

Seafood

– an essential part of 21st century eating patterns;

critical food for your heart, your brain,

your love-life and your baby!

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WHY EATING SEAFOOD IS GOOD FOR YOU

First and foremost, seafood is eaten because it provides a tasty and satisfying meal. At the same time there is a growing awareness of the health benefits which seafood eating brings with it, and of the ever-increasing body of evidence which shows what happens when we don't eat enough of it.

Not only does seafood take the place of other, possibly less healthy every-day meal items, it also provides nutrients which make a valuable and in some cases unique contribution to the supply of essential nutrients needed to ensure that the human body can maintain itself in a state of good physical and mental health.

Seafood is unique nutritionally in several respects:

- Seafood provides little or no carbohydrate, sugar or starch. Those concerned about the weight-gain aspects of carbohydrates can therefore eat seafood freely.
- Seafood is a rich source of vitamins and minerals
- Seafood is unique in that it provides the only nutritionally significant source of certain polyunsaturates, known as 'omega-3', which have important health implications. Much recent research demonstrates the value of these omega-3 polyunsaturates, in heart disease, in arthritis, in cancer, and in promoting good brain function, as well as the fact that we do not eat enough of them.

Further consideration of the vitamins and minerals, as well as the polyunsaturates, and their significance to human health and well-being is dealt with in the next sections.

VITAMINS AND MINERALS

Seafood has long been known as an excellent source of vitamins and minerals. This is especially relevant today when significant parts of the UK population have inadequate intakes of certain of the nutrients that seafood can supply.

The 1999 National Food Survey reveals that the UK National average intakes of zinc, iron, magnesium and potassium fall below the Reference Nutrient Intake, or RNI. Estimates reveal that more than one million people in the UK may not be getting the recommended intakes of these nutrients. Eating more seafood could make a significant contribution to the solution to curing this problem.

Iron & Zinc

Low intake of iron can lead to fatigue, and a reduced immune function. Significant shortage of dietary iron has been reported in women of childbearing age.¹ Low zinc intake can also cause lowering of the immune defences², and is associated with a reduced sex drive³.

Oysters & Sex Life

Oysters are very rich in zinc, but speculation that their reputed aphrodisiac property is due to this has not yet been tested in controlled trials! The fact that semen contains a lot of zinc (levels up to 100 times greater than in blood for example) may provide a basis for this association.

Iodine – The Butler's Brain Power

One of the most common mineral deficiencies in the Western world is iodine. Seafood is a rich source of iodine, and was probably the reason why Bertie Wooster's butler Jeeves considered it to be food

for the brain. Lack of iodine can lead to impaired growth and development, a condition known as Cretinism, in which brain development is stunted. Since the iodine in seafood would historically have prevented this, it seems a logical connection for the “brain-food” concept.

Selenium & Cancer Defences

Selenium is a trace element not currently assessed in UK official surveys of nutrient intakes, though it is attracting much interest as a part of the anti-cancer defences of the human body. Average UK intakes have fallen as a consequence of our greater use of low-selenium European hard wheat for bread baking, in place of the high selenium American hard wheat we formerly used. In this context, the contribution of seafood to selenium intake (a 100g portion for example providing 30-80% of the amounts thought to be needed) is very significant, and may contribute to the reasons behind the reported ⁴ cancer protection offered by seafood.

Other Vitamins

Seafood supplies significant amounts of vitamins A and D, and is one of the few foods to supply meaningful amounts of these vital substances. Substantial amounts of vitamins B1, B2 and B6 are also provided by certain seafoods.

POLYUNSATURATES – THE “OMEGA BALANCE”

Perhaps the most significant feature of seafood, from a nutritional perspective, is the fact that it is the most important source of a type of polyunsaturate that is essential to our health, and which we generally do not consume enough of.

Polyunsaturates are one of a group of three classes of fatty acids, the predominant building blocks of dietary fats and oils (monounsaturates and saturates being the other two). The polyunsaturates are especially important because they are used within the body not only to help form the structure of certain important body components such as brain cells, but they are also used in the manufacture of a vast range of powerful biological control agents.

The polyunsaturates as a class can be further subdivided into two sub groups or families, on the basis of a minor but very important structural feature. The two classes are known as the omega-three (w-3) family and the omega-six (w-6) family. Research during the past 30 years has shown that the two classes of polyunsaturates must be in balance. Humans cannot convert one family to the other, so both families must be supplied in our diets, and in roughly equal amounts.

Time changes everything

Since the mid-1950s, the UK national intake of polyunsaturates has changed dramatically. In response to the messages about cholesterol and heart disease, we have doubled our intake of the omega-6 polyunsaturates, by eating lots of sunflower margarine (70% of the fatty acids in sunflowerseed oil is of the omega-6 family, none is omega-3).

During this same time period, we have reduced our intake of seafood, and in particular we have cut down consumption of oil-rich fish which give us lots of omega-3 polyunsaturates, fish such as herring and mackerel. The “net” result has been that we now have a diet that is short of omega-3, and which supplies too much omega-6.

The consequences

Research published in the last 30 years or so has shown that this has adverse health effects. The heart is more prone to heart attacks; blood is more prone to form clots; joints are more susceptible to arthritis; skin is more sensitive to sunburn; lungs are more sensitive to smoke damage and perhaps pollution; the brain is more likely to malfunction, resulting in depression, aggression and perhaps schizophrenia. The detail of this is not yet fully known, but much of the picture is visible, though with some parts in sharper focus than others. Eating more seafood can help to redress this imbalance, and contribute to easing these scourges of modern life.

THE POWER OF OMEGA 3

On the face of it, the idea that a simple food item such as seafood, or omega-3 polyunsaturates, can have profound effects on areas as different as the brain, kidney, lungs, heart, skin or joints can seem far-fetched. On the other hand, it must be appreciated that each of these areas has at least two things in common:

- One is that they are all made up of cells, and the cells that make up these larger organs or tissues all have as their outer layer a membrane, or skin, in which polyunsaturates (of both the omega-3 and the omega-6 families) form an important part.
- The second is that they all depend for control of the functions they perform on a group of biological regulators called eicosanoids. Eicosanoids are powerful hormone-like substances made by our bodies from polyunsaturates of the omega-3 and omega-6 families.

So, because the cell membrane contains polyunsaturates, and because the behaviour of the membrane depends in part on the amount and type of polyunsaturate present, the presence or absence in the diet of the two types of polyunsaturate can and indeed does have a huge impact on human health and well-being.

It is therefore feasible to expect that altering the dietary intake of polyunsaturates could have wide ranging health effects, and the impact of these changes will be examined in the sections which follow.

THE HEART AND CIRCULATION

Seafood has major benefits for the heart and the entire blood circulatory system. In an age when we are constantly bombarded by media messages that we must eat less of this, or none of that, seafood is one of the few foods that we are encouraged officially to eat more of⁵. The 1994 COMA report on diet and heart disease recommended that UK average intakes of seafood should be doubled, with the increased intake being in the form of oil rich-fish such as mackerel, herring, sprats and sardines. This is a reflection of the substantial body of sound scientific information underpinning these recommendations, evidence which has been accumulating since the 1970's.

The Eskimo Diet

The evidence that the oil in fish helps to reduce heart problems first came to when an eccentric British nutritionist and a pair of Danish medics went to visit remote Inuit settlements in Greenland. They were intrigued by the fact that in spite of having a high fat, high cholesterol diet, the Inuits did not suffer from heart disease, in stark contrast to the UK, where even now one man in ten aged over 40 will die of a heart attack before he retires. The researchers soon reached the conclusion that the Inuit health record was due to the large amounts of the omega-3 polyunsaturates supplied by their seafood diet.

Reducing the Risk of Heart Attacks

Since that time many thousands of tests, investigations and trials have been done to explore the relationship between the omega-3 polyunsaturates and heart disease. More than 20,000 scientific publications have appeared in print. Almost without exception, these studies involving heart disease have shown that increasing the amount of omega-3 polyunsaturates in the diet can reduce risk of death from a heart attack by as much as 30-40%. The most recent and most comprehensive was published in the Lancet in 1999 ⁶.

Seafood – the Answer?

The UK has the unenviable record of being one of the top countries in the world for heart disease deaths. The rate has fallen in recent years, in line with trends in other countries, probably due to reductions in cigarette smoking by men, but we are still very high. Many times higher than for example the Japanese, who eat a lot of seafood, smoke more than we do yet only have 1/10th of the heart death rate. The fact that they regularly come at the top of the longevity league table shows that their seafood-based diet protects their health very effectively.

How Does Seafood Protect the Heart?

No one knows for sure, but most recent research suggests that omega 3 has two positive effects on the heart. One is that it influences the heartbeat rhythm control system, and the other involves a reduction in blood clotting. This latter explanation also helps explain why stroke risk is reduced in seafood consumers, since the formation of a blood clot within an intact blood vessel is the mechanism, which triggers not only a heart attack, but also the most common type of strokes⁷. Whatever the final conclusions of the scientists about how seafood and omega-3 protects the heart, there is no longer any doubt that it does do so. Just this year, the ultra-conservative American Heart Association came off the fence and recommended that people should eat fish twice weekly, so as to reduce their risk of dying from a heart attack.

THE BRAIN

The brain is a fat-based organ. Together with the nerves and the eyes, the brain is in large part built from polyunsaturates. Ignore the water, and 60% of what is left is fat. The childhood playground taunt of “fathead” was nearer to the truth than anyone realised at the time! The fat from which the brain is built is mostly polyunsaturated, and of that, almost half is one of the omega-3s, a fatty acid known as docosahexaenoic acid, or DHA for short.

The brain is uniquely different from other body systems or organs in that it is almost completely built before birth. By this time, more than 75% of the cells that the brain will ever have are formed. The remaining few are formed in the first year or so of life. In terms of the number of brain cells a person has, it is downhill all the way after the age of two! The cells get bigger as the baby grows and learns things, and the brain cells form long tendrils that make connections called synapses with other brain cells. This places a huge importance on making sure that the child in the womb has enough DHA to enable it to build its brain cells according to the blueprint laid down in its genes. Equally important of course is the need to ensure a good intake of the omega-3 polyunsaturates during childhood, when brain cells are getting bigger, and making the sort of connections that are associated with learning.

Babies Need Omega 3 – And May ‘Steal’ to Get It!

If mother does not eat enough seafood, one or more of three things may happen. The first thing is that the mother's own stores of DHA could be raided to provide enough for baby. A similar situation occurs with calcium, which baby needs to form its bones and teeth. If mother's diet does not contain a good level of calcium, the baby will "steal" from the mother, weakening her own bones and teeth in the process. Some experts think that the same thing occurs with DHA. Since the brain is the largest repository of DHA, it seems most likely that this is where it comes from. Studies showing that the brain of a mother can shrink a little during pregnancy may be associated with this.

Seafood & Post Natal Depression

Other experts have drawn a link between loss of DHA from mother's brain, and post-natal depression, or baby blues. A recent study⁸ has looked at the incidence of postnatal depression in 22 countries across the world, and compared this to the national seafood intake in those countries. A very striking relationship was revealed, which in essence showed that higher seafood intake was associated with lower incidence of baby blues. For the UK, a doubling of our seafood intake would halve the number of cases of baby blues from an average of 1 in 6 live births to 1 in 12.

Reducing the Chances of Prematurity

The second thing which can happen if a pregnant woman doesn't eat enough seafood is that the chances of a premature birth are increased. Now while delivering baby a few days or weeks early might on the surface seem attractive, there are very real health drawbacks for baby in early delivery. The building of baby's brain, eyes and nerves takes place during the last 3 months in the womb, and if birth takes place earlier than planned, the process may not be completed. This can (though not necessarily) result in poor health later in life, so is something to be avoided if possible. And eating plenty of seafood is one way to help avoid premature birth. A research study carried out in Denmark⁹ in 2003 showed that mothers who ate plenty of seafood (i.e. 2-3 times weekly) have less than a third of the risk of a premature delivery compared to those who didn't eat much seafood. The effect of the omega-3 polyunsaturates in seafood on the hormone-like substances that govern the birth processes is thought to be the explanation for this.

Omega 3 – Making Brainy Babies

The third possible consequence of Mum not eating enough oil-rich fish may be that the baby is not able to build its brain in the way laid down by its genes. This may result in a lower IQ than might have been the case. DHA is a major component of the brain, and if the supply is not adequate, the baby's brain will use other, substitute materials, which can result in a brain which operates below par. Experimental evidence confirms this, as does the well established finding that breast-fed children have on average a three point IQ advantage over their bottle fed counterparts. This is because breast-milk naturally provides a rich supply of DHA, (provided Mum is eating seafoods!) whereas until recently, bottle feeds did not. This difference will probably diminish now that bottle feeds in the UK are supplemented with DHA.

And it is not only the baby's brain that is affected. More recent evidence¹⁰ has shown that children born to mothers that did not eat much seafood during pregnancy have higher blood pressure at the age of 6 yrs, when compared to children born to seafood-eating mothers. Since blood pressure is an important risk factor in heart disease and stroke, it is possible that the quality of a mother's diet during pregnancy can have a profound adverse impact on her child's health a long time after the period of pregnancy is ended.

Calmer Sleep

The impact of a good omega-3 supply on brain maturity is thought to offer an explanation for one recent study¹¹ which found that babies born to mothers who ate plenty of seafood had a better, calmer, sleep pattern than babies from mothers that did not eat much fish.

Hyperactivity, Dyslexia & Depression

It is also possible that the child could suffer problems such as ADHD (hyperactivity), dyslexia, dyspraxia (clumsiness), and even be more prone to adult mental health problems such as depression or schizophrenia. All of these conditions have been linked to an inadequate supply of seafood in the diet. Recent studies have shown that children with ADHD have lower omega-3 levels in their blood, and one study¹² has shown that supplementing ADHD children with 480mg of omega-3 daily reduces their behavioural problems, improves their reading ability and their dyspraxia. A study carried out with young offenders showed that a supplement of omega-3 polyunsaturates and vitamins/minerals had a profound beneficial effect on their behaviour.

Breastfeeding

Once the child is born the need for DHA in mothers diet does not go away. Breast-milk is the growing baby's only source of the DHA it needs to complete building brain cells, and to make larger those that it already has. This, and other evidence, leads to the conclusion that the dietary supply of DHA can and does have an impact on the brain and the way that it works. This makes it even more important for mothers to breast-feed their infants when at all possible, and for them to ensure that their diet contains plenty of seafood, since it has been established that the level of DHA in breast-milk can be increased if the mother's diet is richly supplied with fish.

Schizophrenia

Schizophrenia is one of the more common mental illnesses, directly affecting more than 1 in 100 people in the UK. Several studies¹³ have shown that increasing the intake of the omega-3 polyunsaturates can radically improve the lives of those affected, as well the lot of their carers. The benefits of the omega-3 polyunsaturates is even apparent when patients are still receiving their main-stream pharmaceutical treatments.

Depression

Depression is another very common cause of disability and ill health. Worldwide seafood consumption patterns show that depression is more common in those countries which do not eat much seafood¹⁴. Several studies have explored the pharmacology aspects, and two studies have shown marked benefits in a group of severely depressed (suicidal) patients. The benefits of the fish oil supplement were so marked that the trial was stopped prematurely, on the grounds that it would have been unethical to continue to deny the placebo group the benefits of the omega-3's¹⁵. Since that time, several other studies have shown that the elderly in particular are less depressed when their omega-3 intake is good.

Coping With Stress

Everyone loses their temper now and again, but some individuals have a shorter fuse than others, especially, it seems when they are under stress. Research in Japan has suggested that increasing omega-3 intake can help people cope with stress better, and reduce the feelings of aggression they might otherwise experience¹⁶.

Dementia and Alzheimer's Disease

It is not only depression that the elderly are prone to; dementia is a common problem, and can range from the inconvenience and frustration of mild memory loss to the more severe forms such as

Alzheimer's Disease. Two recent research projects^{17,18} have found that dementia is significantly less common in elderly people who eat plenty of seafood.

JOINTS

The role of the omega-3 polyunsaturates in the treatment of rheumatoid arthritis has been well established in a series of controlled trials going back more than 15 years. It is now widely accepted that increasing seafood intake can help to reduce joint swelling and tenderness, as well as the pain and fatigue associated with rheumatoid arthritis¹⁹. The Rheumatism and Arthritis Research Council recognises this, and provides advice to this effect in its publications. Usage of aspirin-type painkillers has also been shown to be reduced when RA sufferers were given fish oil²⁰.

Osteoarthritis is the more common form of arthritis, and until recently, little in the way of hard evidence was available on the role of the omega-3 polyunsaturates in this condition. Recent work from the University of Cardiff has shown that the enzymes responsible for the degradation of cartilage can be inhibited by omega-3 polyunsaturates, raising the possibility of a controlled trial to examine the impact of seafood on cartilage loss in osteoarthritis²¹.

Inflammation is a normal part of the human response to the entry of foreign tissue into the body, and as such it is an important part of our defence system. Under some circumstances it appears that the inflammatory response is triggered in a "false alarm" situation. When this happens, the result can be a range of conditions including rheumatoid arthritis, psoriasis, ulcerative colitis, and kidney disease. Increasing the dietary supply of the omega-3 polyunsaturates from seafood can help to counter this process. Trials have shown benefit in psoriasis²², ulcerative colitis²³, and kidney disease²⁴.

CANCER

Without doubt the impact of the omega-3 polyunsaturates on cancer is the hottest research area at present. Evidence is available from several parts of the world to show that cancer patients have lower levels of omega-3 polyunsaturates in their bodies than controls subject without cancer. A recent study from France²⁵ has shown that women with higher intakes of omega-3 polyunsaturates had only 1/3rd of the risk of developing aggressive breast cancer compared to women that did not eat much seafood. A similar study from Sweden²⁶ has found lower omega-3 levels in women with endometrial cancer. A recent Dutch study has shown that lung and pancreatic cancer sufferers are more likely to have low seafood intakes. Laboratory studies of tumour tissues show that omega-3 inhibits the growth of tumours, whereas the omega-6 polyunsaturates that we all eat too much of actually promotes tumour growth²⁷. Laboratory studies also show that the chemotherapy drugs used to treat cancer are more toxic to cancer cells when omega-3 is present²⁸.

CONCLUSIONS

Seafood is arguably the most nutritious of all food groups, with lots of health advantages. It is low in carbohydrate, rich in vitamins and minerals, and is unique in the amounts of the long chain omega-3 polyunsaturates it provides. These key nutrients are in short supply in the UK diet, and are being swamped by too much sunflowerseed oil. A recent Australian study²⁹ showed that more than 70% of Australians are failing to get the minimum recommended intake of the long chain omega-3 polyunsaturates, and thus are at greater risk of all the health problems referred to earlier. Though no hard evidence is yet available, the same finding will probably apply to people in the UK. Redressing this imbalance would improve many

aspects of health, reduce the cost burden on the NHS, and more importantly reduce the burdens of distress and suffering felt by those afflicted, and those who care for them.

Though the quality and quantity of proof available to support these ideas varies from sketchy to complete, there is no doubt that eating seafood several times a week is a good eating plan for a long, happy and healthy future for people of all ages.

REFERENCES

- 1 The Dietary and Nutritional Survey of British Adults. HMSO 1990.
- 2 Dietary Reference Values for Food Energy and Nutrients for the United Kingdom, HMSO 1991.
- 3 Davidson, Passmore, Brock and Truswell ,eds, Human Nutrition and Dietetics;; Churchill Livingstone, London 1979.
- 4 Fredrikson, M.; Hardell, L.; Bengtsson, N.O.; Axelson, O. Colon cancer and dietary habits - A case-control study (Clinical Study). *International Journal of Oncology*. 1995 July; 7 (1): 133-141
- 5 Nutritional Aspects of Cardiovascular Disease, COMA, HMSO 1994.
- 6 Marchioli, R., et al. Dietary supplementation with n-3 polyunsaturated fatty acids and vitamin E after myocardial infarction: results of the GISSI-Prevenzione trial. *Lancet* 1999, 354:447-455.
- 7 Iso,H., et al. Intake of Fish and Omega-3 Fatty Acids and Risk of Stroke in Women. *Journal of the American Medical Association*, 2001, 285;3: 304-312.
- 8 Hibbeln,J.R., Seafood consumption, the DHA content of mothers' milk and prevalence rates of post partum depression:a cross national, ecological analysis. *J.Affec.Disorders*, 2002, 69:1-3:15-29.
- 9 Olsen, S. F.& Secher, N. J., Low Consumption of Seafood in Early Pregnancy as a Risk Factor for Preterm Delivery: Prospective Cohort Study; *British Medical Journal* 2002, 324;7335:447-450.
- 10 Forsyth, J. S.,Willatts, P.,Agostoni, C.,Bissenden, J., et al, Long Chain Polyunsaturated Fatty Acid Supplementation in Infant Formula and Blood Pressure in Later Childhood: Follow up of a Randomised Controlled Trial. *British Medical Journal* 2003, 326;7396;953-955.
11. Cheruku, S. R.,Montgomery-Downs, H. E., Farkas, S. L., et al. Higher Maternal Plasma Docosahexaenoic Acid During Pregnancy Is Associated With More Mature Neonatal Sleep-State Patterning. *American Journal of Clinical Nutrition*, 2002, 76;3;608-613.
12. Richardson, A. J., & Puri, B. K.. A Randomized Double-Blind, Placebo-Controlled Study of the Effects of Supplementation With Highly Unsaturated Fatty Acids on Adhd-Related Symptoms in Children With Specific Learning Difficulties. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 2002 ,26;2;233-239.
- 13 Peet, M., et al, Two Double-Blind Placebo-Controlled Pilot Studies of Eicosapentaenoic Acid in the Treatment of Schizophrenia. *Schizophrenia Research*, 2001, 49;3: 243-251.
- 14 Hibbeln,J.R. Fish Consumption and Major Depression. *Lancet* 1998, 351; 1213.
- 15 Stoll AL et al., Omega 3 fatty acids in bipolar disorder - A preliminary double-blind, placebo-controlled trial. *Archives of General Psychiatry*,1999,56;5:407-412.
- 16 Hamazaki,T., et al., The effect of docosahexaenoic acid on aggression in young adults: a placebo controlled double blind study.*J.Clin.Invest*. 1996,97;4:1129-33.
- 17 Barberger-Gateau,P., Letenneur, L., Deschamps V., et al. Fish, meat, and the risk of dementia: a cohort study. *British Medical Journal*, 2002,325;932-933.
- 18 Tiemeier, H., Van Tuijl, H. R., Hofman, A., et al. Plasma Fatty Acid Composition and Depression Are Associated in the Elderly: the Rotterdam Study. *American Journal of Clinical Nutrition*, 2003, 78;1;40-46.
- 19 Volker D et al. Dietary N-3 fatty acid supplementation in rheumatoid arthritis - Mechanisms, clinical outcomes, controversies, and future directions. *Journal of Clinical Biochemistry and Nutrition*,1996, 20;2: 83-97.
- 20 Lau, C. S. ,. Morley,K,D., & Belch,J,J., Effects of Fish Oil Supplementation on Non-steroidal Anti-Inflammatory Drug Requirements in Patients with Mild Rheumatoid Arthritis- A Double Blind Placebo Controlled Study.*British Journal of Rheumatology*,1993,32;982-989.
- 21 Curtis CL et al., n-3 fatty acids specifically modulate catabolic factors involved in articular cartilage degradation. *Journal of Biological Chemistry*,2000, 275;2:721-724.
- 22 Mayser P et al. Omega-3 Fatty acid-based lipid infusion in patients with chronic plaque psoriasis: Results of a double-blind, randomized, placebo-controlled, multicenter trial. *Journal of the American Academy of Dermatology*,1998,38;4:539-547.
- 23 Belluzzi A et al. Polyunsaturated fatty acids and inflammatory bowel disease. *American Journal of Clinical Nutrition*,2000,71;1:339S-342S.

- 24 Donadio JV. Use of fish oil to treat patients with immunoglobulin A nephropathy. *American Journal of Clinical Nutrition*,2000,71;1:373S- 375S.
- 25 Maillard, V., Bougnoux, P., Ferrari, P.et al. N-3 and N-6 Fatty Acids in Breast Adipose Tissue and Relative Risk of Breast Cancer in a Case-Control Study in Tours, France. *International Journal of Cancer*, 2002 ,98;1: 78-83.
- 26 Terry, P., Wolk, A., Vainio, H., & Weiderpass, E., Fatty Fish Consumption Lowers the Risk of Endometrial Cancer: a Nationwide Case-Control Study in Sweden. *Cancer Epidemiology Biomarkers & Prevention*, 11;1;143-145.
- 27 Bougnoux,P.,et al. Cytotoxic drug efficacy correlates with adipose tissue docosahexaenoic acid level in locally advanced breast carcinoma. *Brit.J. Cancer*,1999, 79;11-12: 1765-69.
- 28 Tisdale,M. Metabolic Abnormalities in Cachexia and Anorexia. *Nutrition* 2000;16:1013-1014.
- 29 Meyer, B. J., Mann, N. J., Lewis, J., et al. Dietary Intakes and Food Sources of Omega-6 and Omega-3 Polyunsaturated Fatty Acids, *Lipids*, 2003 ,38;4:391-398.

FREQUENTLY ASKED QUESTIONS

Are all seafoods equal when it comes to supplying omega-3?

All fish and seafoods contain the long chain omega-3 polyunsaturates. They do differ in the amounts supplied per serving. Generally, fish with non-white flesh, such as herring, mackerel, sardines, and pilchards, supply more than fish with white flesh. A 100g serving of herring for example would provide 1000-2000 mg of long chain omega-3. Sardines and mackerel provide slightly more, while tuna provides somewhat less. White fish such as cod or haddock provide about 200-300 mg per 100g serving. Prawns, lobster or oysters provide similar amounts (100-200mg per 100g).

Are there any non-seafood sources of omega-3?

It is true that certain vegetable oils such as rapeseed, walnut and soybean do contain omega-3 polyunsaturates. However, the omega-3 versions present in these oils are short chain versions, with only 18 carbon atoms in each molecule. The omega-3's from fish are long chain forms, with 20 or 22 carbons. To be useful to the human body, these polyunsaturates must be in the long chain form. The human body can in theory convert the 18 carbon forms into 20 and 22 carbon forms, but in practice, modern diets and lifestyles mean that this process is inefficient at best, and non-existent at worst. The relative effectiveness of the 18 carbon omega-3's is about 1/10th of that of the long chain forms, which means that 10 times as much must be consumed to have the same benefit. Thus to provide the equivalent of 1g of omega-3 from fish oil (with a 30% omega-3 content), you must consume 100g of rapeseed or soya oil (which has an omega-3 content of around 10%).

I have heard the omega-3 are fatty acids? Is this true?

The omega-3 polyunsaturates are a family of polyunsaturated fatty acids. Fatty acids are the building blocks from which edible oils and fats are made up. The polyunsaturates are characterised by the presence of certain structural features which mark them out as being different from other fatty acids. The polyunsaturates are essential nutrients for humans and animals. There are two important families of polyunsaturates, the omega-3 family, and the omega-6 family. The omega-6 family is found mainly in vegetable oils such as sunflowerseed, sesame, corn, soy etc.

What is N-3?

Biochemists and nutritionists use different conventions for describing the position of different atoms within a fatty acid chain. Biochemists use the "n" or "N" convention, while nutritionists use the "w" or "omega" convention. In practice, though confusing to a lay person, there is no difference. Thus n-3 is the same as w-3, w-3 is the same as omega-3, omega-3 is the same as N-3, N-3 is the same as omega-three.