BRITISH JOURNAL OF NUTRITION

Volume: 111

Number: 9

14 May 2014

An International Journal of Nutritional Science



British Journal of Nutrition

An International Journal of Nutritional Science Volume 111, 2014 ISSN: 0007-1145

Aims and Scope

The British Journal of Nutrition is an international, peer-reviewed journal publishing original papers, review articles, short communications and technical notes on human and clinical nutrition, animal nutrition and basic science as applied to nutrition. Correspondence is encouraged in a Nutrition Discussion Forum. The Journal recognizes the multidisciplinary nature of nutritional science and encourages the submission of material from all of the specialities involved in research and clinical practice. The Journal also publishes supplements on topics of particular interest. The British Journal of Nutrition is published twice monthly by Cambridge University Press on behalf of

The Nutrition Society.

The British Journal of Nutrition is available online to subscribers at journals.cambridge.org/bin Tables of contents and abstracts are available free at the same website.

Editor-in-Chief

G C Burdge, Southampton, UK

Deputy Editors

A E Buyken, Dortmund, Germany J L Firkins, Columbus, OH, USA D N McMurray, College Station, TX, USA A M Minihane, Norwich, UK W D Rees, Aberdeen, UK A J Sinclair, Burwood, Australia M B Schulze, Potsdam-Rehbruecke, Germany S J Whiting, Saskatoon, Sask., Canada

Reviews Editors

P J Aggett, Parbold, UK D J Millward, Guildford, UK

Supplements Editor

J V Woodside, Belfast, UK

Statistics Editors

M Heo, Bronx, NY, USA C Mayer, Aberdeen, UK I Saunders, Glen Osmond, Australia N St-Pierre, Columbus, OH, USA

Editorial Board

K G Jackson, Reading, UK E J Johnson, Boston, MA, USA S J Kaushik, Saint Pée-sur-Nivelle, France D S Kelley, Davis, CA, USA C W C Kendall, Toronto, Ont., Canada J P Lallès, Rennes, France L Lauritzen, Copenhagen, Denmark A Laviano, Rome, Italy A M López-Sobaler, Madrid, Spain J A Lovegrove, Reading, UK S R Lynch, Grafton, VA, USA J P McClung, Natick, MA, USA S McNaughton, Burwood, Australia J G Mercer, Aberdeen, UK E A Miles, Southampton, UK T A Mori, Perth, Australia M M Murphy, Reus, Spain P S Nestel, Southampton, UK K Northstone, Bristol, UK U Nöthlings, Bonn, Germany C M Nyachoti, Winnipeg, Man., Canada

M C Ocké, Bilthoven, The Netherlands A Palou, Palma de Mallorca, Spain J H Y Park, Chuncheon, Korea E Perissinotto, Padova, Italy C J Petry, Cambridge, UK K Poore, Southampton, UK S D Proctor, Edmonton, Alta., Canada P Ritz, Angers, France S M Robinson, Southampton, UK E Ros, Barcelona, Spain E Rush, Auckland, New Zealand Y Sanz, Paterna, Spain T Sheehy, Cork, Ireland A Sjödin, Copenhagen, Denmark K S Swanson, Urbana, IL, USA C G Taylor, Winnipeg, Man., Canada R Thompson, London, UK D Tomé, Paris, France D L Topping, Adelaide, Australia J H M de Vries, Wageningen, The Netherlands M R Yeomans, Brighton, UK

Publications Staff

C Goodstein (Publications Manager), C Jackson (Deputy Publications Manager), L Weeks and D Owen (Publications Officers)

The Nutrition Society has as its objective the advancement of the scientific study of nutrition and its applications to the maintenance of human and animal health.

Application of membership is invited from anyone whose work has contributed to the scientific knowledge of nutrition, whether such work has been in the laboratory, the field or the clinic, and whether experimental, clinical, agricultural or statistical in nature. There is also a student membership scheme with reduced subscriptions.

Particulars of The Nutrition Society and application forms for membership are available from The Nutrition Society, 10 Cambridge Court, 210 Shepherds Bush Road, London W6 7NJ, UK. Tel: +44 (0)20 7602 0228, Fax: +44 (0)20 7602 1756, Email: office@nutsoc.org.uk

The Nutrition Society Home Page is at http://www.nutritionsociety.org

© Nutrition Society 2014

T Bohn, Belvaux, Luxembourg J T Brenna, Ithaca, NY, USA J Buyse, Leuven, Belgium R S Chapkin, College Station, TX, USA J K Cleal, Southampton, UK K A Cockell, Ottawa, Ont., Canada A R Collins, Oslo, Norway S J Duthie, Aberdeen, UK U Ekelund, Oslo, Norway A Esmaillzadeh, Isfahan, Iran B A Fielding, Oxford, UK E Forano, St Genes Champanelle, France M Fukushima, Obihiro City, Japan H R Gaskins, Urbana, IL, USA B Glencross, Brisbane, Australia J C G Halford, Liverpool, UK W Hendriks, Wageningen, The Netherlands T Hill, Newcastle-Upon-Tyne, UK L T Ho, Taipei, Taiwan D J Hoffman, New Brunswick, NJ, USA

J J B Anderson, Chapel Hill, NC, USA