

# 34 Nutrition and cancer

## Summary

Cancer (neoplastic disease) occurs when the factors controlling the cell's division are no longer operative. Carcinogens may be found in food, formed from food components, or have their effects modified by food. At present, nutritional advice to reduce the development of cancer would include a reduction in cholesterol consumption, avoidance of obesity, avoidance of fungal contamination of foods, and increase in the intake of wholegrain cereals, fruits and vegetables.

## What is cancer?

Cancer is a term used to refer to a variety of uncontrolled tissue proliferations. Cancers might otherwise be termed 'tumours' of the malignant, as opposed to benign, kind; the difference is one of propensity to spread. Neoplasia\* or neoplastic disease are less emotive terms than 'cancer' to describe disorders of tissue proliferation.

Division of cells, or cell multiplication, is a normal event that allows tissue development or regeneration. It is when the factors controlling the cell's division are no longer operative that neoplastic disease occurs. It is probably normal for aberrant cells to be produced occasionally. This might be because a genetic mutation\* has occurred. Mutations can result from exposure to certain chemicals, radiation or viruses. If there are not too many aberrant cells, the body's defence system can probably get rid of them. Theoretically nutritional factors could influence neoplastic disease development (oncogenesis)\* by affecting mutation or the defence system.

## Nutrition and cancer

Food itself can be a source of carcinogens.\* These are substances that are mutagenic (induced genetic mutations) of a kind which lead to neoplasia. The carcinogens can occur naturally; for example, bracken fern is carcinogenic. A traditional soup is made from bracken fern by the Japanese; perhaps it contributes to the prevalence of oesophageal cancer in Japan. Toxins produced by fungi (moulds) that contaminate food might also cause cancer; for example, aflatoxin

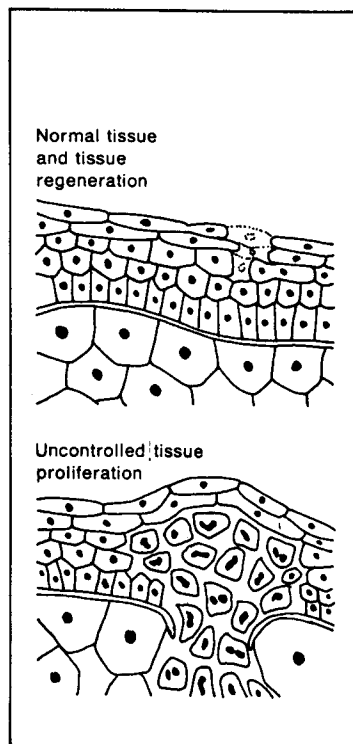


Figure 34.1 Cancer is the uncontrolled proliferation of body cells.

**Neoplasia:** uncontrolled, excessive tissue proliferation.

**Mutation:** a change in the genetic form of a cell.

**Oncogenesis:** the development of tumours.

**Carcinogens:** cancer-producing chemicals.

produced by *Aspergillus flavus*, which contaminates carbohydrate food (peanuts, maize, rice) in humid conditions. Aflatoxins might partly account for the high levels of liver cancer in South-East Asia and Africa.

Butter yellow, which was once used to colour food, is known to be carcinogenic. Food additives must be monitored by health authorities for any possible carcinogenicity. So far additives have been much less of a problem than natural toxicants. Nitrites and nitrates, present naturally\* and added to food, can serve as substrates\* for nitrosamine\* production in the stomach or bladder. Nitrosamines may play a role in the cause of stomach and bladder cancers. Nitrosamine formation might, on the other hand, be inhibited by food chemicals such as ascorbic acid.

Alcohol appears to increase the risk from the carcinogens of tobacco smoke. This is relevant in regard to cancer of the mouth, pharynx, larynx and oesophagus.

Cancer occurs more commonly in the obese, judging from life insurance data. This applies to cancers of the large bowel (colon), rectum, the breast, and lining of the uterus (endometrium). There could be a variety of mechanisms at work here. For example, cholesterol production is greater in the obese, so that there could be more bile acids in biliary secretion and for intestinal micro-organisms to metabolise to carcinogens acting in the large bowel. Fatty (adipose) tissue is

Naturally: in the food as it is grown.

Substrate: substance that can be used in a metabolic process.

Nitrosamine: nitrosamines are formed when nitrites react with amines; can be formed from nitrites.

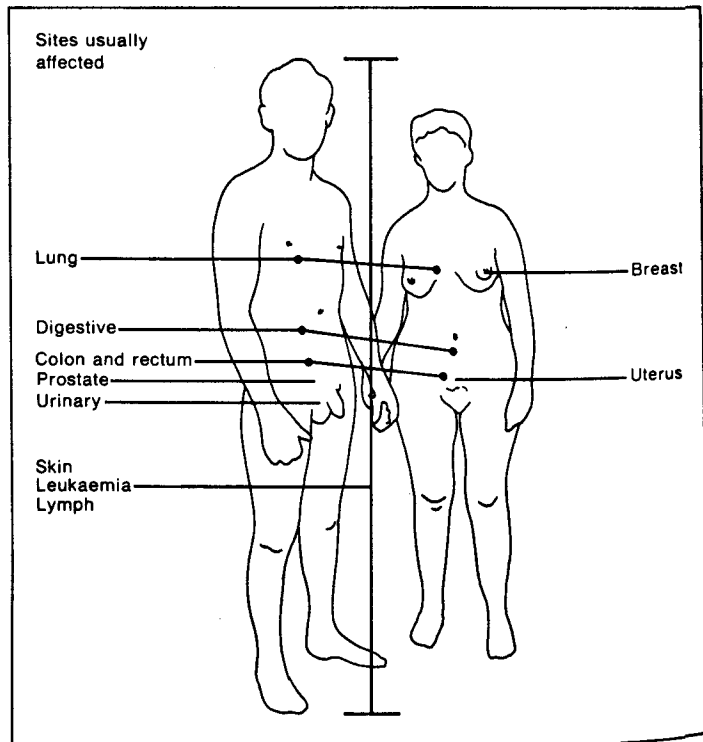


Figure 34.2 Sites usually affected by neoplastic disease in Australia.

the site of formation of the sex hormone oestrogen in post-menopausal women, which has been implicated in gynaecological cancer.

An increased intake of green leafy and yellow vegetables was shown in Japan to be associated with less lung, colon, stomach, and prostate gland cancers. The study was prospective\* over ten years and involved over 260 000 subjects. A possible reason for this association could be the carotenoid\* content of these vegetables. In experimental animals, vitamin A or its analogues have been shown to be protective against the development of epithelial tumours.

One of the important clues to establishing a relationship between food intake and cancer has been the marked differences in cancer prevalence and/or mortality in different parts of the world. Certain neoplastic diseases are more common in affluent societies, and others are more common in under-developed countries.

The colonic cancer\* mortality rates\* of Japanese are greater for those who live in California, intermediate for those in Hawaii, and least for those who live in Japan. The dietary pattern associated with the highest colonic cancer mortality is one of excess energy intake, relatively high energy contribution from meat, and relatively low contribution from vegetables. Such a diet is characterised by a high fat intake, high cholesterol intake, and low dietary fibre intake. A study of food intake and colon cancer mortality data from twenty industrialised countries, including Australia, showed that cholesterol intake was the best predictor of colon cancer mortality. In Australia, Greek, Yugoslavian and Italian migrants in their first sixteen years of residence have about 25 to 30 per cent of the cancer mortality of their non-migrant Australian counterparts. After sixteen years the migrant men are affected in the same way as the non-migrants. These differences could be due partly to differences and changes in food intake patterns. Greeks, for example, have a higher intake of vegetables and a lower intake of meat and alcohol than Australians. It is important to identify any positive contributions to health in Australia that migrant groups might make by way of their dietary patterns.

## Nutrition for cancer patients

Although under-nutrition might be associated with less tumour development in experimental animals, the mal-nourished individual with cancer would be less able to cope with the tumour. One reason for this could be that malnutrition is associated with impaired immunity. Immune mechanisms\* may be helpful in dealing with the tumour. Also chemotherapy (drug treatment) and radiotherapy\* for cancer appear to be better tolerated by well-nourished patients. For these reasons, nutritional support for cancer patients is now receiving much attention.

Prospective: study started at a point in time and continued. A retrospective study looks at events that have preceded a point in time.

Carotenoid: a substance resembling carotene.

Colonic cancer: cancer of the large bowel.

Mortality rate: rate at which people die per unit time.

Immune mechanisms: the body's defence systems usually thought of as taking care of infection.

Radiotherapy: treatment with radiation directed to the tumour site.

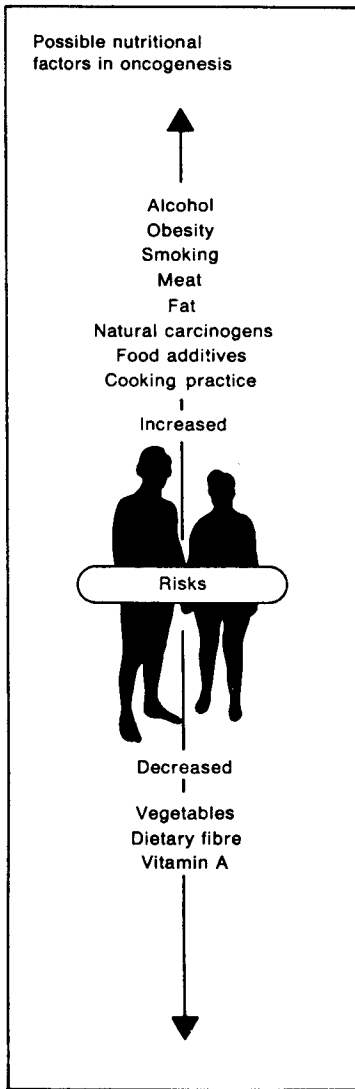


Figure 34.3 There are nutritional factors which can increase or decrease the risk of neoplastic disease.

## Recommendations

Sir Richard Doll, a cancer epidemiologist, has suggested that four practical nutritional recommendations presently seem justifiable to reduce the prevalence of cancer. These are:

1. reduction in the amount of alcohol consumed by those who continue to smoke tobacco;
2. avoidance of obesity;
3. precautions to avoid contamination of food by fungi in hot moist climates; and
4. probably an increase in the consumption of wholemeal bread, vegetables, and fruit, partly to increase the amounts of dietary fibre and vitamins A and C.

## Further reading

SELINGER, B. *Chemistry in the Market Place*. Australian National University Press, Canberra, 1978.

TATTERSALL, M. (Editor) *Preventing Cancer*. Australian Professional Publications, Sydney, 1988.

# FOOD & NUTRITION IN AUSTRALIA

Edited by Mark L. Wahlqvist

in conjunction with the Department of Human Nutrition, Deakin University

Contributors: David R. Briggs, Jill B. Carey,  
Patricia A. Crotty, Delia M. Flint, Gwyn P. Jones,  
Richard S. D. Read, Ingrid H. E. Rutishauser,  
Boyd J. G. Strauss

Illustrations by Neville Todd



Nelson

First published 1981  
Second edition 1982  
Reprinted 1983  
Reprinted 1984 twice  
Reprinted 1985  
Reprinted 1986  
Third edition 1988  
Reprinted 1989  
Reprinted 1992

Thomas Nelson Australia  
102 Dodds Street South Melbourne 3205

© Cassell Australia Ltd 1981  
© Methuen Australia Ltd 1982  
© Thomas Nelson Australia 1988

Cover design by Green Poles Design  
Illustrated by Neville Todd  
Photographs on pages 20, 27, 28, 37, 46 and 66 by Peter Wilson  
Set in 10/11 Garamond by SRM Productions, Malaysia  
Printed in Singapore by  
Kyodo Printing Co. Pte Ltd

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without permission in writing from Thomas Nelson Australia.

National Library of Australia  
Cataloguing-in-Publication Data

Food and nutrition in Australia.

3rd rev. ed.  
ISBN 0 17 007343 2.

1. Food. 2. Nutrition. 3. Food — Social aspects.  
— Australia. I. Wahlqvist, Mark L. II. Briggs,  
David R., 1944 - . III. Todd, Neville.

641'.0994

'I'm an Aussie' reproduced by permission of P. Best and  
Monahan Dayman and Adams  
'The Schoolboy's Lament' reproduced by permission of Brenda Ryan  
'A Dip into the Past' reproduced by permission of Phillip Adams

# Contents

## Section One The sociology of food 1

- 1 Nutrition: does it matter? Mark L. Wahlqvist 2
- 2 History of nutrition in Australia Mark L. Wahlqvist 12
- 3 Culture and food choice Patricia A. Crotty 22
- 4 Australian eating patterns Ingrid H. E. Rutishauser and Delia M. Flint 30
- 5 Food and the law David R. Briggs 49
- 6 Food Faddism Delia M. Flint and Mark L. Wahlqvist 64

## Section Two The science of food 69

- 7 Food production Richard S. D. Read 70
- 8 Food processing Gwyn P. Jones 88
- 9 Food microbiology David R. Briggs and Gwyn P. Jones 99
- 10 Food preparation Jill B. Carey and Richard S. D. Read 115
- 11 Food additives David R. Briggs 138

## Section Three Physiology and metabolism 152

- 12 Digestion and absorption Boyd J. G. Strauss 153
- 13 Metabolism Mark L. Wahlqvist 167
- 14 Exercise and nutrition Richard S. D. Read 176

## Section Four Nutrients and their significance 189

- 15 Energy Jill B. Carey and Richard S. D. Read 190
- 16 Carbohydrates Mark L. Wahlqvist 215
- 17 Dietary fibre Gwyn P. Jones 228
- 18 Lipids Mark L. Wahlqvist 243
- 19 Protein Richard S. D. Read 259
- 20 Water Boyd J. G. Strauss and Mark L. Wahlqvist 273
- 21 Vitamins Mark L. Wahlqvist 281
- 22 Major elements Boyd J. G. Strauss 309
- 23 Minor elements Boyd J. G. Strauss 322
- 24 Alcohol Boyd J. G. Strauss 329
- 25 Natural toxicants in food David R. Briggs 340
- 26 Food composition tables and dietary allowances  
Ingrid H. E. Rutishauser and Delia M. Flint 352

## Section Five Nutritional status 365

- 27 The individual Boyd J. G. Strauss and Delia M. Flint 366

28 The community Ingrid H. E. Rutishauser 373

Section Six Nutrition and the ages of man 383

29 Pregnancy and lactation Ingrid H. E. Rutishauser 384

30 Growing up: infant to adolescent Ingrid H. E. Rutishauser 401

31 The adult and the family unit Mark L. Wahlqvist 430

32 The elderly Delia M. Flint and Mark L. Wahlqvist 433

Section Seven Some issues in nutrition 439

33 Survival nutrition Richard S. D. Read and Gwyn P. Jones 440

34 Nutrition and cancer Mark L. Wahlqvist 449

35 Nutrition and the brain Mark L. Wahlqvist 453

36 Food sensitivities David R. Briggs 457

37 Our neighbours Delia M. Flint and Mark L. Wahlqvist 466

38 Future food supply Richard S. D. Read 472

39 Nutrition education Patricia A. Crotty 485

40 National nutrition policy Mark L. Wahlqvist 498

Section Eight Nutrition resources 507

Index 512