



ICQC Scientific Consensus on Whole Grains (Sept 29th, 2017)

Introduction: The quality of carbohydrates (dietary fiber, whole grains, glycemic index and load) matters greatly to health and disease. In the first International Carbohydrate Quality Consortium (ICQC) meeting in Stresa we developed a consensus report on glycemic index (GI), glycemic load (GL) and glycemic response⁽¹⁾. ICQC decided to focus this second consensus document on the quality of grains, specifically on the benefits of whole grains, since grains are the major source of carbohydrates globally.

Definitions: Variable definitions have been used to define whole grains, most of which focus on retention of similar proportions of bran, germ, and endosperm in wholemeal/wholegrain flour, as in the original kernel. Further distinction should be made to separate intact kernels (i.e. intact, unmilled whole grains) from milled whole grains (i.e. whole grain flours and the products made from them) in standardizing research, translation, and health communications. Additional issues include the effects of processing on changes in micronutrient/phytochemical composition, bio-accessibility and bioavailability, as well as on contamination and on alterations in metabolic responses.

Points of Consensus:

- 1) Whole grains, as opposed to refined grains, provide important sources of many essential minerals and vitamins, dietary fiber, and phytochemicals which together or alone may offer health benefits.
- 2) Strong epidemiologic evidence supports that whole grain consumption is associated with reduced all-cause mortality, by reducing the risk of overweight and obesity, type 2 diabetes, cardiovascular disease and possibly colorectal cancer in diverse populations, although evidence for specific grains remains limited.



- 3) Evidence from short- to medium-term randomized controlled trials using milled whole wheat products does not support a direct effect on fasting blood glucose, insulin levels or blood cholesterol, although some trials show a reduction of post prandial blood glucose and/or insulin responses in the short-medium term. For barley and oats, however, there are sufficient data indicating a beneficial influence on the above biomarkers, plus blood pressure.
- 4) Evidence from observational and randomized controlled trials suggests that a diet rich in whole grains is important in assisting weight control in overweight and obese individuals.
- 5) A high intake of dietary fibre, in particular cereal fibre from whole grains, has been associated with a reduced risk of colorectal cancer in European populations and the World Cancer Research Fund (WCRF) supports these findings.
- 6) Evidence is sufficient to support regular consumption of whole grains for the general population, as has been included in numerous national dietary guidelines. A very small percentage of people have a diagnosis of intolerance to gluten and other components of specific grains (celiac disease, wheat allergy, wheat sensitivity), and it is recommended that they avoid consuming these grain products.
- 7) Evidence from prospective cohort studies shows that increasing whole grain consumption from zero to about two servings/day (approximately 16g dry weight/serving) is associated with health benefits⁽²⁾; some small additional benefits are likely with higher intakes. Data on higher intakes are limited and an upper limit is not clear.
- 8) Current consumption of whole grains in many countries appears far below desirable levels, and in these areas, according to guidelines, higher intakes should be encouraged, especially by replacing refined grains without increasing total energy intake.



- 9) Multifaceted efforts to increase whole grain consumption are needed, which include increasing awareness about health benefits, information on whole grain content of foods, promotion in the general media, efforts by the food industry and food services to make whole grains desirable, enjoyable and affordable and to support a regulatory environment that promotes simple but evidence-based whole grain labelling and on-pack promotion. Whole grain foods with low GI should be encouraged, particularly without increasing total dietary GL and energy intake.
- 10) Several research priorities remain. Additional randomized controlled trials on the health effects of whole grains are needed. They should focus on post prandial glucose and insulin responses, on other intermediate outcomes (e.g., biomarkers), and on clinical endpoints. Such trials should be considerably longer than most studies conducted so far. Epidemiologic research should include investigation of specific grains, distinction between intact whole grain, whole grain flour and refined grains and other aspects of processing, and dose-response relations with comprehensive health outcomes of interest. Research is needed on the most effective strategies to increase consumption of whole grains for optimal health in diverse cultures, including behavioral change, new food policies, culinary innovation, food reformulation, and improvements in agricultural practice.

References

1. Augustin LS, Kendall CW, Jenkins DJ *et al.* (2015) Glycemic index, glycemic load and glycemic response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC). *Nutrition, metabolism, and cardiovascular diseases : NMCD* **25**, 795-815.
2. USFDA (2015) 2015-2020 Dietary Guidelines for Americans. <https://healthgov/dietaryguidelines/2015/guidelines/>.



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Conflicts of interest

Arne Astrup: Arne Astrup is advisor to or a member of advisory boards for a number of food and pharmaceutical producers: Basic Research, USA; Beachbody, USA; BioCare Copenhagen, Denmark; Dutch Beer Institute, Netherlands; Feast Kitchen A/S, Denmark; Gelesis, USA; Groupe Éthique et Santé, France; McCain Foods Limited, USA; Nestlé Research Center, Switzerland; Novo Nordisk, Denmark; Saniona, Denmark; Scandinavian Airlines System, Denmark; Weight Watchers, USA; & Zaluvida, Switzerland. Astrup does not own stock in, or have other ownership interests in, any of the companies to which he provides scientific advice, or in any nutrition company other than those companies whose stock is held by various mutual fund retirement accounts.

He is co-inventor of a number of patents owned by the University of Copenhagen, some of which are licensed to commercial entities, in accordance with Danish law, & co-founder/-owner of the University of Copenhagen spin-out companies Mobile Fitness A/S, Personalized Weight Management Research Consortium ApS (Gluco-diet.dk), and Flaxslim ApS, where he is also member of the board.

Recent research at the University of Copenhagen, Denmark, has received funding via unrestricted grants from or contracts with DC-Ingredients, Denmark, Danish Dairy Foundation, Global Dairy Platform, and Gelesis AS, USA.

Astrup is recipient of honoraria as speaker for a wide range of Danish and international concerns and receives royalties from textbooks, and from popular diet and cookery books. He receives payment as Associate Editor of *The American Journal of Clinical Nutrition* and as a member of the Editorial Committee of *Annual Review of Nutrition*.

Astrup is not advocate or activist for specific diets, and is not strongly committed to any specific diet, e.g. veganism, Atkins diet, gluten-free diet, high animal protein diet, or dietary supplements.

Full profile available on the [University of Copenhagen website](#).



Inger Björck, is retired professor from Lund University, Sweden where she has managed the Antidiabetic Food Centre, a non-profitable research centre including the academy, the health care system and representatives from the industry. Inger Björck is inventor and owner of intellectual property related to the use of certain proteins to facilitate blood glucose regulation. She is also owner of intellectual property related to the use of specific prebiotics and probiotics to improve glycemic regulation and metabolism.

Jennie Brand-Miller is a co-author of books about the glycemic index of foods. She is President of the GI Foundation Limited, a non-profit company that administers the Australian 'GI Symbol' program, and oversees the Sydney University Glycemic Index Research Service (SUGiRS), a non-profit GI testing facility for the food industry. She has received honoraria for speaking engagements on the glycemic index of foods.

Furio Brighenti: Current activities and those completed in the last five years that may represent interests worthy to be disclosed are: None for what concerns ownership or other investments - including shares - in commercial activities, intellectual property rights and consultancy/advice to private stakeholders. For what concerns membership of Managing Bodies or equivalent and other membership or affiliation, Prof. Brighenti served as Deputy-Chancellor for Research at the University of Parma from 2013 to 2017 and as representative of University of Parma of the Steering Board of ASTER, a in-house Public Research organization owned by Regione Emilia Romagna and research institutions of the region. Both position involved coordination of activities with a large number of companies in order to attract European funds and develop Research and Innovation in the Emilia Romagna region. From 2011 to 2016 Prof. Brighenti served as legal representative (President) of the Italian Nutrition Society SINU – a not-for-profit scientific society. Associates to SINU are “Soci Collettivi” including companies operating in the fields of nutrition, body composition, nutrition



software, meal distribution, food production etc. Since 2017 Prof. Brighenti is Member of the Board of the Federation of European Nutrition Societies (FENS). FENS is a non-profit Federation consisting of 26 European Nutrition societies, each representing one country. The main FENS event is the European Nutrition Conference, arranged every 4 years, where many public and private sponsors provide support. For what concerns interest of close family members, Prof. Brighenti spouse, Dr Silvia Valtuena Martinez, MD, PhD, is Scientific Officer at the NDA Unit of the European Food Safety Authority, the agency of the European Union (EU) that provides independent scientific advice and communicates on existing and emerging risks associated with the food chain.

Anette Buyken: Member of the ILSI Europe Expert Group ‘Carbohydrates based recommendations as a basis for public dietary guidelines’ (coordinated by the Dietary Carbohydrates Task Force). Member of the Executive Committee of the German Nutrition Society (Guidelines Committee ‘Carbohydrate intake and prevention of nutrition-related diseases’, Guidelines Committee ‘Protein intake and prevention of nutrition-related diseases’, Head Section “Public Health Nutrition”)

David Jenkins: DJAJ has received research grants from Saskatchewan Pulse Growers, the Agricultural Bioproducts Innovation Program through the Pulse Research Network, the Advanced Foods and Material Network, Loblaw Companies Ltd., Unilever, Barilla, the Almond Board of California, Agriculture and Agri-food Canada, Pulse Canada, Kellogg's Company, Canada, Quaker Oats, Canada, Procter & Gamble Technical Centre Ltd., Bayer Consumer Care, Springfield, NJ, Pepsi/Quaker, International Nut & Dried Fruit (INC), Soy Foods Association of North America, the Coca-Cola Company (investigator initiated, unrestricted grant), Solae, Haine Celestial, the Sanitarium Company, Orafiti, the International Tree Nut Council Nutrition



Research and Education Foundation, the Peanut Institute, the Canola and Flax Councils of Canada, the Calorie Control Council (CCC), the CIHR, the Canada Foundation for Innovation and the Ontario Research Fund. He has received in-kind supplies for trials as a research support from the Almond board of California, Walnut Council of California, American Peanut Council, Barilla, Unilever, Unico, Primo, Loblaw Companies, Quaker (Pepsico), Pristine Gourmet, Bunge Limited, Kellogg Canada, WhiteWave Foods. He has been on the speaker's panel, served on the scientific advisory board and/or received travel support and/or honoraria from the Almond Board of California, Canadian Agriculture Policy Institute, Loblaw Companies Ltd, the Griffin Hospital (for the development of the NuVal scoring system, the Coca-Cola Company, EPICURE, Danone, Diet Quality Photo Navigation (DQPN), Better Therapeutics (FareWell), Verywell, True Health Initiative, Institute of Food Technologists (IFT), Saskatchewan Pulse Growers, Sanitarium Company, Orafti, the Almond Board of California, the American Peanut Council, the International Tree Nut Council Nutrition Research and Education Foundation, the Peanut Institute, Herbalife International, Pacific Health Laboratories, Nutritional Fundamental for Health, Barilla, Metagenics, Bayer Consumer Care, Unilever Canada and Netherlands, Solae, Kellogg, Quaker Oats, Procter & Gamble, the Coca-Cola Company, the Griffin Hospital, Abbott Laboratories, the Canola Council of Canada, Dean Foods, the California Strawberry Commission, Haine Celestial, PepsiCo, the Alpro Foundation, Pioneer Hi-Bred International, DuPont Nutrition and Health, Spherix Consulting and WhiteWave Foods, the Advanced Foods and Material Network, the Canola and Flax Councils of Canada, the Nutritional Fundamentals for Health, Agri-Culture and Agri-Food Canada, the Canadian Agri-Food Policy Institute, Pulse Canada, the Saskatchewan Pulse Growers, the Soy Foods Association of North America, the Nutrition Foundation of Italy (NFI), Nutra-Source Diagnostics, the McDougall Program, the Toronto Knowledge Translation Group (St. Michael's Hospital), the Canadian College



of Naturopathic Medicine, The Hospital for Sick Children, the Canadian Nutrition Society (CNS), the American Society of Nutrition (ASN), Arizona State University, Paolo Sorbini Foundation and the Institute of Nutrition, Metabolism and Diabetes. He received an honorarium from the United States Department of Agriculture to present the 2013 W.O. Atwater Memorial Lecture. He received the 2013 Award for Excellence in Research from the International Nut and Dried Fruit Council. He received funding and travel support from the Canadian Society of Endocrinology and Metabolism to produce mini cases for the Canadian Diabetes Association (CDA). He is a member of the International Carbohydrate Quality Consortium (ICQC). His wife, ALJ, is a director and partner of Glycemic Index Laboratories, Inc., and his sister, CB, received funding through a grant from the St. Michael's Hospital Foundation to develop a cookbook for one of his studies.

Carlo La Vecchia: Soremartec, 2014-17, ISA, Advisory Board, NCI, Advisory Board, honorary.

Marie-Ann Ha: Director of East Anglia Food link.

Simin Liu: Dr. Liu reports consulting payments and honoraria or promises of the same for scientific presentations or reviews at numerous venues, including but not limited to Barilla, Johns Hopkins University, Fred Hutchinson Cancer Center, Harvard University, University of Buffalo, GuangDong General Hospital and Academy of Medical Sciences, and the National Institutes of Health. He is also a member of the Data Safety and Monitoring Board for a trial of pulmonary hypertension in diabetes patients at Massachusetts General Hospital. He receives royalties from UpToDate. Dr. Liu receives an honorarium from the American Society for Nutrition for his duties as Associate Editor.

Geoffrey Livesey: husband of partner who holds shares in Independent Nutrition Logic Ltd, a consultancy. He and his partner have benefitted from



research grants, travel funding, consultant fees, honoraria, and recognition by the American Association for the Advancement of Science (USA), the All Party Parliamentary Group for Diabetes (London, UK). Almond Board of California (USA), BENEIO GmbH (DE), Biotechnology and Biosciences Research Council (UK), British Nutrition Foundation (UK), Calorie Control Council (USA), Cantox (CA), Colloides Naturel International (FR), Coca Cola (UK), Danisco (UK & Singapore), Diabetes Nutrition Study Group (EASD, EU), DiabetesUK (UK), Elsevier Inc. (USA), European Commission (EU), European Polyol Association (Brussels), Eureka (UK), Food and Agricultural Organization (Rome), Granules India (Ind), General Mills (USA), Health Canada (CA), Institute of Food Research (UK), International Carbohydrate Quality Consortium (CA), Institute of Medicine (Washington, DC), International Life Sciences Institute (EU & USA), Life Sciences Research Office, FASEB (USA), Nutrition Society of Australia, Knights Fitness (UK), Leatherhead Food Research (UK), LitghterLife (UK), Matsutani (JPN), Medical Research Council (UK), MSL Group (UK), Porter Novelli (UK), Sudzucker (DE), Sugar Nutrition/WSRO (UK), Tate & Lyle (UK), The Food Group (USA), Weight Watchers (UK), Wiley-Blackwell (UK). World Health Organization (Geneva).

Jordi Salas-Salvadó is a non-paid member of the Scientific Committee of the International Nut and Dried Fruit Foundation. He has received grants/research support from the American Pistachio Growers and International Nut and Dried Fruit Foundation through his Institution. He has received honoraria from Nuts for Life, Danone and Eroski. He reports personal fees from Danone. He is a member of the executive committee of the Instituto Danone Spain.

Thomas Wolever: is a part owner and receives payment as the President and Medical Director of Glycemic Index Laboratories, Inc. (GI Labs, a contract research organization) and Glycaemic Index Testing, Inc. (GI Testing, which supplies services to GI Labs) Toronto, Canada. He has



authored or co-authored several books on the glycemic index for which has received royalties from Philippa Sandall Publishing Services and CABI Publishers. He has received research support, consultant fees or honoraria from or served on the scientific advisory board for Canadian Institutes of Health Research, Canadian Diabetes Association, Dairy Farmers of Canada, Agriculture Agri-Food Canada, Public Health Agency of Canada, GI Labs, GI Testing, Abbott, Proctor and Gamble, Mars Foods, McCain Foods, Bunge, Temasek Polytechnic Singapore, Northwestern University, Royal Society of London, Glycemic Index Symbol program, CreaNutrition AG, McMaster University, University of Manitoba, University of Alberta, Canadian Society for Nutritional Sciences, National Sports and Conditioning Association, Faculty of Public Health and Nutrition, Autonomous University of Nuevo Leon, Diabetes and Nutrition Study Group of the European Association for the Study of Diabetes (EASD). His wife is part owner of Glycemic Index Laboratories, Inc., and Glycaemic Index Testing, Inc., and receives payment as chief financial officer of both corporations.