



Liquid state ^1H high field NMR in food analysis

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Dedicated to Prof. Annalaura Segre (1938–2008), our beloved friend and teacher, an enthusiastic pioneer in the field of Magnetic Resonance in Food Analysis.

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1. Introduction

What do we mean by food? Generally speaking, foods can be defined as materials, usually of plant or animal origin, containing essential body nutrients (proteins, lipids, carbohydrates, vitamins and minerals) necessary to produce energy, stimulate growth, and maintain life. Food is important not only because it satisfies the need to eat but also because an appropriate diet associated to a healthy style of life brings numerous benefits reducing risk of diseases and leading to a general well-being. In order to explore all the different aspects related to food, the modern approach of food science needs to be comprehensive including an exhaustive food characterisation and a profound knowledge of biochemical mechanisms of nutrition including the action of bioactive components in food matrix.

In this sense, a new discipline called Food-omics underlying the importance of a holistic vision in foodstuffs science is emerging as evidenced by the biannual International Conferences on Food-Omics started in 2009 and continuing to date [1]. The four “omics” technologies, i.e. genomics (gene analysis), transcriptomics (gene expression analysis), proteomics (study of the entire protein complement) and metabolomics can be useful to highlight specific as-

pects of foodstuffs providing together the entire picture of foodstuff properties.

Among the “omics” disciplines, metabolomics which investigates the metabolites present in biological systems is closely related to nutrition studies since the major part of nutrients are metabolites produced in biochemical reactions. From a chemical point of view, each foodstuff can be considered a complex mixture containing many metabolites widely ranging in concentration and chemical properties. Many components are already present in the crude products whereas others can arise during storage and processing or can be added for preservation or specific nutritional reasons.

Most foods originate either from plants or animals. Metabolomics of biological systems, described in the literature [2–8], is closely related to food metabolomics. Generally, plant food metabolomics is much more complex than animal food metabolomics due to the enormous diversity of metabolites' chemical structures present in plants especially among the secondary metabolites specific for every species.

In metabolomics, NMR is recognised as one of the main analytical methodologies giving a complete view of the foodstuffs metabolites and, together with a suitable statistical analysis, providing

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