

Results presented at the **SEAFOODplus Conference**

Further evidence of the health value of fish

A healthy diet maintains and promotes health; it increases performance and well-being. Fish plays a decisive role in a healthy diet because it contains high-quality protein with essential amino acids, minerals and vitamins. Fish oils are rich in Omega 3 fatty acids. At their third open conference in Tromsø, SEAFOODplus researchers presented new evidence of just how valuable the food fish is.

A 200-gram portion of fish covers about half of the daily requirements of animal protein. Sea fish is an important source of iodine. Fatty fish species contain a lot of vitamin A and D, lean fish species are particularly rich in B vitamins, and fish oil is rich in eicosapentaen acid. Such facts have long formed part of the basic knowledge of food research. Despite this, a lot of consumers in Europe still ignore the recommendation to eat fish more often and more regularly and instead often prefer to eat fast food and foods that are rich in fat and sugar. The consequences of an unhealthy, one-sided diet can be an increased risk of metabolism disorders, poor blood values and overweight, even obesity. In one of the SEAFOODplus projects, Inga Thorsdottir from the University of Iceland investigated what effects a diet that is rich in seafood has on young people's quality of life. The main question here was what influence fish proteins and fats have on the influenceable health status of overweight people. Do they have an effect on a person's body weight (weight management), and can they reduce metabolic syndrome risk factors?

A total of 320 volunteers from three countries (Iceland, Spain and Ireland) took part in the



Inga Thorsdottir (University of Iceland). Seafood as a part of weight-loss diets increases the effect of the diet in humans.

study. They were all young adults aged between 20 and 40 years, and they were all overweight or even obese with Body Mass Indices (BMI) of between 28 and 32. For the study they were divided randomly into four groups which each followed special weight-loss diets. They were all wholesome diets containing not only proteins but also carbohydrates and fat, and they all reduced calorie intake by about one third. The four groups were then given the following:

1. Control group: placebo capsules, neither fish nor fish oil
2. Lean fish group: 150 g lean fish (cod) three times per week, no fatty fish or fish oil
3. Fatty fish group: 150 g fatty fish (salmon) three times per week, no lean fish or fish oil



Edward Schram (Imares). African catfish can be enriched with selenium via the diet. Ten feeding days with selenium-enriched feed prior to harvest is sufficient.

4. Fish oil group: no fish, but one fish oil capsule every day

Already after four weeks, i.e. after half of the study's duration, participants in all four groups had lost a considerable amount of weight. Participants in group 4 (the group with the fish oil capsules) had lost an average of nearly 5 kg (4.96), the fatty fish group 4.5 kg, and the lean fish group 4.35 kg. The losers were those in the "fish-free" group: they only lost 3.55 kg. In the remaining four weeks of the experiment participants from all four groups lost approximately half of the weight they had lost during the first four weeks. The test winners from the fish oil group were thus able to reduce their weight by more than 7 kg whilst participants without fish lost only 5 kg. From this it can be concluded that a diet with a lot

of fish supports weight loss and makes weight reduction more efficient!

But that was by no means all of the benefits, for regular fish consumption led to further positive effects. Metabolic syndrome risk factors such as blood fat values, glucose and insulin improved measurably; the cholesterol content in the blood had fallen considerably after eight weeks, most strongly in the lean fish group whose cholesterol values at the end of the study had fallen by twice the value of the control group. The "antioxidative capacity" of the blood plasma also rose considerably as a result of fish consumption. Even if at this stage of the research some of the results require further confirmation it is already possible to see that a diet containing seafood reduces health problems and can increase well-being.

Fish consumption supports brain function

The results presented by Gerhard Hornstra* from Maastricht University at the SEAFOODplus Conference in Tromsø were similarly illuminating. He had investigated the influence of fatty acid status on the mental development of children and had found clear indications that essential PUFAs (polyunsaturated fatty acids), particularly the early DHA-status (docosahexaenoic acid), influence brain function and certain aspects of behaviour and cognitive ability. DHA is an important building block for the structure of the brain and influences (among other things) the function of the brain, neuromotor control, and vision. It is even presumed that regular fish consumption can prevent dementia in old people. If, on the other hand, a body lacks PUFAs, DHA, and other substances which fish, in particular, contains

in high quantities, this can lead to depressions, increased stress and aggressiveness, autism and even schizophrenia. In clinical tests the condition of depressive patients, for example, improved measurably if they were treated with fish fatty acids.

The human organism cannot produce PUFAs itself. In order to meet the body's requirements they have to be absorbed continuously in the diet. During pregnancy, the PUFA concentration in the blood of young mothers sinks continuously until the birth because the embryo's requirements for building the body structures have to be met, too. After the birth it takes several months for the mother's PUFA blood values to reach their initial level again. The starting point for Hornstra's study was the question as to whether an embryo's brain values are already "preprogrammed" in the body of the mother through her "PUFA level", and whether this might have an influence on later mental performance. It has, after all, been known for a long time that the concentration of long-chain PUFAs in a baby's blood can vary at birth. The results of the long-term study over seven years show that although the cognitive abilities of children do not correlate with the DHA status at birth, there still seem to be correlations with fine motor skills and with reaction speed to optical stimuli. The higher the DHA value was at birth the fewer problems children have later on. Here, too, it is possible to infer that pregnant women should eat more fish and that children should start eating fish as early as possible.

Catfish fillets enriched with selenium

Fish is naturally a valuable and healthy food, but beyond that the SEAFOODplus researchers are ea-

ger to find out how its health value can be increased further. It was not without reason that they chose the heading "tailor-made seafood products" for their integrated project. Edward Schram (Imares) and Joop Luten (Fiskeriforskning) took a major step in this direction by enriching the fillets of African catfish with healthy selenium. It is known that the feed fishes are fed on has a strong influence on the quality of the fish later on. A lot of what the feed contains is later found in the muscle, i.e. the fillet. So why not try to enrich the fish's

By enriching fish feed with, for example, selenium, scientists hope to be able to produce "natural functional foods"

flesh with health components via the feed, as a means of producing "natural functional food". To test this idea in practice the scientists chose the micro nutrient selenium. Selenium has an antioxidative effect within the body and is said to prevent cancer. Added to this is the fact that Europeans often have an inadequate selenium intake and that fish is one of the most important sources of selenium. Garlic is particularly rich in selenium.

The basic idea of the experiments was irresistibly easy: garlic was mixed into the feed given to the fish for a certain period and then the scientists examined the fish to see whether the selenium contained in the garlic was later found in its muscle flesh. There were, of course, other questions, too, to which the researchers were eager to find answers. How do fish react to garlic feed? What concentrations of the feed additive do the fish accept? How high does the selenium quantity in the feed have to be in order to be able to detect it later on in the flesh?

Already the first experiments were a great success. In each of four test groups which were given feed containing different selenium concentrations (2, 4, 6 and 8 mg/kg) selenium could later be detected in the fillet. The more selenium contained in the feed the higher the selenium content in the fish's flesh - a linear correlation. The aim of the researchers to enrich the fillet with about 0.5 to 0.6 mg selenium per kilogram was achieved straight away. At the same time the experiments showed that it is quite enough to add selenium to the

feed during the last ten days prior to harvesting, as a "finishing diet" so to speak, to upgrade the fish. Subsequent experiments will now be carried out to find out whether the selenium concentration in the fillet decreases again during storage, whether the technique is also suitable for other fish species, and whether consumers accept the flavour of the "garlic fish".

Risk-benefit analysis clearly in favour of fish

Whilst the researchers are calling for people to eat fish regularly, critics warn against too frequent consumption because this might lead to a higher intake of harmful substances. The discussion as to whether the benefit outweighs the risk or vice versa is often pursued grimly and makes consumers uncertain. Can fish consumption really be harmful and if it can, as from what quantity? This is a theoretical problem which is of great practical significance and Nynke de Jong* and Cathy Rompelberg* (RIVM) went to considerable effort to solve

it. They suggest a technique with which benefits and risks can be measured against each other - as in a mathematical equation. This makes it possible to determine exactly how big the health risk is for a particular quantity of a food consumed. The "Quantitative Risk-Benefit Analysis" also takes into account accompanying parameters which might influence the result, e.g. the age and health status of the person concerned, whether they pursue sports regularly, whether they smoke, or whether other risk factors are involved.

The example of folic acid makes the ambivalence of certain substances clear: its positive effects include that it prevents nerve damages and intestinal cancer. On the negative side, however, it can conceal a lack of vitamin B12. If one adds up the positive and negative effects against one another it can be seen that the benefits of folic acid are about one hundred times higher than the risks. In a similar way, de Jong and Rompelberg carried out provisional risk-benefit analyses for different foods from fruit and vegetables to cereal products. In the case of fish they had to consider the indisputable benefits against possible risks such as dioxin, PCBs or organic mercury. Even if a lot of their basic data are still based on assumptions, estimations and hypotheses (because in this respect the health statistics in the EU contain gaps), it was still very apparent that the benefits of fish consumption are quite astonishing. In order to reinforce the validity of such statements it would be important to improve and standardise the capture of basic data in the individual countries.

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* Gerhard Hornstra, Nynke de Jong, and Cathy Rompelberg were invited speakers at the conference. They are not partners in the SEAFOODplus consortium.*