

Woodhead Publishing Series in Food Science, Technology and Nutrition:  
Number 237

# **Fibre-rich and wholegrain foods**

## **Improving quality**

**Edited by  
Jan A. Delcour and Kaisa Poutanen**

**WP**

WOODHEAD  
PUBLISHING



Oxford   Cambridge   Philadelphia   New Delhi

Published by Woodhead Publishing Limited,  
80 High Street, Sawston, Cambridge CB22 3HJ, UK  
www.woodheadpublishing.com  
www.woodheadpublishingonline.com

Woodhead Publishing, 1518 Walnut Street, Suite 1100, Philadelphia, PA 19102-3406, USA

Woodhead Publishing India Private Limited, G-2, Vardaan House, 7/28 Ansari Road, Daryaganj,  
New Delhi – 110002, India  
www.woodheadpublishingindia.com

First published 2013, Woodhead Publishing Limited

© Woodhead Publishing Limited, 2013. Note: the publisher has made every effort to ensure that permission for copyright material has been obtained by authors wishing to use such material. The authors and the publisher will be glad to hear from any copyright holder it has not been possible to contact.

The authors have asserted their moral rights.

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission, and sources are indicated. Reasonable efforts have been made to publish reliable data and information, but the authors and the publisher cannot assume responsibility for the validity of all materials. Neither the authors nor the publisher, nor anyone else associated with this publication, shall be liable for any loss, damage or liability directly or indirectly caused or alleged to be caused by this book.

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming and recording, or by any information storage or retrieval system, without permission in writing from Woodhead Publishing Limited.

The consent of Woodhead Publishing Limited does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific permission must be obtained in writing from Woodhead Publishing Limited for such copying.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation, without intent to infringe.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

Library of Congress Control Number: [Please provide]

ISBN 978-0-85709-038-6 (print)

ISBN 978-0-85709-578-7 (online)

ISSN 2042-8049 Woodhead Publishing Series in Food Science, Technology and Nutrition (print)

ISSN 2042-8057 Woodhead Publishing Series in Food Science, Technology and Nutrition (online)

The publisher's policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp which is processed using acid-free and elemental chlorine-free practices. Furthermore, the publisher ensures that the text paper and cover board used have met acceptable environmental accreditation standards.

Typeset by RefineCatch Limited, Bungay, Suffolk, UK

Printed by TJI Digital, Padstow, Cornwall, UK

<b>13 Fibre-enriched and wholewheat pasta</b> .....	<b>273</b>
<i>C. S. Brennan, Lincoln University, New Zealand</i>	
13.1 Introduction.....	273
13.2 Process variables affecting pasta production.....	277
13.3 Enrichment of pasta with whole grains or dietary fibre.....	281
13.4 Relationship between ingredient selection, processing and nutrition.....	283
13.5 Conclusion and future trends.....	285
13.6 References.....	286
<b>14 Fiber-enriched and wholewheat noodles</b> .....	<b>291</b>
<i>A. S. Ross, Oregon State University, USA</i>	
14.1 Introduction.....	291
14.2 Noodle quality attributes.....	293
14.3 Wholewheat noodles.....	295
14.4 Fiber-enriched wheat flour noodles .....	297
14.5 Wheat flour noodles and resistant starch .....	301
14.6 Wholegrain and fiber-enriched noodles from other botanical sources.....	302
14.7 Conclusion .....	304
14.8 References.....	305
<b>Part IV – Improving the quality of fibre-enriched foods: other products</b> .....	<b>309</b>
<b>15 Fibre-enriched dairy products</b> .....	<b>311</b>
<i>H. D. Goff, University of Guelph, Canada</i>	
15.1 Introduction.....	311
15.2 Dairy product categories and formulations.....	312
15.3 Challenges of fibre enrichment.....	314
15.4 Potential dietary fibre supplements for dairy products.....	316
15.5 Potential product applications.....	319
15.6 Future trends .....	325
15.7 References.....	326
<b>16 Fibre-enriched meat products</b> .....	<b>329</b>
<i>F. Jiménez-Colmenero and G. Delgado-Pando, Instituto de Ciencia y Tecnología de Alimentos y Nutrición (ICTAN-CSIC) (Formerly Instituto del Frío), Spain</i>	
16.1 Introduction.....	329
16.2 Strategies for the development of healthier meat products.....	331
16.3 Fibre as an ingredient in meat product formulation.....	332

x Contents

16.4	Dietary fibre in meat products .....	333
16.5	Future trends .....	342
16.6	Acknowledgements.....	343
16.7	References.....	343
<b>17</b>	<b>Fibre-enriched seafood .....</b>	<b>348</b>
	<i>A. J. Borderías and M. Pérez-Mateos, Instituto de Ciencia y Tecnología de Alimentos y Nutrición (ICTAN-CSIC) (Formerly Instituto del Frío), Spain, and I. Sánchez-Alonso, Instituto de Estructura de la Materia (IEM-CSIC), Spain</i>	
17.1	Introduction.....	348
17.2	Fortification with dietary fibres of aquatic origin.....	349
17.3	Fortification with dietary fibres of terrestrial origin .....	353
17.4	Conclusion .....	362
17.5	Future trends .....	362
17.6	Sources of further information and advice .....	363
17.7	Acknowledgements.....	364
17.8	References.....	364
<b>18</b>	<b>Fibre-enriched beverages .....</b>	<b>369</b>
	<i>L. Viscione, Dupont Nutrition and Health (formerly Danisco UK Ltd), UK</i>	
18.1	Introduction.....	369
18.2	Adding fibres into drinks .....	370
18.3	Types of fibres suitable for fortifying non-dairy drinks: gums and beta-glucans.....	373
18.4	Types of fibres suitable for fortifying non-dairy drinks: fructans and glucose products.....	378
18.5	Typical beverage formulations containing fibre .....	383
18.6	Troubleshooting .....	384
18.7	Future trends .....	384
18.8	References.....	385
<b>19</b>	<b>Fibre-enriched snack foods .....</b>	<b>389</b>
	<i>V. Stojceska, The Manchester Metropolitan University, UK</i>	
19.1	Introduction.....	389
19.2	Extrusion processing of ready-to-eat snacks .....	390
19.3	Nutritional benefits of extruded whole grains .....	392
19.4	Cereal by-products as a new source of dietary fibre.....	399
19.5	Improving the quality of extruded products .....	399
19.6	Conclusion .....	402
19.7	Future trends .....	402
19.8	References.....	403

## Fibre-enriched meat products

**F. Jiménez-Colmenero and G. Delgado-Pando, Instituto de Ciencia y Tecnología de Alimentos y Nutrición (ICTAN-CSIC) (Formerly Instituto del Frío), Spain**

**DOI:** 10.1533/9780857095787.4.327

**Abstract:** This chapter discusses different aspects of the use of dietary fibre in the development of fibre-enriched meat products. It begins by discussing the importance of healthier meat and meat products from the standpoint of the industry and of consumers, and possible strategies for their development. It then describes the technological properties of dietary fibres of interest for meat processing and identifies potential health benefits. Finally, it reviews the use of dietary fibre and fibre-rich ingredients in the formulation of different types (fresh, cooked and fermented) of meat products.

**Key words:** healthier meat product strategies, technological properties of fibre in meat processing, fibre-enriched fresh, cooked and fermented meat products.

### 16.1 Introduction

Dietary fibre (DF) is defined as the remnants of the edible part of the plant and analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the human large intestine (Prosky, 1999). DF as a class of compounds includes a mixture of plant carbohydrate polymers, both oligosaccharides and polysaccharides, for example cellulose, hemicelluloses, pectic substances, gums, resistant starch and inulin, which may be associated with lignin and other non-carbohydrate components (e.g. polyphenols, waxes, saponins, cutin, phytates and resistant protein) (Elleuch *et al.*, 2011). For several decades, interest in the role of dietary fibres in health and nutrition has prompted a wide range of research and received considerable public attention. Various studies have shown that a fibre-rich diet has a number of beneficial effects: it reduces the risk of coronary heart disease, diabetes, obesity and some forms of cancer, and also helps regulate constipation (WHO, 2003; Verma and Banerjee, 2010). Additionally, DF possesses technological properties

Key words: dietary fiber, meat product, health, functional value. INTRODUCTION. The meat industry is one of the most important in the world. One of the directions, for the development of the meat industry, is the production of healthy foods characterized by a lower fat content. Dietary fibers come from grains, vegetables, fruits, and enriched preparations of food products. Traditional sources of fibers and  $\beta$ -glucan in the diet are cereals, such as wheat, oats and barley (Sze et al., 2017). Fruits, vegetables, legumes, soy, psyllium husk and oat bran are good sources of SDF while whole grains are good sources of IDF (Fernandez-Gines et al., 2005). In order to enrich the meat products with fiber, all groups of sources of dietary fiber are used, in particular natural foods rich in dietary fiber, secondary products of processing of vegetable raw materials and purified preparations of dietary fiber [7]. Use of processed grain products in the combined meat products technology can improve nutritional and biological value of the product, contributes to sustainable and equitable distribution of the ingredients, resulting in a product of consistent quality [8]. This is necessary to justify the use of millet as a source of fiber for the production of enriched semi-finished meat products (cutlets "Homy"). The comparison was made for grains produced in accordance with GOSTs: millet, rice, buckwheat, semolina, corn.