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Fruit and Vegetables

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The International Agency for Research on Cancer (IARC) was established in 1965 by the World Health Assembly, as an independently financed organization within the framework of the World Health Organization. The headquarters of the Agency are in Lyon, France.

The Agency conducts a programme of research concentrating particularly on the epidemiology of cancer and the study of potential carcinogens in the human environment. Its field studies are supplemented by biological and chemical research carried out in the Agency's laboratories in Lyon and, through collaborative research agreements, in national research institutions in many countries. The Agency also conducts a programme for the education and training of personnel for cancer research.

The publications of the Agency contribute to the dissemination of authoritative information on different aspects of cancer research. Information about IARC publications, and how to order them, is available via the Internet at: <http://www.iarc.fr/>

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Note to the Reader

Anyone who is aware of published data that may influence any consideration in these *Handbooks* is encouraged to make the information available to the Unit of Chemoprevention, International Agency for Research on Cancer, 150 Cours Albert Thomas, 69372 Lyon Cedex 08, France

Although all efforts are made to prepare the *Handbooks* as accurately as possible, mistakes may occur. Readers are requested to communicate any errors to the Unit of Chemoprevention, so that corrections can be reported in future volumes.

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Contents

List of participants	ix
Preface	xi
1. Definitions and classifications for fruit and vegetables	
Botanical and culinary definitions	1
Botanical definitions	1
Culinary definitions	2
Cultural differences in culinary definitions	3
Summary of definition issues	3
Subgroup classifications for plants, fruit and vegetables	4
Botanical families	5
Growing conditions	9
Fruit development from flowers	9
Food supply and consumption data	13
Edible parts of plants	13
Colour	14
Processing and preparation	14
Considerations for epidemiological studies	18
Fruit and vegetable groupings used in dietary assessment tools	18
Fruit and vegetable groupings familiar to survey participants	19
2. Measuring intake of fruit and vegetables	
Household measures of food availability	23
Household dietary surveys	23
Household budget surveys	23
Food balance sheets	23
Methods to measure dietary intake at the individual level	24
Questionnaire methods	24
Diet history	25
Food frequency questionnaire	25
Brief food frequency questionnaires	27
Recording-based measures of actual intake	27
The 24-hour dietary recall	27
Food records	28
Quantification of fruit and vegetable portions	28
Measurement error and validity	29
Sources of error	29
Validity	29
Effects of dietary measurement error	30
Approaches to evaluating impact of dietary assessment error	32
Estimated validity of measured fruit and vegetable consumption	32
3. Consumption, availability and food policies	
Fruit and vegetable consumption	35
Categories of fruit and of vegetables	35
Age and sex groupings	36
National surveys	36
Selected multi-centre studies	37
Developing countries	40
Availability and time trends in large regions	40
Variations within countries	41
Nutrition and food policies and special campaigns	45
Historical perspective	45
Current policy and dietary guidelines	46
Programmes to implement dietary guidelines and nutrition policy	47
Recommended amounts of fruit and vegetables	47
Campaigns to increase fruit and vegetable intake	48
5 A Day Program—USA	49
Australia	51
Europe	51
4. Cancer-preventive effects	
Human studies	53
General issues	53
Study design	53
Statistical analysis	60
Study context	61
Integration of evidence	61
Effects by site	62
Grouped sites of the upper gastrointestinal tract	62
Oral cavity and pharynx	62
Oesophagus	63
Stomach	66
Colon and rectum	72
Liver	76
Biliary tract	78
Pancreas	78
Larynx	79
Lung	81
Breast	84

Table of contents

Cervix	89		
Endometrium	92		
Ovary	92		
Prostate	94		
Testis	95		
Bladder	95		
Kidney	98		
Brain	101		
Thyroid	101		
Non-Hodgkin lymphoma	103		
Leukaemia	103		
Preventable fraction	246		
Ecological studies	246		
Cross-sectional studies between countries	248		
Cross-sectional studies between regions within countries	248		
Time trend studies	252		
Migrant studies	252		
Summary	252		
Intermediate markers of cancer	252		
Intervention studies	254		
Observational studies	272		
Experimental studies	272		
Animal studies	272		
Effects on spontaneous tumours	272		
Effects on carcinogen-induced tumours	280		
Biomarkers	286		
Effects on phase I and II enzymes	286		
Inhibition of damage to macromolecules	289		
Oxidative damage and defence	290		
Effects on mutation and DNA strand breaks	292		
Effects on DNA repair	292		
Intermediary markers related to the cell cycle	292		
Mechanisms of cancer prevention	293		
Inhibition of endogenous carcinogen formation	293		
Inhibition of radical formation	293		
Inhibition of nitrosation	294		
Modulation of carcinogen bioavailability	294		
Modulation of enzyme systems	294		
Phase I and II enzymes	294		
Antioxidant enzymes	296		
Inhibition of damage to macromolecules	297		
Decreased oxidative damage to lipids, proteins and DNA	297		
		Decreased carcinogen–DNA binding or increased DNA repair	297
		Decreased mutation or cytogenetic damage	298
		Post-initiation effects	299
		Modulation of cell proliferation or apoptosis	299
		Immune function	299
		5. Associations with diseases other than cancer	
		Cardiovascular diseases	301
		Other diseases	302
		6. Carcinogenic effects	
		Human studies	311
		Animal studies	311
		7. Toxic effects	
		Human studies	313
		Animal studies	313
		8. Summary of data	
		Definitions and classifications for fruit and vegetables	315
		Measuring intake of fruit and vegetables	315
		Consumption of fruit and vegetables and relevant policies	316
		Cancer-preventive effects	316
		Human studies	316
		Experimental studies	320
		Mechanisms of cancer prevention	321
		Associations with diseases other than cancer	321
		Carcinogenic effects	321
		Toxic effects	321
		9. Evaluation	
		Cancer-preventive activity	323
		Humans	323
		Experimental animals	323
		Overall evaluation	323
		10. Recommendations	
		Research recommendations	325
		Public health recommendations	326
		References	327
		Working procedures	369

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Preface

Why a Handbook on fruit and vegetables ?

Nutritional research and food policy have shifted focus during the last hundred years. In the early 1900s the focus was on identifying and preventing nutrient deficiency diseases; in the latter part of the last century the attention was on identifying nutrient requirements. More recently, investigations have turned to the role of diet in maintaining health and reducing the risk of non-communicable diseases, such as heart diseases and osteoporosis.

All types of diet have potential health risks as well as benefits associated with their consumption, both at the individual and collective level. During the past 30 years, while meat intake has been associated with increased risk for a variety of chronic diseases such as ischaemic heart disease and some cancers, abundant consumption of fruit and vegetables, legumes, unrefined cereals have been associated with a lower risk for many chronic degenerative diseases and total mortality (see WHO, 2003).

The low consumption of fruit and vegetables in many regions of the world, especially in the developing part, is a persistent phenomenon. Only a small or negligible minority of the

world's population at present consumes the generally recommended high average intakes of fruit and vegetables. In 1998, only six of the 14 WHO regions had an availability of fruit and vegetables equal to or greater than the recommended intakes of 400 g/d (WHO, 2003).

Nutritional epidemiology provides the only direct approach to the assessment of health effects from diet in humans. There are special problems associated with the measurement of diet, including fruit and vegetable intake, particularly in case-control studies. However, in prospective studies within single populations, where there is little dietary variation between individuals, large measurement error can be associated with each assessment.

In 1997, scientists assembled by the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) concluded that diets rich in fruits and vegetables 'decreased the risk of many cancers', and perhaps cancer in general and they endorsed fruit and vegetables as parts of a diet that would reduce risk of various cancers (WCRF/AICR, 1997).

This evaluation originated mainly from the results of case-control studies. Since then, the messages have been clouded by more recent prospective cohort studies that found that such diets may not be protective against cancer. As these newer findings have introduced doubt about the role of fruit and vegetables in cancer prevention, the IARC has considered it important to make a new evidence-based evaluation of the current state of the evidence of a diet rich in fruit and vegetables.

The purpose of this *IARC Handbook* is to provide an up-to-date review of knowledge about fruit and vegetables collectively. Since various types of fruit and vegetables, such as cruciferous vegetables, allium vegetables and citrus fruits, have also been investigated separately, specialist panels will be convened later to look into the evidence concerning these specific categories separately, including the evidence on their main individual chemical components. The first such *Handbook* will consider cruciferous vegetables, isothiocyanates and indoles, and will be published in 2004.