

Enhancing mental performance

NUTRIMENTHE is an ambitious research project which draws on the competencies of some 20 research institutes. Its coordinator, **Professor Cristina Campoy**, highlights the way in which the project aims to make a significant contribution to the welfare of children across Europe

What are the aims and objectives of the NUTRIMENTHE project; why was it initiated and what needs does it address?

NUTRIMENTHE was initiated to study the long-term effects of diet and nutrition on mental behaviour and performance at different stages of a child's life, from before birth to school age. Current evidence is largely based on animal, observational studies, and short-term nutritional intervention studies in humans. NUTRIMENTHE will significantly improve this knowledge through studying the role, mechanisms, risks and benefits of specific nutrients and food components.

The idea that the diet of mothers, infants and children could have an influence on long-term mental performance has major implications for public health practice and policy development, and for our understanding of human biology, as well as for food product development, economic progress, and future wealth creation.

Current evidence of the effect of diet on mental performance is largely based on retrospective animal studies and short-term nutritional intervention studies in humans. In what ways is NUTRIMENTHE improving and building on this knowledge?

NUTRIMENTHE includes six large prospective follow up studies in the general population. Currently, such studies are rare. Two are looking at the role of the diet of pregnant women. There are two nutritional intervention studies in prenatal life and early infancy and a further two in early childhood. The studies are long-term and the children taking part will be followed up to the age of at least nine. The studies are being carried out at centres around Europe including in the UK, Spain, Italy, Germany, Belgium, Poland, The Netherlands and Hungary. Over 20,000 European children are involved in the studies.

Due to the inclusion of some large and excellent cohort studies, a wealth of new information will be generated and linked to food intake data, biochemical measurements and to mental performance measurements which are being undertaken using a harmonised neuropsychological test battery especially designed and developed within the NUTRIMENTHE consortium, and led by the University of Granada.

Can you identify the major challenges and obstacles the project has faced, and explain how they have been overcome?

There were difficulties developing a harmonised neuropsychological test battery as the project had to take into account the different neuropsychological tests available in the different countries. For example, obtaining licences from the companies who have developed the tests, and translation of the tests into numerous languages, all took time. The problems were solved and now two European neuropsychological batteries have been developed, adapted for age, which are being used with the children taking part in the studies.

Can you offer an insight as to whether the link between diet and cognitive performance has influenced consumer behaviour? In what ways can such information be discerned?

NUTRIMENTHE is investigating what consumers currently understand about the link between diet and mental performance as there is little research to date. A study in four countries (UK, Germany, Hungary and Spain) involving nearly 200 parents and teachers of children aged 4 – 10 asked their views on the mental effects of food. Parents described mental performance mainly in terms of attention and concentration but also mentioned 'intelligence', 'thinking' and 'learning'. Teachers also reported an awareness of the effect of diet on children's performance in school and spoke of witnessing changes in behaviour after lunch and related this to what children had eaten. The consumers in this study were already aware that



diet affects aspects of mental performance and may already make food choices for their children based on this knowledge. Future studies will take this further and include asking consumers to what extent a child's development depends on diet. This work is important as it impacts on how NUTRIMENTHE will communicate messages about the effects of diet and hence, further influence consumer behaviour, especially parents, as they play a pivotal role in the establishment of children's food choices and eating habits.

What would you highlight as the project's most prominent achievements so far?

A major achievement of the project is the level of collaboration between the partners that highlights the success of EU funded projects. NUTRIMENTHE incorporates a wide variety of scientific disciplines, nationalities and types of organisations all working to address the link between diet and mental performance. There are 20 partners in the consortium, from eight EU countries and the U.S. The partners meet once every six months to discuss progress and share results, but there is regular communication between partners aside from this, as the research plan comprises 13 work packages involving at least three different partners. NUTRIMENTHE has now entered its third year and the partners have become increasingly integrated in this time. A friendly atmosphere has developed that will determine a better outcome for the project as a whole. New activities and deliverables are being planned and developed together which will enrich the final content and results.



Food for thought

The relationship between diet and mental performance in youngsters is a broad and burgeoning issue for researchers. Now in its third year, the **NUTRIMENTHE** project seeks to harness a far greater understanding of the connections, and offers practical and validated advice to policy makers and stakeholders

THE LINKS BETWEEN diet and mental performance in children have become more defined in recent years and the broad research area has proved fertile ground for research groups globally. However, there is still a lack of clarity and little consensus where the role nutrients have on neurodevelopment and mental illness is concerned. Spearheading investigations in Europe is the NUTRIMENTHE project, an ambitious, multidisciplinary project drawing on the expertise and competencies of some 20 research centres from eight countries across the continent. NUTRIMENTHE also enjoys fruitful liaisons with its U.S. based partner, Martek Biosciences Corporation, and its integrated approach facilitates extensive and robust experimental studies, which are complemented and supported by prospective observational studies and cutting-edge molecular techniques.

The programme is presently addressing a range of key issues surrounding mental health in European children, and seeks to enhance understanding of the way in which dietary factors link to cognitive development, anxiety, attention-deficit hyperactivity (ADHD), and depression. Such disorders place notable financial strain on European health and welfare systems; recent estimates suggest that conduct disorders affect up to 35 per cent of the 92 million children in Europe, leveraging costs of around 150,000

euros per child. Given the strong suggestions that the diet of infants, children, as well as prenatal mothers, bears influence on mental performance in the long term, NUTRIMENTHE has the potential to deliver major contributions in

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shaping the future of public health practices and policy development. The project's coordinator, Professor Cristina Campoy, is keen to elaborate on this point: "The knowledge and quantification of how much influence these dietary factors have on the mental performance across the EU's child population will have a major impact, not only for consumers or parents, but also for institutions,

policy advisers and product development," she explains. With this in mind, the project's merits and social values are clearly manifest.

A MULTI-FACETED APPROACH

To an extent, NUTRIMENTHE marks a paradigmatic shift in studies of the link between diet and mental performance. Until recently, evidence supporting the aforementioned link stemmed predominantly from three broad categories of investigation: retrospective studies, animal studies, and short-term nutritional intervention studies in humans. Now, however, NUTRIMENTHE strives to build significantly upon existing knowledge by mobilising studies into the role, mechanisms, risks and benefits of specific nutrients and food components. It is anticipated that findings made in this regard will enable clinicians to develop effective strategies in response to the specific needs of children, thereby improving their mental performance.

It is significant that NUTRIMENTHE has been designed in a way that supports studies of infants and children at various ages, from foetal stage (early programming) to late childhood. Research conducted under the project's banner involves a quantification of the effects that key nutrients bear on early programming. The project also executes analyses of the impact of foodstuffs on mental state, as Campoy outlines: "NUTRIMENTHE will offer the opportunity



to assess not only mental performance or behaviour related to diet, but also general health status, as well as other confounding factors". This encompasses aspects of mood, activation, attention, motivation, effort, perception, memory, and intelligence.

However, there are notable difficulties associated with cognitive and behavioural tests involving children, which – broadly speaking – can be attributed to their erratic temperaments, mistrust of strangers, and wariness of alien or unfamiliar environments. NUTRIMENTHE is sensitive to such considerations, and has harnessed the abilities of key experts from child psychology and psychiatry to abet studies and assist in the development of optimal tools and clinical recommendations. Further to this, the project seeks to develop an appropriate and standard neuropsychological battery; this will be pivotal in establishing a comparable methodology for cognitive assessment in EU children, and the move promises to yield integrated and corroborated results.

MECHANISTIC INSIGHT

The programme is paying particular attention to several nutrients which have been previously identified as being significant in relation to mental performance in children. Among these are folic acid, B-vitamins and Long Chain Polyunsaturated Fatty Acids (LCPUFAs); indeed, studies recently conducted in male preterm infants who were supplemented, postnatally, with LCPUFAs for an average time period of one month recorded a 13 point advantage in verbal IQ some seven to eight years later, compared with those who were afforded typical postnatal care. NUTRIMENTHE aims to build on these findings by studying genetic polymorphisms and the way in which LCPUFAs influence neurodevelopment, mental performance and behavioural disorders. Campoy remarks: "NUTRIMENTHE will create a more mechanistic insight by specific work on genotyping to unravel uncertainties in the role

of LCPUFAs and also by extensive bio-analytic work". In addition, neurophysiological measures have been included in several work packages. Owing to this, behavioural measurements can be linked to brain imaging techniques.

DISSEMINATION

Significantly, NUTRIMENTHE's remit extends beyond investigative research; it encompasses a comprehensive dissemination programme, through which recommendations borne out of research findings are offered as dietary advice to pregnant women, as well as parents with newborn babies, infants and children. Through this, the project delivers tangible contributions to the welfare of citizens across Europe – optimising, as far as possible, the brain health, mental performance, behaviour and wellbeing of a confounding number of children. In 2008, the European Food Safety Authority (EFSA)'s Nutrition Panel published scientific criteria that could be utilised by EU policy makers in assessing which foods may carry nutrition and health claims. This, coupled with the general public's increasing awareness of the health benefits of certain foodstuffs, has stimulated NUTRIMENTHE to implement a thorough, uniform training and dissemination programme to ensure that recommendations are consistent and valid. The programme will include details on the development of specific food products, data to qualify health and nutrition claims and a communication drive to consumers and the public, based on economic analyses, consumer data and systemic literature reviews.

NUTRIMENTHE is well-positioned in an area of broad and growing interest for researchers. With three years remaining until its formal completion, the project is set to better define the links between nutrients and mental performance in infants and children and, crucially, provide much-needed assistance to policy makers and health practitioners in the long term.

INTELLIGENCE

NUTRIMENTHE

EFFECT OF DIET ON THE MENTAL PERFORMANCE OF CHILDREN

OBJECTIVES

NUTRIMENTHE has established a team of leading international scientists from top academic centres and a leading food multinational, providing a critical mass of experts in the effect of diet on children's mental performance, epidemiologic studies to analyse the long-term effects of pre- and early postnatal diet on children's mental performance and illness.

KEY COLLABORATORS

Professor Cristina Campoy (Coordinator), **Professor Ricardo Closa Monasterolo**, **Professor Miguel Garcia Fuentes** - Spain
• **Professor Philippe Goyens** - Belgium
• **Professor Berthold Koletzko, Mr Niels Straub, Professor Thomas Illig** - Germany
• **Professor Monique Raats, Professor Anita McDonald, Ms Alexandra Thurston, Dr Pauline Emmett, Dr Claire Horton** - UK
• **Dr Alan S Ryan** - USA • **Dr Sheila Wiseman, Professor Frank Verhulst** - Netherlands
• **Professor Hania Szajewska, Dr Dariusz Gruszfeld** - Poland • **Professor Tamas Decsi** - Hungary • **Professor Marcello Giovannini** - Italy

CONTACT

Professor Cristina Campoy
Project Coordinator

University of Granada
Department of Paediatrics
School of Medicine
University of Granada
Avenida de Madrid, 11-18012-Granada
Spain

T +34 629308695
E ccampoy@ugr.es

www.nutrimenthe.eu
www.ugr.es

CRISTINA CAMPOY gained her PhD at the University of Granada in 1989. A Professor of Paediatrics since 1989, she has held a research fellowship for the 'Infant Nutrition and Metabolism' research group since 1992 and is currently Director of the Excellence Centre for Paediatric Research EURISTIKOS at the University of Granada.

