NUTRIENT ADEQUACY OF EXCLUSIVE BREASTFEEDING FOR THE TERM INFANT DURING THE FIRST SIX MONTHS OF LIFE

DEPARTMENT OF NUTRITION FOR HEALTH AND DEVELOPMENT
DEPARTMENT OF CHILD AND ADOLESCENT HEALTH AND DEVELOPMENT
WORLD HEALTH ORGANIZATION

The World Health Organization was established in 1948 as a specialized agency of the United Nations serving as the directing and coordinating authority for international health matters and public health. One of WHO's constitutional functions is to provide objective and reliable information and advice in the field of human health, a responsibility that it fulfils in part through its extensive programme of publications.

The Organization seeks through its publications to support national health strategies and address the most pressing public health concerns of populations around the world. To respond to the needs of Member States at all levels of development, WHO publishes practical manuals, handbooks and training material for specific categories of health workers; internationally applicable guidelines and standards; reviews and analyses of health policies, programmes and research; and state-of-the-art consensus reports that offer technical advice and recommendations for decision-makers. These books are closely tied to the Organization's priority activities, encompassing disease prevention and control, the development of equitable health systems based on primary health care, and health promotion for individuals and communities. Progress towards better health for all also demands the global dissemination and exchange of information that draws on the knowledge and experience of all WHO's Member countries and the collaboration of world leaders in public health and the biomedical sciences.

To ensure the widest possible availability of authoritative information and guidance on health matters, WHO secures the broad international distribution of its publications and encourages their translation and adaptation. By helping to promote and protect health and prevent and control disease throughout the world, WHO's books contribute to achieving the Organization's principal objective — the attainment by all people of the highest possible level of health.

NUTRIENT ADEQUACY OF EXCLUSIVE BREASTFEEDING FOR THE TERM INFANT DURING THE FIRST SIX MONTHS OF LIFE

NANCY F. BUTTE, PHD
USDA/ARS Children's Nutrition Research Center, Department of Pediatrics,
Baylor College of Medicine, Houston, TX, USA

MARDIA G. LOPEZ-ALARCON, MD, PHD
Nutrition Investigation Unit, Pediatric Hospital, CMN, Mexico City, Mexico

CUTBERTO GARZA, MD, PHD
Division of Nutritional Sciences, Cornell University, Ithaca, NY, USA

GENEVA
WORLD HEALTH ORGANIZATION
2002

WHO Library Cataloguing-in-Publication Data

Butte, Nancy F.

Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life / Nancy F. Butte, Mardia G. Lopez-Alarcon, Cutberto Garza.

1.Breastfeeding 2.Milk, Human – chemistry 3.Nutritive value 4.Nutritional requirements 5.Infant I.Lopez-Alarcon, Mardia G. II.Garza, Cutberto III.Expert Consultation on the Optimal Duration of Exclusive Breastfeeding (2001 : Geneva, Switzerland) IV.Title.

ISBN 92 4 156211 0 (NLM Classification: WS 125)

Designed by minimum graphics
Printed in France

Contents

Abbreviations & acronyms

AI	Adequate intake
BMD	Bone mineral density
BMC	Bone mineral content
CDC	Centers for Disease Control and Prevention (USA)
DPT	Triple vaccine against diphtheria, pertussis and tetanus
DXA	Dual-energy X-ray absorptiometry
EAR	Estimated average requirement
EAST	Erythrocyte aspartate transaminase
EPLP	Erythrocyte pyridoxal phosphate
ESPGAN	European Society of Paediatric Gastroenterology
FAO	Food and Agriculture Organization of the United Nations
IDECG	International Dietary Energy Consultative Group
IU	International units
NCHS	National Center for Health Statistics (USA)
NPN	Non-protein nitrogen
PLP	Pyridoxal phosphate
PMP	Pyridoxamine phosphate
PNP	Pyridoxine phosphate
PTH	Parathyroid hormone
RE	Retinol equivalents
SD	Standard deviation
SDS	Standard deviation score
UNICEF	United Nations Children's Fund
UNU	United Nations University
WHO	World Health Organization

Foreword

This review, which was prepared as part of the background documentation for a WHO expert consultation,[1] evaluates the nutrient adequacy of exclusive breastfeeding for term infants during the first 6 months of life. Nutrient intakes provided by human milk are compared with infant nutrient requirements. To avoid circular arguments, biochemical and physiological methods, independent of human milk, are used to define these requirements.

The review focuses on human-milk nutrients, which may become growth limiting, and on nutrients for which there is a high prevalence of maternal dietary deficiency in some parts of the world; it assesses the adequacy of energy, protein, calcium, iron, zinc, and vitamins A, B6, and D. This task is confounded by the fact that the physiological needs for vitamins A and D, iron, zinc – and possibly other nutrients – are met by the combined availability of nutrients in human milk and endogenous nutrient stores.

In evaluating the nutrient adequacy of exclusive breastfeeding, infant nutrient requirements are assessed in terms of relevant functional outcomes. Nutrient adequacy is most commonly evaluated in terms of growth, but other functional outcomes, e.g. immune response and neurodevelopment, are also considered to the extent that available data permit.

This review is limited to the nutrient needs of infants. It does not evaluate functional outcomes that depend on other bioactive factors in human milk, or behaviours and practices that are inseparable from breastfeeding, nor does it consider consequences for mothers. In determining the optimal duration of exclusive breastfeeding in specific contexts, it is important that functional outcomes, e.g. infant morbidity and mortality, also are taken into consideration.

The authors would like to thank the World Health Organization for the opportunity to participate in the expert consultation;[1] and Nancy Krebs, Kim Michaelson, Sean Lynch, Donald McCormick, Paul Pencharz, Mary Frances Picciano, Ann Prentice, Bonny Specker and Barbara Underwood for reviewing the draft manuscript. They also express special appreciation for the financial support provided by the United Nations University.