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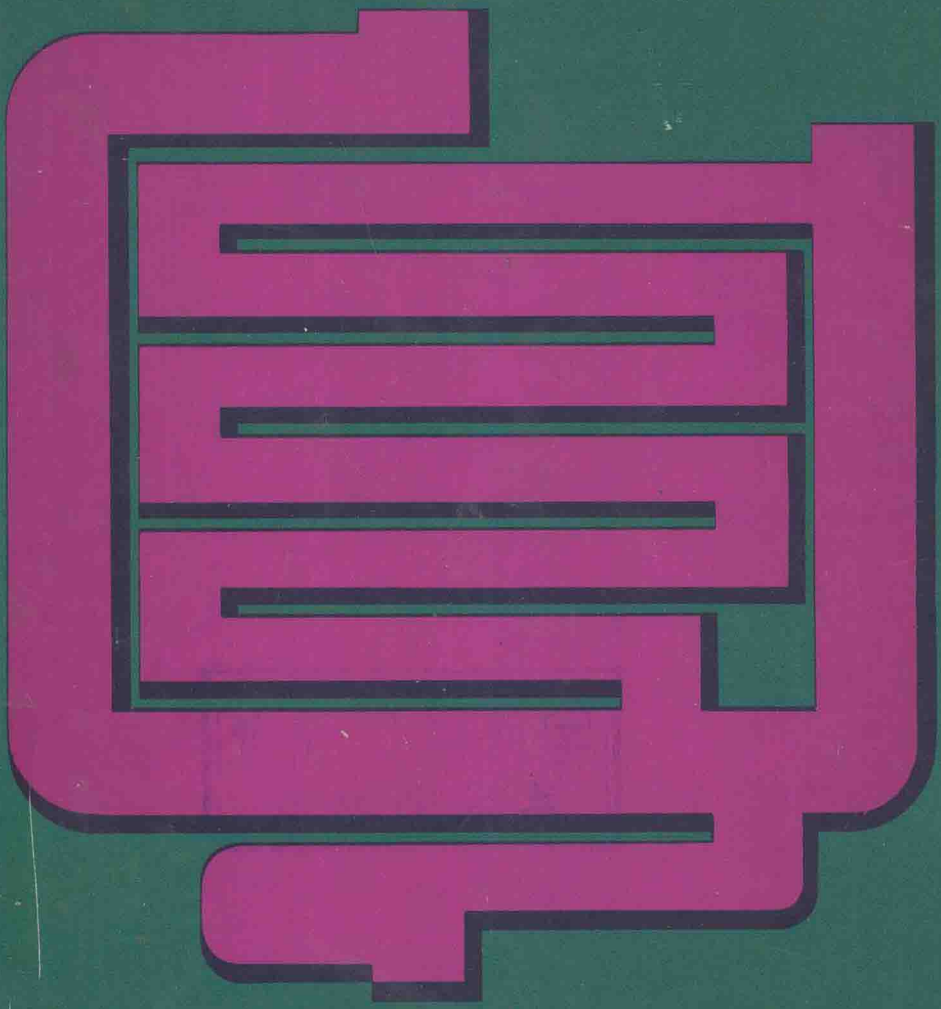
MEDICAL ASPECTS OF DIETARY FIBER



EDITED BY GENE A. SPILLER
AND RUTH McPHERSON KAY

MEDICAL ASPECTS OF DIETARY FIBER

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MEDICAL ASPECTS OF DIETARY FIBER

TOPICS IN GASTROENTEROLOGY

Series Editor: **Howard M. Spiro, M.D.**
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PANCREATITIS
Peter A. Banks, M.D.

MEDICAL ASPECTS OF DIETARY FIBER
Edited by Gene A. Spiller, Ph.D., and Ruth McPherson Kay, Ph.D.

NUTRITION AND DIET THERAPY IN GASTROINTESTINAL DISEASE
Martin H. Floch, M.S., M.D., F.A.C.P.

In order to appreciate the requirements of the science, the student must make himself familiar with a considerable body of most intricate mathematics, the mere retention of which in the memory materially interferes with further progress. The first process in the effectual study of the science must be one of simplification and reduction of the results of previous investigations to a form in which the mind can grasp them. The results of this simplification may take the form of a purely mathematical formula or of a physical hypothesis. The disadvantage of a physical hypothesis is that we see the phenomenon only through a medium. So we are liable to a blindness to facts and rashness in assumptions which a partial explanation encourages.

James Clerk Maxwell, 1855
On Faraday's lines of force

Selected by contributors

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Foreword

Dietary therapy has always been important to medical practice even if it has more often been sacramental than physiological in effect. "You are what you eat" meant a lot to primitive tribes whose new leader had to eat part of his predecessor, and giving diets brought out the priest in the physician even if he or she had heard that "nothing that enters into a man defiles a man." What people eat began to take on new meaning, however, a generation ago when Schoenheimer and others made clear that body fat and muscle protein were not the sluggish unchanging masses they had appeared but instead were storehouses of energy and material influenced by food, activity, and metabolic processes. Fiber, or residue as it was then still called, however, seemed unimportant; even the gastroenterologist concerned with keeping the bowels open by three cooked fruits, three cooked vegetables, and twelve glasses of water each day sometimes felt like a shaman if his cure for constipation worked. Nobody any longer read Arbuthnot Lane's charming Victorian book, *The Way Out,* which placed the blame for most human ailments on constipation; Lane even removed the bowel to cure the costive ills.

Burkitt revived a scientific interest in fiber and the possible connection between diet. constipation, and many physical disorders by observing the volume and frequency of stools on an African diet and on an English diet. His first observation stirred up a whole cauldron of scientific experimentation, and others have taught the evils of the low-fiber diet. Today, high-fiber diets are as popular among the laity as among physicians, who prescribe the amount of fiber in the diet as punctiliously as the degree of blandness a few years ago. Now is certainly the moment for fiber, as interest in high-fiber diets greets the increasing vegetarianism of the children. Spinach today has a finer image than 40 years ago, when it stood for the authority of parents and divided the generations! The father on a high-fiber diet to prevent diverticular disease and colon cancer, and incidentally to scrub his coronary arteries, can meet his vegetarian children in one great if sometimes gassy festival of love. Yet proof of the virtues of fiber is needed, and that is what Spiller and Kay's fine book is all about.

It is hard for the physician to keep abreast of the patient who reads handouts from the local nature food stores, but physician and nutritionist alike should realize what is being learned about the superficially so rigid material. In their fine up-to-date compendium Spiller and Kay and their contributors tell the reader what fiber is, what it does, and how it apparently works. This book has all the latest information, reviewing even the benefits that fiber may have for the patient with high plasma or biliary lipids, and is an example of how workers at the very frontiers of the field can quickly bring what they know to the practitioner. In this book, I learned that fiber is more than a simple substance, that fiber from carrots differs from fiber from bran, and that the role of fiber in human disease depends upon its behavior within the gut, which in turn depends upon the type of fiber and how it affects lipids, carbohydrates, and sterol absorption.

High-fiber diets may be turning eating habits back 50 or 100 years, and that seems to be all for the good. Still, it is important for physicians to separate the wheat from the chaff—even if this book may make them believe that the chaff is better for them. Spiller and his colleagues have given so much useful information that I am delighted to include this book in our series on gastrointestinal problems. I believe the book is important reading for dieticians, nurses, general internists, gastroenterologists, surgeons, and the concerned layman.

Howard M. Spiro, M.D.

Preface

In the late 1970s, our books *Fiber in Human Nutrition* and *Topics in Dietary Fiber Research* were published. The contents of these volumes reflected a systematic effort to clarify nomenclature, chemistry, analytical procedures, and physical properties of fiber. Epidemiological data were reviewed, as were physiological studies in man and animals. In the brief span of four years, considerable progress has been made, particularly in the prophylactic and therapeutic status of fiber in clinical medicine. This volume presents a complete and current analysis of the medical aspects of dietary fiber and is intended for use by physicians, clinical nutritionists, and the growing body of investigators active in fiber research.

The role of fiber in human disease depends on its behavior within the gastrointestinal tract. The fiber content and the composition of the ingesta influence the time required for passage through the gut as well as the rate and site of nutrient absorption. Moreover, disparate effects are observed, dependent on the type of fiber, anatomical location within the gut, and characteristics of the material available for mucosal uptake. Changes in glucose, lipid, and sterol absorption occur that are relevant to disorders of carbohydrate and cholesterol metabolism. Recent clinical studies suggest that fiber may have important therapeutic potential in the treatment of diabetes mellitus (Chapters 10 and 11) and may also influence plasma and biliary lipids (Chapters 8 and 9).

The clinical effects of dietary fiber in the lower bowel are well documented, but responsible mechanisms remain uncertain. Early hypotheses suggesting that the beneficial effect of fiber on colonic function was related to the hygroscopic properties of the ingested material are probably oversimplistic. A series of complex events in the large bowel result in significant degradation of fiber and attendant and important alterations in the bacterial metabolism of other compounds. In the realm of colonic disease, the role of fiber in the treatment of simple constipation and diverticular disease is well established (Chapters 1–3). The link between fiber intake and colonic carcinoma is attractive, but as yet unproven (Chapters 5–7). The effects of the metabolites, such as volatile fatty acids, produced by microbial fermentation of dietary fiber in the

gut, are not well understood. In fact, how do these metabolites affect the gut wall and, after absorption, other body tissues?

Furthermore, the medical implications of altered intakes of dietary fiber must be considered in the context of the entire diet. Fiber and other nutrients undoubtedly interact. An increase in fiber consumption is likely to result in displacement of other dietary constituents, which themselves influence various disease processes. Many investigators have stressed the need for and the difficulty of such a multivariate approach to nutrition and disease. Finally, the pharmacological use of concentrated plant fibers has added a new facet to the study of the effects of high-fiber diets. The use of such highly concentrated sources, e.g., guar gum, in controlling glucose metabolism (Chapter 10) is a challenging concept for the clinical and pharmacological investigator.

Even though Chapters 1–3 of *Fiber in Human Nutrition* thoroughly covered the definition, chemistry, and analysis of dietary fiber, we have added a Glossary on basic terminology as an appendix to this book. As any reader of the literature in this field is aware, definitive nomenclature is still far from being established. We hope this Glossary will be useful in achieving more uniformity. In addition, the Dietary Fiber Workshop of the XI International Congress of Nutrition (Brazil, 1978) elicited some excellent suggestions, which were summarized by us in the *American Journal of Clinical Nutrition* (**32:**2102, 1979). The importance of proper terminology and definition cannot be overemphasized.

We hope this volume will not only function as a valuable clinical and scientific reference but will also stimulate continued research in an important and intriguing area of human nutrition.

We are grateful to Alethe Echols and her assistant Lee Buck for their extensive editorial work.

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