RECENT ADVANCES IN HUMAN NUTRITION

BROCK

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With special reference to Clinical Medicine

by

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With a number of invited contributions on special subjects

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PREFACE

THIS volume is prepared especially for the information of medical practitioners who have not time to keep abreast of the very large literature in nutritional science, but who are interested in its relevance to medical practice. It may also be of use to dietitians.

Its emphasis will be on human nutrition, although it will refer to nutritional experiments on animals when they are apparently relevant to the problems of man.

For this reason the contributors (with the exception of two of those reviewing the field in other languages and the activities of FAO and WHO) are all actively engaged in clinical practice.

It will be specially orientated towards the clinical practitioner, but this statement must be qualified in the following respects:

(1) It will not go into the detail of diets even in fields where there have been recent advances. This detail is left to dietitians and books on dietetics.

(2) It will put considerable emphasis on preventive nutrition because the striking advances of the last decade have led particularly in this direction.

This second qualification should make the review of interest to public health administrators and dietitians for they have the responsibility of promoting health on the same principles as those used by clinicians in answering the questions asked by their more informed and intelligent patients about preventive dietetics.

The task of preparing the General Review and its bibliography has been greatly simplified by the appearance, since this monograph was planned, of two comprehensive textbooks.

"Human Nutrition and Dietetics", by Davidson, Meiklejohn and Passmore, was published in Great Britain in 1959.[91] A second edition of "Modern Nutrition in Health and Disease", by Wohl and Goodhart, appeared in the U.S.A. in 1960.[447] The availability of recent review and documentation has enabled the author to concentrate on high-lighting those trends which are of real interest to the clinician. Other literature has been reviewed up to June 1960.

Chapter 18 is an addendum prepared immediately after the Fifth International Nutrition Congress in September 1960. It has made possible a fully up-to-date review of recent trends.

In addition to the General Review signed contributions have been

invited from individuals who are expert in selected fields, and/or because of their special familiarity with literature in languages other than English. The editor is very happy to include chapters from some very distinguished workers in their particular branches of the subject.

The author of this book is entirely responsible for views expressed and interpretations made in the general review of trends. He has dealt with general principles and has referred the reader to the signed chapters and recent texts for detail.

Cape Town has proved to be a fertile field for the study of clinical nutrition because it is one of the meeting places of old and new cultures. In this centre the new culture has been strong enough to provide the adequate resources of a well-established and well-equipped university medical school and to apply them to a comparison of different stages of cultural and economic development.

In these contrasts differences of dietary habit and of nutrient availability have been of the greatest importance.

J. F. BROCK

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GENERAL REVIEW OF TRENDS

CHAPTER 1

INTRODUCTION

IN a symposium on Significant Trends in Medical Research[71] the author[44] reviewing research in clinical nutrition for the decade commencing 1950 drew attention to the rediscovery by clinical medicine and public health of amino acids and fatty acids, interest in which had, up to 1950, largely been submerged by an almost exclusive preoccupation with vitamins on the part of clinicians and public health workers.

The decade commencing 1960 promises new trends in human nutritional science. Their application to clinical medicine is likely to be both interesting and disconcerting; interesting because it is apparent that many aspects of man's mixed diet must be related to his long-term experience of health and disease; disconcerting because the uncertain implications of many advances will provide fresh ammunition for the food quacks. Orthodox medicine has ignored the food nostrums of quacks on the fallible philosophy that man, being an omnivorous animal, merely has to eat enough of a reasonably mixed diet to obtain his "recommended allowances of nutrients" while avoiding an excess of "empty calories" which will produce obesity. It has been assumed that the body is capable of eliminating any reasonable excess quantity of low-calorie nutrients and adapting itself to almost any balance of foodstuffs without being temporarily or permanently affected. It seems clear in 1960 that this optimistic estimate of the adaptability of the human constitution can no longer be accepted. Apart from short-term effects it seems likely that man's constitution is determined in part by his habitual food habits. This subject is dealt with briefly below under the heading *Diet and Constitution*. The subject is further taken up in Ch. 14 under the heading *Long-term Cumulative Effects of Diet*. It is a central theme of this book that constitution is determined in part by habitual diet and that therefore habitual diet must be considered in discussing the ætiology of a large group of diseases of uncertain and multiple ætiology which includes some of the major degenerative diseases of middle life. For Western medicine this may be the most important lesson coming from the study of clinical nutrition to influence thought in the 1960s.

The Scope of Clinical Nutrition. The field of nutrition, and even of clinical nutrition, is so wide that it interdigitates with every other medical discipline. This merely emphasizes that food is a fundamental necessity of life, and healthy food of healthy life. In the last resort good nutrition is indistinguishable from good health. This relationship is two-way and a breakdown at either end leads to a vicious circle of ill-health and malnutrition. This will be discussed especially in the section on malnutrition and diarrhœa, but the vicious circle principle is valid in every system of the body.

To narrow the scope of the book it has been decided to concentrate on the effects of dietary malnutrition; namely upon that half of the circle which runs from unsatisfactory food to disorder of bodily systems (in distinction from that half of the circle which runs from disordered systems through faulty appetite, digestion, assimilation, metabolism and excretion back to unsatisfactory food). In a book on clinical nutrition we cannot avoid consideration of those disorders which are conditioned, even when a good diet is readily available, by the mechanisms listed, but the discussion will return always to a dietary orientation. Only in this way can we avoid expanding the monograph into a textbook of medicine.

World Nutrition. Although the international public health aspects of malnutrition are not strictly within the purview of this book they cannot be ignored. Every clinician, even in the developed regions, is aware that there is a world problem of food in relation to population growth. Clinicians in underdeveloped regions are pressingly aware of the problems of malnutrition, undernutrition and even famine and starvation. They cannot feel an urgent interest in the possible long-term effects of diet on constitution and degenerative disease so long as these more urgent problems surround them daily and determine a community life expectation so short that the degenerative diseases are not likely to represent a community problem. Their colleagues in the developed regions can no longer live in an ivory tower because of the "internationalization" of the world. As the underdeveloped regions develop, the satisfaction of their pressing needs for the protective foods such as good quality proteins and vitamins may threaten the "plenty" of the developed regions. The "recommended allowances" of the privileged nations are already challenged as unrealistic or unattainable in the underdeveloped regions. The leaders of the relevant specialized international agencies (FAO, WHO, UNICEF) are saddled with a dilemma; are the recommended allowances of, say, the U.S.A., unnecessarily generous or must the rest of the world be satisfied

indefinitely with allowances which are suboptimal for health. Clinicians in the developed regions are vitally concerned in the first alternative. If the recommended allowances are overgenerous does their application contribute to any form of overnutrition? If so, should they be reduced? (Ch. 11). Alternatively, would a scaling-down of these allowances undermine reasonable body reserves and contribute to impaired vitality with increased susceptibility to infective and other acute diseases in the present (see Ch. 29 on Nutrition and Infection) or to impaired constitution and increased liability to degenerative disease in the future? (See Ch. 14 on Constitution and Degenerative Disease). If the latter alternative be right then the conclusion is of practical importance for the clinicians of the underdeveloped regions and to the public health and nutrition administrators of the specialized nutrition agencies of UNO and of individual nations.

For these reasons the author has included a section in Ch. 16 on World Population Growth and Food Supplies and has invited a contribution from WHO and FAO (Ch. 33).

Geographical Pathology. In Cape Town Nature has provided a unique natural experiment. It consists in the juxtaposition of three racial groups living in the same well-localized geographic and climatic environment, but differing markedly in their socio-economic status and in the incidence of undernutrition, malnutrition, and "social diseases" such as tuberculosis, syphilis and infantile diarrhœa. Interracial studies in this area and studies in geographical pathology throughout the African continent have led to some fascinating speculations about the role of malnutrition in general, and of protein malnutrition specifically, in the ætiology of some diseases prevalent in the tropical regions.

In the strictly temperate Mediterranean-type climate of Cape Town interracial studies have been pursued in freedom from the complicating effects of tropical disease which make interpretations of the role of malnutrition difficult throughout a large part of the Central African belt.

Of the two non-white racial groups, one—the Cape coloured people—has followed for more than a hundred years the cultural and dietetic pattern of the European, and differs in no radical sense from the equivalent pattern of the underprivileged European.[38] The other group—the Bantu—comes from a rural pastoral background in which the cultural and dietetic pattern is vastly different from that of the European. Very few of the Bantu have been urbanized for more than a generation, and the great majority are migrant

labourers returning to their homes after living for a year or two in the city.[48] These migrant labourers retain to a very large extent the cultural and dietetic background of their home environment, while their urbanized brethren—a small minority—are slowly trending towards the European pattern. During his brief stay in the city environment the Bantu migrant labourer tends to produce, even in the year 1960, florid scurvy, the very disease which led the Dutch East Indies Company in 1652 to establish a revictualling station for their commercial navy on the site which has now become the City of Cape Town.[185]

The contrast between White, Cape Coloured and Bantu experience of ischæmic heart disease led to studies on the role of quantity and quality of dietary fat in the ætiology of this important degenerative disease of privileged westernized people which have been recorded in a symposium on dietary fat, cholesterol metabolism and coronary disease.[389] This fascinating field of study has also been reviewed in Chs. 8 and 19. In the symposium a review on ischæmic heart disease in African populations[53] has covered the background of the various racial groups in the African continent. Their mode of life and particularly their dietary habits have been recorded in a chapter entitled *Interracial studies in the South Western tip of the African Continent in relation specially to Cirrhosis and Primary Cancer of the Liver.*[94] The subject of endemic cirrhosis and primary cancer of the liver in the Central African belt and some other parts of the world is reviewed in Ch. 13. Its relevance to this book is in the theory that chronic protein malnutrition sensitizes the liver to the action of cirrhotigens and carcinogens which could be resisted or detoxified by a well-nourished system.

Nutrition Literature. Apart from the two text books[91, 447] referred to in the preface there are many general and special texts that can be consulted. On the American scene the first edition of Jolliffe's "Clinical Nutrition" is now slightly out-of-date, but a second edition is due in 1960 or 1961. For a compact reference to facts on applied biochemistry and physiology of human nutrition the "Heinz Handbook of Nutrition" (1959) is invaluable.

This monograph emphasizes the importance of malnutrition in the tropics and in the ætiology of some "tropical diseases". Comprehensive literature in this field is less satisfactory and up-to-date. Two recent books constitute, however, valuable background reference to the important interrelationships between nutrition and parasitic disease in tropical pædiatrics; "Infant Nutrition in the Sub-Tropics and Tropics", by D. B. Jelliffe,[212] and "Diseases of

Children in the Sub-Tropics and Tropics", by H. C. Trowell and D. B. Jelliffe.[406]

The journals now devoted to nutrition, even if one limits one's interest to clinical application, are almost too prolific for review. In the English language the author would like to pay tribute to the value of *Nutrition Reviews*. The short reviews in this admirable journal are critical, topical, timely and most helpful. For abstracts in all fields *Nutrition Abstracts and Reviews* is still pre-eminent. Other international reviews are published in *Excerpta Medica* (*Amsterdam*).

It is difficult to recommend nutrition periodicals to the general physician who will probably refer to them only as he is led by one of the reviews or abstracts. In the English language the Nutrition Society of Great Britain publishes regularly the *British Journal of Nutrition* and the *Proceedings of the Nutrition Society*. In the U.S.A. the *American Journal of Clinical Nutrition* and *Metabolism*, both contain nutrition articles of general interest to the physician. The *Journal of Nutrition*, official organ of the Institute of Nutrition of the U.S.A., is less clinically oriented.

Tropical journals such as the *Transactions of the Royal Society of Tropical Medicine and Hygiene* and the *Journal of Tropical Nutrition* often contain important articles on clinical nutrition and the same is true of many general medical periodicals such as the *Lancet* and the *American Journal of Medicine*. Very recent nutrition communications in the U.S.A. are picked up quickly in *Federation Proceedings*.

1959 saw the birth of *World Review of Nutrition and Dietetics* under the editorship of G. H. Bourne.[33]

In the 1960 volume of *Annual Reviews of Medicine* there is a chapter on *Nutrition and Nutritional Diseases*, by N. Jolliffe and R. S. Goodhart.[219]

CHAPTER 2

FOODS, CALORIES AND NUTRIENTS

THE term *foodstuff* is defined as "anything which can be used as food". In the plural it can be abbreviated to *foods*. (By contrast the word food (nutriment) is often used to indicate a mixture of foodstuffs which appeals to taste and satisfies hunger.) Foods are used to yield energy and to build up and repair the body. Energy is obtained by breakdown of food through various pathways, but especially through oxidation of acetyl coenzyme A, the common channel into which carbohydrates, fats and many proteins go via 2-carbon acetate fragments before ultimate oxidation. No clear distinction is ordinarily made between *foods* and *nutrients* and this sometimes leads to confusion since foods are variable combinations of nutrients. Thus, in the BMA recommended allowances[90] proteins are listed as nutrients although they consist of a variable pattern of amino-acids which, at least in the case of the essential amino-acids, are their ultimate nutrients. Furthermore almost all foods contain some protein and what are correctly called protein-rich foods (often wrongly called proteins) consist of proteins (with a variable pattern of amino-acids), carbohydrates, fats, vitamins and minerals—not to mention water. In Ch. 7 this subject is further developed in relation to the confusion which has arisen over the term *protein malnutrition* which is far from synonymous with either *protein deficiency* or *amino-acid deficiency*. Similar principles can be applied to the consideration of fatty foods, fats and fatty acids and to starchy foods, carbohydrates and the various sugars which make up carbohydrates, it is doubtful whether knowledge is ripe for a clear distinction between the terms *foods* and *nutrients*, but the ambiguity of present terminology should be appreciated.

Carbohydrates, fats and proteins are to some extent interchangeable as sources of energy, but their cost is very different. Carbohydrate foods are the cheapest for yielding energy and provide up to 90 per cent of the energy needs of poor people, especially in the tropics. In the diets of the rich this figure may be less than 50 per cent and proteins become a considerable, and expensive, source of energy. It is suggested that 55 to 65 per cent is an optimum