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Fish: How to Determine Risks and Benefits?

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Introduction

Fish and seafood consumption has been connected to several beneficial health effects, especially with the prevention of cancer, decreased risk of coronary heart disease and cardiovascular disease as well as decreased inflammatory diseases as arthritis [1]. Historically the main effects of fish consumption have been attributed to the high content of long chain omega 3 (n-3) polyunsaturated fatty acids (PUFA). On the other hand it gets more and more clear that also other nutrients from fish have positive effects on human health. Beside the n-3 PUFA, fish and other seafood are a significant source of a well-balanced amino acid composition, taurine and choline, the Vitamins D and B_{12} as well as calcium, phosphorus, iodine and selenium. Depending on the general nutrition of a population, fish and seafood also might provide significant proportions of Vitamin A, iron and zinc [1].

However, beside the positive effects on human health, heavy metals, dioxins, PCB's and other contaminants in fish have been discussed for a long time and resulted in the question whether consumption of fish is beneficial or not [2-10].

The amount and proportion of possible contaminants in fish depend on many factors as for example feed and the environment were the fish come from, but also species and fat content. Therefore in many countries, there have been market studies in order to evaluate the presence and level of contaminants in order to be able to give consumers recommendations [4,6,9,11,12]. In general the levels of the analyzed contaminants as for example heavy metals, PCBs and dioxins were below the restriction levels both in the US [12] and in EU [4,6,9,13,14]. and the authors concluded that there was no risk for human health from the evaluated species.

Nevertheless, it is very difficult to guess the content of contaminants in a specific fish or a fish product and in addition to evaluate the risks connected to its consumption for the consumer. Hence consumers still might be unsure whether fish consumption is beneficial or rather risky. Yet, considering that more and more fish is coming from aquaculture, subjected to strict control and monitoring, and also pond aquaculture is only executed in uncontaminated ponds and artificial feeds are controlled as well, consumption of this fish should be safe. There has been one well known scandal where accidentally contaminated material ended up in chicken feed (Belgian dioxin scandal). But to our knowledge something like this has never occurred with fish feed.

Beside this, in an evaluation of the data concerning the benefits and risks of fish consumption, the authors show that the benefits of the recommended two servings of fish a week clearly exceed the potential risks [12]. The authors remind also that other foods are not necessarily uncontaminated but certainly do not contain the valuable long chain n-3 PUFA. They recommend even women in childbearing age to eat fish but to avoid selected species of fish. They conclude: 'Avoidance of modest fish consumption due to confusion regarding risk and benefits could result in thousands of excess CHD death annually and suboptimal neurodevelopment in children [12]. Also the FAO published a report in 2011 on the risks and benefits of fish consumption in which the benefits of the nutrients especially the n-3 PUFA of fish are weighed against the

risk of fish consumption, due to their contamination with for example dioxins and MeHg [15]. The report as well recommended promoting fish consumption, but also to assess the health risks associated with fish consumption also focusing on additional and new information [15]. Sioen et al. [7] summarized the risk and benefits from fish consumption related to n-3 PUFA and MeHg and suggested a framework using a calculated ratio between DHA and mercury content to determine the risk and benefit of consumption for each species. Solutions like this might be a good way to evaluate the risks and benefits also for other contaminants and give the consumers a relatively easy possibility to decide how much and what type of fish to consume.

Considering the available information, the consumption of fish twice a week as recommended by FAO and other authorities can only be supported. If in doubt the consumers can always choose fish from aquaculture or herbivourus fish which have a lower bioaccumulation of possible contaminants due to their lower position in the feed chain. In addition, constant monitoring and sound publication of the contents of beneficial compounds as well as contaminants along with information about the reference dose (dose which can be consumed on a daily basis for a life time without expectation of adverse effects) or maximum allowed levels could help consumers to make sound choices.

As in many cases, proper communication is important along the whole production chain in order to assure safe products and make the consumers able to make sound choices for healthy food.

References

1. Lund EK (2013) Health benefits of seafood; Is it just the fatty acids? Food Chemistry 140: 413-420.

2. Gochfeld M, Burger J (2005) Good Fish/Bad Fish: A Composite Benefit–Risk by Dose Curve. NeuroToxicology 26: 511-520.

3. Hellberg RS, DeWitt CAM, Morrissey MT (2012) Risk-Benefit Analysis of Seafood Consumption: A Review. Comprehensive Reviews in Food Science and Food Safety 11: 490-517.

4. Miklavcic A, Stibilj V, Heath E, Polak T, Tratnik JS, et al. (2011) Mercury, selenium, PCBs and fatty acids in fresh and canned fish available on the Slovenian market. Food Chemistry 124: 711-720.

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5. Sioen I, Van Camp J, Verdonck FAM, Thuyne VN, Willems JL, et al. (2007) How to use secondary data on seafood contamination for probabilistic exposure assessment purposes? Main problems and potential solutions. Human and Ecological Risk Assessment 13: 632-657.

6. Szlinder-Richert J, Usydus Z, Malesa-Ciecwierz M, Polak-Juszczak L, Ruczynska W (2011) Marine and farmed fish on the Polish market: Comparison of the nutritive value and human exposure to PCDD/Fs and other contaminants. Chemosphere 85:1725-1733.

7. Mahaffey KR, Sunderland EM, Chan HM, Choi AL, Grandjean P, et al. (2011) Balancing the benefits of n-3 polyunsaturated fatty acids and the risks of methylmercury exposure from fish consumption. Nutrition Reviews 69: 493-508.

8. Hrádková P, Pulkrabová J, Kalachová K, Hloušková V, Tomaniová M, et al. (2012) Occurrence of halogenated contaminants in fish from selected river localities and ponds in the Czech Republic. Archives of Environmental Contamination and Toxicology 62: 85-96.

9. Karl H, Ruoff U, Bluthgen A (2002) Levels of dioxins in fish and fishery products on the German market. Chemosphere 49: 765-773.

10. Sioen I, De Henauw S, Van Camp J (2010) Nutrition-Toxicological Dilemma on Fish Consumption. Modern Dietary Fat Intakes in Disease Promotion. Springer-Verlag Berlin, Berlin.

11. Kilic D, Cakirogullari GC, Ucar Y, Theelen R, Traag W (2011) Comparison of PCDD/F and dl-PCB levels in Turkish foodstuffs: industrial versus rural, local versus supermarket products, and assessment of dietary intake. Food Additives and Contaminants Part a-Chemistry Analysis Control Exposure & Risk Assessment 28: 913-924.

12. Mozaffarian D, Rimm EB (2006) Fish intake, contaminants, and human health - Evaluating the risks and the benefits. Jama-Journal of the American Medical Association 296: 1885-1899

13. Kruzikova K, Randak T, Kensova R, Kroupova H, Leontovycova D, et al. (2008) Mercury and Methylmercury Concentrations in Muscle Tissue of Fish Caught in Major Rivers of the Czech Republic. Acta Veterinaria Brno 77: 637-643.

14. Has-Schön E, Bogut I, Rajković V, Bogut S, Čačić M, et al. (2008) Heavy Metal Distribution in Tissues of Six Fish Species Included in Human Diet, Inhabiting Freshwaters of the Nature Park "Hutovo Blato" (Bosnia and Herzegovina). Archives of Environmental Contamination and Toxicology 54: 75-83.

15. FAO, WHO (2011) Report of the joint FAO/WHO expert consultation on the risks and benefits of fish consumption. FAO Fisheries and Aquaculture report 978. Rome, Italy.