

The Importance of Immunonutrition

Nestlé Nutrition Institute Workshop Series

Vol. 77

The Importance of Immunonutrition

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**Nestec Ltd., 55 Avenue Nestlé, CH-1800 Vevey (Switzerland)
S. Karger AG, P.O. Box, CH-4009 Basel (Switzerland) www.karger.com**

Library of Congress Cataloging-in-Publication Data

Nestlé Nutrition Workshop (77th : 2012 : Panama, Panama), author.
The importance of immunonutrition / editors, Maria Makrides, Juan B.
Ochoa, Hania Szajewska.
p. ; cm. -- (Nestlé Nutrition Institute workshop series, ISSN
1664-2147 ; vol. 77)
Includes bibliographical references and index.
ISBN 978-3-318-02446-3 (hard cover : alk. paper) -- ISBN 978-3-318-02447-0
(e-ISBN)
I. Makrides, Maria, editor of compilation. II. Ochoa, Juan B., editor of
compilation. III. Szajewska, Hania, editor of compilation. IV. Nestlé
Nutrition Institute, issuing body. V. Title. VI. Series: Nestlé Nutrition
Institute workshop series ; v. 77. 1664-2147
[DNLM: 1. Child Nutritional Physiological
Phenomena--immunology--Congresses. 2. Lipids--physiology--Congresses. 3.
Metagenome--immunology--Congresses. 4. Nutritional
Status--immunology--Congresses. W1 NE228D v.77 2013 / WS 130]
QP141
612.3'045--dc23

2013025200

The material contained in this volume was submitted as previously unpublished material, except in the instances in which credit has been given to the source from which some of the illustrative material was derived.

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Printed on acid-free and non-aging paper (ISO 9706)

ISBN 978-3-318-02446-3

e-ISBN 978-3-318-02447-0

ISSN 1664-2147

e-ISSN 1664-2155

KARGER

Basel · Freiburg · Paris · London · New York · New Delhi · Bangkok ·
Beijing · Tokyo · Kuala Lumpur · Singapore · Sydney

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Preface

A healthy immune system is essential for normal existence and recovery from illness. Innate immunity, activated during illness, prepares us for successfully combating infection and healing wounds. Adaptive immune responses allow for long-term monitoring protecting us from neoplasia, fungi and mycobacterial infections among others. Successful immune responses require a careful orchestration of complex checks and balances avoiding excessive inflammation while preventing anergy. Uncontrolled inflammation can lead to self-injury as is observed in autoimmune diseases such as rheumatoid arthritis. On the other hand, dysfunctional T lymphocyte responses lead to uncontrolled opportunistic infections and tumor growth.

Nutrients in our diet form the necessary building blocks and substrate for all cellular function. We are indeed ‘what we eat’, literally. In just one generation, humanity has gone from struggling at finding ways to feed all to an epidemic of obesity that grips the entire world. Modern dietary habits are a causative factor for abnormal immune responses and illness. Type 2 diabetes, hypertension, atherosclerosis, and a growing list of cancers are linked to inflammation caused by the same dietary habits that cause obesity. The types of lipids and carbohydrates (and the amount) that we eat make us sick. Obesity is associated with uncontrolled inflammation and with an increased incidence of certain tumors.

Just as certain nutrients make us sick, others could potentially be beneficial in the prevention or management of illness. These nutrients appear to work by modifying immune responses (hence the name immunonutrition) when given during illness. Progressively, and sometimes painstakingly, we have accrued knowledge as to their mechanisms of action. This book summarizes the work performed by scientists at the forefront of studying immunonutrients in health and disease and provides the compilation of the data presented at 77th Nestlé Nutrition Institute Workshop on Immunonutrition. This book will discuss several different topics on immunonutrition: (1) arginine and glutamine; (2) lipids, including fish oil and branched-chain fatty acids, and (3) probiotics. In addi-

tion, this book will also discuss the presence of insulin, TGF- β and other bioactive peptides in milk.

Arginine and glutamine are two closely related amino acids described as being 'conditionally' essential, meaning that deficiencies in these amino acids develop during illnesses and may require dietary replacement to maintain or restore normal biological functions. Deficiencies in arginine are now being recognized in a number of illnesses and conditions such as asthma and sickle cell disease and after trauma. Arginine deficiency may also be important in the pathophysiology of sepsis. Glutamine may be highly important for maintaining mucosal trophism.

Milk contains more than just a combination of macro- and micronutrients with bioactive peptides such as insulin, TGF- β and others. The roles of peptides are progressively being understood. Insulin for example may play important roles in mucosal trophism for the GI tract, while it has been suggested that TGF- β may help regulate inflammation in inflammatory bowel disease.

Lipids may modify immune responses through several mechanisms. The type of lipid in the diet may determine the type of prostaglandin generated by cyclooxygenases. Eicosapentaenoic acid may play biological roles in T cells as agonists for peroxisome proliferator-activated receptors. Docosahexaenoic acid (DHA) is an essential fatty acid in the growth of the brain. Neuroprotectin 1 produced from DHA may regulate inflammation in the brain.

Humans have ten times more microbial cells than human cells, with the highest concentration of microorganisms located within the digestive tract. Around 1,000 different species have been identified with current microbiological techniques. Microbiota mediates many key functions, including metabolic, trophic, and protective (barrier) functions. Many of the microbes maintain health, while others are potential pathogens and can cause illness. Though the concept is not new, surprisingly little is known about the exact role and mechanisms by which these microorganisms contribute to human health or disease. Significant progress at identifying the gut microbiome has led to a better understanding of the interactions between them and our organs and tissues. Probiotics, while not considered a nutrient, are certainly part of our diet. The roles that resident or ingested organisms may play in disease are now potential targets of treatment.

It is our hope that you find this book useful in your practices, be it in the research lab or at the bedside.

*Maria Makrides
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Hania Szajewska*

Foreword

Nutrients have a tremendous potential to modulate the actions of the immune system, a fact which has a significant impact on public health and clinical practice.

The concept of pharmaconutrition – a central element of intensive care management – implies a bridge between drugs and nutrition. During the last decade, the role of nutrition, beyond providing the calories and the macro- and micro-nutrients for survival, has been well established and clinically proven. At the 77th Nestlé Nutrition Institute Workshop held from October 28th to November 1st 2012, world experts gathered in Panama City to present their latest findings on how nutrient status can modulate immunity and improve health conditions in pediatric patients. The 3 sessions of this workshop covered major aspects of the interplay between nutrients and the regulation of immunity and inflammatory processes.

The first session explored the pharmaceutical value of specific amino acids (arginine and glutamine) and hormones for addressing immune disorders and infant development. It is now understood that some amino acids have the ability to speed up the recovery of children admitted to intensive care. We took a closer look at the relationship between arginine metabolism and asthma, the role of this amino acid in T-lymphocyte function, and investigated the rationale for glutamine supplementation to improve outcomes in premature infants.

Many immune disorders and diseases are associated with dysregulation of the gut microbial homeostasis. The second session revolved around gut function and immunity, and the right balance of probiotics. The right microbiome can modulate the immune system and help protect from infectious disease, obesity and allergy. Getting the right mix of probiotics is key to unlocking their full benefits. The overview of the MetaHIT project presented during this session showed that individuals can be clustered based on their microbial metagenome profile, thus laying the framework for profiling health and disease.

The third session explored the role of lipid mediators and how their types and proportions can tip the balance in favor of health or disease. Given in the right time and conditions, lipids can prevent allergy, modulate the inflammatory process in the gut and play a protective role when cell homeostasis is threatened by neurodegeneration. It was discussed that early LC-PUFA supplementation not only supports cognitive function but also may program brain development in later life stages.

We wish to thank the three chairpersons – Prof. M. Makrides, Prof. J. Ochoa and Prof. H. Szajewska for establishing an excellent scientific workshop program. We are also indebted to the renowned speakers who have further debated and increased our understanding of this important topic through their presentations and participation. We thank the many experts who came from across the globe to review and discuss the importance of immunonutrition.

Finally, we wish to thank and congratulate Luis Carlos Delgado and his team from Nestlé Nutrition LATAM for their excellent logistical support and hospitality that allowed us to not only enjoy the scientific program but also experience the historical spirit of Panama City.

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77th Nestlé Nutrition Institute Workshop
Panama, October 28th–November 1st 2012

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