Limits of Human Endurance

Editors

Luc J.C. van Loon  Maastricht, The Netherlands
Romain Meeusen  Brussels, Belgium
Contents

VII Preface
IX Foreword
XIII Contributors

1 Caffeine, Exercise and the Brain
Meeusen, R.; Roelands, B. (Belgium); Spriet, L.L. (Canada)

13 Carnitine and Fat Oxidation
Stephens, F.B.; Galloway, S.D.R. (UK)

25 Hydration during Intense Exercise Training
Maughan, R.J. (UK); Meyer, N.L. (USA)

39 Intense Exercise Training and Immune Function
Gleeson, M.; Williams, C. (UK)

51 Physiological and Performance Adaptations to High-Intensity Interval Training
Gibala, M.J. (Canada); Jones, A.M. (UK)

61 Effect of β-Alanine Supplementation on High-Intensity Exercise Performance
Harris, R.C. (UK); Stellingwerff, T. (Canada)

73 Dietary Protein for Muscle Hypertrophy
Tipton, K.D. (UK); Phillips, S.M. (Canada)

85 The Role of Amino Acids in Skeletal Muscle Adaptation to Exercise
Aguirre, N. (USA); van Loon, L.J.C. (The Netherlands); Baar, K. (USA)

103 National Nutritional Programs for the 2012 London Olympic Games: A Systematic Approach by Three Different Countries
Burke, L.M. (Australia); Meyer, N.L. (USA); Pearce, J. (UK)
121 Concluding Remarks: Nutritional Strategies to Increase Performance Capacity
van Loon, L.J.C. (The Netherlands); Meeusen, R. (Belgium)

127 Subject Index

For more information on related publications, please consult the NNI website: www.nestlenutrition-institute.org
Preface

Nutrition is one of the key factors that modulate exercise performance. A healthy diet, adapted to the specific demands imposed upon by the individual athlete’s training and competition, is required to allow optimal performance. Specific nutritional interventions have been developed to increase exercise endurance, allowing us to further improve sports performance in a variety of exercise tasks. In the 76th Nestlé Nutrition Institute Workshop, a group of expert scientists in the field of nutrition and exercise discussed the ergogenic properties of various nutritional interventions and presented research to show that dietary strategies can be applied to extend the limits of human endurance. Recent scientific findings on topics such as caffeine and its effect on the brain, carnitine and fat oxidation, ergogenic properties of β-alanine, dietary protein and muscle reconditioning, nutrition and immune status, and the importance of proper hydration were discussed. Last year, London hosted the 2012 Summer Olympics. Such an event provides a challenging landscape for nutritionists not only to ensure proper dietary management throughout the games but also to apply effective nutritional interventions that have been developed in the years preparing for the event. Success and failures of nutritional intervention were discussed from the perspective of 3 key nutritionists during the 2012 Olympics: Louise M. Burke for the Australian Institute of Sports, Nanna L. Meyer for the United States Olympic Committee, and Jeni Pearce for the English Institute of Sport. This workshop explored some of the many properties of dietary intervention to improve exercise performance capacity and, as such, to extend the limits of human endurance. We hope that the following chapters will provide the reader with many novel insights into the complex interaction between nutrition and exercise, allowing them to define more effective dietary strategies to improve health and performance.

Luc J.C. van Loon
Romain Meeusen
Foreword

The 76th Nestlé Nutrition Institute Workshop, The Olympic Sports Nutrition Conference, was timed to coincide with the London 2012 Olympic Games and was held in London and Oxford.

It brought together some of the world’s greatest minds in sports nutrition to discuss and further our understanding of the ability of nutrition to support athletes in achieving the highest levels of performance and endurance.

Nutrition knowledge and practice has advanced since the last Olympic Games in Beijing, and the workshop gave the opportunity to examine emerging best practice in terms of eating plans, nutrition guidelines and hydration, alongside the latest discoveries such as the performance-enhancing effects and limitations of caffeine, carnitine, β-alanine and dietary protein.

Also discussed was the role of nutrition and supplements and the balance required to build specific performance capabilities, lower the risk of illness or injury and speed recovery rates.

While the focus of the conference was on elite athletes, it was interesting to note that some of these discoveries can be applied beyond this niche, to improve performance outcomes in the elderly for example.

We wish to warmly thank the chairpersons of this workshop Prof. Luc J.C. van Loon and Prof. Romain Meeusen for establishing an excellent scientific program.

We are also indebted to the renowned speakers and discussants that have furthered debate and understanding on this important topic through their presentations and participation. We thank the many experts who came for taking the time and effort to join us and discuss the influence nutrition can have on the limits of human endurance.
Finally, we wish to thank and congratulate Jeni Pearce from the English Institute of Sport, and her team, for their excellent logistical support and for exemplifying the best of British hospitality and helping us all to enjoy and embrace the Olympic spirit.

*Eric Zaltas, MS, IOC Dipl. Sports Nutrition*
*Global Head R&D, Performance Nutrition*
*Nestlé Nutrition*
Contributors

Chairpersons & Speakers

Prof. Luc J.C. van Loon
Department of Human Movement Sciences
NUTRIM School for Nutrition, Toxicology and Metabolism
Maastricht University Medical Centre+
NL–6200 MD Maastricht
The Netherlands
E-Mail L.vanLoon@maastrichtuniversity.nl

Prof. Michael Gleeson
School of Sport, Exercise and Health Sciences
Loughborough University
Ashby Road
Loughborough
Leicestershire LE11 3TU
UK
E-Mail m.gleeson@lboro.ac.uk

Dr. Keith Baar
College of Biological Science
Dean’s Office
University of California
Davis, One Shields Avenue
Davis, CA95616
USA
E-Mail fmblab@googlemail.com

Prof. Louise M. Burke
Australian Institute of Sport
Leverrier Crescent
Bruce, ACT 2616
Australia
E-Mail louise.burke@ausport.gov.au

Prof. Martin J. Gibala
Department of Kinesiology
McMaster University
1280 Main Street West
Hamilton, ON L8S 4K1
Canada
E-Mail gibalam@mcmaster.ca

Prof. Roger C. Harris
Junipa Ltd.
4 Armstrong Close
Newmarket
Suffolk CB8 8HD
UK
E-Mail junipa@ymail.com

Prof. Ron J. Maughan
School of Sport, Exercise and Health Sciences
Loughborough University
Ashby Road, Loughborough
Leicestershire LE11 3TU
UK
E-Mail R.J.Maughan@lboro.ac.uk

Prof. Romain Meeusen
Vrije Universiteit Brussel
Faculty LK
Dept. Human Physiology & Sports Medicine
Pleinlaan 2
B-1050 Brussels
Belgium
E-Mail rmeeusen@vub.ac.be
Dr. Francis B. Stephens
MRC/Arthritis Research UK Centre for Musculoskeletal Ageing Research
University of Nottingham Medical School
Queen's Medical Centre
Nottingham NG7 2UH
UK
E-Mail francis.stephens@nottingham.ac.uk

Prof. Kevin D. Tipton
Health and Exercise Sciences Research Group
University of Stirling
Stirling, Scotland FK9 4LA
UK
E-Mail k.d.tipton@stir.ac.uk

Invited Discussants
Prof. Stuart M. Phillips/Canada
Prof. Lawrence L. Spriet/Canada
Dr. Trent Stellingwerff/Canada
Dr. Stuart D.R. Galloway/UK
Prof. Andrew M. Jones/UK
Dr. Jeni Pearce/UK
Dr. Clyde Williams/UK
Dr. Nanna L. Meyer/USA

Participant
Mr. Zibi Szlufcik/Germany

Nestlé Participants
Prof. Ferdinand Haschke/Switzerland
Dr. Natalia Wagemans/Switzerland
Mr. Frank Jimenez/USA
Mr. Eric Zaltas/USA