

BaSeFood: sustainable exploitation of bioactive components from the Black Sea Area traditional foods

F. D'Antuono^{1*}, A. Sanches-Silva^{1†} and H. S. Costa^{1†}

*Campus Universitario di Scienze degli alimenti, Food Science University Campus, Piazza Goidanich 60, Cesena, Italy;

†Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, Avenida Padre Cruz, Lisboa, Portugal

Summary

The Sustainable exploitation of bioactive components from the Black Sea Area traditional foods (BaSeFood) is a 3-year collaborative research programme, funded by the 7th Framework Programme, launched on the 1st of April 2009. The project, which is coordinated by Dr Filippo D'Antuono (University of Bologna), consists of a research consortium of 13 partners, namely Italy (two), the United Kingdom, Greece, Portugal, Serbia and six Black Sea area countries: Russian Federation, Ukraine (two), Romania, Bulgaria, Turkey and Georgia. BaSeFood will contribute scientifically by studying the bioactive compounds within traditional foods of the Black Sea area using rigorous analytical and biological assays. The vast array of characteristics of traditional foods will be considered, as well as any associated consumer-perceived benefits, related to health claims, so that they can be properly understood by the consumer and exploited by food processors to produce more healthy traditional foods.

Keywords: BaSeFood, bioactive compounds, food composition databases, health claims, phytochemicals, traditional foods

Introduction

Bioactive components are defined as 'inherent non-nutrient constituents of food plants with anticipated health promoting/beneficial and/or toxic effects when ingested' (Gry *et al.* 2007, p. 434). The definition is rather dynamic and a list of components and associated properties is available in the literature (Goldberg 2003). Bioactive components are intrinsic, measurable characteristics of foods and food ingredients. These components have attracted the attention of scientists, opening

an almost unlimited field of investigation and a stream of research-motivated suggestions. Bioactives, however, are typically not perceived by consumers; in fact, few are aware of their precise nature and role (Grunert & Wills 2007). Globally, the literature on the identification, characterisation and specific sources of plant bioactives is vast. State-of-the-art reviews are available that clearly summarise the nature, occurrence and potential function of major plant bioactive substances. Among these, some intermediate steps of European Union (EU)-funded projects can be cited (Lindsay & Clifford 2000; Denny & Buttriss 2007).

Historically, food habits have been determined by the availability of local resources, evolving with similar trends in different geographic areas. The flux of plant domestication started from easily storable, energetic cereals, pulses and oilseeds, followed, at a later stage, by

Correspondence: Prof. Filippo D'Antuono¹, Professor, Campus Universitario di Scienze degli alimenti Food Science University Campus, Piazza Goidanich 60, 47521 Cesena, Italy.
E-mail: dantuono@agrsci.unibo.it

¹On behalf of the BaSeFood partners.

fruits and vegetables (Damania *et al.* 1998). Prior to this, an adequate supply of 'bioactives' was guaranteed by the residual gathering habits of human kind, to which the supposed excellent health status of pre-agricultural men is thought to be related (Kious 2002). The present nutritionists' point of view that a healthy diet is first of all a varied diet, alongside recommendations to increase the intake of bioactives of plant origin (Kapiszewska 2006; Brunner *et al.* 2007; Cooke 2007; Feldeisen & Tucker 2007) are both in agreement with the previously mentioned evidence from paleo-anthropological research.

The perception of traditional food value spontaneously occurs in local communities, through the association of generally positive cues to a complex of perceived immaterial traits. Because traditional consumers maintain a degree of independency in their perception and choices, 'traditionality' is perceived as a positive trait for food choice. Therefore, the food industry is trying to exploit this positive attitude via the production of foods derived from tradition. Urban consumers of Western Europe have only recently begun to lose their link with original places, and with this comes the loss of direct knowledge of traditional foods. Therefore, 'traditionality' has tended to become another credence attribute of food quality, requiring communication from third parties, such as certification bodies or professionals. The combination of these two facts has given rise to a tendency towards legislative regulation. The various proprietary labels at EU level such as, 'Protected Designation of Origin (PDO)'; 'Protected Geographical Indication (PGI)' and 'Traditional Speciality Guaranteed (TSG)', are in fact aimed at: (1) defining traditional foods in order to protect them from other imitations; and (2) supplying information about traditional foods to the consumers.

Until recently, the traditional/healthy connection had not been established. Yet a recent issue of the *Anthropology of Food* (Amilien & Holt 2007) has highlighted the many positive socioeconomic aspects of local or traditional foods, by referring to definitions and the legal aspects of origin certification, although they only marginally refer to their health-promoting properties. Currently, an introduction of the health-promoting concept comes from a completely different perspective, being exploited by industry as a means of designing and marketing added-value foods. Primarily, this has been a science-driven, top-down approach, with no initial reference to traditional foods. The high failure rate within the food industry to develop and promote new products has been attributed to an inability to listen to the voice of consumers (Stewart-Knox & Mitchell 2003). Con-

sumers still place classical search cues or prior experience first in their food choices (Verbeke 2006), and are not ready to associate food with medicines (Urala & Lahteenmaki 2007). Within the mechanisms of food choice, however, traditional foods are often associated with health (Azam & Battcok 1999). The spontaneous positive association of these two concepts is presently viewed as a powerful tool by the food industry, to create new products based on tradition with potential health-promoting properties attached. The successful exploitation of this concept is however complicated by its intrinsic double 'credence' nature, which requires accurate, credible and reliable information being available to the public.

Interestingly, research on plant bioactives has undergone a profound evolution during the last century. Some so-called secondary metabolites have been initially considered for their potential toxicity. At present, the dominant approach is to consider mainly the positive aspects of bioactives upon human health. This fact is connected to a changed socio-economic context that allows people to consume a more varied diet. Consequently, the occurrence of food-related syndromes caused by an excess or lack of nutrients, such as goitre [associated with high Brassica vegetable consumption during winter (glucosinolate excess)] or pellagra [a vitamin deficiency disease (niacin deficiency) because of a staple diet based on corn] are rarer. Broadly speaking, research on bioactives can be divided into two main strains: the characterisation and quantification of bioactives in plants and evaluating the bioactivity of plant extracts or their components. For both research strains, there is a wealth of literature available, with a definite prevalence towards investigating the antioxidant properties of plant components. In this case, there is a clear evolution from the use of simple empirical-imitative methods, *e.g. in vitro* antioxidant tests for the rapid characterisation of plant matrices, to the use of cell and animal models, and clinical studies; with the latter being adopted when the goal is to acquire a deeper knowledge of the precise actions and mechanisms of specific bioactive compounds.

Background to the project

Health claims relating to bioactives in traditional foods often fail to promote new economic chances for European small and medium enterprises (SMEs) and other stakeholders if they are not properly placed within an acceptable context. Benner (2005) indicates that the development of new products should be primarily determined by a bottom-up, chain approach, instead of being driven by a pure scientific and technological push. This

concept, initially used to analyse the marketing potential of new industrial crops (Wallis *et al.* 1989), is rather consolidated, based upon a theoretical background, also in food science (Fuller 2004). Consequently, the key role of a demand-driven marketing approach to new product development has been incorporated within European recommendations (Commission of the European Communities 2007).

Other important points associated with the development of this project include concerns over the increasing incidence of both metabolic syndromes and chronic-degenerative diseases, some of which have been associated with non-optimal nutritional food habits and poor lifestyle choices (Bulló *et al.* 2007; Esposito *et al.* 2007; Lutsey *et al.* 2008). These issues have been taken into account in the recent campaign aimed at promoting increased consumption of fruits and vegetables among consumers, based on extensive epidemiological evidence (Steinmetz & Potter 1991, 1996; Verhoeven *et al.* 1996; Lila 2007) and better self-awareness among consumers with regard to nutritional issues (Katz *et al.* 2005).

Major attention has already been devoted to functional food product development. The development of these foods was first pioneered by Japan (Kobomura 1998) followed by major growth within the USA and Western European markets in recent years. Moreover, new regulations issued by the European Parliament and by Council on the 20th December 2006 (Official Journal of the European Union, OJ 404, 30/12/2006), which detail the requirements for the substantiation of scientific health claims, are a milestone within this sector. The regulations themselves highlight the constraints faced by the industry regarding the development of functional foods with attached health claims. Nevertheless, they provide regulatory guidelines by which the industry can develop targeted foods for the healthy foods market; while also ensuring that commercial interests do not overwhelm sound health-promoting concepts.

It is worth mentioning, however, that consumer perceptions of health claims are not yet well defined. The timing of the launch of prospective health-promoting foods largely depends upon the establishment of trust between consumers, health food suppliers as well as the credibility of regulatory or proprietary health claims (Urala & Lahteenmaki 2007). At present, a top-down approach and a commodity-based flux of materials tend to prevail in the healthy food production chain. This results in the generation of high-added value products among food processors, often alongside scarce consumer participation within the decision-making process.

Basefood aims and structure

Background concepts

The basic fundamental concepts on which BaSeFood structure and activities have been developed are inherent to the following key points:

- There is increased concern, especially in the Western industrialized world, regarding the increase in chronic degenerative diseases associated with non-optimal nutritional food habits;
- Several plant components (bioactives) are presently being studied for their potential positive effects on human health. This interest has produced several thousand scientific papers, yet a number of uncertainties still remain with respect to health claim substantiation;
- Unified approaches have therefore been taken, such as the establishment of international standards for database management as well as the format for data acquisition, to which BaSeFood will refer;
- The health-promoting concept is considered a powerful tool to add value to food and as such, is highly regarded by the European Food industry representatives seeking new market opportunities;
- Both the scientific approach for the study of bioactives and the industrial approach for product development are often led by technology or the science push, often not taking into account the chain perspective and the opinion of end-user consumers. This can result in a high failure rate in the launch of new products and can contribute to a lack of consumer trust in science;
- Traditional foods are often considered as a concentration of positive traits, connected to several aspects of their food chain production, including a positive spontaneous relationship with health and health enhancement. With respect to other areas, foods of the Black sea region are still less investigated for their health-promoting properties.

Within these concepts, the medium-term strategic lines within which BaSeFood will operate are to:

- Create opportunities. These will be attained through research and development activities, generating a base of knowledge from which SMEs and other stakeholders can derive transferable information for product development within a European regulatory context.
- Create trust. Especially in consumers, in order to enforce the synergy between the health-promoting and the traditional food characteristics, and to support the perception of food value by addressing environmental, conservation and equity issues.

Table 1 BaSeFood Work Packages (WP)

WP number	WP name	Responsible Institution*
1	Surveying, recording and describing traditional foods	HHF
2	Bioactive components, nutritional and microbiological characterization of traditional foods	INSA
3	Health-promoting properties, absorption and bioactivity of target components	IFR
4	Technological-chain effects on bioactives in traditional foods	ONAFI
5	Chain development and consumer issues in health-promoting traditional foods	ASE
6	Dissemination	UNIBO
7	Management	UNIBO

*HHF, Hellenic Health Foundation; INSA, Instituto Nacional de Saude Dr Ricardo Jorge; IFR, Institute of Food Research, ONAFI, Odessa National Academy of Food Technologies; ASE, Bucharest University of Economics; UNIBO, Alma Mater Studiorum – University di Bologna.

From an operative point of view, BaSeFood will contribute by scientifically studying bioactives of Black sea area (BSA) traditional foods using rigorous analytical and biological assays, within the context of unifying methodologies and data acquisition. It will also consider a vast array of characteristics of traditional foods and consumer issues, in order to put health claims in a more favourable context so that they are properly understood by consumers and can therefore contribute to economically viable traditional food upscaling by food processors.

Project's structure and objectives

The general objectives of BaSeFood are to contribute towards the establishment of a rationale for integrating the concepts of health-promoting foods with traditional foods, in order to create the knowledge base for sustainable economic development in the area of food production and in the processing of tradition-based healthy foods. This general goal is being pursued via the completion of a number of work packages (Table 1), within which the specific objectives of this project are allocated. Details regarding the precise nature of these work packages are as follows:

Work package 1 – Surveying, recording and describing traditional foods in the Black Sea area

This project aims to produce ample documentation on traditional foods in the BSA at a national (major or staple traditional foods), regional and local levels. This objective will be pursued via the production of:

- Preliminary information regarding the combination of food/bioactives, to be investigated further within the other sections of the project;

- Detailed documentation of selected traditional foods via the generation of integrated reports, specific to each selected food. These may be used to contribute to proprietary claims at a national or European level, or for health and nutritional claims. This will also include an implementation phase for data recording and the registration of flow charts;
- Additional documentation and preliminary reports, on a larger number of foods, describing all aspects of available knowledge (*e.g.* raw materials, other ingredients, preparation methods, historical and folkloric features). These may help to stimulate the interest of stakeholders, and will enable interaction with other work packages, including indexing according to the coded system (LanguaL)¹.

Work package 2 (WP2) – Bioactive components, nutritional and microbiological characterisation of traditional foods

WP2 activities are aimed at characterising selected foods as follows:

- To source traditional foods of plant origin (*e.g.* cereal-based foods, fruits, vegetables, oilseeds, herbs, spices and fermented foods) that are significant for their bioactive content and potential health-promoting properties. These will be derived on the basis of current literature and modern food databases;
- To produce analytical data detailing the overall nutritional and bioactive content of selected foods, and to

¹LanguaL stands for 'Langua aLimentaria' or 'language of food'. It is an automated method for describing, capturing and retrieving data about food globally. <http://www.langual.org/>

compare it with the results available in Food composition databases, namely EuroFIR-BASIS²;

- To produce documentation relating to the key micro-organisms involved in food processing, with special reference to the effect of bioactive retention, and food safety.

Work package 3 (WP3) – Health promoting properties, absorption and bioactivity of selected components

WP3 activities are aimed at producing evidence relating to the health-promoting properties of selected foods. This will entail a range of activities on specific biochemical and metabolic functions as follows:

- To screen an ample number of combinations of food/bioactives for antioxidant and antiplatelet activities, using *in vitro* tests;
- To screen selected foods/bioactives for their potential positive effects in reducing cardiovascular disease (CVD) risk factor, by means of cultured cell system assays;
- To screen selected food/bioactives for micro-organism-mediated gut function regulation;
- To organise and carry out two clinical intervention trials aimed at screening the effect of selected foods on specific CVD risk markers on humans.

Work package 4 (WP4) – Technological effects on bioactives in traditional foods

This part will entail investigating the fate of key bioactive components during processing, and draw upon the development of technological protocols to improve their retention, in order to promote traditional food production with attached health claims. To achieve this, the project aims to:

- Review the literature regarding the retention of selected bioactive substances, and to examine the potential of food databases to preliminarily estimate retention factors;
- Assess processing flow charts, with special attention to the evaluation of critical points for bioactive retention in some traditional foods to determine retention factor variation in selected unit operations;
- Examine some case studies for traditional food for the purpose of nutritional, technological and safety improvement.

²European Food Information Resource (EuroFIR) is a 5-year Network of Excellence funded by the European Commission's Research Directorate General under the 'Food Quality and Safety Priority' of the Sixth Framework Programme for Research and Technological Development; BASIS – BioActive Substances in Food Information System.

Work package 5 (WP5) – Chain development and consumer issues in health-promoting traditional foods

WP5 will foresee the following activities:

- To produce a list of priority traditional foods with attached health claims. This will be on the basis of stakeholders' responses;
- To produce individual survey-based reports on the :
 - (1) Attitudes of consumers within the Black Sea region population towards their own traditional foods;
 - (2) Attitudes of migrants from Black Sea Countries towards their native traditional foods;
 - (3) Knowledge and attitudes of Western European sample populations towards traditional foods from the BSA.

Work package 6 (WP6) – Dissemination

In order to maximise the impact of the project's results through effective dissemination, we aim to:

- Produce a master plan for project dissemination purposes;
- Implement a project-based website;
- Involve a wide range of stakeholders, with special attention given to the view of SMEs and local interest groups in the development of this project;
- Expand upon the current knowledge base necessary for the sustainable development of health-promoting traditional foods.

Consortium description

The consortium partners are as follows:

- (1) Alma Mater Studiorum – Università di Bologna (UNIBO, Italy);
- (2) Institute of Food Research (IFR, UK);
- (3) Hellenic Health Foundation (HHF, Greece);
- (4) Instituto Nacional de Saúde Dr Ricardo Jorge (INSA, Portugal);
- (5) Odessa National Academy of Food Technologies (ONAFIT, Ukraine);
- (6) Uzhhorod National University (UZHNU, Ukraine);
- (7) State educational institution of the high professional education 'Moscow State University of Food Productions' (MSUFP, Russian Federation);
- (8) Spread European Safety European Economic Interest Grouping (SPES – GEIE, Italy);
- (9) Bucharest University of Economics (ASE, Romania);
- (10) Biological Farming Association – Elkana (ELKANA, Georgia);

- (11) Institute for Medical Research (IMR, Serbia);
 (12) University of Food Technologies (UFT, Bulgaria);
 (13) T C Yeditepe University (YEDITEPE, Turkey).

Ongoing work

Since its commencement, the project has started to survey, record and describe traditional foods in the BSA to include their bioactive components and nutritional and microbiological characterisation. In line with this, chemical analyses of bioactive compounds and nutritional composition in Black Sea area countries (BSAC) traditional food samples and primary foods will be carried out by the Instituto Nacional de Saúde Doutor Ricardo Jorge (Portugal), the Institute of Food Research (United Kingdom) and the University of Bologna (Italy). From each category of foods (*e.g.* cereals and cereal-based foods; fruits; vegetables; products from oilseeds; herbs, spices, aromatic plants and fermented products), key bioactive compounds will be selected for analyses. Bioactive components (such as phenolics, glucosinolates, tocopherols, carotenoids, terpenoids) will also be analysed.

The nutritional composition of selected traditional foods and other components will also be analysed in order to produce an overview of the nutritional value of each traditional food. These analyses will be based upon the following measurements: moisture content, ash content, total nitrogen (for protein), total fat, individual fatty acids, cholesterol, starch, total sugars, dietary fibre, vitamins (A, E, C and B₂) and minerals and trace elements (Na, Fe, Zn and Se).

Specific studies on food groups, characterised for their importance in the area, or on foods from specific raw materials, including their development, have also commenced. The aim of these studies is to produce monographs including all aspects connected to these groups, from history to local processing schemes. It is hoped that these contributions will enhance the knowledge base regarding these foods and highlight opportunities for further development. Until now, these groups include foods from primitive wheat species, leafy kales, buckwheat, wholemeal bread, halva, kwass, cold pressed oil, dried or concentrated fruits and herbs.

Conclusions

BaSeFood intends to make a significant contribution to the substantiation of nutrition/health claims for traditional foods from the Black Sea region, to enhance the cooperation between researchers and stakeholders and to promote sustainable economic development for European SMEs and BSA Countries.

Acknowledgement

BaSeFood (Sustainable exploitation of bioactive components from the Black Sea Area traditional foods), project no. 227118, is financed by the European Commission under the 7th Framework Programme.

Conflict of interest

The authors have no conflict of interest to disclose.

References

- Amilien V & Holt G (2007) Anthropology of Food, S2. From local food to localized food/De produits locaux à produits localisés. Available at: <http://aof.revues.org/sommaire402.html>.
- Azam AS & Battcock M (1999) Promoting and protecting traditional food products. *Intermediate Technology Food Chain* 25: 3–5.
- Benner M (2005) The chain information model: a systemic approach for food product development. PhD Thesis, Wageningen University, the Netherlands.
- Brunner EJ, Rees K, Ward K *et al.* (2007) Dietary advice for reducing cardiovascular risk. *Cochrane Database Systematic Reviews* 4: CD002128.
- Bulló M, Casas-Agustench P, Amigó-Correig P *et al.* (2007) Inflammation, obesity and comorbidities: the role of diet. *Public Health Nutrition* 10: 1164–72.
- Commission of the European Communities (2007) Communication from the Commission to the Council, the European Parliament, the European economic and social committee and the committee of the regions. A Lead market initiative for Europe.
- Cooke L (2007) The importance of exposure for healthy eating in childhood: a review. *Journal of Human Nutrition and Dietetics* 20: 294–301.
- Damania AB, Valkoun J, Willcox G & Qualset CO (eds) (1998) The origins of agriculture and crop domestication. In: *ICARDA*, p. 345. Syria: Aleppo.
- Denny A & Buttriss J (2007) *Plant Foods and Health: Focus on Plant Bioactives. Synthesis Report No 4*. EuroFIR Project Management Office. British Nutrition Foundation: London, UK.
- Esposito K, Ciotola M & Giugliano D (2007) Mediterranean diet and the metabolic syndrome. *Molecular Nutrition & Food Research* 51: 1268–74.
- Feldeisen SE & Tucker KL (2007) Nutritional strategies in the prevention and treatment of metabolic syndrome. *Applied Physiology, Nutrition, and Metabolism* 32: 46–60.
- Fuller GW (2004) *New Food Product Development*. CRC Press: Boca Raton, FL.
- Goldberg G (2003) *Diet and Health*. British Nutrition Foundation. Wiley & Sons: London.
- Grunert KG & Wills JM (2007) A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health* 15: 385–99.
- Gry J, Black L, Eriksen FD *et al.* (2007) EuroFIR-BASIS: a combined composition and biological activity database for bioactive compounds in plant-based foods. *Trends in Food Science & Technology* 18: 434–44.

- Kapiszewska M (2006) A vegetable to meat consumption ratio as a relevant factor determining cancer preventive diet. The Mediterranean versus other European countries. *Forum Nutrition* **59**: 130–53.
- Katz DL, O'Connell M, Yeh MC *et al.* (2005) Task Force on Community Preventive Services. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. *MMWR Recommendations and Reports* **54**: 1–12.
- Kious BM (2002) Hunter-gatherer nutrition and its implications for modern societies. *Nutrition Noteworthy* **5**: 1–5.
- Kobomura K (1998) Japan redefines functional foods – includes related article on Japan's policy of labelling food products with health. *Prepared Foods*. Available at: http://findarticles.com/p/articles/mi_m3289/is_n5_v167/ai_20791764.
- Lila MA (2007) From beans to berries and beyond: teamwork between plant chemicals for protection of optimal human health. *Annals of the New York Academy of Sciences* **1114**: 372–80.
- Lindsay DG & Clifford M (2000) Editorial. *Journal of the Science of Food and Agriculture* **80**: 793–4.
- Lutsey PL, Steffen LM & Stevens J (2008) Dietary intake and the development of the metabolic syndrome. *Circulation* **117**: 754–61.
- Steinmetz KA & Potter JD (1991) Vegetables, fruit and cancer. I. Epidemiology. *Cancer Causes & Control* **2**: 325–57.
- Steinmetz KA & Potter JD (1996) Vegetables, fruit and cancer prevention: a review. *Journal of the American Dietetic Association* **96**: 1027–39.
- Stewart-Knox B & Mitchell P (2003) What separates the winners from the losers in new food product development? *Trends in Food Science & Technology* **14**: 58–64.
- Urala N & Lahteenmaki L (2007) Consumers' changing attitudes towards functional foods. *Food Quality and Preference* **18**: 1–12.
- Verbeke W (2006) Functional foods: consumer willingness to compromise on taste for health? *Food Quality and Preference* **17**: 126–31.
- Verhoeven DTH, Goldbohm RA, van Poppel G *et al.* (1996) Epidemiological studies on Brassica vegetables and cancer risk. *Cancer Epidemiology Biomarkers & Prevention* **5**: 733–48.
- Wallis ES, Woods IM & Bith DE (1989) New crops; a suggested frame for their selection evaluation and commercial development. In: *New Crops for Food and Industry*, (GE Wikens, N Haq, P Day eds), Chapman and Hall: London.