

# Contents

## VII Preface

## IX Foreword

## XIII Contributors

### World Nutrition Situation

- 1 Country-Level Action to Improve Nutrition and Health: A View from the Field**  
Jiménez, J. (Chile)
- 11 Global, Regional and Country Trends in Underweight and Stunting as Indicators of Nutrition and Health of Populations**  
Neufeld, L.M.; Osendarp, S.J.M. (Canada)
- 21 Global Distribution and Disease Burden Related to Micronutrient Deficiencies**  
Black, R.E. (USA)
- 29 Predicting the Health Effects of Switching Infant Feeding Practices for Use in Decision-Making**  
Yarnoff, B.O.; Allaire, B.T. (USA); Detzel, P. (Switzerland)
- 39 Addressing the Double Burden of Malnutrition with a Common Agenda**  
Uauy, R. (Chile/UK); Garmendia, M.L.; Corvalán, C. (Chile)
- 53 Summary on World Nutrition Situation**  
Uauy, R. (Chile/UK)

### Evidence on Interventions and Field Experiences

- 59 Interventions to Address Maternal and Childhood Undernutrition: Current Evidence**  
Bhutta, Z.A.; Das, J.K. (Pakistan)
- 71 Maternal Nutrition Interventions to Improve Maternal, Newborn and Child Health Outcomes**  
Ramakrishnan, U.; Imhoff-Kunsch, B.; Martorell, R. (USA)

- 81 Fetal Growth Restriction and Preterm as Determinants of Child Growth in the First Two Years and Potential Interventions**  
Christian, P. (USA)
- 93 How Can Agricultural Interventions Contribute in Improving Nutrition Health and Achieving the MDGs in Least-Developed Countries?**  
Dorward, A. (UK)
- 111 Long-Term Consequences of Nutrition and Growth in Early Childhood and Possible Preventive Interventions**  
Adair, L.S. (USA)
- 121 Summary on Evidence on Interventions and Field Experiences**  
Black, R.E. (USA)

Future Perspectives: Impact of Early Life Nutrition

- 123 The Global Epidemic of Noncommunicable Disease: The Role of Early-Life Factors**  
Singhal, A. (UK)
- 133 Obesity and the Metabolic Syndrome in Developing Countries: Focus on South Asians**  
Misra, A.; Bhardwaj, S. (India)
- 141 Preventing Atopy and Allergic Disease**  
Heine, R.G. (Australia)
- 155 Nutrition and Chronic Disease: Lessons from the Developing and Developed World**  
Prentice, A.M. (UK/The Gambia)
- 161 Summary on Future Perspectives**  
Singhal, A. (UK)
  
- 163 Subject Index**

For more information on related publications, please consult the NNI website:  
[www.nestlenutrition-institute.org](http://www.nestlenutrition-institute.org)

## Preface

The UN Millennium Development Goals Report 2012 says: ‘Despite clear evidence of the disastrous consequences of childhood nutritional deprivation in the short and long terms, nutritional health remains a low priority. It is time for nutrition to be placed higher on the development agenda.’ The 78th Nestlé Nutrition Institute Workshop, which took place in Oman in March 2013, focused on improving the nutrition and health of young women and children.

The first session was dedicated to the analysis of world nutrition situation in achieving Millennium Development Goal (MDG) 1. The presentations were designed in a way to cover the global distribution of malnutrition and micro-nutrient deficiencies in world population of young women and infants and disease burden related to it. A separate topic focused on the implementation of strategies and policies that can reduce infant and maternal morbidity and mortality during the first 1,000 days.

The second session of the workshop covered the interventions that have been and could be deployed to help achieve the MDGs, particularly the nutrition component of MDG 1 and MDGs 4 and 5 on reducing child and maternal mortality. With less than 3 years remaining before the MDG target date of 2015, there is increasing commitment and urgency for scaling up all proven interventions that will have the needed impact. The presentations in this session were designed to review the evidence on ways to achieve the MDGs and the potential contributions of nutrition-specific and disease control interventions, as well as the possible role of sectors other than health. Two presentations considered broadly the maternal and child interventions, including those that are being implemented but could be brought to greater scale and those that could be implemented now given current knowledge on their effects. Two presentations reviewed the issues regarding maternal undernutrition, fetal growth restriction and gain in length and weight in childhood and implications for stunting and adult noncommunicable diseases. The fifth presentation was selected to explore the possible contributions of agriculture to nutrition

and the MDGs. It is expected that reduction of poverty will help achievement of all of the MDGs, but enhanced agriculture may have particular contributions to make for the MDGs that are the focus in this workshop.

The final session of the workshop, at first glance, appeared out of step with the previous two sessions and the overall theme of the meeting. However, while meeting the MDGs is the most important priority for many lower-income countries (as highlighted by earlier speakers), many countries in transition face a 'double burden' of disease, with noncommunicable disease fast becoming the predominant health issue facing rich and poor populations alike. The aim of this last session therefore was to look into the future and highlight the problems of obesity, cardiovascular disease and atopic disease which emerging countries will face within the next 20 years.

The four presentations in the last session covered the causes and consequences of noncommunicable disease in both the developing and developed world, reviewed the latest scientific evidence for underlying mechanisms, and discussed the implications for public health and policy makers. Speakers highlighted the impact of early feeding practices (in fetal life, early infancy and early childhood) on programming the risk of noncommunicable disease, as well as the role of nutrition and other environmental factors throughout the life course in predisposing to chronic disease. As always, presentations were followed by lively discussion particularly on the more controversial scientific hypotheses such as the impact of infant growth on the risk of later obesity and cardiovascular disease, and emerging data on the importance of the microbiome in the development of atopic eczema and other allergic conditions. Although more research is clearly needed, the message was clear – lessons need to be learnt from both the developed and developing world in order to stem the current global epidemic of noncommunicable disease.

On behalf of all participants, we are particularly indebted to Prof. Ferdinand Haschke – Head of Nestlé Nutrition Institute, and his team for providing this fantastic opportunity for discussion and learning. Thank you.

*Robert E. Black  
Atul Singhal  
Ricardo Uauy*

## Foreword

The Nestlé Nutrition Institute has previously organized several workshops in the field of public health and nutrition [1–3]. This time, for the 78th Nestlé Nutrition Institute Workshop in Oman, the theme ‘International Nutrition – Achieving Millennium Goals and Beyond’ was chosen. During the workshop, international target setting was discussed as we looked into how it has been used to influence health outcomes in two highly important segments of the world population – young women and their children. The workshop was the first Nestlé Nutrition Institute event with global broadcasting; it allowed us to share this fantastic program with thousands of scientists around the world.

The world nutrition situation was analyzed, including evidence how country-level action can influence nutrition, in particular agricultural and nutritional interventions. We learned about the strong influence global distribution of resources has on the burden of disease: infant feeding practices in 20 developing countries are associated with improved growth and lower burden of disease. Despite all efforts to support breastfeeding, the question was addressed why only 30–40% of infants are exclusively breastfed until 6 months of age and what can be done to improve the situation. As far as the infant food industry is concerned, there is a need to work with governmental agencies and NGOs and to follow and respect the country-specific interpretation of the WHO code on marketing of breast milk substitutes.

Evidence on interventions and field studies indicated that maternal undernutrition and micronutrient deficiencies are strongly related to low birthweight. Providing women of reproductive age with adequate nutrition is key for successful pregnancy outcome and breastfeeding. Monitoring growth of infants and children to prevent or correct micronutrient deficiencies can have a lifelong effect: iron deficiency anemia with its negative effect on brain function was addressed as an example.

Nutrition during the fetal and postnatal periods was also discussed due to the rising recognition of its value as a means of preventing noncommunicable dis-

eases such as obesity and related complications – diabetes, cardiovascular diseases and stroke. Interventions in developing and developed countries must address maternal obesity [4] as well as fetal and postnatal nutrition – the critical period of the first 1,000 days. Another important topic was prevention of allergic disease and atopic dermatitis through early nutritional intervention. It can now be concluded that such a strategy may help reduce the burden of diseases such as chronic lung disease.

We would like to thank the three chairmen for putting the program together: Prof. Robert E. Black, Prof. Ricardo Uauy, and Prof. Atul Singhal.

We would also like to thank the speakers, moderators and scientific experts in the audience, who have contributed to the workshop content and professional discussions.

Finally, we thank George Salem, Anwar Hanan and their teams from Nestlé Nutrition Middle East for their logistic support.

## References

- 1 Black R, Michaelsen KF (eds): Public Health Issues in Infant and Child Nutrition. Nestlé Nutr Workshop Ser. Vevey, Nestec, 2000, vol 48, view publication.
- 2 Bhatia J, Bhutta ZA, Kalhan SC (eds): Maternal and Child Nutrition: The First 1000 Days. Nestlé Nutr Workshop Ser. Vevey, Nestec/Basel, Karger, 2013, vol 74.
- 3 Drewnowski A, Rolls BJ (eds): Obesity Treatment and Prevention: New Directions. Nestlé Nutr Workshop Ser. Vevey, Nestec/Basel, Karger, 2012, vol 73.
- 4 Haschke F: Evaluation of growth and early infant feeding: a challenge for scientists, industry and regulatory bodies; in Shamir R, Turck D, Phillip M (eds): Nutrition and Growth. World Rev Nutr Diet. Basel, Karger, 2013, vol 106, pp 33–38.

*Dr. Natalia Wagemans*, MD, PhD  
Global Medical Advisor  
Nestlé Nutrition Institute  
Vevey, Switzerland

*Prof. Ferdinand Haschke*, MD, PhD  
Chairman  
Nestlé Nutrition Institute  
Vevey, Switzerland



78th Nestlé Nutrition Institute Workshop  
Muscat, March 20–22, 2013





# Contributors

## Chairpersons & Speakers

### **Prof. Linda S. Adair**

Carolina Population Center  
UNC Chapel Hill  
Campus Box 8140  
123 West Franklin St.  
Chapel Hill, NC 27516-2524  
USA  
E-Mail linda\_adair@unc.edu

### **Prof. Zulfiqar A. Bhutta**

Aga Khan University  
Stadium Road  
PO Box 3500  
Karachi 74800  
Pakistan  
E-Mail zulfiqar.bhutta@aku.edu

### **Prof. Robert E. Black**

Johns Hopkins Bloomberg School of  
Public Health  
Department of International Health  
615 N. Wolfe Street, Room E-8527  
Baltimore, MD 21205  
USA  
E-Mail rblack@jhsph.edu

### **Prof. Parul Christian**

Johns Hopkins Bloomberg School of  
Public Health  
Department of International Health  
Center for Human Nutrition  
615 N. Wolfe Street  
Room 2541  
Baltimore, MD 21205  
USA  
E-Mail pchristi@jhsph.edu

### **Prof. Andrew Dorward**

Centre for Development, Environment  
and Policy  
School of Oriental and Africa Studies  
(SOAS)  
University of London  
36 Gordon Square  
London WC1H 0PD  
UK  
E-Mail Andrew.Dorward@soas.ac.uk

### **Prof. Ralf G. Heine**

Department of Gastroenterology &  
Clinical Nutrition  
Department of Allergy & Immunology  
Royal Children's Hospital Melbourne  
Murdoch Children's Research Institute  
University of Melbourne  
Flemington Road  
Parkville, VIC 3052  
Australia  
E-Mail ralf.heine@rch.org.au

### **Prof. Jorge Jiménez**

Departamento de Salud Pública  
Facultad de Medicina PUC  
Marcoleta 434  
Santiago de Chile  
Chile  
E-Mail jjimenez@med.puc.cl

### **Prof. Anoop Misra**

Fortis-C-DOC Centre  
C6/57 (ground floor)  
Safdarjang Development Area  
New Delhi 16  
India  
E-Mail anoopmisra@gmail.com

**Prof. Lynnette M. Neufeld**

Director, Monitoring, Learning and  
Research  
Global Alliance for Improved Nutrition  
PO Box 55  
1211 Geneva 20  
Switzerland  
E-Mail lneufeld@gainhealth.org

**Prof. Andrew M. Prentice**

MRC International Nutrition Group  
Nutrition & Public Health Intervention  
Research Unit  
London School of Hygiene & Tropical  
Medicine  
Keppel Street  
London WC1E 7HT  
UK  
E-Mail andrew.prentice@lshtm.ac.uk

**Prof. Usha Ramakrishnan**

Emory University  
1519 Clifton Road NE  
Atlanta, GA 30322  
USA  
E-Mail uramakr@sph.emory.edu

**Prof. Atul Singhal**

UCL Institute of Child Health  
30 Guilford Street  
London WC1N 1EH  
UK  
E-Mail a.singhal@ucl.ac.uk

**Prof. Ricardo Uauy**

INTA Universidad de Chile  
Macul 5540  
Santiago 11  
Chile  
E-Mail druauy@gmail.com

**Prof. Benjamin O. Yarnoff**

RTI International  
3040 E. Cornwallis Road  
Research Triangle Park, NC 27709  
USA  
E-Mail byarnoff@rti.org

**Participants**

Ayman AbdelRahim/Bahrain  
Mohamed AlRefaei/Bahrain  
Hasan Isa/Bahrain  
Saheera Saleh/Bahrain  
Christiane Leite/Brazil  
Hugo Ribeiro Junior/Brazil  
Mahmoud Alzalabany/Egypt  
Mohamed Shaltout/Egypt  
Simich Rita/Hungary  
Arunkumar Desai/India  
Shrawan Kumar/India  
Jameela Kunjachan/India  
Archisman Mohapatra/India  
Sunil Kumar Nag/India  
Ray Basrowi/Indonesia  
Badrul Hegar/Indonesia  
Wenny Lazdya Taifur/Indonesia  
Mario De Curtis/Italy  
Bashar AlKhasawneh/Jordan  
Ali Almatti/Jordan  
Samir Faouri/Jordan  
Furat Kreishan/Jordan  
Mohammad Rawashdeh/Jordan  
Hussein Wahbeh/Jordan  
Eiman Alenaizi/Kuwait  
Hanan Ben Nekhi/Kuwait  
Raafat Raad/Kuwait  
Fadi Chamseddine/Lebanon  
Mariam El Abdallah El Rajab/Lebanon  
Bernard Gerbaka/Lebanon  
Bassam Ghanem/Lebanon  
Patricia Hoyek/Lebanon  
Tahera Al Lawati/Oman  
Tawfiq Al-Lawati/Oman  
Salim Al Maskary/Oman  
Mariam Al Waili/Oman  
Huda Al Zidi/Oman  
Ezzat Abdel Aziz/Oman  
Mohey Hasanein/Oman  
Salah Salem/Oman  
Yaser Wali/Oman  
Huma Fahim/Pakistan  
Kadil Jr Sinolinding/Philippines  
Grace Uy/Philippines  
Mohamed Al Jamal/Qatar  
Mohamed Kayyali/Qatar  
Ahmed Masoud/Qatar  
Fahmi Nasser/Qatar  
Elena Lukushkina/Russia  
Nayel Abdaly/Saudi Arabia  
Mohammed Al Amrani/Saudi Arabia

Mohammed Al Tamran/Saudi Arabia  
Hatem Alhani/Saudi Arabia  
Khalid Almanee/Saudi Arabia  
Ali Alshamrani/Saudi Arabia  
Saeed Dolgum/Saudi Arabia  
Omar Saadah/Saudi Arabia  
Harbi Shawoosh/Saudi Arabia  
Marco Turini/Singapore  
Tengku Marina Badlishah/Switzerland  
Denis Barclay/Switzerland

Yannick Evrard/Switzerland  
Mael Guillemot/Switzerland  
Hanan Anwar/United Arab Emirates  
Mohammad Cheikhali/United Arab  
Emirates  
Mohammad Howidi/United Arab  
Emirates  
Sherif Mosaad/United Arab Emirates  
Mahmoud Tana/United Arab Emirates  
Sameh Zakher/United Arab Emirates