PROCEEDINGS OF THE NUTRITION SOCIETY

Volume: 79

Number: 2

May 2020

Available online at cambridge.org/core

Symposia featured in this issue:

Plenary Lectures

The effects of ethnicity on nutrient availability and disease

Sex differences in nutrient availability and health

Genetic and phenotypic variation, nutrition and health

Global strategies to improve micronutrient status; current opinion and implications for nutrition policy



Proceedings of the Nutrition Society

Volume 79, 2020 ISSN: 0029-6651

Aims and Scope

Proceedings of the Nutrition Society publishes papers and abstracts presented by members and invited speakers at the scientific meetings of The Nutrition Society.

Coverage includes

- Cellular and molecular nutrition (including immunology)
- Nutritional genomics
- Nutrition and the food chain
- Clinical nutrition and metabolism
- Obesity and body composition
- Infant nutrition

- Diet selection and control of intake
- Nutrition and behaviour
- Reproduction, growth and development
- Public health nutrition
- Nutrition policy
- Sports and exercise nutrition
- Animal nutrition and metabolism
- Molecular aspects of nutrition
- Functional foods
- Macronutrient metabolism
- Micronutrients and antioxidants
- Companion animal nutrition
- Epidemiology

The *Proceedings of the Nutrition Society* is published four times a year by Cambridge University Press on behalf of the Nutrition Society. Symposium papers are published in February, May, August and November and are available as hard copy or electronically; Original Communications from individual meetings are published electronically only and comprise an OCE issue.

The journal is available on the Internet at: cambridge.org/pns

Editor in Chief

J E Drew, Rowett Institute of Nutrition and Health, University of Aberdeen, UK

Editorial Board

C Atkinson, University of Bristol, UK S Caton, University of Sheffield, UK F Lithander, University of Bristol, UK L Owen, University of Salford, UK V Ranawana, University of Aberdeen, UK M Siervo, University of Nottingham, UK

Science Committee

J Brameld
Council Member - Animal
F Thies
Chair/Scientific Officer
A Gallagher

B Griffin
Council Member - Academia
Council Member - Academia
FENS 2019 Representative
C J Seal

A Gallagher C J Seal
FENS 2019 Scientific Programme Committee Chair Treasurer

L Brennan D Ball
Irish Section Secretary Scottish Section Secretary

R Elliott A Welch W Hall

Cellular and Molecular Nutrition Theme Public Health Nutrition Theme Whole Body Metabolism Theme

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

Honorary Officers of the Society

S Lanham-New C I Seal J Lovegrove President Secretary Treasurer B Corfe D Sewell J Woodside F Thies Programme Officer Scientific Officer Membership Officer Publications Officer P Hunking C Ruxton B Bray E Gibnev Training and Education Trustee without Portfolio Strategic Communications International Affairs

Application for membership is open to any person who has a genuine interest in the science of human or animal nutrition and its application to human or animal health. Reduced subscriptions are available to full-time student members and those within 2 years of graduation, retired members, the unwaged and members who reside in low income countries (as defined by the World Bank).

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

© Nutrition Society 2020



Proceedings of the Nutrition Society

Volume 79, 2020 ISSN: 0029-6651

Publishing, Production, Marketing, and Subscription Sales Office:

Cambridge University Press Journals Fulfillment Department, University Printing House, Shaftesbury Road, Cambridge CB2 8BS, UK.

For Customers in North America:

Cambridge University Press 1 Liberty Plaza, Floor 20 New York, NY 10006 USA

Special sales:

This journal accepts advertisements and inserts. We also provide bulk reprints of suitable papers to meet teaching or promotional requirements. Please contact ad_sales@cambridge.org for further details.

Subscription information:

Proceedings of the Nutrition Society is an international journal published by Cambridge University Press on behalf of The Nutrition Society as four issues per year. Symposium papers are published in February, May, August and November; Original Communications are published online (only).

Annual subscription rates:

Volume 79, 2020 (4 issues): Internet/print package: £809/\$1577 Americas only Internet only: £576/\$1120 Americas only

Japanese Agent: Maruzen Company Ltd, PO Box 5050, Tokyo International, 100–31, Japan.

Back volumes are available. Please contact Cambridge University Press for further information.

Claims for non-receipt of journal issues will be considered on their merit and only if the claim is received within six months of publication. Replacement copies supplied after this date will be chargeable.

Despatch: deliveries outside the UK are by ASP Printflow Airsaver unless other arrangements are made. Customers requiring airmail delivery should indicate

clearly their requirements and add an additional 10% to the relevant subscription price.

US POSTMASTERS: please send address corrections to Proceedings of the Nutrition Society, Cambridge University Press at the New York address.

Directions to Contributors are available from the Society at the address below or can be found on the Society's website at http://www.nutritionsociety.org (concise Directions to Contributors can be found inside the back cover).

Offprints: The authors (or main author) of an accepted paper will receive a free PDF file of their paper. Paper offprints are available for a fee and should be ordered at proof stage. No page charges are levied by this journal.

Copyright: As of July 2000 the copyright of all articles submitted to the *Proceedings of the Nutrition Society* is retained by the authors or their institutions. For articles prior to this date permission for reproduction of any part of the journal (text, figures, tables or other matter) in any form (on paper, microfiche or electronically) should be sought directly from the Society, at: The Publications Office, The Nutrition Society, 10 Cambridge Court, 210 Shepherds Bush Road, London W6 7NJ, UK.

Disclaimer: The information contained herein, including any expression of opinion and any projection or forecast, has been obtained from, or is based upon, sources believed by us to be reliable, but is not guaranteed as to accuracy or completeness. The information is supplied without obligation and on the understanding that any person who acts upon it or otherwise changes his/her position in reliance thereon does so entirely at his/her own risk. Neither the Society nor Cambridge University Press accepts responsibility for any trade advertisement included in this publication.

Typeset by Techset Composition India (P) Ltd., Chennai, India.

This journal issue has been printed on FSC-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see www.fsc.org for information. Printed by Bell & Bain, Glasgow, UK.

Proceedings of the Nutrition Society is covered in Current Contents®/Agriculture, Biology & Environmental Sciences, SciSearch®, Research Alert®, Current Contents®/Life Sciences, Index Medicus® (MEDLINE®), AGRICOLA®, CAB ABSTRACTS®, Global Health, BIOSIS® Database, EMBASE/Excerpta Medica and Elsevier BIOBASE/Current Awareness in Biological Sciences, CINAHL and Chemical Abstracts Service.