Welcome…..

……to the fifth NUTRIMENTHE project newsletter

NUTRIMENTHE is a large scale integrated project funded through the Cooperation Programme's Theme Two; Food, Agriculture and Fisheries, and Biotechnology of the European Union's Seventh Framework Programme. The project has been running since March 2008 and has been set up to address the evidence that early nutrition can affect later mental performance, cognitive development and behaviour in children. This newsletter serves as a gateway to the NUTRIMENTHE project for partners, the wider scientific community and the public in general.

In this newsletter:

- NUTRIMENTHE at the 11th European Nutrition conference.
- Work published by NUTRIMENTHE partners
- The six consensus statements agreed by the Global Summit on Omega-3.
- Overview of omega-3 and omega-6 fatty acids from papers published by NUTRIMENTHE partners

NUTRIMENTHE news

NUTRIMENTHE at the 11th European Nutrition Conference, Madrid 28th October 2011

The Federation of European Nutrition Societies (FENS) will be holding its 11th nutrition conference from October 26-29th 2011, in Madrid. 2000 delegates are expected to attend the event which is offering an extensive programme of symposia, workshops and oral presentations covering a diverse range of nutrition issues that face the population of Europe.

NUTRIMENTHE workshop "Nutrition and Cognitive Function" Friday 28th October (8.30-10.30).

The workshop is an opportunity for NUTRIMENTHE researchers to present their most recent research. The speakers include NUTRIMENTHE partners, Dr Henning Tiemeier and Dr Eva Lattka.

Dr Tiemeier from the Erasmus Medical Center, Rotterdam, will present results from the Generation R study which, as part of NUTRIMENTHE, has recently been investigating whether maternal diet affects foetal growth and cognition and behaviour in childhood. Dr Tiemeier will present results from recent work, investigating whether there is a link between folate levels, maternal thyroid function, diet during pregnancy and behaviour in three-year-olds.

Dr. Eva Lattka from Helmholtz Zentrum Munich will present results from the Avon Longitudinal Study of Parents and Children (ALSPAC). Work published previously by ALSPAC has shown that eating fish during pregnancy is beneficial to cognitive development in children, especially for verbal IQ (1). Now, as part of NUTRIMENTHE, ALSPAC is looking at the interaction between fatty acid desaturase (*FADS*) genotypes, fatty acids and fish intake on mental performance in children and furthermore, how analysis of the genetic regulators of fatty acid levels, might contribute to individual dietary recommendations during critical periods of human life such as pregnancy.

NUTRIMENTHE's workshop at FENS will be chaired by Dr. Elliot Berry from the Hebrew University-Hadassah Medical School. Jerusalem who will also talk about Leptin as a Survival Hormone and Co-chaired by Prof Cristina Campoy, who will give an overview of the NUTRIMENTHE project.

For more about the 11th European Nutrition Conference click here.

For more about NUTRIMENTHE's workshop click here.

NUTRIMENTHE researchers find that maternal thyroid function may affect cognitive development in early childhood

NUTRIMENTHE researchers from the Erasmus Medical Centre, Rotterdam, have published the results of work looking at how maternal thyroid function might affect cognitive development in early childhood (2). During pregnancy, the developing foetus relies on a supply of maternal thyroid hormone, production of which is increased during pregnancy, particularly low levels of which can lead to mental retardation in children.

The researchers looked in more detail at how verbal and non-verbal communication in young children is related to thyroid hormone levels in the blood of women during early pregnancy and in babies at birth. They found that severe lack of thyroid hormone (hypothyroxinemia) predicted a higher likelihood of expressive language delay at 18 months and 30 months. Expressive language includes the ability to form sentences, use grammar correctly, and retell a story or event. A risk of non-verb al cognitive delay (block building, imitation, planning and organising) was also found. The researchers

concluded that low levels of thyroid hormone in pregnant women can affect foetal brain development and put children at risk of expressive language delay. In the current study, thyroid hormone levels were measured at one time point during pregnancy, thus future research will build upon the current study by measuring thyroid hormone levels throughout pregnancy.

NUTRIMENTHE researchers further our knowledge on how our genetic make-up influences how we process fatty acids

Previously, NUTRIMENTHE researchers published work looking at the regulation of the fatty acid desaturase 2 gene (*FADS2*) which codes for an enzyme involved in the production of long-chain polyunsaturated fatty acids (LC-PUFAs) and established that genetic variation can affect the transcription rate of this gene (3). In recent months, NUTRIMENTHE has published more work looking at the relationship between genetic variation in *FADS1* and *FADS2* and blood levels of fatty acids in pregnant women and in breast milk. The researchers found that genetic variants of *FADS1* and *FADS2,* common in the population, are associated with levels of fatty acids in the red blood cells of pregnant women, including docosahexaenoic acid (DHA) considered important for foetal development (4). In a further study fatty acids were extracted from breast milk 1.5 and 6 months after birth. The studies concluded that genetic variation in mothers can affect the supply of fatty acids, particularly the omega-6 fatty acid arachidonic acid, to babies during breastfeeding (5); Thus Nutrimenthe is showing that the supply of fatty acids during pregnancy and breastfeeding may not just depend on dietary supply, but also genetic variation.

NUTRIMENTHE is on YouTube!

NUTRIMENTHE researchers explain the rationale behind their studies and results to date

Nutrition news

Global Omega-3 Summit reaches a consensus

The Global Summit on Nutrition, Health and Human Behaviour – Sustainable Long-Chain Omega-3 for a Better World, took place in Bruges on the 3rd and 4th March 2011. There were 13 keynote speakers and 60 participants. The discussion included the role of LC-PUFAs in health and mental health and what the dietary requirements should be. Participants were scientists and representatives from government bodies as well as food industry and industry associations from 15 countries.

By the end of the meeting the delegates reached a consensus and published six key messages that should shape future policy development as well as bring the right quality and quantity of long chain omega-3 to people around the world.

The six consensus statements are:

1) Brain and heart disorders resulting from eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) deficiency are the biggest challenges to the future of humanity.
2) Tissue concentrations of omega-3 relative to omega-6 are the key variable for health – not dietary intake.
3) An intake of at least 1000mg of EPA and DHA is recommended for people consuming a typical Western-type diet.
4) Shorter chain omega-3 (alpha linolenic acid, stearidonic acid and EPA) have poor conversion to DHA in humans
5) To make the omega-3 targets feasible, reduce linoleic acid and increase alpha linolenic acid in human and animal diets and increase the availability of long-chain omega-3 (especially DHA) for human consumption in a sustainable, environmentally responsible way.
6) Education of all stakeholders is key to achieving these changes

For more detailed feedback click here.

The website of the Global Summit can be found here.

World breastfeeding week

World Breastfeeding Week is celebrated every year during the first week of August in more than 120 countries to encourage breastfeeding and improve the health of babies around the world. It commemorates the Innocenti Declaration made by the World Health Organisation (WHO) and UNICEF policy-makers in August 1990 to protect, promote and support breastfeeding.

According to the WHO, “breastfeeding is the normal way of providing young infants with the nutrients they need for healthy growth and development”. The WHO recommends that babies are exclusively breastfed for the first 6 months of life. Breast milk is the ideal food for newborns and infants as it provides all the nutrients they need for healthy development including antibodies that help protect infants from common childhood illnesses.

For the WHO 10 facts about breastfeeding click on the link "Read more about breastfeeding" here:

Recent news on breastfeeding includes a study from the UK that suggests breastfed babies develop fewer behavioural problems (read more) and a new report suggests that breastfeeding rates have increased in the UK. Read more.

Focus On

A brief overview of Omega-3 and Omega-6 fatty acids

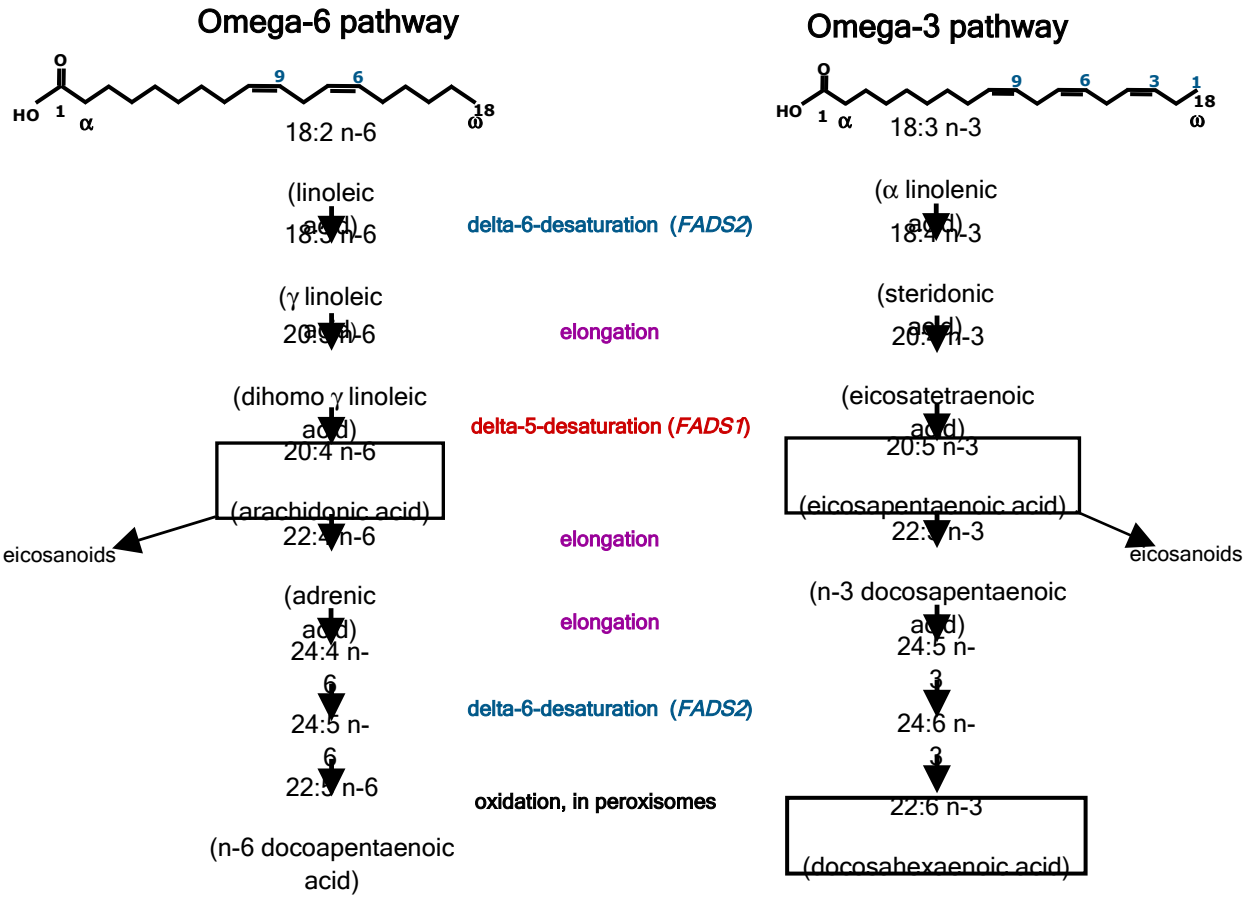
This latest issue of the NUTRIMENTHE newsletter has included information about omega-3 and omega-6 fatty acids and the genes encoding the enzymes involved in their synthesis. The following is a brief overview of omega-3 and omega-6 fatty acids from a number of papers published by NUTRIMENTHE researchers (see references 6-10 and those therein).

Fatty acids are classified as aliphatic compounds comprising a carboxyl group and a hydrocarbon chain of varying length and degree of saturation. Saturated fats have no double bonds in the hydrocarbon chain; monounsaturated fats have one double bond, polyunsaturated fats (PUFAs), have two or more. Omega-3 and omega-6 fatty acids are classified as polyunsaturated fatty acids (PUFAs). They are derived from alpha linolenic (ALA) and linoleic acid (LA) respectively.

These two fatty acids are essential, to humans, as they must be obtained from the diet. Sources of LA include plant oils such as corn, safflower, soybean and sunflower. Sources of ALA include nuts, green plants and plant oils, such as rapeseed and flaxseed. In a typical western diet, up to 20% of dietary fat is comprised of PUFA, the most abundant of which is LA, up to 95% of PUFA intake. Fatty acids are stored between three main 'compartments', short-term storage (e.g. in blood plasma), medium-term storage (e.g. in the membranes of red blood cells) and long-term storage (e.g. adipose tissue).

In humans, LA and ALA can be converted to fatty acids with longer chain lengths and a higher degree of unsaturation (addition of more double bonds) by a series of alternating desaturating and chain elongation steps. The enzymes involved in these steps are Delta 5 desaturase (D5D) and Delta 6 desaturase (D6D), and elongase. D5D and D6D are encoded by the genes *FADS1* and *FADS2*. A *FADS3* gene also exists but the function of the protein product of this gene has yet to be fully characterised. The D5D and D6D enzymes are found in the majority of human tissues with the highest activities in the liver and significant activity also in adipose tissue, brain, heart and lung.

LA and ALA are converted to other PUFAs and also to the LC-PUFAs, arachidonic acid (AA) and eicosapentaenoic acid (EPA) respectively. EPA is further converted to docosahexaenoic acid (DHA) and all three can be sourced from the diet. AA is found in high quantities in meat, eggs and offal. EPA and DHA from oily fish such as salmon, mackerel, herring and tuna. Dietary sources of these fatty acids may be of importance as in humans (and newborns), conversion of ALA and LA to LC-PUFAs is rather low and especially for the conversion of EPA to DHA. It might be assumed therefore that LC-PUFAs should be obtained, pre-formed, from the diet, although this is currently a matter of debate.



Mammalian pathways of omega-3 and omega-6 fatty acid synthesis

AA, EPA and DHA comprise 10-15% of the content of all structural lipids in cell membranes. AA and EPA are both processed further to other biologically active substances, eicosanoids, including, prostaglandins and leukotrienes which have a role in inflammation and the regulation of immunity. In general, AA-derived eicosanoids have pro-inflammatory effects whereas EPA derived eicosanoids are rather less inflammatory.

The enzymes involved in the synthesis of PUFAs favour the production of omega-6 fatty acids, including AA. Furthermore it has been suggested that there is a link between high dietary intake of omega-6 PUFAs and inflammatory disease.

DHA is the most abundant omega-3 fatty acid in the mammalian brain, incorporated into the nervous tissues during the pre- and post- natal period of rapid neural growth. DHA levels have been shown to affect visual, cognitive and motor functions in animal and human studies thus levels of fatty acids in humans become significant when considering the development of cognitive abilities. In a series of publications, the ALSPAC study team has documented that maternal fish intake during pregnancy has a positive effect on communication skills and behavioural development in children. The implication is that the fatty acid content in fish may underlie this relationship.

PUFA levels in humans may not only be affected by dietary intake but also in variation of the genes encoding the D5D and D6D enzymes, *FADS1* and *FADS2*. A number of studies have reported that genetic variation in *FADS1* and *FADS2* affect the synthesis of

AA and contribute to the variability of fatty acid levels in the short, medium and long-term storage compartments. However, DHA levels were shown not to be associated with *FADS* variation reflecting the need for this fatty acid to be obtained, predominantly, via the diet. However, DHA synthesis is higher during pregnancy compared to men and non-pregnant women, which may reflect the need for this fatty acid to be supplied during pregnancy. In the future, NUTRIMENTHE expects to learn more about how genetic variation impacts on how fatty acids are processed during pregnancy and link the studies to mental performance measurements in children.

Resources

The next NUTRIMENTHE partner meeting

The next NUTRIMENTHE partner meeting will take place in Madrid on October 25th 2011, with the possibility of starting on the 24th October.

References

1: Hibbeln *et al.,* 2007. Maternal seafood consumption in pregnancy and neurodevelopmental outcomes in childhood (ALSPAC study): an observational cohort study. Lancet 369: 578-585.
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4: Koletzko *et al.,* 2011. Genetic variants of the fatty acid desaturase gene cluster predict amounts of red blood cell docosahexaenoic acid and other polyunsaturated fatty acids in pregnant women: findings from the Avon Longitudinal Study of Parents and Children. Am. J. Clin. Nutr. 93: 211-9.
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6: Glaser *et al.,* 2011. Genetic variation in polyunsaturated fatty acid metabolism and its potential relevance of human development and health. Maternal and Child Nutrition. 7 (suppl 2), 27-40.
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8: Lattka *et al.,* 2010. Genetic variants of the *FADS1 FADS2* gene cluster as related to fatty acid metabolism. Curr. Opin. Lipidol. 21: 64-36.
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Abstracts of NUTRIMENTHE's publications can be found here.

Contact details

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NUTRIMENTHE website