INFOODS (International Network of Food Data Systems) mailing list, especially INFOODS regional data centre coordinators, and through experts having attended the Expert Consultation. Compilers sent information of their published user food composition databases, as well as from their unpublished reference databases. No limitations concerning the year of publication were set.

2.3. Data processing

All data obtained before February 2008 are considered baseline data. All data obtained afterwards but published before February 2008 are considered updated baseline data. Data published between February 2008 and December 2009 are considered for the reporting period of 2009. Each food that counted for the indicator was categorized according to the number of components analysed: 1, 2–9, 10–30 and >30 components. Moreover, other information was documented, such as reason for inclusion