

# Preface

The metabolic and health effects of both nutritive and non-nutritive sweeteners are controversial and subjects of intense scientific debate. These potential effects span not only important scientific questions but are also of great interest to the media, the public, and potentially even regulatory bodies.

Over the past 30 years, the amount of sweeteners consumed in the United States and worldwide has increased along with other major sources of calories in the diet including added fats, flour, and cereal products. Recent epidemiologic studies have suggested possible associations between the consumption of sugar-sweetened beverages (SSBs) and an increased risk of obesity, heart disease, hypertension, and possible inflammatory responses and a decrease in dietary quality—although other studies have disputed these findings resulting in an ongoing, intense scientific debate. Furthermore, it is clear that epidemiologic studies do not establish cause and effect. Randomized clinical trials have provided conflicting evidence on these issues. The American Heart Association has recommended limiting consumption of added sugars to no more than 150 kcal/day for the average adult man and 100 kcal/day for the average adult woman, recommendations that are different and much more restrictive than those of the Institute of Medicine and Dietary Guidelines for Americans, 2010.

Non-nutritive sweetened beverages have recently been associated with increased risk of high blood pressure, heart disease, and preeclampsia. The effects of non-nutritive sweeteners on appetite and food consumption remain controversial. The physiologic and neurologic responses to “sweetness” per se remain areas of intense scientific inquiry.

Several investigators have asserted that both added sugars and non-nutritive sweeteners may be addictive, leading to overconsumption of calories, citing both human and animal data. Other researchers strongly dispute the assertion that sugars are addictive, citing other studies that provide contradictory evidence and the failure of consuming sugar to meet medical criteria for the diagnosis of addiction. Several recent papers have utilized functional MRI (fMRI) findings to suggest that sweeteners may stimulate reward pathways in the brain; other fMRI studies have not supported these findings. More papers are anticipated in this emerging area in the next few years.

Interest in sweeteners has extended far beyond the scientific community. For example, some schools have eliminated chocolate milk from their lunch menus because of a concern over added sugar. Mayor Bloomberg from New York City proposed the prohibition of certain sizes of SSBs from restaurants regulated by the Department of Public Health in New York City based on his belief that this would be a meaningful approach to obesity prevention. The state Supreme Court of New York struck down this proposed ban. Several prominent scientists have suggested increased taxation or other regulatory measures to limit consumption of SSBs. All of these findings and recommendations have been disputed by other scientists and organizations.

With all the interest in sweeteners, what is the current state of science in this area? When are we acting on insufficient knowledge, political correctness, or emotion rather than scientific evidence?

The goal of this book is to provide an evidence-based reference for nutrition professionals, other health care workers, and other interested individuals based on current scientific understandings on the interaction between both nutritive and non-nutritive sweeteners and health.

It has been my pleasure to serve as the editor of this volume. In this effort I have been honored to be joined by an internationally prominent group of scientists and investigators in diverse areas related to sugars and health. What has emerged is an evidence-based, comprehensive textbook covering multiple issues related to sugars and their putative health effects.

As with any editorial project, some decisions had to be made from the onset. While there are numerous sweeteners, we made the decision to focus on the ones that were most prominent in the debate about sugars and health; therefore, we have focused our efforts almost entirely on fructose, high fructose corn syrup, and sucrose. Since non-nutritive sweeteners have also been prominent in scientific debates and public discussions, we also included a chapter on non-nutritive sweeteners.

The book consists of 21 chapters divided into five sections. The first section contains overviews related to such topics as a general discussion of sweeteners and health and a historical perspective on the manufacture, composition, and applications of these three sugars. Also discussed are the metabolism of nutritive sweeteners in humans, current understandings of solid versus liquid calories, and a separate chapter on non-nutritive sweeteners.

The second section moves on from these general considerations to issues related to global perspectives on sweeteners. The section starts with a chapter on most recent trends of worldwide consumption of sweeteners. The following chapter explores evidence from prospective cohort studies and controlled trials. The third chapter examines public policy issues related to fructose-containing sugars, while the fourth chapter provides an industry perspective focusing specifically on high fructose corn syrup.

The third section delves into functional effects of fructose, high fructose corn syrup, and sucrose. This section includes a chapter on sweeteners and dietary quality as well as a chapter on energy regulating hormones and sweeteners. The ensuing chapter on sweeteners and the brain highlights emerging science in this area. The section concludes with a chapter on the important topic of whether or not sugars are addictive.

The fourth section summarizes issues related to sweeteners in healthy populations. The opening chapter of this section elucidates the health effects of sweeteners in children and adolescents. The second chapter provides a case study exploring flavored milk and dietary quality. The section concludes with chapters on sugar-sweetened beverages and hydration and one on sugars, sports drinks, and performance.

The final section explores issues related to sweeteners in chronic disease and includes chapters on diabetes, nonalcoholic fatty liver disease, fruit juice and childhood obesity, and sugars and cardiovascular disease.

I challenged every chapter author to deliver state-of-the-art science based on objective evidence to provide information that would be useful to not only nutrition professionals and other health care practitioners but also public policy experts, the media, and the public at large. All chapter authors have risen admirably to this challenge.

Editing an academic textbook is the ultimate exercise in collaboration. I am grateful to all of the chapter authors who have done a magnificent job in sorting through an enormous body of scientific literature to provide expert scientific summaries of key topics in an emotional area where considerable misinformation exists.

In addition to my scientific colleagues, I also want to acknowledge the expert editorial work of my Editorial Director, Beth Grady, who has helped coordinate the entire process and keep this project moving forward. My Executive Assistant, Carol Moreau, deftly handles my complex schedule to free time for such large editorial projects. My editor at Springer Publishing, Amanda Quinn, was an early and strong supporter of this project. Our Series Editor, Dr. Adrienne Bendich, also strongly endorsed this effort and has made numerous, helpful suggestions concerning its organization. Our Development

Editor, Kevin Wright, has done an excellent work in coordinating all aspects of the publication process. To these individuals, I am grateful. If credit is due for this book it rests with the chapter authors and all of the other individuals I have mentioned.

As always, my family including my loving wife Stephanie and our four great daughters Hart, Jaelin, Devon, and Jamie provide the love and support which makes it all worthwhile. I hope that that which has emerged is a useful, authoritative book that will help advance a sound, scientific discussion of fructose, high fructose corn syrup, sucrose, and health.

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