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Local Mediterranean Food Plants and Nutraceuticals

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Over the millennia, human nutrition has developed from a hunter-gatherer one to one based on agriculture. The former obviously dictated the formation of small migrating communities, whose diet consisted predominantly of products from wild animals and wild plants, while the development of agriculture made larger communities possible, and allowed a diet based mainly on products from plants cultivated on a relatively large scale, and on the limited consumption of meat from flocks and herds.

Today, we depend on a tiny number of domesticated species and this is due to plant and animal domestication which is regarded to be the most important cultural development in the past 13,000 years of human history [1]. In many rural regions, especially of Southern and Central/Eastern Europe, non-cultivated food plants are still gathered or grown on a small scale and consumed as healthy ‘snacks’, salads, vegetables or are produced on a small scale giving rise to local varieties or cultivars. Such food has been called ‘local food’ [2].

In general terms, wild varieties tend to be richer in micronutrients and bioactive secondary metabolites than the corresponding cultivated ones. Such secondary plant metabolites are produced in adaptation to local environmental conditions, which in the Mediterranean area are often pro-oxidative. This would require adaptive responses by producing ‘protective’, bioactive compounds. It is of interest, in this respect, that polyphenolic molecules are produced in response to stress, and these compounds have been shown to activate a group of components, the sirtuin family of deacetylases, that had arisen in primordial eukaryotes, possibly to help them to cope with adverse conditions [3]. Sirtuins are found in plants, yeast and animals where they appear to be involved in slowing down the
aging process, implying an underlying conserved mechanism. The transfer of compounds produced in response to stress signaling molecules from one species to another in their environment is the basis of the ‘xenohormesis hypothesis’ [3]. In this way, organisms can prepare in advance for a deteriorating environment.

Whatever the conceptual basis of the above hypothesis, it is very relevant for human health that the intake of minor compounds produced by plants in response to stress results in the transfer of the protective effects to our organism. Therefore, research in this area provides clues for improving our understanding of the mechanisms that induce the production of bioactive molecules in plants and in setting up strategies for the exploitation of their potential applications to optimized human nutrition.

Consequently, ‘local foods’ represent a type of mutual interactions between the availability of locally growing, edible plants, on one side, and the nutritional requirements and needs of populations living in those areas. The persistence of few of these ‘spots’ up to modern times provides the opportunity for investigating, with updated experimental approaches, the features of these plants, the nature of their nutrients and their potential role in health promotion.

**Ethnobotany**

Core to the project, which is summarized in this volume, is the ethnobotanical study of local food plants in selected regions of the Mediterranean. Ethnobotany investigates the relationship between humans and plants in all its complexity, and is generally based on a detailed observation and study of the use a society makes of plants, including all the beliefs and cultural practices associated with this use. Ethnobotanists live with the members of a community, share their everyday life and, of course, respect the cultures which host them. Ethnobotanists have a responsibility both to the scientific community as well as to the indigenous cultures. Ethnobotanists use a complex set of methods derived from the social and cultural sciences including the taking of detailed field notes and collect carefully documented plant samples (voucher specimens) that allow for precise determination of the plant species. Ethnobotanical studies have a multitude of theoretical and applied interests and in fact only very few are in any way directly linked with projects in the area of discovering novel food or pharmaceutical products. While many researchers in the natural sciences and the general public often see such ethnobotanical information as a source of inspiration for ‘us’, the continued knowledge about and use of these resources in the regions of origin will require not only their recognition as local knowledge or traditional ecological knowledge, but also their study and development from a multidisciplinary perspective. Clearly, this is only possible if the
‘traditional keepers’ of this knowledge have a say in its future use and benefit from such research and development.

Specifically, in this project the focus is on local Mediterranean food plants, a topic which despite the diversity of traditional food knowledge around the Mediterranean has until recently received relatively little attention in the scientific literature: wild gathered fruits and vegetables [cf. 1, 4–6].

Core to our approach is an emphasis on two closely linked but conceptually and methodologically distinct goals: On the one hand the ethnobotanical studies for the basis of developing leads for new nutraceuticals by characterizing plant extracts derived from plant species with potential health beneficial effects traditionally used in rural communities of Southern Italy, Greece (Crete) and Southern Spain (see especially chapters 4–7). As importantly, the project gives new value to local food products which have been used for many generations and which now are on the brink of becoming forgotten and seeks methods to assure the preservation of this knowledge for future generations by highlighting the local relevance of these resources (see especially chapter 3), by disseminating the information on a local level in the national languages [e.g. 4, 5]. Next, biological-pharmacological effects of selected plants were studied (see below).

**Local Plant Foods and the Cardiovascular System**

The first biological system that is encountered by food components in entering our body, after leaving the gastrointestinal tract, is the cardiovascular (CV) system. Throughout the whole life period, macro- and micronutrients and a variety of other compounds, most of them still largely undefined, are ingested, and maximal concentrations are reached in the post-prandial phase, a time period that is progressively attracting greater attention in research on the impact of nutrition on the CV system [7] and health in general. After digestion, absorption, possible metabolism and transport, nutrients also interact via the CV system with peripheral tissues. Of special relevance, with reference to the direct effects on CV health, are those exerted by compounds present in local food plants, and have been shown to act as modulators of vascular functions. Among them, flavonoids, comprising mainly quercetin and kaempferol, and a variety of phenolic compounds are able to exert risk-lowering effects on mortality from coronary heart disease [8].

A long-standing presence in the Mediterranean dietary habits is also covered by special foods or components of the diet such as olives and olive oil, and wine. Olive oil has been used throughout the millennia by numerous civilizations and presumably before the start of agriculture. To the peoples of the Mediterranean this oil has been more than a mere food: it has medicinal and...
magical uses and is an endless source of fascination and wonder. The phenolic components of olive oil have been shown to exert a variety of effects on modulators of the vascular system, both in vitro as well as in animal models and humans [9, 10]. Wine has also been a constant component of the diet in countries in the Mediterranean basin, as the millennial history of its use in ancient civilizations such as those in Greece, Israel and Rome shows. Wine, especially red wine, has been shown to contain microcomponents of phenolic nature that are potent antioxidants and exert protective actions on vessel walls, so that moderate consumption of this beverage appears to be a healthy habit.

Cellular constituents of vessel walls, from the endothelium to cells of the muscular layer and those that penetrate into the wall from blood, modulate vascular functions through the production of a variety of ‘functional’ modulators. These include on one side promoters of vasodilation (e.g. nitric oxide and prostacyclin), as well as those that are involved in ‘inflammatory’ responses, e.g. the cytokines and various types of proinflammatory molecules. In addition, the formation of oxidative derivatives of circulating macromolecules, such as oxidized lipoproteins, oxidative alterations of cellular DNA, contribute to the onset and progression of chronic pathologies in the CV system, such as the atherosclerotic disease. Such processes were shown in the studies described in this volume, devoted to the effects on the CV system, to be favorably affected by the phenolic components extracted from the plants under investigation.

**Mediterranean Diet(s): Food for Thought?**

Neurodegenerative events, due to neuronal loss or malfunction, include both normal brain aging and severe maladies such as Alzheimer’s disease. Cell death within the brain, especially of neurons, is particularly troublesome as their new formation only proceeds at marginal levels. Recently, research advances in the understanding of the effect of fruits and vegetables rich in secondary plant metabolites – which for a long time have been considered as anti-nutrients – on animal and human physiology (especially of the brain), is gaining momentum [11].

Among all cellular tissues, the brain most tightly controls the access of organic and inorganic molecules, including dietary constituents and their metabolites, in order to minimize the impact of potentially hazardous molecules. Polyphenolic molecules, which have been shown to enter the brain in small amounts, are of particular interest, as they boost cellular resistance to deleterious oxidative stress due to a pleiotropic interplay with direct and indirect antioxidant mechanisms. Whereas the latter effects become evident by changes in the amplitude of biomarkers, for example, lipid peroxidations,
numerous animal studies mirror the beneficial impact of plant foods and their constituents on brain function by means of improved performance in behavioral tests. Last but not least, large long-term epidemiological studies indicate that people greatly benefit in terms of reduced risk for the onset of severe neurodegeneration, by consuming a Mediterranean-style diet rich in fruits and vegetables [12].

These data, together with those obtained in studies on other biological systems [13], provide the background for applications to the development of nutritional strategies for health promotion and are an essential element of the overall approach presented in this volume. While over the last decades some information on such major food components has been gathered, prior to this project practically nothing had been known about local food.

This volume is the outcome of a European Union funded project on local components of the various variants of Mediterranean diets and will hopefully stimulate further ethnobotanical, pharmacological and nutritional studies in this emerging field [13]. We gratefully acknowledge the support of all partners of the consortium ‘Local Food-Nutraceuticals’ and, of course, the funding provided by the European Union (KA1 ‘Food, Nutrition and Health’, FP5, QLRT-2001-00173; 2002–2004).

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