



ASSOCIATE PARLIAMENTARY FOOD & HEALTH FORUM



The links between diet and behaviour

3.30-5.30pm, Wednesday 9 May

House of Lords Committee Room G

Minutes

Introduction

Dr Ian Gibson, the Chairman, noted that Lord Rea, the FHF Chairman., would be arriving late. He thanked the guest speakers for coming to give evidence. Dr Gibson explained that the Associate Parliamentary Food and Health Forum was holding an informal inquiry into the links between diet and behaviour, and that members of the inquiry team would seek to ensure that their conclusions and recommendations reached a wider audience. The objective was to ensure that the advice of scientists and academics on the links between diet and behaviour was taken into account by those in authority.

Professor John Stein, University of Oxford

John Stein is a Professor of Neurophysiology at Oxford University, a Fellow of Magdalen College, a Fellow of the Royal College of Physicians and Chair of the Dyslexia Research Trust. He supervises the work of Dr Alexandra Richardson and Bernard Gesch, two earlier contributors to our inquiry.

John Stein (JS) began by explaining that he did not want to repeat the evidence previously given to the inquiry team by his academic colleagues, Alexandra Richardson and Bernard Gesch, though he endorsed their views and had helped to design their studies. He wanted to explain what interested him in the field of diet and behaviour, in the hope it would also interest the inquiry team.

JS drew attention to the quotation by Jared Diamond who had said the “invention of agriculture was the biggest mistake ever made by the human race”, his point being that when man evolved his diet had been rich in protein, vitamins and omega-3, but the development of agriculture had led to a diet which provides too much starch and omega-6.

JS was given cod liver oil as a boy, like other children of his generation, as a result of the intervention of Dr Hugh Sinclair who, at the age of 28, persuaded the Government during WW2 to provide free cod liver oil and orange juice to all pregnant mothers and young children. He thought it important because 20% of the brain structure is made of omega-3 long chain polyunsaturated fatty acids (PUFAs), mainly docosahexanoic acid (DHA) which is derived mainly from fish oils.

In Hugh Sinclair's view the modern diet is deficient in omega-3 and includes too much omega-6 and too much saturated fat. Omega-3 is important for the flexibility of brain cells, favouring rapid neurotransmission. Omega-3s protect neuronal function - 30% of the membranes enclosing some nerve cells consist of DHA. If this form of omega-3 is deficient, signalling can be slowed down by up to 90%.

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JS's colleague, David Horrobin, who was also tutored by Hugh Sinclair, helped discover how EPA is converted into eicosanoids: thromboxanes, prostaglandins (3 series), leucotrienes (5 series) and resolvins. These are important because they are all anti-inflammatory and lead to a reduction in stress reactions, in contrast to the effects of omega-6 which are pro-inflammatory.

Fish is fabulous because it speeds up neuronal responses by increasing membrane flexibility, and thus improves magnocellular timing functions; increases neurogenesis, neurite outgrowth (via syntaxin) and synapse formation whilst decreasing programmed cell death (apoptosis). As a result it can improve memory (for example, in patients with Alzheimer's); strengthen hemispheric lateralisation; protect against inflammation; reduce pain transmission (via inhibiting TRPV1 receptors) and prevent the accumulation of insoluble amyloid precursor protein (which develops in patients with Alzheimer's).

Omega-3 essential fatty acids (EFAs) increase the production of syntaxin, which helps communications between nerves and helps a person consolidate and lay down memories. It has been shown that the more fish a person eats the less likely he is to get Alzheimer's disease.

The role of omega-3 in improving timing functions of magnocellular neurones in the brain is of particular interest to JS. He described the difference between nerve cells which are much larger than others, that is magnocellular, and smaller nerve cells (parvocellular). The smaller nerve cells are important for static responses, for example to colour and fine detail whereas the magnocellular type are important for rapid responses, for timing events. They have a high sensitivity to motion and flicker; they control attention and eye movements and are very vulnerable to omega-3 deficiency.

JS showed a slide (slide 9) which illustrates the visual magnocellular system, which directs visual attention and eye movements. It is a system of large neurones which are specialised for temporal processing – tracking changes in light, sound, position etc. Magnocellular neurones allow for large, rapid signalling and fast conduction. They all express the same surface antigen, CAT 301. These magnocellular neurones are found throughout the brain: in the visual, auditory, skin, and muscle proprioceptors, the cerebral cortex, hippocampus (which is important for memory), cerebellum and brainstem (which is important for movement).

The high dynamic sensitivity of magnocellular neurones requires high membrane flexibility, which is provided by a local environment of essential fatty acids, particularly the omega-3s, found in fish oils. Thus they are very vulnerable to omega-3 deficiency.

Omega-3 deficiency is important for children's behaviour because the ability to focus attention is vital for sequencing letters and numbers, skilled movements, detecting facial and emotional expressions, such as tone of voice and gestures. Impaired development of magnocellular neurones is found in many neuro-developmental disorders, such as prematurity, foetal alcohol syndrome, developmental dyslexia, dyspraxia, dysphasia, ADHD, autistic spectrum disorders and Williams syndrome, as well as schizophrenia, depression and anti-social behaviour. In all these conditions the child's ability to focus attention precisely is reduced.

JS noted that these conditions are all slightly different, though they overlap, and omega-3 is not the only factor that is relevant: genetic and environmental factors are also important. However impaired magnocellular function makes them vulnerable to omega-3 fatty acid deficiency. This explains why randomised controlled trials (RCTs) using omega-3 supplements have consistently shown improvement in these developmental disorders, such as dyslexia, dyspraxia, ADHD, depression, schizophrenia and anti-social behaviour.

RCTs are valuable because they eliminate confounding factors, so that the only thing that differs between the active and the control group is the treatment, as a result they can prove causation. However the size of the trial is important. Some academics, for example, Richard Peto, will not place any reliance on small trials because their results can be misleading. The largest trials to date using omega-3 fatty acids - carried out by Bernard Gesch at HM YOI Aylesbury and Alexandra

Richardson in Durham schools - involved only some 200 individuals in each case. To be statistically convincing, larger RCTs are required (ideally involving more than 1000 individuals) and these should be funded by the Government because of the public benefit that would be derived from holding them.

JS noted that we cannot rely on the suppliers of fish oil supplements to finance large RCTs because fish oil cannot be patented so they would derive no more benefit than their competitors from positive results. In any case, large RCTs are very expensive.

John concluded by noting that at present there is no evidence that increased omega-3 consumption would help ordinary normal children – that is those who are not suffering from developmental disorders – though there is a prima facie case, as during WWII, for it being beneficial.

Questions

Dr Ian Gibson (IG) asked JS why he thought the Government has not already funded such trials. **JS** thought there were two primary factors: the lack of nutritional education in medical schools, which resulted in nutrition having a relatively low status and being regarded as somewhat “alternative”; and a cultural lack of interest in food.

Baroness Miller of Chilthorne Domer (SM) asked how many trials are needed to prove a case given that many of the witnesses who had given evidence to the Forum were already convinced. **JS** said that in order to convince sceptics, large RCTs were needed so that the statistical power of the results was strong. Only when the probability of the result being due to the treatment and not chance is greater than 1 in 1000 will some people, such as Richard Peto, be convinced. The probability of Bernard Gesch’s results (which showed a 26% reduction in offences) being due to the treatment rather than chance was only 1 in 30.

SM expressed concern about the option of food fortification on the grounds that it would not encourage people to eat a better diet and it would reinforce the cereal-based diet rich in omega-6. **JS** agreed that it would be preferable for people to eat more oily fish because these fish contain not only the desirable EFAs but the vitamins and minerals, such as zinc, required to help metabolise them. However, given that people do not eat oily fish in adequate quantities, he thought food fortification was better than no action. He noted that no-one objects now to the fortification of food with iodine and folic acid and fortification with omega-3 was arguably less dangerous than, for example, fluoridation because omega-3 would have to be consumed in enormous quantities to have any negative effect (for example in reducing blood clotting).

Baroness Gibson (AG) asked how much the next study JS and Bernard Gesch were conducting in prisons would cost and whether the cost had been a factor in delaying Home Office support for the project. **JS** said the cost of the study would be £1.5 million, an ideal study would cost some £2 million, but the Home Office spends vast sums of money on other treatments that have not been shown to have any effect whatsoever. He thought the problem was more institutional and the result of cautious rather than innovative attitudes on the part of middle-ranking Civil Servants. Another factor could be Home Office concern that support for the project could imply an acceptance on their part that the prison diet is inadequate, whereas it is often excellent. The problem is not that healthy food is not provided in our prisons but that prisoners choose to eat unhealthy options.

Sarah Jayne Stanes from the Academy of Culinary Arts noted that most chefs are not trained in nutrition and that as a nation we do not value cooking and food enough.

Earl Baldwin of Bewdley (EB) asked why JS believed the general population might benefit from increased consumption of omega-3 given that there was no evidence that this was the case and how omega-3 nutritional status should be measured. **JS** said that he suspected one of the problems – as Hugh Sinclair found in the 1930s – is that there is a great deal of concealed

nutritional deficiency in the general population. Children with no vulnerabilities in terms of metabolising EFAs who eat a healthy balanced diet are unlikely to be helped by EFA supplements, but the vast majority of children, including especially those living in deprived areas, do not eat a healthy diet. He referred to Hugh Sinclair who believed children ate a better diet in 1943 than in 1983. JS said he would like to do a nutritional survey in under-privileged communities.

IG asked JS what he thought the effect of positive trial results for EFAs would be. **JS** said we know that the IQ of children fed on breast-fed milk which is rich in omega-3 is 5-10% higher than bottle-fed babies, so it is possible that the IQ of the general population would rise if we all consumed more omega-3 and that anti-social behaviour would fall, though probably not by as much as the 26% found at Aylesbury YOI. He also thought people would be happier because there is a strong link between omega-3 deficiency and depression. He said that 25% of the British population will be depressed at some point in their lives and omega-3 is known to relieve depression. He suggested there is a good case for fortifying food with omega-3 for our general physical health because of its positive effect on cardiovascular health.

IG suggested that some doctors think vitamin D is important for cardiovascular health. **JS** said there is a theory that statins affect our vitamin D status because they occupy the vitamin D receptor and this is linked to depression. Some studies have suggested that omega-3 is as good as statins in reducing LDL cholesterol.

IG asked whether JS thought better diet should be achieved by Government diktat or better understanding. **JS** said he would welcome Government intervention on this issue because it would result in a public good that may not be achieved otherwise.

Professor Malcolm Peet, Doncaster and South Humber Healthcare NHS Trust

Malcolm Peet is a Consultant Psychiatrist in the NHS working with people who are experiencing their first episode of psychosis. He is a former Head of the University Department of Psychiatry, Sheffield, and he now holds an Honorary Professorship from that university. His main interest now is in the practical implementation of the knowledge he has gained from his research.

Malcolm Peet (MP) very briefly outlined the metabolic pathway of EFAs (see slide 2), which can be derived from flax oil or fish oils. He is a vegan and obtains his omega-3 from an algae-derived supplement, which avoids the depletion of fish stocks and any possible chemical contamination. He noted that companies are now in the process of seeking to modify foods genetically to produce EPA and DHA.

MP briefly described the physiological effect of omega-3 fatty acids on the brain, including brain development, gene expression, neurotransmission and the immune system.

IG intervened to ask why omega-3 rather than omega-6 or omega-9 was important. **JS** explained that omega-3 is so-called because the first double bond between carbon atoms is three away from the methyl end (DHA has 22 carbon atoms) and this affects the way it works. Membranes are made of layers and the closer the double bond is to the methyl end of the chain, the more flexible it is. The other reason omega-3 is important is that the eicosanoids form the substrate for signalling molecules and they depend on the double bond between the third and fourth carbon atoms.

The omega-3 long chain polyunsaturated fatty acids can be synthesised slowly from shorter omega-3s such as alpha linoleic acid (18 Carbon atoms) derived from plant sources (rapeseed, flax, walnut), but the longer chain omega-3 fatty acids: EPA (20 C) and DHA (22C) that are required by the brain are obtained much more efficiently from oily fish. However, even these fish do not synthesise them themselves; they derive them from algae. Some companies are now using genetically engineered seaweed to produce DHA and EPA in quantity.

MP's main interest now is in the clinical application of this knowledge to patients suffering from depression or schizophrenia. He said there are very strong grounds for thinking that omega-3 fatty acids are of great importance for depression. He referred to various epidemiological studies, including Joseph Hibbeln's (described to the inquiry team in March, which demonstrated that international variations in population rates of depression correlate with national fish consumption. He said that other studies have clearly shown that individuals who are infrequent fish eaters are more likely to become depressed and that depressed patients have low levels of omega-3 fatty acids in their cell membranes. MP accepts that one could argue that these correlations do not establish cause and effect, but there is also evidence that omega-3 fatty acids are of therapeutic benefit in depression.

The evidence for the effectiveness of omega-3 fatty acids in the treatment of depression comes from several double blind placebo controlled trials conducted by various independent groups in different countries. Efficacy is further supported by a recent meta-analysis, conducted by a working group of the American Psychiatric Association, which included all available placebo controlled trials to date.¹ The studies generally used omega-3 fatty acids given together with existing anti-depressant treatment and found that omega-3 improved the response rate. The best evidence base is for a dose of 1 gm daily of EPA plus DHA (the two main omega-3 fatty acids in fish oil). MP accepts that meta-analysis is only as good as the trials it is based on and reflects the way trials are selected unless all known studies are included

MP said there is very little research on omega-3 fatty acids as a sole treatment for depression. The best evidence base is for a dose of 1 gm daily of EPA plus DHA (the two main omega-3 fatty acids in fish oil). He referred to one small study in children with depression conducted in Israel, which found that EPA 0.5 to 1 gm daily was effective as a sole treatment in these young people. He believes this trial needs to be replicated on a larger scale.

MP noted that other nutrients are also important for depression. The best evidence is for folic acid, which has been demonstrated to be beneficial in three RCTs. Tryptophan was thought to be effective, but it was taken off the market because the supplements were contaminated by chemicals. Some other nutrients have been investigated, and there is some evidence for their relevance, they include: zinc, selenium, vitamins B6 and B12, iron and chromium.

MP said that omega-3 fatty acids had also been found to be significant in the treatment of other conditions, such as recurrent self-harm, borderline personality disorder and childhood behavioural and learning difficulties.

MP's main focus, other than depression, is the treatment of schizophrenia. He said the incidence of schizophrenia is similar across the world, but epidemiology shows that the outcome of treatment for schizophrenia is better in developing countries than in more developed countries. This correlates with national diet: a high saturated fat, high sugar diet is associated with worse long-term outcomes.

We know that blood levels of omega-3 and omega-6 fatty acids are reduced in people with schizophrenia. However, treatment studies using omega-3 fatty acids in schizophrenia have given mixed results.

MP described a study carried out in Europe, discussed at a conference but not yet published, which indicated that young people at high risk of schizophrenia may have a lower rate of developing the illness if they are given omega-3 fatty acids. Other trials have shown that people who have developed their first episode of schizophrenia may need less anti-psychotic medication if they are also treated with omega-3 fatty acids. However in established schizophrenia treatment with omega-3 fatty acids has shown no consistent benefit.

¹ Freeman MP, Hibbeln JR, Wisner K L, Davis J M, Mischoulon D, Peet M, Keck P E Jr, Marangell L B, Richardson A J, Lake J. Omega-3 fatty acids: Evidence basis for treatment and future research in psychiatry. *Journal of Clinical Psychiatry* 2006, 67, 1954-67

MP referred to a Department of Health publication, "New Ways of Working for Psychiatrists: enhancing effective person-centred services through new ways of working in multi-disciplinary, multi-agency contexts" (October 2005). This report discusses the role of dieticians and reports: "Service users need to have access to care, which is appropriate to the individual, timely and supported. Service users suffer more physical ill health, related to lifestyle and have needs, which have not been met from the primary care services." The report recognises that there are insufficient specialist dietetic posts within the mental health services and action needs to be taken to address this. However, despite this report and the fact that many patients want nutritional advice, insufficient progress has been made. The importance of good nutrition is better accepted by patients than medical professionals.

MIND did a survey of people with mental health problems and found that a surprisingly high number of them use dietary strategies such as increasing consumption of fruit and vegetables and decreasing consumption of sugar. MP believes that the diet which is good for our physical health is good for our brain and it would be strange if that were not the case. If people eat a healthy, balanced diet it will improve their physical and mental well-being. He believes that everyone suffering from their first episode of psychosis or major depression should have access to proper dietary advice. His own NHS Trust, the Doncaster and South Humber Healthcare NHS Trust, is a forward looking Trust and is providing such advice.

They are working to put science into practice by developing a nutrition service for patients. They provide a nutritional assessment for young people presenting to services with early symptoms of psychosis and they have established a "Mood and Lifestyle Clinic" for people with depression. The clinic looks at diet and other factors, such as exercise, which is known to be important for tackling depression. They are developing a simplified and structured procedure for dietary analysis and advice for use by non-specialists within mental health services, in order to disseminate this knowledge and skill to other NHS Trusts.

Questions

IG asked MP if he thought the human brain is still evolving. **MP** said that there is recent evidence that the genetic make-up of the brain changed not that long ago, in evolutionary terms. Omega-3 was important for the evolution of the brain, and was made possible by a very high fish intake. It is thus possible that the modern diet if it is maintained for many generations may affect the evolution of the brain. Meanwhile genes set the upper and lower limits at which we can function and the right diet will help us function at the optimum level.

AG asked how long the Doncaster and South Humber Healthcare NHS Trust had been working on its dietary advice and what had been the response of their patients. **MP** said they had been working on it for some 3 years and the patients in general are very receptive to a dietary approach. Given the nature of their health problems, many of these young people can be difficult to engage with and they have found that discussing diet is often the best way to begin. He said it is difficult to measure the impact of the dietary treatment because it is only one of several concurrent approaches, but it is enabling them to use lower levels of drugs. Other clinicians have noticed clear improvements in the condition of patients who have used the Mood and Lifestyle Clinic.

The Countess of Mar (MM) asked if MP was treating in-patients or out-patients. He said most of his work now is with out-patients. In the past he had looked at the diet of in-patients and had noted their very high sugar intake, which was due to large amounts of sugar in their tea and the consumption of sugary drinks from hospital vending machines. He and his colleagues had persuaded their Unit to remove sugary drinks from the vending machine, but he noted they still remained in many hospitals, which also often have franchises selling "fast-food". **IG** asked if he was aware of similar good practice in other hospitals/Trusts and MP said he was not.

EB asked MP if his vegan supplement was as good a supply of omega-3 fatty acids as a fish oils supplement. **MP** said he thought it was adequate, but at present supplements derived from algae contain less EPA than fish oils.

IG said he is sitting on the Mental Health Bill Standing Committee and he asked what advice the speakers would give him to take to those meetings. **MP** said he did not want to give the impression that the correct diet alone is sufficient to solve all mental health problems, but they know that many of the young people coming to them with depression or schizophrenia eat very bad diets and they know many of them go on to develop diabetes and cardiovascular problems, so it would certainly be worth encouraging them to eat a balanced healthy diet. MP said the science in this area is strong, but doctors are not trained in nutrition and there is resistance on the part of the medical profession to recognising its importance.

Dr Jennifer Lisle of the Royal College of Physicians Faculty of Public Health suggested that patients may be receptive to dietary advice because it enables them to assert some control over their treatment and MP agreed and said that it also enabled the families involved to help. She also suggested that encouraging people to eat more fish for their physical rather than mental health might ensure the advice was more readily accepted by the public.

Dr Malcolm Garland, Dept. Psychiatry, Royal College of Surgeons in Ireland (RCSI)

Malcolm Garland is a Consultant Psychiatrist working in Dublin and Senior Lecturer at RCSI.

Malcolm Garland (MG) said he entirely agreed with the comments of John Stein and Malcolm Peet and he particularly endorsed their views on the disdainful attitude of medical schools to the significance of diet for the treatment of illnesses. He said that there was no doubt in his mind that fish oils are important.

MG expressed regret that the pharmaceutical companies have vast resources to undertake large and very expensive trials of new drugs, while it is very difficult to undertake research in the field of nutrition because of a lack of funding.

His own involvement in research on nutritional factors preceded Joseph Hibbeln's 1998 epidemiological study, but he had been very influenced by it. This study, which had been published in the Lancet, showed a clear negative correlation between the incidence of depression and fish consumption.

MG showed a slide (slide 3) which showed how the essential fatty acids are derived from dietary fat and which illustrates the difference between essential and non-essential polyunsaturated fatty acids (PUFAs). He noted that EPA and DHA, the two important fatty acids for the brain and behaviour, can be synthesised but are most easily obtained from fish and seafood consumption.

MG noted that omega-3 is important for rheumatological and dermatological health as well as cardiovascular and mental health and he showed a slide (slide 4) which illustrates the early benefit of omega-3 therapy for a range of illnesses. Essentially the graphs indicate that if you achieve the optimum nutritional status (that is, correct any nutritional deficiencies) you feel better.

Rats fed omega-3 have raised levels of serotonin in the brain (see slide 6). Bar charts from a study published in Nature in 2006 (slide 7) show that omega-3 promotes brain growth as well as the flexibility of brain cells. This has important implications for brain healing after injury.

Slide 8 shows that animals supplemented with omega-3 have a lower level of plaque formation, thus lowering the progression of Alzheimer's and there is evidence for a similar effect in humans.

MG said that man's ancient diet, before the agricultural revolution, had a balance of 1:1 in terms of omega-3 to omega-6, whereas the ratio is now some 1:20. So as well as increasing consumption

of omega-3, we might also think in terms of reducing omega-6 consumption, but there had been surprisingly little discussion of this issue in the literature.

Increased dietary omega-6 is not simply derived from increased cereal and vegetable oil consumption but, because it is available through other foods depending on what they are fed, there is the additional knock on effect of increasing our omega-6 levels by consuming farmed animals and animal products. Thus eggs from battery chickens will have relatively low levels of omega-3 compared with supermarket eggs (see slide 11). Farmed animals such as salmon have less omega-3 than the wild variety.

Stoll et al showed in 1999 that omega-3 helps achieve remission in bipolar disorder (see slide 12). Nemets et al demonstrated in 2002 that patients with depression benefited from omega-3 supplementation (see slide 13). MG also suggested there was some evidence that “healthy” people function better, feel less fatigued and have reduced levels of anger, anxiety, confusion and depression when taking omega-3 supplements (see slide 14, illustrating the findings of Fontani *et al* in 2005).

MG’s own research, conducted with Joseph Hibbeln and others, had looked at the effect of omega-3 supplementation on “noisy” patients – those patients presenting with a number of problems including self-harm, impulsivity and family problems – because they wanted to investigate its impact on a range of measures. This was in keeping with their view that if modern populations are deficient in omega-3s then supplementation should improve all and not just some aspects of mental function.

IG intervened to ask if the guest speakers believe omega-3 would help most people with mental health problems. **JS** said he believes this is true, but he would recommend that proper studies are carried out as/when patients are given omega-3 supplements so that the effect on them could be measured. **MG** suggested scientific evidence should lead any debate on policy, but **JS** pointed out that public policy is often made without any scientific evidence to show it will be effective. **MG** said it is important to note that there are sound RCTs as well as epidemiological studies to demonstrate the beneficial effect of omega-3 on a range of illnesses.

MG said that he and his colleagues had measured the nutritional status of their patients and found that total levels of omega-3 and omega-6 were significantly lower in the self-harm group than the control group after adjusting for confounding factors, such as fish consumption (see slide 16). Moreover the lower levels of omega-3 (but not omega-6) correlated closely with increased levels of impulsivity and depression. The findings of different omega-3 levels in populations eating roughly equal amounts of fish could be accounted for by genetic or metabolic reasons and requires further study.

The patients in the next, and principal, study² were split between 25 in a control group (receiving placebo) and 25 in the group receiving supplements. Although this was a small study, and a larger RCT is needed, they believe their results are valuable. The depression scores improved for patients taking the supplements and the scores were still diverging from the control group when the study ended (at 12 weeks), suggesting that they might continue to improve with a longer period of supplementation (see slide 18). MG emphasised that a change in a BDI score of 16-17 points is a big change and would be very noticeable clinically. The perceived stress scores, which measure responses to everyday factors, also continued to diverge throughout the study period with patients taking the supplements showing a clear benefit (see slide 19). The “Daily Hassles and Uplift” score (slide 20) again shows benefit for those taking the active treatment. These scores are independent of the scores for depression and indicate several different mechanisms of omega-3 action. However the measures for impulsivity did not change, which was against expectation.

² Malcolm R. Garland, Brian Hallahan, Mairead McNamara, Philip A. Carney, Helen Grimes, Joseph R. Hibbeln, Andrew Harkin and Ronan M. Conroy: Lipids and essential fatty acids in patients presenting with self-harm. *British Journal of Psychiatry* (2007) 190 112-117.

MG expressed regret that they did not have enough patients and the trial had not gone on long enough to see whether there was any significant change in the incidence of self-harm between the two groups. He would like to undertake a larger study to see whether omega-3 supplementation does reduce patients repeating non-lethal self-harm.

The cost of this study had been 70-80,000 euros, which he argued was much less than would be required to produce similarly statistically valid results for pharmaceutical drugs.

MG's conclusion is that to reach optimum omega-3 status we need to increase fish-consumption four-fold to two portions of oily fish a week and this is not without problems, for example possible mercury contamination could undo the benefit of additional omega-3. He noted with interest that companies such as Monsanto are attempting to modify foods to increase their omega-3 content.

Questions

Lord Rea (NR) welcomed JS's physiological explanation for the significance of omega-3, but queried his view that fish oil supplement companies had no interest in funding RCTs. **JS** reiterated his view that individual companies were unlikely to provide the £2-3 million required for large RCTs because they would gain no benefit relative to their competitors from such research. He believes the Government should commission the research for the public good.

NR also asked for confirmation that algae-derived supplements would be a good source of omega-3 and **JS** agreed they are a good source.

MM said that consumption of cod liver oil had helped reduce the pain of arthritis as well as depression suffered by a member of her family.

Professor Jack Winkler asked **MG** what evidence he had for his view that food was being fortified with alpha linolenic acid. **MG** said he believed you can taste the difference when fish oil is used to fortify food, but he emphasised he is not a dietician. **JW** noted that there had been a large increase in the number of foods being fortified with omega-3 and we need to know what EFA sources are being used by the companies concerned. **MG** emphasised that some of the oily fish that were good sources of omega-3 were widely available, such as pilchards and mackerel.

Conclusion

Lord Rea thanked the speakers for their presentations and the meeting ended.

CLC, May 2007