biology and life sciences forum

MDPI

Proceeding Paper

Development of a Latin American Native Food Composition Database †

Natalia Bassett [1,2], Constanza Rossi [1,2], Argentina Amaya [1], Francisco Ríos [1] and Norma Sammán [1,2,*]

[1] Centro Interdisciplinario de Investigaciones, Tecnologías y Desarrollo Social para el NOA (CIITED), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Universidad Nacional de Jujuy, San Salvador de Jujuy 4600, Argentina; natybassett@gmail.com (N.B.); cotyrossi@hotmail.com (C.R.); argentinaamaya12@gmail.com (A.A.); fran_stal@hotmail.com (F.R.)

[2] Instituto Superior de Investigaciones Biológicas (INSIBIO), CONICET, Universidad Nacional de Tucumán, San Miguel de Tucumán 4000, Argentina

* Correspondence: normasamman@gmail.com

† Presented at the III Conference la ValSe-Food and VI Symposium Chia-Link Network, online, 15–17 November 2021.

Abstract: Food composition data have a fundamental function in studies on nutrition, health, and agriculture, among others. Many factors affect the nutrient content of food, and for this reason, it is essential to have updated and reliable data on the composition of the main foods consumed. The objective of this work was to develop a food composition database (FCDB) that compiles the composition of native foods of Latin America, mainly grains/seeds, tubers, and derivatives. An interdisciplinary work group of compilers was formed. A search of various sources was carried out (scientific publications, laboratory and technical reports, and theses), and a total of 78 publications were collected. For compilation, a form composed of eight worksheets was prepared. The initial sheet contains general data and food identification; the remaining ones contain information on the proximal composition, amino acids, fatty acids, vitamins, and minerals. Each section has an evaluation of data quality, which determines whether it will be included in the FCDB or not. After an exhaustive analysis based on compliance with the minimum requirements previously established, 58 publications and laboratory reports were selected. The main reason for rejection was the lack of moisture information (60%), followed by low data quality (30%). Information is available on the composition of at least 26 grains and derived products (i.e., quinoa, amaranth, and kañiwa) and five tubers and roots (Andean potatoes and ocas), which are currently being uploaded to the website (http://insibio.org.ar, accessed on 16 December 2021) for user availability. This database will provide information on the composition of regional foods generated and compiled using international standards.

Keywords: database; food; Latin American; native; grains

Citation: Bassett, N.; Rossi, C.; Amaya, A.; Ríos, F.; Sammán, N. Development of a Latin American Native Food Composition Database. *Biol. Life Sci. Forum* **2021**, *8*, 6. https://doi.org/10.3390/blsf2021008006

Academic Editors: Loreto Muñoz and Claudia M. Haros

Published: 16 December 2021

1. Introduction

The Food and Agriculture Organization of the United Nations (FAO) actively promotes the conservation and sustainable use of biodiversity for nutrition and agriculture as a means of increasing dietary diversity. However, at present, there is a strong tendency to reduce the base of global food security to a few species. This decline reduces the ability of farmers and ecosystems to adapt to changes and opportunities that arise. From a research point of view, solving this situation requires a greater range of species. This involves revaluing and including those that are used by populations and communities. In the case of the Andean region, underutilized species are adapted to the agroecological conditions of the region, are used by local farmers, and thereby contribute to sustainable production and the stability of the ecosystem. However, there is limited knowledge of the nutritional values of these species and a lack of strategies for their inclusion in food and nutrition programs. Food composition data have a fundamental function in studies on nutrition,

health, and agriculture, among others. Biodiversity is a concept that summarizes the different kinds of organisms in the biosphere, namely, plants and animals, as well as genes that have the organisms and their habitat. Many factors affect the nutrient content of food, and for this reason, it is essential to have updated and reliable data on the composition of the main foods consumed. This can be achieved through the preparation and use of a food composition database (BDCA) and/or food composition tables (TCA) regionally and nationally.

The Andes, with about 8000 km of travel on the western side of South America from Venezuela to Patagonia, Argentina, are important geological heterogeneity ecological life zones and host biodiversity. The most prominent influence of the Andes is the plant biodiversity and cultural aspects. Some examples of crops typical of the native Andean foods are Andean potatoes, oca, yacón, amaranth, cañihua, tarwi, and quinoa, among others. Although these crops are native to different areas of Latin America, their cultivation and consumption have spread to other areas of the world [1].

The process of preparing a table must follow standardized procedures, which guarantee a quality final product. That is why the Food and Agriculture Organization of the United Nations (FAO) has made available a series of documents aimed at standardizing production processes and a compilation of chemical composition data in order to maximize the quality of the tables obtained [2].

Within this framework, the objective of this work is to report the process of preparing an updated and methodologically adequate Table of Food Composition of Native Foods of Latin American, which responds, among others, to the needs of food programs and to the formulation of new healthy foods [3,4]. It is expected that this BDCA contributes to the knowledge of forgotten or underutilized crops and, hence, contributes to their recovery and revaluation; provides nutrition researchers with estimates of the contribution of biodiversity to nutrition; allows agricultural researchers to select those crops or breeds that have a high-quality nutritional profile for agricultural research, dissemination, and larger scale production.

2. Materials and Methods

2.1. Description

The present work was based on the systematic compilation of food composition data, both analytical and published or from laboratory reports, which was followed by a methodological unification of the information compiled to develop a homogeneous database. For this reason, this research is descriptive, cross-sectional, and retrospective.

To carry out the objective, a working group of technicians and professionals was formed. It was important to train compilers in the general principles of compilation, organization of databases, and preparation of food composition tables, as well as in knowledge of food sampling plans and analytical methods for data generation and quality verification, thus forming the criteria for the selection of the material that is to be incorporated into the BDCA.

2.2. Information Gathering

The database document repository is a collection of original online documents containing analytical data, either from the scientific literature (e.g., searched for in PubMed, ScienceDirect, or Scopus) or laboratory reports. All available information was taken as the universal or target population, including published works, graduate and postgraduate theses, laboratory reports, and papers presented and published at congresses and scientific meetings.

2.3. Criteria for Inclusion of the Information in the BDCA

The inclusion criteria of the search pointed to works that contained the following information:

- General information: name of the food; variety; a detailed description of the food; analyzed part; scientific name; trade name (for industrialized products); the number of samples analyzed; origin of the samples (geographic, local of acquisition); analytical methods used; bibliographic reference of the analytical method; origin of the information (laboratory that performed the analysis).
- Minimum food information: description of the handling of samples; humidity; percentage information of the nutrients analyzed; some index of variability as range or standard deviation; analytical quality control; date of production of the food analysis.

2.4. Food Groups

Three food groups were defined (A—cereals and derivatives; B—vegetables and legumes; C—seeds and derivatives) out of the 16 groups of LATINFOODS. Each group was assigned an identification letter.

The food description was formulated using the updated 2017 LanguaL System. LanguaL is a food description thesaurus that provides a standardized language using faceted classification. The descriptors include additional information (scientific names, references, synonyms, processes). It also includes the Codex Alimentarius classification [5–7].

2.5. Compilation Forms

The designed compilation form is composed of eight worksheets. The initial sheets contain general data and food identification; the remainder contain information on proximal composition, amino acids, fatty acids, water, and fat-soluble vitamins and minerals. Each food is classified according to the system adopted by LATINFOODS; the group is registered only with the letter to which it belongs, and then a three-digit numerical code is given to each food entry, which indicates the order within the group. The unit of measurement is g/100 g food on a wet basis (as consumed). For other nutrients, the units are those agreed in INFOODS and are explicitly indicated. In all cases, the humidity data must be included. Each section has an evaluation of data quality, which determines whether it will be included in the FCDB or not (Figure 1).

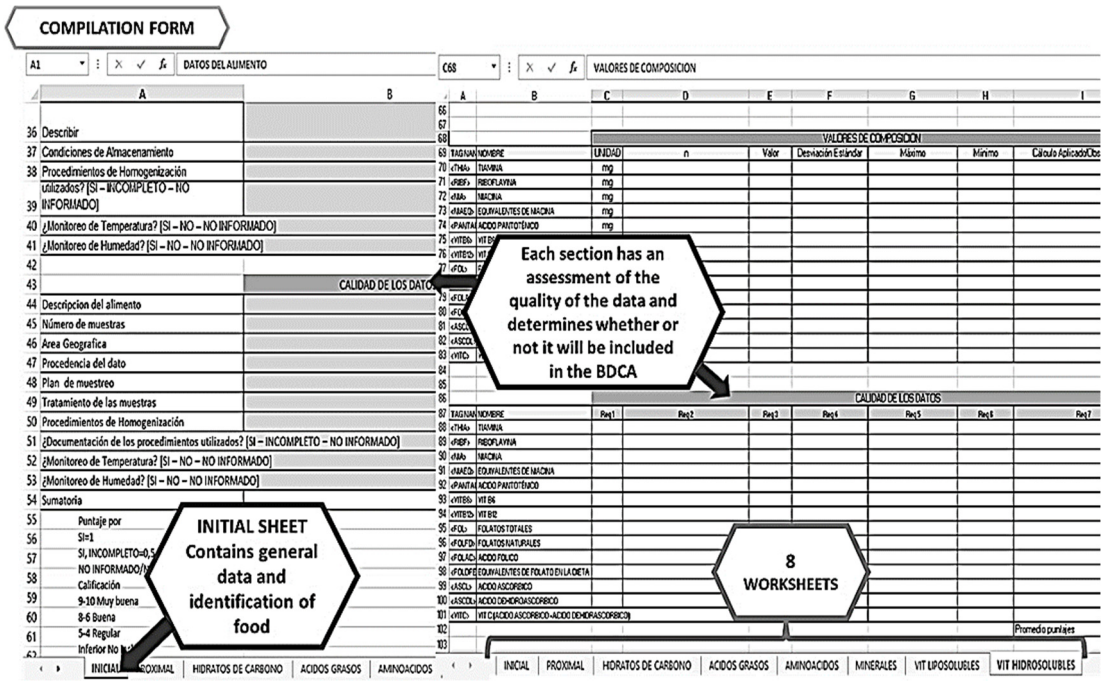

Figure 1. Latin American native food composition data compilation form.

2.6. User Manual Preparation

The analysis and the preparation of the user manual was carried out with the guides and steps necessary to complete the forms for the collection of native food composition data. In addition, the working group was trained on how to use them. Criteria were agreed on the type of data and description of the foods to be included in the compilation sheets.

3. Results

3.1. Number of Works Collected and Their Origins

After an exhaustive analysis based on compliance with the minimum requirements previously established, 78 publications and laboratory reports were selected. After the first step of the analysis of the compliance with minimum inclusion criteria and the evaluation of data quality, 43 publications were incorporated into the database (Figure 2). Some published works include more than one record for the analysis of the composition of varieties of grains and seeds and also of simple derivatives, such as flours (for this reason, the database currently has approximately 110 records, although it is updated every three months). In the case of Latin American native foods, it is very important to determine the variability within the same food because of the great biodiversity. Among the works selected to be part of the database, the main countries in Latin America to which the publications belong were Argentina, Mexico, Peru, and Ecuador. Outside Latin American territory, publications from Canada, Nigeria, and Portugal, among others, were selected. Regarding the period in which the works were published, these data are presented in Figure 3.

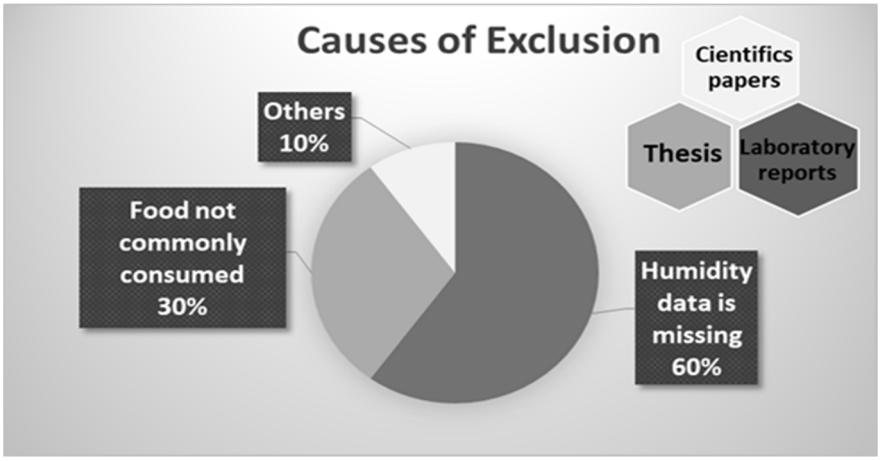

Figure 2. Causes of exclusion and distribution of data included in the BDCA.

3.2. Foods with more Frequency of Appearance

The database contains information on proximal composition only of vegetable origin, mostly raw, although some information on minimally processed products (flours) is included. Information is available on the composition of at least 26 grains and derived products (i.e., quinoa, amaranth, and kañiwa) and five tubers and roots (Andean potatoes and ocas). Moreover, also included are 11 legumes (chia and beans); 1 Sacha inchi; and 5 yellow, white, and purple maize, among others (Figure 4).

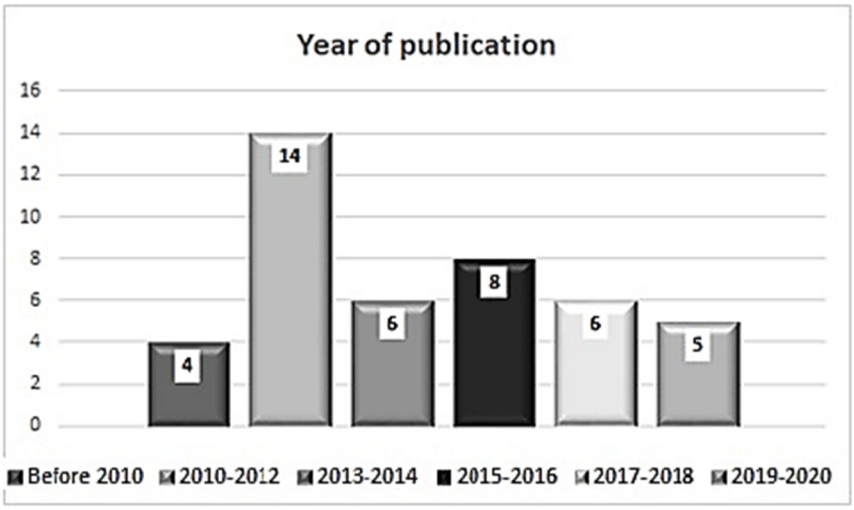

Figure 3. Year distribution of published composition data.

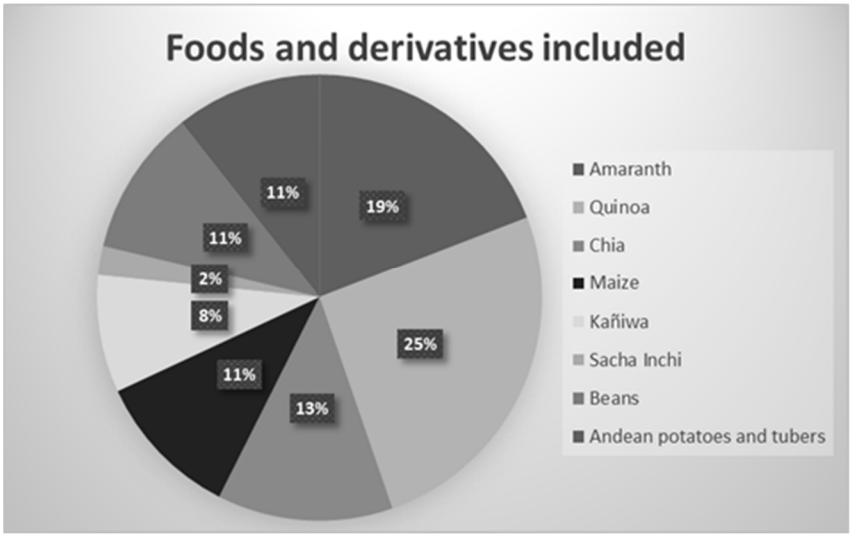

Figure 4. Foods and derivates included.

3.3. Causes of Rejection of Information and Data Quality

Of the total (N = 78) pieces of information collected, 43 (55.1%) were selected; the rest were rejected for different reasons mainly due to the low quality of the data. Table 1 and Figure 2 show the distribution of the data included in the BDCA and the causes of exclusion, respectively. The main reason for rejection was the lack of information of humidity data (60%), followed by food not commonly consumed (30%) and others (10%). Regarding the quality of the data of the publications included in the database, Figure 5 shows to which category the analyzed works belong.

Table 1. Amount of data accepted or rejected in the BDCA.

Accepted Data	Not Accepted Data	Rejected Data	Total
N = 43	N = 15	N = 20	N = 78
55.1%	19.2%	25.6%	100%

Figure 5. Data quality.

4. Discussion

In Latin America, most of the countries have developed TCAs, and although many of them are not available on the web, this information should be prioritized. In general, the amount of foods and micronutrients analyzed is low, so it is generally necessary to resort to other sources of information, such as TCAs and BDCAs, developed outside the region and that are more robust, such as those of the US, Denmark, and Canada. However, most of these BDCAs do not contain information on Andean native products, therefore indicating the importance of having a database with native foods of the region.

The working group held periodic meetings in which all the information was collected and distributed to achieve agreements, uniformity of criteria, and management of the compilation forms and how to complete them.

The information on the composition of the native foods entered into the BDCA refers mainly to macronutrients; there are few works with water-soluble and fat-soluble vitamin data. Some races of maize and varieties of chia were entered as average data taking into account the content of the main nutrient, for example, protein or lipid content; all entries are clearly explained in the section *Observations* of the worksheets. In other cases, the differences in the content of some macronutrients, such as proteins, were so significant that the data were entered into the BCDA as an individual record for each variety. In general, there is also very little information on the content of fatty acids and amino acids in these native Latin American foods. Quinoa and amaranth seeds are the food items that present the most complete data.

Regarding the number of publications found in the systematic search, among the native grains with the highest number of publications were quinoa and amaranth. To a lesser extent, data were found on kañiwa, chia, and legumes. Finally, Sacha inchi was the food with the fewest records. It could also be observed that the publications referring to these crops were made mainly between the years 2010 and 2012 and 2015 and 2016. Currently, there is a decrease in scientific publications and reports on the composition of these autochthonous foods.

This database is available to users at the following link: http://insibio.org.ar/.

5. Conclusions

A database is a tool that provides an affordable way to manage information on the composition of native foods generated and compiled using international standards, which are currently displayed in different types of scientific work.

This BDCA will contribute to bringing new insights into the research field of generally underutilized genetic resources of biodiversity in Latin America, which could be used as non-conventional food.

A future goal is to continue the process of compilation, improving the harmonization and standardization of composition data to allow their comparison and interchange. Composition data for recipes and meals will also be compiled.

Institutional Review Board Statement: Not applicable, since this study does not involve humans.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in figures and tables within this article.

Acknowledgments: This work was supported by grant Ia ValSe-Food-CYTED (119RT0567) and CIITED-CONICET.

References

1. FAO. *The State of the World's Biodiversity for Food and Agriculture*; Bélanger, J., Pilling, D., Eds.; FAO Commission on Genetic Resources for Food and Agriculture Assessments: Rome, Italy, 2019; 572p, Available online: http://www.fao.org/3/CA3129EN/CA3129EN.pdf (accessed on 5 October 2021).
2. OMS/FAO; Organización de las Naciones Unidas para la Alimentación y la Agricultura. International Network of Food Data Systems (INFOODS). Available online: http://www.fao.org/infoods/ (accessed on 5 October 2021).
3. Sammán, N.; Rossi, M.C.; Ríos, F.; Romero, I.; Levy, L.; Tenisi, M.; Barrios, R. Desarrollo de una tabla nacional de composición de alimentos para diseñar políticas y programas de seguridad alimentaria. *Rev. Argent. Salud Pública* **2020**, *12*, 25.
4. Sammán, N.; Masson, L.; de Pablo, S.; Ovelar, E. Food composition activities in Argentina, Chile and Paraguay. *J. Food Compos. Anal.* **2011**, *24*, 716–719. [CrossRef]
5. Charrondiere, U.R.; Burlingame, B. Report on the FAO/INFOODS Compilation Tool: A simple system to manage food composition data. *J. Food Compos. Anal.* **2011**, *24*, 711–715. [CrossRef]
6. Ireland, J.D.; Møller, A. LanguaL food description: A learning process. *Eur. J. Clin. Nutr.* **2010**, *64*, S44–S48. [CrossRef] [PubMed]
7. LanguaL. The International Framework for Food Description. 2017. Available online: http://www.langual.org (accessed on 5 October 2021).