

ACTION OPTIONS ON OMEGA-3 – RECOMMENDATIONS, SOURCES, POLICIES

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In May 2007 the National Institute for Health and Clinical Excellence in the UK approved the use of supplements of omega-3 fatty acids (O3s) with cardiac patients (NICE, 2007). In the US, the Food & Drug Administration has approved health claims for O3s reducing cardiovascular risk (FDA, 2004). In the Netherlands a report will shortly be published on the successful use of combination O3 supplements in controlling the aggression of offenders in prison. In the UK, Natural Justice has received funding and approval for a major trial in the same area (www.naturaljustice.org.uk).

Throughout the spring of 2007 the Parliamentary Forum on Food & Health conducted an Inquiry on Diet and Behaviour. It heard the latest evidence and therapeutic practice from international specialists on the benefits of O3 for foetal development, the mental and physical growth of children, behaviour and performance in schools, the control of violence and the treatment of depression, schizophrenia and bi-polar disorder (www.fhf.org.uk)

These are specific, incremental developments, cumulatively indicative of the increasing acceptance, in the world of politics as well as the world of science, that most people would be healthier, mentally as well as physically, if they consumed more O3s.

Work on these essential fatty acids is in transition from a phase of research and advocacy to a phase of policy and practice. The prospect of widespread real world applications generates two concrete questions. How much O3 should people eat? From what sources should they obtain it? This article summarises the options for answering those questions.

How much O3 should people eat?

UK dietary recommendations do not give a clear answer to this question. Three currently applicable reports for the general population deal with the subject: guidance from the Committee on Medical Aspects of Food Policy on Dietary Reference Values (COMA 1991), another expert report

on Cardiovascular Disease (COMA, 1994), and advice from the Scientific Advisory Committee on Nutrition on fish consumption (SACN, 2004).

All three are narrowly focused. The DRV report deals only with avoiding deficiency in EFAs. The two later reports base their recommendations solely on cardiovascular considerations. None considers mental health in any form. None mentions the O6/O3 balance. All produce different targets.

SACN recommends that adults should eat two portions of fish per week, of which one should be oily. A portion is 140g. This is explicitly an endorsement of the 1994 COMA recommendation. However, when SACN converts this advice into O3s, it means 0.45g/d, whereas COMA recommends 0.2g/d.

SACN is more forthcoming on the reasoning behind its advice but that only exposes more clearly the problems in this field. Expert committees that produce dietary recommendations, not just in Britain but everywhere, not just about O3s but all nutrients, face a dilemma between principle and pragmatism. Do they specify the ideal diet for the human animal? Or do they prescribe feasible improvements in the population for whom they are writing?

Ideal intakes are often distant from current consumption. So distant that they would seem, to many people, like prescriptions for another species. Bears and ospreys might eat that much fish but surely not modern Britons.

Closing the gap would require major changes in food production as well as consumption, transforming both economy and culture. The challenge is daunting. There is an adage in nutrition: food that is not eaten provides no nutritional gain. The same is true of dietary recommendations: if people do not even attempt to achieve them, there will never be any public health benefit.

As a result, many expert committees adopt the pragmatic approach, not just as a fallback compromise, but as a conscious strategy (Gibney, 1994). It is also, in part, an expression of good intentions, a desire to make a difference.

A sophisticated example appears in the first of the major British reports on the new nutrition, from the National Advisory Committee on Nutrition Education (NACNE, 1983). At the time, the UK was obtaining 38% of its total energy from fat. The committee clearly felt the figure should be 30%. So it expressed this as the "long term goal" (principle), then set an intermediate target (pragmatism) of 34%.

So too SACN, less subtly, asserts that "this recommendation represents a minimal and achievable average population goal and does not correspond to the level of fish consumption required for maximum nutritional benefit" (Para 1.12). Well-intentioned perhaps but ill-informed. The report contains hundreds of scientific references on other subjects, but not one to justify this pragmatic adjustment. No evidence of any kind is presented to support it. There is not even any argument in prose to rationalise the recommendation.

The target certainly is "minimal". Only four paragraphs earlier SACN recognised that "at least 1.5g/d LC n-3 PUFA is required for demonstrable beneficial effects on cardiovascular risk factors".

Despite the modest aspirations, it is implausible that this target is “achievable”. Current average UK consumption of oily fish is 50g per week (SACN, 2004, Annex 1). Meeting the recommendation would require almost trebling intake. Over the 15 years between the two most recent National Diet and Nutrition Surveys of adults, average oily fish consumption increased 16g/wk (from 34g/wk to 50g/wk). Adding 90g/wk more to reach the target would require a rocket-like acceleration of recent trends.

In sum, SACN’s oily fish recommendation is guesswork, good-hearted guesswork, but if we are rigorous, still just guesswork. Six natural scientists had a stab at estimating what is culturally feasible in the 21st century UK, what the British population might wear in the way of fish. The result is simultaneously incomplete, unsubstantiated, and unrealistic. Anyone who cares about O3s and the health issues associated with them need pay no heed to this recommendation.

Two alternative approaches to estimating desirable intakes have recently emerged, both of which cover mental/behaviour issues. The Avon Longitudinal Study of Parents and Children (ALSPAC) measured the fish intakes of women while pregnant and the subsequent development of their children (Hibbeln et al, 2007). The recommendation derived from this, “the best longitudinal study in the world” (Hibbeln, 2007a), is that “consumption of less than 340g/week in pregnancy was detrimental, that is, increased the risks for low verbal IQ and abnormal behaviours among children. The optimum level, however, may be even higher and remains to be determined (Hibbeln, 2007b).”

Specialists at the US National Institutes of Health have developed a different method of formulating Recommended Daily Intakes. Applied to O3s, it involves, in part, international comparisons of the relation between national rates of relevant mental and physical illnesses, and levels of fish consumption (Hibbeln et al, 2006). Japan has high levels of fish consumption and low disease rates; the UK and most other developed western societies, the reverse. The practical outcome is a target by which “the majority of the populations (98-99%) are protected from...increased risk of chronic illnesses. By this criterion, 2g/pp/pd of LC n-3 PUFA are needed in the UK (Hibbeln, 2007b).” This is four-and-a-half times the SACN recommendation.

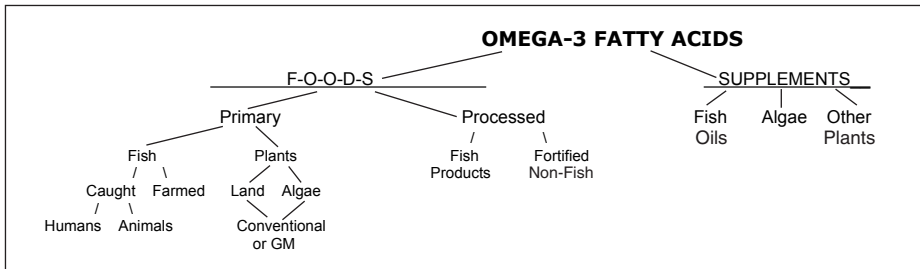
There is an additional dimension to dietary recommendations that is not considered in any of the official UK reports: the balance between O6s and O3s. For many specialists in the field, this is as important as the absolute amounts of O3s. The principled target for the human brain is 2:1 or less (Crawford et al, 2003). Pragmatists might settle for anything below 7:1. Even this is not very pragmatic, however, because a conservative estimate of the current ratio in the UK, based on aggregate availability of the relevant fatty acids, is 15:1, with some sub-groups who are high consumers of vegetable oils, especially Asians, having ratios up to 40:1 (Ghebremeskel, 2007).

Reducing that ratio would involve substantial changes, especially in the oils used by the food industry, a major source of O6s in the UK diet. But from a policy perspective, focussing on the O6/O3 balance offers an

important advantage. It is possible to narrow the ratio either by cutting O6s or by raising O3s. And, of course, both.

What sources should provide increased O3 consumption?

Whatever the exact recommendations, they are likely to propose a substantial increase in O3 consumption. Where will the extra supplies come from? The diagram below sets out the options. It aspires to be comprehensive. The discussion that follows briefly considers each possibility in turn. In every case, there are major policy issues to be resolved, in addition to nutritional questions. The diagram takes the form of a decision tree because, in the real world, choices will have to be made.



Primary foods (fish)

Virtually all nutritionists agree that fish would be the best source, because of their O3 concentration, plus the other nutrients and trace elements they contain. And while oily fish are the richest, parts of some white fish, like cod, also provide useful amounts.

But are there enough fish in the sea? Especially if everyone actually ate fish at the higher levels likely to be recommended in future?

At present, the majority view is that natural supplies will not suffice. Stocks of the principal ocean fish consumed by humans have been seriously depleted in recent decades (Clover, 2005). At the same time, the acidification of the oceans, because of climate change, is creating a less hospitable environment for plankton and other marine micro-organisms (Kolbert, 2006). The aquatic food chain is under attack simultaneously at the top and the bottom. In any case, radical changes are needed just to maintain the status quo, not only in fish conservation but in marine management generally.

There is an alternative view that, large predator fish apart, we have actually underdeveloped the potential food resources of the marine environment that makes up most of earth's surface. As arable land is fully exploited, we may in time systematically "agriculturalise the oceans". Perhaps, but that would be a long-term project, requiring massive investment and cultural change. We might be wise to start soon, but it is not an option for dealing with O3 deficiencies now, or for the medium term ahead.

However, among the “optimists” about fish supplies is the UK government, in company with most governments around the world (DEFRA, 2005). They are in charge of fisheries policies, trying to simultaneously sustain both marine resources and their domestic fishing industries, all the while maintaining the traditional posture that governments are in control of the situation. Many are sceptical. But if the time comes when the need to increase O₃ consumption is generally agreed, then such optimists will be in charge of meeting the demand. That will test their competence and creativity in fish policy.

In the shorter term, we could make better use of the supplies we already have. In each country, people traditionally consume only a selection of the available edible fish. The result is substantial discards by local fishing industries of nutritionally significant catches. So, expanding the range of popularly consumed fish is feasible, if culturally difficult.

There is also substantial waste of both caught fish and fish oils through spoilage. But recovery is not always easy or cheap.

Furthermore, many fish are turned into fishmeal for animal feed. Of Peru's catch, for example, 90% is used in this way. A proportion could be transferred to human use in diverse forms. But fishmeal is already in short supply. Substantial diversion would have economic consequences for the livestock industries, over which conflict would be certain. Overall, increased efficiency in the use of existing fish resources is possible, but not without problems.

Farmed fish are a more important alternative. But, in addition to health and environmental concerns, current rearing regimes often involve feeding caught fish to the farmed fish. So there are doubts whether aquaculture is a sustainable source of supply for oily fish, especially on the increased scale required.

Even if enough fish were available, it is questionable whether the British would eat them, at least at the optimum levels that minimise O₃-related diseases. Japanese fish consumption per capita is over six times current UK intakes.

In sum, by all means, more fish. By all means, too, more protection for fish stocks and more investment in marine resources. But, it would be imprudent to rely on fish alone to meet all the requirements for increased O₃ consumption.

Primary foods (plants)

Plants are nutritionally and economically inferior sources of O₃s, but have a comparative advantage in sustainability. Traditionally, oil seeds have provided the major supply.

Increasingly, however, attention is turning to cultivating algae, for supplements and food fortificants that are already on the market. Algae are the original source of O₃s in fish, so the option exists to use them directly, cutting out the middleman, as it were.

This prospect has become much more serious recently because of algae's potential use as a feedstock for biofuels, which would greatly increase supplies. It remains to be seen whether this will prove technically and economically viable. But if so, then further questions arise: about the price relation between fuel and food uses, and how the two applications can economically co-exist.

But there is a more immediate policy issue linked to plant sources. Research has intensified on genetically modifying plants to increase their O3 content. These include oil seeds, especially rapeseed, soybeans and linseed, but also brassicas and now GM algae, as well.

The aim in the first instance is to increase the O3 yield, and hence lower the cost, compared to conventional crop sources. If successful, GM crops would become the overwhelming source of plant-derived O3s, on economic grounds alone, at least in countries hospitable to the new genetic technologies.

DuPont is predicting that its high O3 soybean will move into commercial production in 2008. Monsanto's competitor is not far behind. BASF is working on brassicas, in co-operation with some universities involved with the European Union's five-year multinational project "Lipgene" (the genetics of lipids). Lipgene also includes its own independent sub-programme on O3s.

These are all examples of nutritional, as opposed to agronomic, genetic modifications. The goal is to improve the nutrient profiles of the plants rather than their growing properties. This is known in the industry as output rather than input GM. Their advantage is that they offer perceptible benefits for consumers, rather than just for seed companies and farmers.

Nonetheless, opposition to GM technology in Europe has been extremely strong and enduring, not least in Britain. European politicians have been responsive to this opposition, instituting restrictions if not quite prohibitions. Any attempt to introduce additional GM crops, even for good nutritional reasons, is bound to be controversial.

The real policy question, therefore, is not plant v fish sources. Both are already being used and both will probably expand. The issue is whether those plant sources should be GM. A policy choice will soon be unavoidable.

Processed Foods

If governments and health professionals have been slow to accept the increasing evidence on O3s, the food industry has responded with entrepreneurial alacrity.

Recently, processed foods fortified with O3s have proliferated in the UK. These include bread, pasta, muesli, eggs, fat spreads, dressings, milk, juices, yoghurt and probiotic drinks. They are mainstream products involving major brands (Unilever, Heinz, Muller) and supermarket own label ranges

(Tesco, Sainsbury, M&S). Exotic niche products have also sprouted, like O3 saucisson, pancakes and ice cream.

This surge of new product development is partly based on technical improvements in the micro-encapsulation of O3s, to control rancidity and fishy tastes. But it also reflects industry's perception of the public's perception of O3s --- the widespread, if imprecise belief that they are good for you. Consumers and businessmen are persuaded, even if others quibble about a deficiency of randomised controlled trials. O3s are approaching the status of vitamins, popularly accepted as "healthy," even if few could explain exactly why.

As a result, O3s have become the nutrient-of-the-moment in the food industry. They are added to diverse products, for marketing as much as health purposes. But some people have their intakes increased nonetheless, if not yet on a scale to impact on public health. Consumer guides to selecting the best products have already appeared (Elkins, 2007).

Strategically, this is a significant development in nutrition policy. The focus shifts from changing people to changing foods. That is, it improves the popular foods people already eat, rather than requiring them to change their dietary habits. Fortification with folic acid is a recent precedent, with another nutrient that is unlikely to be consumed in sufficient quantity from primary food sources.

This approach contrasts with long-standing preferences of nutritionists, that people fulfil their requirements from a mix of unprocessed foods. But in a country with a low level of fish consumption and resistant to all forms of genetic modification, how exactly are the British to increase their O3 intakes?

The pragmatic case is to put what they need into what they will eat. With O3s, this is also a low risk strategy, because there is little chance of overdosing.

Even if this strategy is accepted, nutritional issues remain: the nutrient profiles of the carrier foods (O3 ice cream) and the amount of the food that must be consumed to meet even current O3 targets (seven glasses of milk). There are better and worse foods to fortify.

Ironically, one of the most suitable has been overlooked. The most popular form in which fish is consumed in the UK, more popular even than fish and chips, is canned tuna (SACN, 2004, Annex 1, Table 4.2). Tuna are naturally high in O3s. But the canning process, which removes most of the oil-rich dark flesh and belly flaps, means few O3s are left in the form of tuna that most people eat.

One option is to add O3s back into the can, up to the levels that were originally in the fish. This is "restorative fortification." It is already an established and uncontroversial practice where processing eliminates other nutrients, for example, vitamin E in sunflower margarine, or vitamin C in blackcurrant drinks.

In fact, few if any of the many tuna products on the British market incorporate this form of fortification. You can buy tuna with added salsa sauce, but not with added O3s. Of all the policy possibilities, the mandatory restorative fortification of canned tuna is the quickest, easiest and cheapest mechanism for significantly increasing O3 consumption in the UK.

The current pattern of British consumption also suggests another option. Barely a quarter of people eat any oily fish, in any form. The challenge is not just to get existing consumers to eat more, but to entice non-consumers to eat any oily fish at all.

A precedent exists for a successful response. In the 1930s, following Boyd-Orr's documentation of widespread nutritional deficiencies, the British government asked Unilever to develop a new form of fish product that would be popular enough to influence population health. The result was the fish finger. New types of processed oily fish products, designed for the mass market, is a plausible approach to deficiencies in the 21st century as well. Chile has already responded to this challenge with children's burgers and hot dogs made from salmon and yellowfin.

But a related policy issue is fast approaching. The commercial momentum in developing thousands of new foods that promise diverse health benefits, not just for O3s but for many nutrients, has made obvious the need for a legal framework to control unsubstantiated promotional hyperbole. Thus, after more than a quarter century of trying, the EU this year finally agreed a Regulation on food claims.

Public consultations are now underway in member states on both "nutrition" claims, that describe the content of a product (high or low in some nutrient), and "health" claims that refer to the effect it will have on the eater (reducing disease risk or promoting well-being). The aim is to produce lists of permissible claims in both categories. Once approved, the process of adding new claims to the lists will be time-consuming.

This creates a special urgency for O3s. While the definitions of some content claims are already agreed, like "low sugar", the European Food Safety Authority tried and failed to establish what constitutes a product "high" or "rich" in O3s (EFSA, 2005). The goal is to resolve the deadlock in 2008.

After initially trying to ban health claims on the psychological and behavioural effects of foods, the EU relented. They are now allowed, as well as claims to physical benefits. And they may be made for foods naturally rich in some nutrient, as well as for fortified products. This creates a major opportunity for O3s, which are significant for brain development and functioning at all life stages. But it also creates a major challenge because, rightly or wrongly, the scientific case in these areas has not yet received the same degree of acceptance as that for physical benefits, like reduction in cardiovascular risk.

So far, products fortified with O3s have flourished without being able to claim anything more than that they contain some. O3s are effectively

treated like other unexplained “miracle ingredients,” of which the advertising industry is so fond. If fortified processed foods are to be part of the policy mix for increasing O3 consumption, then that strategy would be greatly enhanced if products were able to claim, credibly and in plain English, how much they contain and what good they will do.

Supplements

Supplements are another approach where a gap has opened between the conventions of good nutrition, on the one hand, and the self-reinforcing upward spiral of consumer choice and commercial conduct on the other.

Over-the-counter sales of O3 supplements are rising. New products are appearing based on fish oils, algae and other plant sources. Consumer guides have appeared here too, to explain the complex diversity of O3 supplements now on the market, with varying dosages, varying sources and varying target consumers.

Many nutritionists, however, find them a poor substitute, lacking the antioxidants and trace elements (especially iodine, selenium and zinc) contained in oily fish. Professional suspicions of single nutrient supplements have been strengthened through recent exposures of sharp practice by some entrepreneurs --- links between recommending therapists and supplying companies, extortionate pricing in specific contexts (Kutz, 2006), and suspect “trials” funded by manufacturers (Goldacre, 2006). The EU is proposing regulation of dosages, but that is a limited instrument and still a long way off.

No one, not even manufacturers, suggests that basic nutritional requirements should be met by supplements. Indeed, one of the science fiction horror stories of the era, alongside the alien invasion, is the prospect of people fed on pills rather than food.

Nonetheless, in the real world, therapists and O3 researchers have identified vulnerable groups with high needs and low intakes – pregnant women, infants, hyperactive children, aggressive offenders, psychiatric patients of many types, the middle aged at risk of cardiovascular disease and osteoporosis, the elderly approaching senility.

For such groups, the risks of low intakes and the benefits of higher are increasingly well documented, for both prevention and therapy. Supplements offer an option for raising consumption that combines adequacy with palatability.

It is improbable that those at risk would spontaneously increase their consumption of primary foods sufficiently, even under doctor’s orders. It is equally unlikely that all would be able to afford O3 supplements on the normal commercial market, even if they were so inclined.

Practical policy questions therefore arise in abundance. Should supplements be recommended for selected vulnerable groups? If so, what doses for what applications? Should they be made available through social distribution

channels – antenatal clinics, welfare food schemes, schools, prisons, primary care surgeries, residential homes? If so, who pays, how much? If the total cost is high, as it is likely to be, should some groups have priority? If so, which ones?

In this policy area, doing nothing is definitely an option. Many will rationalise inaction on diverse grounds – principled preferences for primary foods, other health care priorities, insufficient clinical trials, freedom of consumer choice, the adequacy of commercial provision, administrative complexity, the cost to the public purse, etc. Those who believe vulnerable groups deserve better will have to be resolute.

Conclusion

O3s are a field where there is neither scientific certainty nor policy consensus. But that is true in all areas of life. Decision-making in the face of uncertainty and without unanimity is part of the human condition. Yet life goes on; we act, purposefully, sometimes even wisely. And so we can with O3s as well.

The UK does not have agreed, rational recommendations on O3 consumption, for the general population or specific sub-groups. Establishing such targets is a pre-requisite for practical action. With public policies, we need to know what we are aiming for before we try to achieve it.

Given the wide range of mental and physical problems associated with a deficiency of O3s, tackling the recommendation issue again through another sub-group of a generalist nutrition committee is unlikely to succeed. Reaching an actionable consensus may require creating a specialist O3 commission that incorporates all relevant disciplines.

Whoever takes on the task will face the choice between the ideal and the feasible. Pragmatists will need rational grounds for deciding what is “achievable.” And credible implementation programmes to achieve it.

However, the world does not stand still while nutritionists make up their minds. Among specialists, practical initiatives and treatments with O3s are already underway in selected fields.

Meanwhile, commercial innovations in fortified foods and supplements are accelerating, with variable logic and quality, some sensible and useful, some bizarre and opportunistic. These developments may or may not prove beneficial in the long term. But most are undertaken independently, without serious consideration of the complex public health or distributional issues involved. This is nutrition policy by default.

We can do better than that. O3s are, literally, essential for health. The costs and consequences of deficiency are enormous, and rising. Of course, we will always need a deeper understanding of the problems, more research and better evidence. But the science base on the functions and effects of O3s is already voluminous. We know enough now for constructive, practical action, with nil risk of harm. It is time to design a nutrition policy for omega-3 fatty acids.

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