

## Essential Fatty Acids – Dr. S. V. Padgaonkar

In contrast to the food supply available to man throughout most of history, the typical modern Western diet contains a large amount of fat. Fats are found in both plant and animal foods and there are several different types.

**Saturated fats:** These are found in animal foods such as meat, butter and cheese, and plant foods such as coconut oil and palm oil. Trans fats are unsaturated fats, which have undergone a chemical process called hydrogenation to turn them into saturated fats. They are found in packaged foods such as pastries, cookies, crackers and baked goods. High intakes of saturated fats are associated with an increased risk of many diseases. As little dietary fat as possible should come from these fats, with a maximum of 10%.

**Monounsaturated fats:** These include those found in canola, olive and peanut oils, and may also help to lower cholesterol and decrease platelet aggregation. They are also less susceptible to oxidation.

**Polyunsaturated fats:** These are found in oils of plant origin such as safflower, sesame, sunflower and corn, and may help to lower cholesterol and decrease platelet aggregation, thus reducing the risk of heart disease. However, polyunsaturated oils are susceptible to oxidative damage and may also lower beneficial HDL cholesterol levels. A high intake of polyunsaturated fats has been linked to an increased risk of cancer. Experts recommend that no more than 10% of dietary fat should come from polyunsaturated fats.

**Omega-3 and omega-6 fatty acids:** Linoleic acid is an omega-6 fatty acid and alpha linolenic acid is an omega-3 fatty acid. These terms refer to characteristics in the chemical structure of the fatty acids. Other omega-3 fatty acids are produced in the body using alpha linolenic acid as a starting point. These include eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Other omega-6 fatty acids can be produced in the body using linoleic acid as a starting point. These include gamma-linoleic acid (GLA), dihomo-gamma-linoleic acid (DHGLA) and arachidonic acid.

### Functions of Essential Fatty Acids

Essential fatty acids are involved in energy production, the transfer of oxygen from the air to the bloodstream, and the manufacture of haemoglobin. They are also involved in growth, cell division and nerve function. Essential fatty acids are found in high concentrations in the brain and are essential for normal nerve impulse transmission and brain function.

**Cell membranes:** Essential fatty acids are components of cell membranes. They are essential for many body functions, including oxygen use and energy production, control of the substances passing in and out of cells, cell to cell communication, and regulation by hormones. Cell membranes are partly made up of phospholipids, which contain fatty acids. The type of fatty acids in the diet will determine what type of fatty acids go to make up cell membranes. A phospholipid made from a saturated fat has different structure and is less fluid than one which incorporates an essential fatty acid. This loss of fluidity makes it difficult for the cell to carry out its normal functions, and increases the cell's susceptibility to injury and death. The relative amounts of omega-3 fatty acids and omega-6 fatty acids in cell membranes also affect their function.

**Prostaglandins:** Essential fatty acids are also involved in the manufacture of prostaglandins, substances which play a role in a number of body functions, including hormone synthesis, immune function, regulation of the response to pain and inflammation, blood vessel constriction, and other heart and lung functions.

There are various types of prostaglandins and these have different effects. Prostaglandins are divided into three main types; those of the 1 and 3 series are usually considered to have beneficial effects while those of the 2 series are usually considered to have harmful effects. EPA, the omega-3 fatty acid that is formed from alpha linolenic acid, is the precursor of the series 3 prostaglandins. Series 1 and 2 prostaglandins are formed from omega-6 fatty acid, linoleic acid. It can be converted to DHGLA, the precursor of the series 1 prostaglandins and to arachidonic acid, which is the precursor of the series 2 prostaglandins. The types of oils in the diet, including the balance of omega-6 to omega-3 oils, plays a role in determining whether DHGLA is converted to favourable series 1 prostaglandins or to harmful series 2 prostaglandins.

Series 1 and 3 prostaglandins act to dilate blood vessels, reduce clotting, lower harmful LDL cholesterol levels, raise beneficial HDL cholesterol levels and have anti-inflammatory actions. Series 2 prostaglandins have the opposite actions. The balance of prostaglandins in the body is affected by diet and can determine whether a person is at increased risk of disease.

**Deficiency:** Symptoms of essential fatty acid deficiency may include fatigue, dry skin, immune weakness, gastrointestinal disorders, heart and circulatory problems, growth retardation, mental problems and sterility. It is likely that a lack of dietary essential fatty acids plays an important role in the development of many common diseases.

Modern food production processes have had a large impact on the types of fat in foods. People now eat smaller amounts of essential fatty acids and more refined and unnatural fats and oils, such as trans fatty acids. The commercial refinement of fats and oils has led to a lower availability of essential fatty acids in the diet, and also transforms essential fatty acids into toxic compounds. Refined fats may also prevent the body from using the essential fatty acids that do remain in the diet.

**Cardiovascular disease:** There are many population studies demonstrating that people who consume omega-3 fatty acid-rich diets have a reduced risk of heart disease. This was first noticed in countries such as Greenland and Japan where fish consumption is particularly high. Studies in other countries have found similar effects. The evidence suggests that eating fish once a week will help prevent coronary heart disease and people with cardiac disease may benefit from eating two fish-containing meals per week.

In a study reported in the New England Journal of Medicine, researchers in Holland investigated the relationship between fish consumption and coronary heart disease in a group of men in town of Zutphen. Information about the fish consumption of 852 middle-aged men without coronary

heart disease was collected in 1960. During 20 years of follow-up, 78 men died from coronary heart disease. The results showed that compared to those who did not eat fish, death from coronary heart disease was more than 50% lower in those who ate at least 30g of fish per day. These include the Health Professionals Follow-Up Study.

In a study reported in 1989, researchers examined the effects of dietary changes in the prevention of further heart attacks in 2033 men who had recovered from one attack. Some of the men were given various pieces of dietary advice, one of which was to increase the consumption of fatty fish to around two to three portions per week. Those advised to do this had a 29% reduction in death from all causes and a 33% reduction in death from heart attack compared with those who were not advised to eat fish. These beneficial effects may be due to the anti-arrhythmic effects of omega-3 fatty acids.

Results from the Western Electric Study showed a reduced risk of coronary heart disease mortality and non-sudden cardiac death but not a reduced risk of sudden cardiac death with increasing fish consumption. This study involved around 2000 middle-aged men followed up for around 30 years. The results of this study differ from those obtained from the US Physicians' Health Study published in 1998 in which researchers investigated the links between fish consumption and the risk of sudden death from heart attack in 20,551 US male physicians aged from 40 to 84. The follow-up period was 11 years, and in that time there were 133 sudden deaths. The results showed that men who ate fish at least once per week had around half the risk of sudden cardiac death when compared with men who consumed fish less than once a month. Neither dietary fish consumption nor omega-3 fatty acid intake was associated with a reduced risk of total heart attack, non-sudden cardiac death, or total cardiovascular mortality. However, fish consumption was associated with a significantly reduced risk of death from all causes. The difference in sudden death definition may explain the different results obtained in the two studies. In this study, the association between fish consumption and sudden cardiac death was stronger than that between omega-3 fatty acid intake and sudden cardiac death. It is therefore possible that other substances present in fish may be exerting protective effects.

However, in a 1995 study, researchers at the University of Washington examined the links between risk of heart attack and the consumption of fatty acids from seafood, and assessed both directly and indirectly through examination of blood samples. The study involved 334 patients with primary cardiac arrest and 493 population-based control cases, matched for age and sex. The results showed that an intake of 5.5g of omega-3 fatty acids (equivalent to one fish-containing meal a week) reduced the risk of heart attack by 50%. Their results also showed a correlation between higher red blood cell levels of omega-3 fatty acids and reduction in risk of heart attack. Those with the highest levels had a 70% reduction in risk compared to those with the lowest levels.

Research done in Finland suggests that a high intake of fish and omega-3 fatty acids is associated with an increased risk of coronary death. In one study, a high intake of local lean fish was associated with a high intake of mercury which may outweigh the benefits of an increase in omega-3 fatty acid intake. High intakes of omega-3 fatty acids are also associated with a lower risk of strokes.

**Cancer:** The results from some, but not all, epidemiological studies indicate that the level of dietary fat intake and the types of fatty acids consumed influence cancer risk and disease progression. High intakes of omega-6 fatty acids seem to increase the risk of cancers while high intakes of omega-3 fatty acids may provide protection. The fatty acid composition of fat tissue reflects the dietary consumption of essential fatty acids over a period of years. These observations are supported by results from animal studies, which demonstrate that polyunsaturated omega-6 fatty acids stimulate carcinogenesis and tumor growth and metastasis, whereas long-chain omega-3 fatty acids have inhibitory effects. Reducing total fat intake and increasing the ration of omega-3 to omega-6 fatty acids in the diet may be particularly useful for groups at a relatively high risk of cancer, and may also be useful after surgery to help prevent disease recurrence.

**Prostate cancer:** Dietary intake of essential fatty acids may play a role in prostate cancer cell proliferation. Epidemiological studies have demonstrated that men whose dietary intake is high in omega-6 fatty acids have a higher incidence of clinical prostate cancer. Diets high in omega-3 fatty acids may have a protective effects.

**Breast cancer:** In a 1994 study done in France, researchers assessed the links between the levels of various fatty acids in breast fat tissue, and the spread of tumours in 121 patients with cancer. The results showed that a low level of alpha linolenic acid was linked to tumour invasion of other tissues.

Other research suggests that omega-3 fatty acids inhibit breast cancer and that the degree of this inhibition depends on background levels of omega-6 fatty acids. Results from the European Community Multicentre Study on Antioxidants, Myocardial Infarction, and Cancer (EURAMIC) study published in 1998, suggest that an increase in the ratio of omega-3 fatty acids to total omega-6 fatty acids in fat tissue decreases the risk of breast cancer. In this study, total levels of omega-3 or omega-6 fat were not consistently associated with breast cancer.

**Colon cancer:** Population and laboratory studies suggest that omega-3 fatty acids may help to prevent and inhibit colon cancer. In a study published in 1995, death rates for colorectal cancer in 24 European countries were correlated with current fish and fish oil consumption and with consumption 10 and 23 years previously. In men, there was a reduced risk of death from colorectal cancer and current intake of fish, a weaker link with fish consumption ten years earlier, and none with consumption 23 years earlier. The researchers concluded that fish consumption is associated with protection against the later stages of colorectal cancer, but not with the early initiation stages.

**Rheumatoid arthritis:** A low intake of omega-3 fatty acids may contribute to the development of rheumatoid arthritis. Omega-3 fatty acids have an anti-inflammatory action, most likely due to effects on prostaglandin metabolism. In a population-based case-control study published in 1996, researchers compared diets in 324 women with rheumatoid arthritis and 1245 women with no disease. The results showed that consumption of broiled or baked fish, but not of other types of fish, was associated with decreased risk of rheumatoid arthritis. Women who ate between one and two servings per week had a 22% lower risk compared with those who ate fish less than once a week. Women who ate fish more than twice a week had a 43% reduced risk.

**Asthma:** A low dietary intake of omega-3 fatty acids may contribute to or worsen asthma symptoms, most likely due to increased inflammation. The ratio of omega-3 to omega-6 fatty acids has been shown to be low in asthma sufferers. Supplements may be useful in relieving symptoms in some asthmatics, although not all studies have shown beneficial effects.

**Depression:** Recent research suggests that omega-3 fatty acid deficiency may also be linked to depression and aggression. In a 1998 UK study, researchers assessed the omega-3 fatty acid levels in the diet and in red blood cell membranes of ten depressed patients and compared these with non-depressed patients. The results showed that the severity of depression was linked to red blood cell membrane levels and to dietary intake of omega-3 fatty acids.

**Pre-eclampsia:** Omega-3 fatty acid deficiency may be linked to pre-eclampsia. In a 1995 study, women with the lower levels of omega-3 fatty acids were seven times more likely to have had their pregnancies complicated by pre-eclampsia compared with those women with the highest levels of omega-3 fatty acids. An increase in the ratio of omega-3 to omega-6 fatty acids was associated with a reduction in risk of pre-eclampsia.

**Other symptoms:** Deficiency may also be linked to attention deficit hyperactivity disorder, anorexia nervosa, premenstrual syndrome, skin disorders, inflammatory bowel disease, multiple sclerosis and immune disorders.

### Daily intake

The amount of essential fatty acids needed depends on a person's levels of activity and stress, nutritional state and body weight. Three to 6g (one teaspoon) per day of linoleic acid prevents signs of deficiency in most healthy adults, while an optimal amount may be 9 to 18g per day. Two to 9g (one of two teaspoons) of alpha linolenic acid may be a good daily dose. Some omega-3 and omega-6 fatty acids such as EPA and arachidonic acid can be obtained ready made from food rather than being made from linoleic and alpha linolenic acid.

The ratio of omega-3 oils to omega-6 oils may also be important in the development of disease. The omega-6 to omega-3 ratio in healthy populations consuming traditional diets ranges from 5.2 to 1.6. Modern diets have decreased the consumption of omega-3 oils and the omega-6 to omega-3 ratio is currently around 20:1. Consuming an oil such as flaxseed oil, which has a high omega-3 to omega-6 ratio, can correct a deficiency, but long-term exclusive use may lead to an omega-6 deficiency.

Recent evidence from a number of studies suggests that as little as two to three 3-ounce servings per week of EPA-rich fish may have beneficial effects in preventing disorders such as heart disease and arthritis. The benefits are more pronounced when the diet is low in fat.

### Sources

Omega-3 fatty acids such as EPA are found in cold water fish. Mackerel, herring, halibut and salmon contain the most, with lesser amounts in tuna and shrimp.

Flaxseed oil is a good source of essential fatty acids and is particularly high in omega-3 oils. It is difficult for the digestive system to break down raw flaxseeds sufficiently to obtain enough essential fatty acids, so using flaxseed oil or grinding the seeds is preferable. As essential fatty acids deteriorate quickly, flaxseeds are best kept in refrigerator and ground when you need them.

Linoleic acid is found in safflower, sunflower and corn oils. Evening primrose oil, blackcurrant and borage oils contain varying amounts of the omega-6 fatty acid, gamma-linolenic acid (GLA). As GLA is the precursor of beneficial series 1 prostaglandins, supplements are quite popular. However, some studies show that long-term use of these supplements increases arachidonic acid levels and decrease EPA levels which may increase the risk of heart disease and cancer.

### Supplements

There are many types of essential fatty acid supplements available, including flaxseed oil, fish oils, evening primrose oil, blackcurrant oil, and borage oil. These are available in capsule and free oil forms. Some experts advise avoiding fish oil supplements because they may have toxic contaminants. Fish oil supplements should not be taken during pregnancy due to the damaging effects of high doses of vitamin A.

All essential fatty acids deteriorate rapidly when exposed to light, heat, air and metals. It is important to be aware of the processing and storage methods used when buying supplements. Oils should be organic, unrefined, extracted at temperatures below 98 degrees F, and stored in light-resistant plastic containers.

The long-term effects of large doses of essential fatty acids are unclear. They may include an increased risk of stroke, nosebleeds and prolonged blood clotting time.

### Therapeutic uses of supplements

Manipulating cell membrane structure and prostaglandin metabolism through dietary fats can be used to prevent or treat cardiovascular disease, cancer, inflammatory conditions such as arthritis, allergies and several other disorders. It may take several weeks to see changes after adding essential fatty acids to the diet.

**Cardiovascular disease:** Omega-3 fatty acid supplements have been used to treat and prevent various types of cardiovascular disease. Supplements have been shown to have beneficial effects on cholesterol and triglyceride levels. In a 1994 study, researchers assessed the effects of fish oil supplements on 350 men and women aged from 30 to 54 years who were enrolled in a hypertension prevention trial. Once a day for 6

months, the participants received either a placebo or 6g of purified fish oil, which supplied 3g of omega-3 fatty acids. The results showed that the fish oil increased HDL-cholesterol levels significantly. The effect was more marked in the women.

Supplements have also been shown to affect blood clotting through effects on platelets, and to lead to a reduction in production of prostaglandins and other substances that damage artery walls. Other studies have shown that omega-3 fatty acids reduce the build-up of white blood cells in atherosclerotic plaque. A 1997 Australian study showed that flaxseed oil improved the elasticity of artery walls. This tends to decrease with increasing cardiovascular risk and has also been shown to improve with increasing intake of omega-3 fatty acids from fish.

**High blood pressure:** Dietary omega-3 fatty acids supplementation has been shown to be effective in treating mild high blood pressure. In a 1996 study of 78 patients with untreated mild hypertension. Norwegian researchers found that overall blood pressure was reduced by about six points in people who took fish oil supplements, compared with those who took a corn oil placebo. In some cases it may also be an effective addition to drug treatment. In a 1996 study, 21 men whose blood pressure was not successfully controlled with anti-hypertensive medication were randomised to receive either fish oil (4.5g omega-3 fatty acids per day) or a placebo. Blood pressure readings were taken at the start of the study and at four and eight weeks. Both systolic and diastolic blood pressures were significantly reduced in the fish oil group at both week four and at week eight. Supplements have also been useful in preventing high blood pressure in heart transplant patients. However, not all studies have shown beneficial effects.

**Cancer:** Omega-3 fatty acids seem to exert tumour-suppressive effects. A low fat diet that includes omega-3 fatty acid supplements may help to lower the risk of cancer and may also help to prevent the recurrence of tumour in those who have had cancer. In a study published in 1997, Norwegian researchers studied the relationship between incidence of lung cancer and intake of dietary fats, high-fat foods, fish, and fish products in 25,956 men and 25 496 women aged from 16 to 56. During the follow-up period, 153 cases of lung cancer were identified. The results showed that those who took cod liver oil supplements had around half the risk of those who did not.

Essential fatty acids may also boost immune function. Studies on the immune T cells in cancer patients taking fish oil capsules suggest that omega-3 fatty acids bring about beneficial changes. In a Greek study published in 1998, researchers investigated the effect of dietary omega-3 fatty acids and vitamin E on the immune status and survival in both well-nourished and malnourished cancer patients. The study involved 60 patients with solid tumours who were randomised to receive dietary supplementation with either fish oil (18g of omega-3 fatty acids) or placebo daily. The authors measured various indicators of immune function. The results showed that omega-3 fatty acids had a significant immune-enhancing effect and seemed to prolong the survival of malnourished patients.

GLA has been shown to be effective in killing cancer cells and is well-established as a topical treatment for some types of cancer, including bladder cancer. It has also been shown to kill various other types of cancer cells.

In a 1994 study, 32 breast cancer patients aged 32 to 81 years and classified 'high risk' due to the spread of their tumours to the lymph nodes in their armpits, were studied for 18 months following an Adjuvant Nutritional Intervention in Cancer (ANICA) protocol. This nutritional protocol was added to the surgical and therapeutic treatment of breast cancer and involved treatment with a combination of nutritional antioxidants, (vitamin C 2850mg, vitamin E 2500 IU, beta carotene 32.5 IU, selenium 387 mcg plus secondary vitamins and minerals) essential fatty acids (1.2g gamma-linolenic acid and 3.5g of omega-3 fatty acids) and 90 mg of coenzyme Q10 per day.

The researchers measured various biochemical markers of cancer progression, tumour spread and the clinical condition of the patients. Quality of life and survival were also assessed during the trial. The main observations were that none of the patients died during the study period (The expected number was four); none of the patients showed signs of further distant metastases; quality of life was improved (no weight loss, reduced use of pain killers); six patients showed apparent partial remission.

**Arthritis:** Fish oils from dietary sources or capsules have been shown to reduce the pain, swelling and stiffness of arthritis. This may be due to the effects on the immune response and on prostaglandins, cytokines and leukotrienes that mediate the inflammatory processes involved in rheumatoid arthritis. Arthritis sufferers may have reduced medication needs if they take omega-3 fatty acids.

In a 1994 study, Belgian researchers enrolled 90 patients in a 12-month, double-blind, randomised trial comparing daily supplementation with either 2.6g of omega-3 fatty acids, or 1.3g of omega-3 fatty acids plus 3g of olive oil, or 6g of olive oil. The researchers found significant improvement in both the patients' evaluation and in the physician's assessment of pain in those taking 2.6g per day of omega-3 fatty acids. The number of patients who were able to reduce their anti-rheumatic medications was significantly greater in the group taking 2.6g of omega-3 fatty acids.

Research also suggests that GLA-containing essential fatty acids obtained from evening primrose, blackcurrant and borage seed oils are effective in treating rheumatoid arthritis.

In a 1996 double-blind study done at the University of Massachusetts Medical Centre, researchers investigating the clinical efficacy and adverse effects of 2.8g per day of GLA in the treatment of 56 patients with active rheumatoid arthritis. This was followed by a six-month, single-blind trial during which all patients received GLA. Treatment with GLA for six months resulted in statistically significant and clinically relevant reductions in the signs and symptoms of disease activity. During the second six months, both groups exhibited improvement in disease activity. In the group who had continuously received GLA, 16 of 21 patients showed meaningful improvement at 12 months compared with study entry.

In another randomised, double-blind, placebo-controlled study, US researchers investigated the effects of blackcurrant seed oil on arthritis patients over a period of 24 weeks. Treatment with the supplement resulted in reduction in signs and symptoms of disease activity in patients with RA. In contrast, patients given a placebo showed no change in disease. However, results of studies using GLA have been mixed and this may be due to the ability of GLA to raise tissue levels of arachidonic acid while reducing the level of omega-3 fatty acids. Omega-3 fatty acids from fish oil or flaxseed oil may be more beneficial.

**Pregnancy and breastfeeding:** The omega-3 fatty acid, DHA, is the major structural and functional essential fatty acid in the central nervous system. It is essential for normal development of eye function and vision in the growing foetus. In premature babies, the levels of DHA are positively related to head circumference, birth weight and birth length. These results suggest that increasing omega-3 fatty acids during pregnancy may be beneficial to both mother and child.

**Skin disorders:** Essential fatty acids have been shown to have beneficial effects in the treatment of skin disorders. This is likely to be due to effects on prostaglandin metabolism. In a 1997 Italian study, researchers treated 30 eczema patients with GLA (274mg twice a day) and 30 with placebo for 12 weeks. During this time, the patients assessed their own symptoms and they were also assessed by a dermatologist every four weeks. The patients who received GLA showed gradual improvements in itching, redness, vesicle formation and oozing, which were statistically significant compared with the control group. Borage seed oil capsules have also shown beneficial effects in the treatment of atopic dermatitis, as have evening primrose oil capsules.

Essential fatty acid supplements may be beneficial in psoriasis sufferers. Analysis of blood and fat tissue has shown that the amount of anti-inflammatory alpha linolenic acid decreases, while the level of arachidonic acid, which has inflammatory effects, increases. These changes may be more pronounced in patients with severe psoriasis than in those with a mild form of the disease.

The results of a 1993 study suggest that eating oily fish may help reduce the symptoms of psoriasis. Some small studies suggest that fish oil supplementation may be beneficial in psoriasis. In a 1998 study, researchers from several European centres treated 83 patients with either an omega-3 fatty acid-based lipid emulsion or a placebo. There were significant improvements in symptoms, as assessed both by the patients and the researchers. Essential fatty acid supplements also help to reduce the toxicity of immune-suppressant and vitamin A-derivative drugs.

**Menstrual pain:** Omega-3 fatty acids have also been shown to relieve menstrual pain. In a 1996 study, researchers assessed the effects of fish oil supplements on girls aged from 15 to 18 who reported suffering from period pain. Twenty-one girls received fish oil supplements (1080 mg EPA, 720 mg DHA and 1.5 mg vitamin E) and the other 21 received a placebo. After two months, the groups switched treatments for another two months. The amount of painkillers that the girls took during each menstrual period was also compared over the four months. After two months of treatment with fish oil, there were marked reductions in symptoms and painkiller use. Placebo did not ease pain.

**Diabetes:** Diabetics are at increased risk of cardiovascular disease, so increased intakes of omega-3 oils may be beneficial in helping to reduce this risk. There were some concerns that omega-3 fatty acid supplements would worsen blood sugar control in diabetics but more recent studies suggest that this is not the case. In a 1997 Italian study, researchers evaluated the effect of omega-3 fatty acid supplements on 935 patients with high blood fat levels, both with and without glucose intolerance or diabetes. The results showed improvements in blood fat levels and no worsening of blood sugar control.

Diabetics seem to have a reduced ability of convert linoleic acid to GLA. This may lead to defective nerve function, as metabolites of GLA are known to be important in nerve membrane structure, blood flow, and impulse conduction. In a 1993 double-blind, placebo-controlled study, UK researchers compared the effects of placebo and GLA (480 mg per day) on the course of mild diabetic neuropathy in 111 patients over a one-year period. They used various nerve conduction, sensation and reflex tests, and the results of these showed that the change in response to GLA was more favourable than the change with placebo.

**Inflammatory bowel disease:** Omega-3 fatty acid supplements have been used to treat Crohn's disease. They may be useful in correcting abnormalities in fatty acid and prostaglandin metabolism and act to reduce inflammation. A 1996 Italian study published in the New England Journal of Medicine showed beneficial effects of fish oil in treating Crohn's disease. Researchers involved in the one year, double-blind, placebo-controlled study investigated the effects of an enteric fish oil preparation on the maintenance of remission in 78 patients with Crohn's disease who had a high risk of relapse. Every day, the patients received either nine fish oil capsules containing a total of 2.7g of omega-3 fatty acids or placebo. The proportion of patients in the treatment group who remained in remission after a year was 59 per cent, compared to only 26 per cent of patients in the placebo group. Enteric-coated capsules may be particularly useful as side effects such as unpleasant taste, bad breath and diarrhoea are minimised.

**Other uses:** Essential fatty acids are likely to be useful in the treatment of inflammation due to their effects on prostaglandin metabolism. This may be beneficial in acne, allergies and autoimmune diseases. Other disorders for which they might be beneficial include AIDS, Alzheimer's disease, breast pain, immune disorders and neurological problems.

GLA and alpha linolenic acid have been used to prevent migraine. Some research suggests that essential fatty acids may be beneficial in reducing the frequency and severity of attacks in multiple sclerosis sufferers. These effects may be related to the role played by essential fatty acids in the formation of myelin, the fatty sheath that coats the nerves.

**Interactions:** Magnesium, selenium, zinc, niacin, vitamins B6, A, C and E are necessary for the conversion of linoleic acid to other omega-6 fatty acids.

(References Available on Request)

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