Plenary 4: Bioactives: From Composition to Activity and Beyond

Antioxidants: from anthocyanins to zeaxanthin
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Background – Antioxidants have been a rapidly growing area of scientific research over the last decade. The term “antioxidant” is now widely recognised, and to some extent understood, by the general public as media coverage increases and the food industry promotes their health benefits. However, there is still considerable confusion over what compounds are antioxidants, the levels present in different foods, which foods have the highest antioxidant capacity and their particular health benefits. Accurate data on the antioxidant composition of foods is important for a number of reasons, including for the food industry to be able to promote their products and for health professionals to compare different foods in order to make the best recommendations for their clients. It is also an essential tool for population studies and intervention trials in order to translate the promise surrounding the health benefits of antioxidants into validated reality.

Review – Participants at the First International Congress on Antioxidant Methods agreed that antioxidant methods must be standardized but disagreed on the best methods to use (1). Analysis of antioxidants is a complex issue because of the number of compounds involved, the variety of ways in which they act and the different food matrices they are present in. There are several different approaches to quantifying antioxidants:

1) Measure individual antioxidant compounds: Some antioxidants such as vitamin C, vitamin E and selenium are relatively simple to quantify. However, the challenges lie in identifying and quantifying the carotenoids and flavonoids as these groups are made up hundreds and thousands of different compounds respectively. The U.S. Department of Agriculture, Agricultural Research Service (2) is building up food composition databases for selected carotenoids, flavonoids, proanthocyanidins and isoflavonoids. These databases provide useful information but have their limitations and because of the number of compounds present in some foods it may make food labels complex if antioxidants were to be shown.

2) Quantify antioxidants by class (e.g. total phenolics, total carotenoids): This is perhaps the simplest way to measure some antioxidants. There is consensus that the Folin-Ciocalteu method is an appropriate assay for quantification of total phenolics (3) and simple spectrophotometric methods are available for total carotenoids. There are limitations to these general assays and they do not always provide enough information to be meaningful.

3) Determine antioxidant capacity: This approach has benefits over simply quantifying antioxidant components as it provides a measure of their effectiveness. The difficulty is that no one assay can capture the different modes of action of antioxidants. Current commonly used and accepted methods include the oxygen radical absorbance capacity (ORAC) assay and the Trolox equivalent antioxidant capacity (TEAC) assay (3). These assays are useful measures of in vitro activity but it may be more important to learn how the compounds affect cell activity and if any of the beneficial antioxidants are absorbed. Hence, there is a need to develop better processes for cell model screening of biological activity, and subsequent absorption.

Conclusions – With the growing research and consumer awareness of antioxidants it is important to have accurate antioxidant composition and antioxidant capacity data for consumer education, food labelling and promotion. However, there is still some way to go before a consensus is reached on the best measures to use.

References