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EDITED BY ELHADI M. YAHIA



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- *To Mariam, Nadia-Amina, and Tarek*
- *To my students, who taught me more than I taught them*
- *To the health of the world*

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Foreword

The importance of including a variety of fruits and vegetables in our diet in order to maintain our general health and to avoid chronic diseases is recognized by both the scientific community and the public. Increasing public awareness of the health benefits to be accrued from consuming plant foods containing high levels of nutrients is illustrated by, and has been exploited by, the marketing of the so-called “superfoods,” which include fruits and vegetables like açai, blueberry, broccoli, kale, pomegranate, and others. This is despite there actually being no scientific or legal definition of a superfood – just that a marketer has highlighted its nutrient density. A similar situation exists for so-called “functional foods,” usually meaning processed foods that have been fortified with biologically active compounds (often or even usually plant based) that have been related to health promotion. A distinction between superfoods and functional foods is that, in contrast to super foods, products marketed as functional foods usually are required by law to contain compounds that have clinically proven and documented health benefits.

The phytochemicals that are responsible for the nutritional and health benefits accruing from consumption of fruits and vegetables are numerous and varied. While many of these phytochemicals are ubiquitous, such as the vitamins and dietary fiber, many more are unique to different groups of produce or even to individual species. Arguably, the nutritionally important phytochemicals are a subset of an even larger array, all with critical functions in the physiology of the plants in which they are found. Much research has been conducted for the purpose of identifying either the biological function of phytochemicals in plant physiology or their biological activity in animals and humans leading to health-related effects. However, with over 8000 phytochemicals known, this work is far from complete. Indeed, matters are complicated by accumulating evidence that the actions of phytochemicals, in both plant physiology and animal or human health, are synergistic. This means that studying individual phytochemicals in isolation, although to some extent unavoidable, is probably a mistake in terms of developing a complete understanding of their roles. At

this time, there is clearly a need for the current phytochemical picture, incomplete as the knowledge still may be, to be assembled in one place for the benefit of the scientific and academic communities. This book, *Fruit and Vegetable Phytochemicals: Chemistry and Human Health*, which Elhadi Yahia has assembled with the assistance of more than 200 individual chapter authors, admirably addresses that need.

The chapters in the first part of this book explore either the biological activity and bioavailability of phytochemicals from fruits and vegetables, and the benefits in terms of human health when they are included in the diet, or the biological function of phytochemicals in the physiology of fruits and vegetables. Fruits and vegetables have always been considered to be healthy foods containing essential vitamins, minerals, and dietary fiber. This group of chapters includes coverage of those basics, but ventures beyond to examine the full array of phytochemicals for which evidence has been found that they either promote general health and vitality, such as through their action as antioxidants, or exhibit more specific effects in protecting against the onset of cancer, cardiovascular and neurodegenerative diseases, and diabetes. Other chapters describe the biosynthesis and biological functions of various phytochemicals in fruits and vegetables. In sum, these chapters bring the reader up to date on the body of scientific knowledge concerning phytochemistry, phytochemicals, and their influence on human health.

The 12 chapters in the second part of the book address the influence of postharvest handling and technologies on fruit and vegetable phytochemicals as well as methods to measure both the amounts of phytochemicals and their functional properties in fruits and vegetables. How fresh fruits and vegetables are handled, stored, and transported can have important consequences in terms of their phytochemistry. How they are processed and cooked also impacts phytochemical composition. Methods of extraction of phytochemicals from fruits and vegetables for use in functional foods and nutritional supplements are also covered. Several of the chapters here address sensory and other quality aspects in relation

to phytochemicals, including the technologies of handling and processing that influence phytochemical composition and therefore fruit and vegetable quality. Phytochemicals certainly contribute to the sensory appeal of fruits and vegetables. For many fruiting organs, this likely relates to evolutionary selection favoring consumption by animals and leading to seed dispersal. Fruits and vegetables contain diverse arrays of colored compounds, including chlorophyll, carotenoids, flavonoids, and betalains, which contribute to the attractiveness of produce to animals and humans. Fruits and vegetables also produce complex and varied arrays of volatile aroma compounds and soluble taste compounds that are incredibly important in our enjoyment of these healthy foods. Employing proper harvesting, handling, storage, and processing practices to ensure the highest possible desirability of fruits and vegetables has many benefits. As expressed by the late Dr. Adel Kader, “Providing better flavored fruits and vegetables is likely to increase their consumption, which would be good for the producers and marketers (making more money or at least staying in business) as well as for the consumers (increased consumption of healthy foods).”

The third part of this book comprises about three dozen individual chapters covering the phytochemistry of different fruit and vegetable species. These chapters serve to further illustrate the wonderful diversity of phytochemicals found in fruits, vegetables, and nuts.

Dr. Yahia’s effort in bringing together this gathering of experts to compile the state of the art on the phytochemistry of fruits and vegetables is praiseworthy. This book is sure to be used to guide future research on the topics included within it – both for identifying what is known and for revealing that which is still unknown. This book will also be appreciated for pointing out the important future research directions that need to be taken in order for us to make full use of fruits and vegetables in our diet for improving human health. My hope is that you, as a reader, appreciate the effort that went into creating this encyclopedic coverage of fruit and vegetable phytochemicals and the roles they play in plant and human life, as I am sure that it will inspire many of you in your future research and teaching.

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