FOOD POISONING

ITS NATURE, HISTORY AND CAUSATION MEASURES FOR ITS PREVENTION AND CONTROL

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FOOD POISONING

FOREWORD

It is only during the past two or three decades that the real nature of the illnesses commonly grouped together under the popular term ' food poisoning ' has been shown.

Modern research has proved these conditions to be due to the infection of food by definite organisms or their toxins. The food itself has little or nothing to do with the illness, except to act as a carrier or vehicle of distribution, just as water may carry the cause of typhoid fever or milk that of scarlet fever.

The work on this subject has been done by many observers in many places, and the results are recorded in many scientific papers and reports not readily available to the general, or even professional, reader.

The author of this work has done a great service in bringing all this work together in due perspective in one volume in a manner which would not have been possible a few years ago.

Here is a complete account of the whole subject which ought to dispel many erroneous ideas still prevailing and provide a reference for all those interested in this fascinating aspect of the public health.

GERALD LEIGHTON, M.D.

AUTHOR'S PREFACE

In compiling this work, my intention has been to collect and present in readable form in one volume the fundamental facts relative to the many kinds of human food poisoning. The selection of essential material has been somewhat difficult, because a very large part of the information on the various subjects, especially bacterial food poisoning, is so widely distributed in numerous medical works, scientific treatises, journals and pamphlets, or recorded in Public Health Reports published during the past decade as a result of the investigations, studies and experiments by medical experts and observers in this country, the Colonies and the Public Health services and Universities in the United States of America.

No originality is claimed for this book. Many well-known works of reference have been consulted, and I gratefully acknowledge my indebtedness to the authors concerned.

Some interesting historical matter concerning early food-poisoning investigations has been included to indicate the sequence of events leading up to important bacteriological discoveries.

References are appended to each chapter for the use of readers desirous of consulting the original articles or books.

Quotations and Figures 28, 29, 30, 32 and 33 from official publications are included by permission of the Controller of His Majesty's Stationery Office, the Ministry of Agriculture and Fisheries and the Ministry of Health.

An Appendix on the Contamination (and Decontamination) of Foods by Poisonous Gases used in War has been kindly contributed by Mr. Henry Eastwood, M.R.San.I., Food Contamination Officer, Borough of Hornsey, London.

I am greatly indebted to Sir William Savage, M.D., for his valuable assistance, and my sincere thanks are accorded to Professor W. W. C. Topley and Professor G. S. Wilson for kindly permitting me to quote from their work on " The Principles of Bacteriology and Immunity " ; to friends, both at home and abroad, including Professor K. F. Meyer, Dr. J. G. Geiger, Dr. F. W. Tanner and Dr. S. R. Damon, for allowing me to make extracts from their writings, and to the Rockefeller Institute for Medical Research, New York, for consenting to excerpts being reprinted from their Monograph on " Botulism " by the late Dr. Ernest Dickson.

I am grateful, too, to all those who loaned photographs of some of the early investigators and to the publishers of "Food Manufacture," for their guidance and help. Finally, I must acknowledge the valuable help received from my wife in the preparation of the manuscript and index.

E. B. D.

EPSOM 1943

PREFACE TO SECOND EDITION

IT is gratifying to note that the demand for this work has necessitated the publication of a second edition, the preparation of which has afforded an opportunity of carefully revising certain parts of the text, and of incorporating new and up-to-date material, including a chapter on Staphylococcus Food Poisoning. This particular type of illness, due to enterotoxin-producing staphylococci, has excited considerable interest and discussion. Investigations and much experimental work have been carried out in this connection during the past few years.

My sincere thanks are accorded to Professor C. E. Dolman for kindly permitting me to quote from his writings on this subject.

A new Appendix has been added on the laboratory investigation of food poisoning cases and the media recommended for the isolation of members of the Salmonella group. I am extremely grateful to Dr. J. E. McCartney for his valuable help and suggestions in its preparation.

Additional photographs have been included in order to add interest to the work, which it is hoped will be received as favourably as its predecessor.

The reproductions of poisonous fungi are from Bulletin No. 23, Ministry of Agriculture and Fisheries, by permission of the Controller of His Majesty's Stationery Office.

E. B. D.

EPSOM 1946

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PART I

CHAPTER I

INTRODUCTION

THE term 'Food Poisoning,' used in its broadest sense, embraces a variety of human ailments caused by poisonous substances transmitted by the food or drink ingested. In its strictly technical sense, however, it is confined to infections and intoxications associated with certain pathogenic organisms; the majority of outbreaks to-day are of this type.

This book is devoted to the following categories of food poisoning:

Bacterial food poisoning (including botulism),
Contamination of food by metals,
Poisonous plants and fungi,
Poisonous fish and shell-fish,

and includes food sensitisation or food allergy.

Bacterial food-poisoning outbreaks frequently occur during the summer months. Sometimes they assume large proportions, especially when the milk supply is the source of infection. Owing to a considerable number of outbreaks being of a mild and temporary type and limited to one or more persons or members of the family, they are frequently overlooked or are not investigated. Only when the malady is of a really serious nature and medical advice is sought, or when a considerable number of persons are attacked simultaneously, are investigations made into the origin. Now that food poisoning is notifiable, more cases and more outbreaks are thoroughly analysed.

To ptomaines have been assigned the chief cause, not only of the harmful effects resulting from the ingestion of tainted meats, but of food poisoning generally, and in consequence it has been difficult to eradicate the indiscriminately applied term 'ptomaine' poisoning. Proof has been definitely established that these putrefactive alkaloids are not present in the early stages of decomposition and are only formed when putrefaction has advanced to such a degree that the food becomes repulsive.

Substantiation of this is found in an address given before the Canned Food Section of the London Chamber of Commerce in 1922 by the late Sir William Willcox, who said : " The idea that food poisoning is due to ptomaines is quite exploded. I have made a very large number of analyses in fatal cases of poisoning and suspected poisoning ; but although I searched most minutely for all signs of alkaloidal poisons, ptomaines, and so on, unless there are some genuine chemical poison there, my efforts to find these poisons failed. I used not to succeed in finding ptomaines in the viscera which were examined, though many of them were of an extremely advanced nature as regards decomposition which had occurred. So that we can dismiss these ptomaines as the cause of food poisoning."

Rapid advances made in bacteriology and pathology furnish conclusive proof that the majority of cases of food poisoning (apart from non-bacterial food poisoning) are due to infection of the human subject by pathogenic bacilli (Salmonella) together with the toxins they manufacture. The term ' ptomaine ' poisoning used in connection with food poisoning, therefore, is misleading and should be discarded in all scientific literature.

The provision of an attractive uncontaminated and unadulterated food supply is a problem of vital importance and one that has never excited so much interest in the medical profession, Government departments, public health officials, educational authorities and food manufacturers as it has during the past few years. Food is now prepared, preserved and manufactured in immense quantities by various methods and processes, often by massed production. Machinery has to a large extent replaced manual labour. Food products are frequently transported long distances in a variety of vehicles under varying conditions and are handled by a considerable number of persons before finally reaching the consumer. Thus they are exposed to contamination of all descriptions through carelessness or ignorance.

In recent years, however, there has been an important metamorphosis. The major portion of our food supply has been beyond criticism or suspicion. This is attributable not merely to legislation, which exacts in every way higher standards for products and manufacture, but to a genuine desire on the part of manufacturers, canners and traders to place on the market clean, wholesome food. Through their various trade organisations, by bacteriological and chemical research and other means, marked progress has been made in manufacture, preservation, storage,

transportation and distribution. Control of bacteria in food is now the aim of a large number of industries. This is accomplished by such means as pasteurisation, processing, the use of harmless preservatives, refrigeration, quick freezing, etc. The safeguarding and controlling of our food supplies goes to the very root of public health, and it is only by investigation and elucidation of the many difficulties associated with food poisoning, as briefly referred to above and amplified at some length in this work, that we have been able to make material and satisfactory progress towards the solution of a big problem, fraught as it is with innumerable complexities.

CHAPTER II

HISTORICAL

FROM time immemorial food has been recognised as a cause of disease. Down through the ages man has gained considerable knowledge—often unpleasant or painful—as to what is fit and what is not fit to eat. Only in comparatively recent years have investigations been made and definite information obtained as to the origin and nature of the disease-producing properties associated with certain foods.

Meat, frequently the cause of outbreaks of illness, was used as an article of diet from the earliest times. Researches of geologists proved that prehistoric man lived partly on the flesh of animals. The higher hieroglyphics of the Egyptians revealed that meat and meat foods entered largely into the dietary of the ancient nations, and regulations regarding their use were introduced and officially enforced. Even in those far-off days it was recognised that animals which had died a natural death, or were killed "to save their lives," were unfit for human consumption.

Food poisoning, which was mentioned in the ancient writings of Hippocrates, Horace, Ovid and other philosophers, was of a somewhat different nature: it resulted from the accidental consumption of poisonous fungi, herbs or plants.

Records tell us that the Greek poet Euripides lost his wife, daughter and two sons, who during his absence had eaten poisonous fungi in mistake for the edible variety.

Theophrastus (300 B.C.), in his history of plants, makes several references to poisons, and records that these were sometimes added to food with criminal intent or for monetary greed. Zenophon (400 B.C.) remarks that the addition of poison to food and drink was so common amongst the Medes that it was customary for the cup-bearers to taste the wine before it was offered to the King. In the Middle Ages intentional poisoning was so common that official food tasters were appointed.

During the Roman period oysters were used by Empresses, who were not the most devoted or virtuous of wives, as easy and agreeable agents in which to administer poison to their husbands or lovers. Historical records mention a number of interesting

incidents in which food was adulterated in Roman, Grecian and early English times.

Adulteration of food was practised with impunity. Sick animals were slaughtered and the diseased meat disguised or treated with preservatives and sold as sound food ; the result can be well imagined. Cleanliness in slaughter-houses and premises where food was prepared was unheard of.

During the early part of the 19th century investigators of cases of food poisoning (especially meat) assigned their cause to chemical poisons in decomposed food ; later, however, they were attributed to putrefactive alkaloids (ptomaines). Such outbreaks were not associated with any bacterial theories.

Albert von Haller made the first scientific observations and experiments relating to the effects of decomposed protein substances upon animals. He injected aqueous extracts of putrid meat and blood into their circulations, which caused symptoms resembling those seen in septic diseases. Experimental work on these lines was also carried out by Gaspard (1822–4) and Magendies (1823) and aroused great interest.

Panum (1856), a Kiel professor, attempted to disclose the nature of the septic poison. He demonstrated that the poisonous qualities exhibited by putrid fish were of a chemical nature and undestroyed by boiling. Bergmann and Schmiedeberg (1868) believed that the active poison was a substance they termed 'sepsin.' Later, more extensive studies were made upon the poisons in decomposed food, especially putrefying meat, and upon their effects on animals. This resulted in the publication of voluminous literature on the subject, amongst which were the monographs by Hiller (1879) and Gussenbauer (1882). Putrefactive alkaloids designated 'ptomaines' by Francesco Selmi (1872), the Italian chemist, were isolated by Nencki in 1876. In 1882–9, Brieger, Ladenburg, Vaughan and Novy investigated these substances and found they possessed highly poisonous properties, especially when injected into animals. Ladenburg (1883) prepared the first putrefactive alkaloid (Cadaverine) by synthetic methods, and in 1888 Vaughan and Novy compiled a work on ptomaines and leucomaines. Vaughan (1884) isolated 'tyrotoxicon' (a substance closely allied to ptomaines) from cheese, which had caused symptoms of poisoning.

The ptomaine theory, although it at times caused considerable controversy amongst scientists and the medical profession, was nevertheless widely accepted for many years, and the general

presumption was that the real cause of food poisoning had been discovered.

It may be mentioned in passing that it was suggested by Schwaun (1837) that putridity was really a biological process ; this was confirmed by Pasteur in 1863.

The works of Vaillard (1902), Fornario (1906), Cathcart (1906) and other observers have since proved that these substances were comparatively non-toxic to experimental animals except when administered in excessively large doses, far larger than ever likely to be ingested under natural conditions. Also that ptomaines were not present in food until it had reached an advanced stage of decomposition when it would be repugnant in appearance and nauseating to the normal senses. Moreover, cases of food poisoning often resulted from the consumption of meat which showed no sign of decomposition and was normal in appearance.

Savage (1921) studied the relation of putrid food to illness. This was his opinion on the subject :

" The view which credits decomposed food with toxic properties largely rests upon a misconception due to the isolation of non-specific poisonous bodies called ptomaines from decomposing food, and then assuming that these bodies which are toxic by ingestion, and not at all, or to a very limited extent by feeding, are the cause of food poisoning. . . . I have fed a series of kittens with extremely putrid mixtures of canned meat and fish over long periods and without demonstrating any definite signs of toxicity. I am unaware of, and have been quite unable to find, any evidence in favour of the popular conception as to the great toxicity of incipiently putrid food or even definitely decomposed food ; . . . there is no evidence of any scientific value that the general public runs any risk of illness from this source."

Tanner (1933) summarised the objections to ptomaine poisoning as a cause of illness as follows :

" 1. Foods which would cause it would have to be in the later stages of decomposition, since presence of ptomaines is related to putrefaction. Most people would refuse to partake of such food.

" 2. Some foods are purposely putrefied in order to improve their flavour. Such is the case with cheese, and even with meat, although in the latter case it is not carried as far as in the former. The Chinese also allow eggs to age.

" 3. The toxicity of ptomaines isolated from putrefied foods has not been satisfactorily established.