DIETARY FATS AND OILS in human nutrition

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

dietary fats and oils in human nutrition

Report of an Expert Consultation

jointly organized by

the Food and Agriculture Organization of the United Nations

and

the World Health Organization

held in Rome, 21–30 September 1977

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P-86
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FAO and WHO are concerned about the effects of dietary fats and oils on the health and performance of people and nations. The problem of apparent deficits and excesses in consumption in both the developing and developed countries remains controversial and complex; it is, in fact, one of the most important questions being studied by nutritionists and health authorities throughout the world. This publication is a synthesis of current knowledge based on papers submitted to and discussions at a joint FAO/WHO expert consultation on the subject.

COVER: Detail from *The Olive Orchard* by Vincent Van Gogh (in the Chester Dale Collection, National Gallery of Art, Washington, DC).

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Joint FAO/WHO Expert Consultation
The Role of Dietary Fats and Oils in Human Nutrition

Rome, 21–30 September 1977

A Joint FAO/WHO Expert Consultation on the Role of Dietary Fats and Oils in Human Nutrition was held in Rome 21–30 September 1977. The meeting was opened by Dr. E.M. DeMaeyer of the World Health Organization, Geneva, who expressed the appreciation of FAO and WHO to the participants.

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

There are in the world millions of people whose health suffers because of an insufficiency of the right kinds of food. By contrast, among prosperous people diseases associated with dietary excesses are common. The principal nutritional problem of the developing countries appears to be a deficit of dietary energy, whereas that of developed countries is overconsumption. Furthermore, the contrast in fat intakes is very great. The problem of dietary fat in human nutrition is controversial and complex, and it is, in fact, one of the most important questions yet faced by nutritionists.

FAO and WHO are concerned about the implications of dietary fats in human nutrition because of the positive contribution fats might make to the health and performance of many people and nations, and because of the possible adverse effect of certain fats on atherosclerosis and on obesity and its complications. During the last decade there have been significant advances in knowledge of the nutritional value and physiological effects of different fats. Some of these advances may lead to a revision of current views about the quality of dietary fat.

There are two general considerations: firstly, the importance of fats in food and, secondly, the safety aspects.

Dietary fat is important for five reasons:

(*i*) as a source of energy;

(*ii*) for cell structure and membrane functions;

(*iii*) as a source of essential fatty acids for cell structures and prostaglandin synthesis;

(*iv*) as a vehicle for oil-soluble vitamins;

(*v*) for control of blood lipids.

In addition, fat contributes to the palatability of food and is thus important in cooking and food processing.

In considering the safety of fats, a major issue that remains to be resolved is that of the health implications of the brassica-derived oils and partially hydrogenated marine oils. Guidelines regarding the use of such oils and fats for human consumption are urgently needed.

Finally, it is important to establish to what extent crop and animal management affects the nutritional quality of the food eaten.

This publication is a synthesis of the papers presented and the subsequent discussion on them. It attempts to record the current status of knowledge of dietary fats and oils in human nutrition.

1. DEFINITIONS

The definitions used follow those employed in previous FAO/WHO reports, the 1973 report on energy and protein requirements (11) being used as a reference. Because of the specialized nature of lipid biochemistry and nutrition, the following additional information is presented.

Fats and oils

This group of water-insoluble organic substances predominantly consists of triglycerides — i.e., glyceryl esters of fatty acids. Fats are distinguished from oils only by their different melting points: fats are solid and oils liquid at room temperature; however, the general term "fats" is commonly used to refer to the whole group and is synonymous with "lipids."

Classification of fats

Although fats constitute a diverse group of substances, they can be roughly divided into two classes:

(*1*) *Neutral* fats, which include the triglycerides, cholesterol, other sterols and isoprenoid groups with their esters (vitamins A, D, E and K also fall into this category).

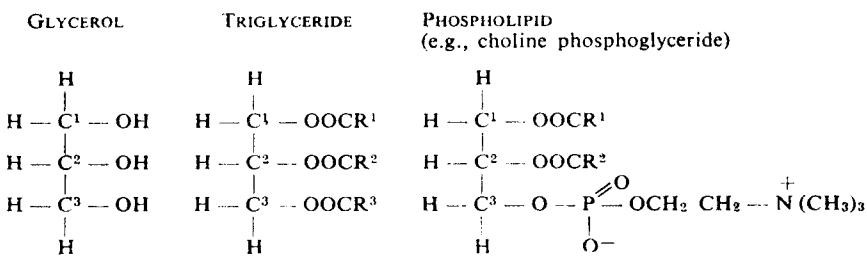
(*2*)*Amphiphilic* fats, which consist of the phospholipids, the principal members being the choline phosphoglycerides (lecithins), ethanolamine, serine and inositol phosphoglycerides, together with the sphingo lipids such as sphingomyelin. The amphiphilic group possesses the property of forming bilayers. Because part of the molecule (the phosphate ester) is strongly polar (miscible with water) and the aliphatic part is nonpolar, the phospholipids have the property of orienting on the surface of a large molecule, on an aqueous surface or on an interface between two immiscible layers. It is this property which is thought to play an important part in their biological role in the formation of cell membranes and in their industrial use as surfactants or emulsifiers.

Broadly speaking, this chemical classification follows the *biological functions* of the two separate groups of fats in the body:

(*1*) *Storage* fats, mainly triglycerides, which are accumulated in specific depots in the tissues of plants and animals. These fats are the most important energy reserves of the body, and in animals they are also a source of essential nutrients. The composition of the fatty acids in these triglycerides is related to the diet.

(*2*) *Structural* fats, mainly consisting of phospholipids and cholesterol. Quantitatively these are the second most important structural group in all soft tissues of the body and are present in unusually high concentrations in the brain. The fatty acid component of the phospholipids is of crucial importance to their properties and function in biological membranes. The composition of the fatty acids in the phosphoglycerides in general exhibits a tissue and species specificity. Although they are subject to dietary alteration, extreme conditions are needed to change their composition appreciably.

The basic structures of the main group of the fats are shown below:



R^1, R^2 and R^3 refer to different or similar fatty acids. Usually the 1 and 3 positions of the carbon chain are occupied by a saturated fatty acid and the 2 position by an unsaturated one.

Fatty acids

The principal fatty acids of relevance to this report are mostly straight chain aliphatic monocarboxylic acids with an even number of carbon atoms. Common names and the modified Geneva names of the International Union of Pure and Applied Chemistry (IUPAC) are mostly used for fatty acids. For example: palmitic acid $CH_3(CH_2)_{14}COOH$ is systematically called hexadecanoic acid; stearic acid $CH_3(CH_2)_{16}COOH$