Volume 2 Issue 8 August 2018

# Challenges and Impact of the Increase of Data and Information on Bioactive Polyphenols in Food

Estela Guardado Yordi<sup>1,2,3\*</sup>, Amaury Pérez Martínez<sup>1,3</sup>, Lourdes Santana<sup>2</sup>, Enrique Molina<sup>1,2</sup> and Eugenio Uriarte<sup>2,4</sup>

<sup>1</sup>Facultad de Ciencias Aplicadas, Universidad de Camagüey "Ignacio Agramonte Loynaz", Cuba

<sup>2</sup>Facultad de Farmacia, Universidad de Santiago de Compostela, España

<sup>3</sup>Facultad de Ciencias de la Tierra, Universidad Estatal Amazónica, Ecuador

<sup>4</sup>Facultad de Ingeniería, Instituto de Química Aplicada, Universidad Autónoma de Chile, Chile

\*Corresponding Author: Estela Guardado Yordi, Facultad de Ciencias Aplicadas, Universidad de Camagüey "Ignacio Agramonte Loynaz", Cuba.

Received: June 18, 2018; Published: July 10, 2018

## Introduction

The prevention of chronic diseases is a challenge of the food sciences, along with other biomedical sciences. Diseases as cancer, cardiovascular, diabetes mellitus, neurodegenerative, among others, are high prevalent around the world. Different sciences can contribute to improve global health. A multidisciplinary effort, which includes biomedicine, chemistry, mathematics, physics, in conjunction with computer science, is the ideal approach. It would be interesting to contribute to solve this global problem from the characterization of bioactive compounds present in food and understand the challenges we face with the increase of data compiled in food databases.

In this sense, the bioactive components of food have been studied. Among them polyphenolic compounds have been studied in recent decades. They are chemical substances that isolated or in the food matrix can provide benefits to this health problem. There is epidemiological evidence linking the beneficial effects of dietary polyphenols to the prevention of such diseases [1-3]. Diets rich in fruits and vegetables, for example, have been linked to lower mortality rates associated with cardiovascular diseases and some types of cancer [4-6].

There are numerous studies that have focused on the beneficial role of polyphenols when they act as antioxidants by different mechanisms. This interest is mainly due to the discovery of its antioxidant effects in vitro and its proposed beneficial role in several chronic diseases [7-10]. However, these results become controversial, especially when some of those substances have also been associated with contrary activities, for example pro-oxidant activity. Polyphenols on diet are present in fruits, vegetables, cereals, some seeds and drinks such as wine, tea or beer, among others [6]. Other matrices carrying these phytochemicals are functional foods (FFs), fortified foods, nutraceuticals and dietary supplements [11]. Many of these are also investigated for their potential as drugs, due to the multiple activities they may present [12].

There are controversial aspects that require a deep benefit/ safety study of this type of bioactive compounds. One aspect discussed is the benefit of polyphenols when they act as antioxidants, since current studies are inconclusive, and in some cases contradictory [10]. In this sense, Bouayed (2010) stated that some of these benefits have been overestimated as "double-edged edge" in the redox cell state [13]. Some determining factors that impact on the balance between the beneficial or harmful effects of these natural compounds are the chemical structure of the antioxidant polyphenols, the dose and the matrix that supports them [13].

Other paradoxical aspects are based on the fact that some antioxidants can act as pro-oxidants under certain conditions [4,13]. Pro-oxidants can be beneficial, increasing the levels of endogenous antioxidant defenses [14-17]. They have also been investigated for their potential as anticancer agents [12]. But because of the prooxidant mechanisms, polyphenols can also become genotoxic, and by clastogenic processes damage DNA [18].

Due to the increased interest in polyphenols, both academic and industrial, the information on the amount and type of them in food has recently increased [19]. This is one of the novel aspects in food science we want to highlight for future challenges. New food composition databases (FCDb) have been developed. They are different from the traditional ones, being focused on the amount and

**Citation**: Estela Guardado Yordi, *et al.* "Challenges and Impact of the Increase of Data and Information on Bioactive Polyphenols in Food". *Acta Scientific Nutritional Health* 2.8 (2018): 36-39. type of polyphenols present in different dietary matrices. These FCDbs contain information on hundreds of foods. Examples of this are those published by the USDA (United States Department of Agriculture), such as: Database for the Flavonoid Content of Selected Foods, Database for the Isoflavone Content of Selected Foods, Phenol-Exlorer and EuroFIR-BASIS [20-23]. The proper management of this data through different predictive methodologies offer the possibility of generating new information and exploring the complex interactions between diet and the human organism [5,24]. This is an emerging challenge for food science and public health. Collaborative work between computer scientists, and the use of artificial intelligence techniques, can contribute to generate new knowledge, so far not provided. The complexity of the food must be taken into account. In this sense, Fardet (2015) has proposed to analyze the health benefits of bioactives from a holistic and nonreductionist perspective [25]. To achieve such challenges, the use of chemoinformatics could be of interest [24], a tool that has been poorly explored in the characterization of the bioactivity of phenolic compounds in foods. The FAO (Food and Agriculture Organization) uses it in the search for safe additives, using software that is sometimes not affordable [26].

The evidence described above suggests the interest of future work on the safety of such compounds [27]. Although polyphenols and their derivatives are supposedly safe at physiological doses as part of the diet, the modifications of the dosage and the matrix that supports them (as is the case of nutritional supplementation) have not reached the expected results [10]. The relationship that could exist between the chemical structure of an antioxidant/prooxidant and the prediction of possible oxidative damage to DNA, either isolated or analyzed in the context of a food matrix, are also unknown. All these aspects become more important in view of the different design strategies of FFs or enriched ones, in nutritional supplements and even drugs.

It is interesting to note that the use of complex classification and regression models in biomedical sciences is increasing [28]. The development of chemoinformatics is an example. Chemoinformatics aims to produce useful models that can predict the chemical and biological properties of compounds [29]. Its main application has been focused on the area of knowledge of pharmaceutical sciences. The background of its use in the food sciences is more limited and focused mainly on the development of food additives [30]. The models obtained by these multivariate techniques have good predictive quality and have been carried out for example in beverages and infusions: fruit juices [31], Moscatel wine [32,22], red wine and green tea [34].

#### Highlighting important ideas and evidences

Dietary polyphenols are present in various dietary matrices, either forming a natural part in foods belonging to different food groups or forming part as a bioactive component of FFs.

FFs have recently been defined by Functional Food Center as: "natural or processed foods containing known or unknown biologically active compounds; which in defined quantities provide clinically proven health benefits for the prevention, management and treatment of chronic diseases" [35].

Polyphenols can also be part of other dietary matrices such as dietary supplements that are designed according to different pharmaceutical forms. For example, ellagic acid is a phenolic acid that has been marketed as a nutraceutical, functional food and dietary supplement [11].

New paradigms related to the food-health binomial emphasize on the positive aspects of the diet. The available data on the amount and type of polyphenols in food are increasing every day [7-8]. Several polyphenols have been described in foods and beverages [36], which are known by a variety of physicochemical properties, bioavailability, biological properties and effects on health [37]. These aspects are essential for a detailed and complete information on the nature and amounts of polyphenols found in main foods consumed by humans.

The number of polyphenols in food is an important information for researchers in the food sciences and nutrition, food producers, regulatory authorities, dieticians or consumers. It gives the possibility to generate new knowledge such as: compare the polyphenols content between foods, calculate the intake of polyphenols by populations, study the association with health and diseases and/ or to evaluate the relative contribution of these products to the intake of a particular polyphenol, compared to other food sources.

The access to these FCDb allows to verify the existence of a high amount of data/information that had been dispersed and to explore it in search of new information and knowledge. However, there are still few applications derived from the use of these databases [38,39].

It can be interesting to process information from the data offered by the FCDb of phytochemicals, through artificial intelligence techniques, because they are considered complex systems.

**Citation**: Estela Guardado Yordi, *et al.* "Challenges and Impact of the Increase of Data and Information on Bioactive Polyphenols in Food". *Acta Scientific Nutritional Health* 2.8 (2018): 36-39.

## **Bibliography**

- Uttara B., *et al.* "Oxidative Stress and Neurodegenerative Diseases: A Review of Upstream and Downstream Antioxidant Therapeutic Options". *Current Neuropharmacology* 7.1 (2009): 65-74.
- 2. Reuter S., *et al.* "Oxidative Stress, Inflammation, and Cancer: How Are They Linked?" *Free Radical Biology and Medicine -Journal* 49.11 (2010): 1603-1616.
- 3. Kris-Etherton PM., *et al.* "Bioactive Compounds in Foods: Their Role in the Prevention of Cardiovascular Disease and Cancer". *The American Journal of Medicine* 113.9 (2002): 71S-88S.
- 4. FECYT. Alimentos Funcionales. Madrid: Fundación Española para la Ciencia y la Tecnología (FECYT) (2005).
- Prior RL. "Oxygen Radical Absorbance Capacity (Orac): New Horizons in Relating Dietary Antioxidants/Bioactives and Health Benefits". *Journal of Functional Food* 18.B (2015): 797-810.
- Rothwell JA., *et al.* "Phenol-Explorer 3.0: A Major Update of the Phenol-Explorer Database to Incorporate Data on the Effects of Food Processing on Polyphenol Content". *Database* (2013): bat070.
- Arts ICW and PCH Hollmanm. "Polyphenols and Disease Risk in Epidemiologic Studies". *American Journal of Clinical Nutrition* 81.1 (2005): 317S-325S.
- Scalbert A., *et al.* "Dietary Polyphenols and the Prevention of Diseases". *Critical Reviews in Food Science and Nutrition* 45.4 (2005): 287-306.
- 9. Haytowitz DB., *et al.* "Sources of Variability in the Flavonoid Content of Foods". *Procedia Food Science* 2 (2013): 46-51.
- Halliwell B. "The Antioxidant Paradox: Less Paradoxical Now?" British Journal of Clinical Pharmacology 75.3 (2012): 637-644.
- Chengguo L and N Zhongguo. "Functional Dairy Products Ingredients and Its Standard". *Tang, Wenqian* 33.10 (2014): 1-5.
- 12. Martín-Cordero C., *et al.* "Pro-Oxidant Natural Products as Anticancer Agents". *Current Drug Targets* 13.8 (2012): 1006-1028.
- 13. Bouayed J. "Polyphenols: A Potential New Strategy for the Prevention and Treatment of Anxiety and Depression". *Current Nutrition and Food Science* 6.1 (2010): 13-18.
- Schaffer S and B Halliwell. "Hydroxytyrosol Induces Proliferation and Cytoprotection against Oxidative Injury in Vascular Endothelial Cells: Role of Nrf2 Activation and Ho-1 Induction". *Journal of Agricultural and Food Chemistry* 59.19 (2011): 10770-10771.

- Kasper JW., et al. "Nrf2:Inrf2 (Keap1) Signaling in Oxidative Stress". Free Radical Biology and Medicine 47.9 (2009): 1304-1349.
- Mattson MP and A Cheng. "Neurohormetic Phytochemicals: Low-Dose Toxins That Induce Adaptive Neuronal Stress Responses". *Trends in Neurosciences - Cell* 29.11 (2006): 632-639.
- 17. Halliwell B. "Free Radicals and Antioxidants: Updating a Personal View". *Nutrition Reviews* 70.5 (2012): 257-265.
- Gaspar J., *et al.* "Prooxidant Activities of Flavonols: A Structure Activity Natural Antioxidant and Food Quality in Atherosclerosis and Cancer Prevention". Natural Antioxidants and Food Quality in Atherosclerosis and Cancer Prevention. Eds. Kumpulainen, JT and JT Salonen. Great Britain: The Royal Society of Chemical (1996). 450.
- 19. Pérez-Jimenez J., *et al.* "Identification of the 100 Richest Dietary Sources of Polyphenols: An Application of the Phenol-Explorer Database". *European Journal of Clinical Nutrition* 64.3 (2010): S112-S120.
- 20. Holdena JM ., *et al.* "Development of a Database of Critically Evaluated Flavonoids Data: Application of Usda's Data Quality Evaluation System". *Journal of Food Composition and Analysis* 18.8 (2005): 829-844.
- 21. Bhagwat S., *et al.* "Usda Database for the Flavonoid Content of Selected Foods, Release 3.1" (2013).
- 22. U.S. Department of Agriculture, Agricultural Research Service. "Usda Database for the Isoflavone Content of Selected Foods. Release 2.0" (2008).
- Gry J., et al. "Eurofir-Basis a Combined Composition and Biological Activity Database for Bioactive Compounds in Plant-Based Foods". Trends in Food Science and Technology 18.8 (2007): 434-444.
- Scalbert A., *et al.* "The Food Metabolome: A Window over Dietary Exposure". *American Journal Clinical Nutrition* 99.6 (2014): 1286-1308.
- 25. Fardet A. "Complex Foods Versus Functional Foods, Nutraceuticals and Dietary Supplements: Differential Health Impact (Part 1)". *Agro FOOD Industry Hi Tech* 26.2 (2015): 20-24.
- 26. Scotti L., *et al.* "In Silico Methods Applied in Food Chemistry: A Short Review with Bitter and Mutagenic Compounds". *Letters in Drug Design and Discovery* 9.5 (2012): 527-534.
- 27. McKevith B., *et al.* "The Food Standards Agency's Antioxidants in Food Programme a Summary". *Journal of Human Nutrition and Dietetics* 16.4 (2003): 257-263.

**Citation**: Estela Guardado Yordi, *et al.* "Challenges and Impact of the Increase of Data and Information on Bioactive Polyphenols in Food". *Acta Scientific Nutritional Health* 2.8 (2018): 36-39.

- 28. Ayres M., *et al.* "Aplicações Estatísticas Nas Áreas Das Ciências Bio-Médicas". Instituto Mamirauá, Belém (2007).
- 29. Mitchell JBO. "Machine Learning Methods in Chemoinformatics". Wiley Interdisciplinary Reviews: Computational Molecular Science 4.5 (2014): 468-481.
- Guardado-Yordi E., et al. "Antioxidant and Pro-Oxidant Effects of Polyphenolic Compounds and Structure-Activity Relationship Evidence". Nutrition, Well-Being and Health. Eds. Bouayed, Jaouad and Torsten Bohn. Croatia: INTECH (2012): 23-48.
- Leopold LF., et al. "Prediction of Total Antioxidant Capacity of Fruit Juices Using Ftir Spectroscopy and Pls Regression". Food Analytical Methods 5.3 (2012): 405-407.
- Silva SD., *et al.* "Application of Ftir-Atr to Moscatel Dessert Wines for Prediction of Total Phenolic and Flavonoid Contents and Antioxidant Capacity". *Food Chemistry* 150 (2014): 489-493.
- Prommajak T., et al. "Prediction of Antioxidant Capacity of Thai Indigenous Plant Extracts by Proton Nuclear Magnetic Resonance Spectroscopy". Chiang Mai University Journal of Natural Sciences 14.2 (2015): 208-221.
- 34. Zhang MH., *et al.* "Determination of Total Antioxidant Capacity in Green Tea by near-Infrared Spectroscopy and Multivariate Calibration". *Talanta* 62.1 (2004): 25-35.
- 35. Martirosyan DM and J Singh. "A New Definition of Functional Food by Ffc: What Makes a New Definition Unique?" *Functional Foods in Health and Disease* 5.6 (2015): 209-223.
- Neveu V., *et al.* "Phenol-Explorer: An Online Comprehensive Databaseon Polyphenol Contents in Foods". *Database* (2010): bap024.
- Manach C., et al. "Bioavailability and Bioefficacy of Polyphenols in Humans. I. Review of 97 Bioavailability Studies". The American Journal of Clinical Nutrition 81.1 (2005): 230S-242S.
- Bhagwat S., *et al.* "Process of formulating USDA's Expanded Flavonoid Database for the Assessment of Dietary intakes: a new tool for epidemiological research". *British Journal of Nutrition Journal* 114.3 (2015): 472-480.
- Bhagwat S., et al. "Usda Develops a Database for Flavonoids to Assess Dietary Intakes". Procedia Food Science 2 (2013): 81-86.

## Volume 2 Issue 8 August 2018

© All rights are reserved by Estela Guardado Yordi., *et al.* 

Citation: Estela Guardado Yordi, et al. "Challenges and Impact of the Increase of Data and Information on Bioactive Polyphenols in Food". Acta Scientific Nutritional Health 2.8 (2018): 36-39.