WHAT – eating salmon may not be good for me?

We have been told for years that oily fish, such as salmon, contain the "right" kinds of fats: fats that are good for us. Why is this currently not true?

By Elinor Bartle, with researcher Jérôme Ruzzin 07.06.2013

The problem is that many environmental pollutants are stored in fats – including the "good" fat (oils) of salmon.

For several years now BIO researcher Jérôme Ruzzin has become increasingly intrigued and concerned with this issue. Ruzzin highlights an increasing number of new studies that are documenting a disturbing and highly unexpected trend: studies involving people regularly eating two or more servings of fish per week - especially "good" fatty fish - have been shown to develop an increasing risk for getting type 2 diabetes.

How can this be happening?

The downside of living in an industrialised society

Many environmental pollutants are fat-soluble. When fat-soluble compounds are ingested by organisms, including ourselves, they are stored in the fatty tissues and organs where they can remain for long periods of time (up to several years). Top predators, such as humans, polar bears, tuna and even salmon, ingest the compounds stored in the fats of all the organisms below them in the food chain. Thus fat-stored contaminants may be in low (and non-toxic) levels for organisms at lowest levels of the food chain, but these become increasingly concentrated as one moves up the chain.

Can environmental pollutants cause type 2 diabetes?

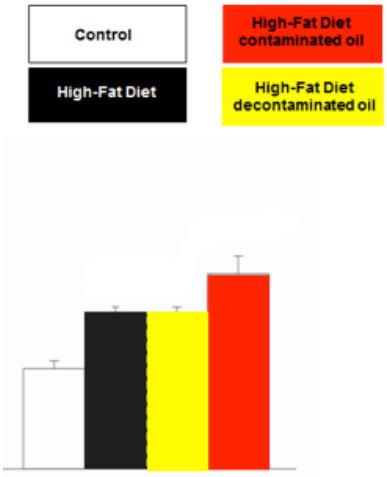
Because it is difficult to undertake experiments on environmental pollutants directly on humans, Ruzzin has had to study this question indirectly. Recently he undertook some studies in rats and mice that had dramatic results – contaminated oils from salmon are definitely implicated in increased obesity and incidence of type 2 diabetes in the research animals.

The following figures help to tell the story of the results of the different experiments Ruzzin has undertaken.

Figure 1 – Effect of different diets on obesity

In Figure 1 we see the results from rats given 4 different diets. The figure gives an indication of obesity by showing the amount of body fat deposited over the experimental period.

- The white group, the control group, were fed a "normal" diet.
- The black group, the high-fat group, received the normal diet, supplemented with high-fat content.
- The red group received the same diet as the black group, but the high-fat content was oil taken from salmon (and untreated).
- The yellow received the same diet as the black group, and the high-fat content was oil taken from salmon, but the salmon oil used for this group had been rinsed to remove any environmental pollutants that had been stored in the fish oil.



Results:
The figure shows, unsurprisingly that the white group, the control group, had the lowest fat deposition.
The remaining 3 groups (black, yellow, red) had the same amount of fat supplement, but the results show that the red group had a significantly higher deposition of body fat. It seems that the contaminants that were stored in the salmon oil actually caused the animals in the red group to deposit more fat, making them more obese.

Is the difference effecting obesity in a way that also has an effect on type 2 diabetes? Ruzzin tries to find answers to this question in a second experiment shown in Figure 2.

Figure 2 – Effect of contaminated / decontaminated salmon oil on insulin sensitivity

In Figure 2 we see the results of studies of insulin sensitivity undertaken on the animals in the previous study. Insulin sensitivity gives us important insights into an organism's metabolism because changes in insulin sensitivity can result in an organism developing diabetes symptoms and ultimately diabetes. It is also associated with an increased risk for several other diseases including cardiovascular disease (see Figure 4).

The results here are particularly interesting!

The white, control group again sets a kind of baseline for comparison. Animals of the black group – those "forced" to become obese because of their high-fat diet – show less insulin sensitivity, as expected.

What is interesting to see are the results for the red and yellow groups! The yellow, decontaminated oil group, actually had insulin sensitivity levels near "normal", even though, as we saw in Figure 1, these animals were overweight. Whereas, the results for the red, contaminated oil group, showed even lower insulin sensitivity than those of the black, overweight group.

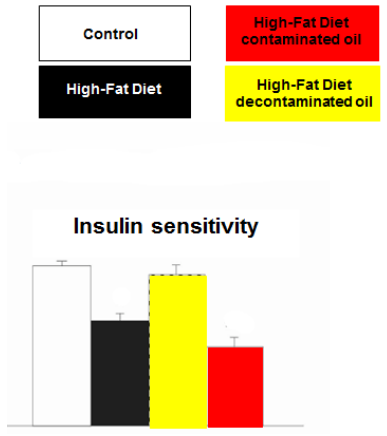
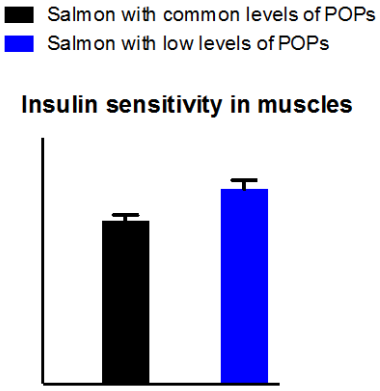


Figure 3 - Effect of eating "normal" salmon filet on insulin sensitivity

The studies discussed above used the oil extracted from salmon. Ruzzin decided to approximate the effects on humans even more closely by using whole salmon filets in his experimental diets. He then compared two groups of mice on two different diets.

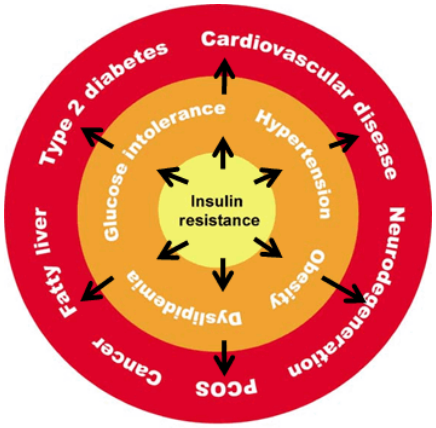
In the figure showing the results, the black group had a "normal" fish filet component, the same as we would have from the fish we can buy from the store. The blue group had the same amount of fish filet in their diet, but the fish had come from an aquaculture facility where the fish food had been modified so it contained 50% less persistent organic pollutants (POPs).



Animals from both groups developed type 2 diabetes symptoms, but those for the animals from the black group were much worse. As mentioned above, this black group ate the same fish that many of us do when we are trying to be healthy and eat oily fish at least once a week!

Figure 4 - From insulin resistance to type 2 diabetes!

Ruzzin uses an image from a study published a few years ago to show the disturbing progression of metabolic disease (Biddinger, Kahn 2006). It starts in the centre the idea of developing with decreased insulin sensitivity (insulin resistance), such as the rats in the first experiment above were experiencing. This is in yellow – a first warning. Progressing outwards in the next orange circle are the next level of metabolic disorders in terms of severity. Finally, the outside red circle includes the most serious metabolic disorders, including type 2 diabetes.



Ruzzin's interest in the eating salmon dichotomy coincides with the research concerns of Professor Anders Goksøyr, Department Head at BIO. For many years Goksøyr has been studying the effects of environmental pollutants.

Read more about their work in this translation of their recent article in "*Bergens Tidende"*, the most widely read paper in Western Norway. The article is entitled, "How environmental pollutants can threaten our health" (link to translation).