Risk Assessment of Parasites in Fishery Products

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Why are we focused on **FISHERY PRODUCTS?**

**EU fish production value chains ("Fish dependence")**

- EU fishing industry the fourth largest in the world (6.4 million tons/year; 13 million tons consumed)
- Processing industry 4000 companies (SMEs) and 350,000 people
- World-class fish consumer (22.3 kg; up to 40 kg) 25.5 kg person/year in Spain; 32 kg Galicia

**Benefits**

**EAT FISH about three times a week as a part of a HEALTHY diet:**

It has medicinal, grounding and strengthening properties:

- Filled with Omega-3 fatty acids
- Vitamins (D, B2)
- Rich in calcium, phosphorous, minerals
**Why are we focused on **PARASITES**?**

Emergent or Re-emergent risk in fishery products

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**The status quo? unsatisfactory**

- Many knowledge gaps
- Many gaps between discovery and market up-take!!

What are our EVIDENCES on **POTENTIAL RISKS**?

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**SCIENTIFIC OPINION**

**Scientific Opinion on risk assessment of parasites in fishery products**

EFSA Panel on Biological Hazards (BIOHAZ)

European Food Safety Authority (EFSA), Parma, Italy

**ABSTRACT**

Human fishery product-borne parasitic diseases are caused by cestodes, trematodes and nematodes and are caused by infection following ingestion of viable parasites, or as allergic (hypersensitivity) reactions against parasite antigens. For allergy, the only parasite in fishery products implicated is the nematode *Anisakis simplex*, and sensitisation occurs via infection by live larvae. Once sensitised, response to nematode allergens can be highly aggressive and generate severe disease. In a sensitised individual, infection can provoke a concurrent *A. simplex* allergic episode or can be elicited by exposure to allergen alone from killed parasite: the relative epidemiological impact for each is unknown. Allergy to *A. simplex* is relatively common in some regions in Spain but rarely reported in other parts of Europe. Prevention of sensitisation is most likely to be effective by control of *A. simplex* infection. There is more information on the resistance to physical and chemical treatments by *A. simplex* than for other fishery parasites, and the properties of other parasites are likely to be similar. Many traditional marinating and cold smoking methods are not sufficient to kill *A. simplex* and freezing or heat treatments remain the most effective processes guaranteeing killing. All wild caught seawater and freshwater fish must be considered at risk of containing any viable parasites of human health concern if these products are to be eaten raw or almost raw. For wild-catch fish, no sea fishing grounds can be considered free of *A. simplex*. For farmed Atlantic salmon reared in floating cages or onshore tanks and fed on compound feedstuffs however, the current risk of infection with *hniasuids* is negligible. Apart from farmed Atlantic salmon, sufficient monitoring data are not available for any other farmed fish therefore it is not possible to identify which fish species do not present a health hazard with respect to the presence of parasites.
I. Consumer AT RISK: Health impact

**ZOONOTIC DISEASE**

*Anisakiasis/Anisakidosis*

**Gastric, intestinal, gastro-allergic**

Severe gastrointestinal pain, fever, vomiting, diarrhoea, dispepsia, abdominal distensión, acute intestinal obstruction,...

**ALLERGY**

urticaria, rhinitis, conjunctivitis, asthma, angioedema, ANAPHYLACTIC shock

**OTHERS**

Colitis, rheumatological disease, oral mucosa disease, strangulated hernia, sepsis, cancer,…

**OCCUPATIONAL ALLERGY**

(fishmongers, fishermen, fishery and aquaculture workers, cooks)
II. Fish quality AT RISK: **Economic impact**

(EC) Reglament 178/2002: unfit for human consumption

**Welcome to the real life!**

**RASFF** (only Spain; 2015-2018): 6 official notifications

**AECOSAN** (PNCOCA; 2016): 1,028 official inspections (1.7%)

**SUPERMARKETS** (2016): 85,000 internal complaints
25% of consumers avoided purchasing/consuming fishery products due to the presence of *Anisakis* spp.

31% would always avoid, if there were a high chance of *Anisakis* ssp. in their fish, purchasing/consuming fishery products due to this parasite.
If consumer, product and market are at risk, What we can do?

the EC launched a SPECIFIC CALL (First Time!!) for a better managing of this EMERGENT HAZARD

THEME KBBE.2012.2.4-02

(Food safety and quality issues related to parasites in seafood)

Funding scheme: Collaborative Project targeted to SMEs (30%)

Key performance topics (needs on EFSA)

Surveillance and monitoring in Fish species/Fishing areas/Production systems
Diagnostic awareness of allergic reactions and epidemiological studies
Interventions in the food web to inactivate parasites
Management structure
PARASITE Consortium

- 21 partners (15 RTDs; 6 SMEs)
- 12 countries (9 EC + 3 Asiatic region)
- different background

- Fish providing countries
Risk Assessment

- WP2: Exposure Assessment
- WP4: Hazard identification
- WP5: Hazard characterization
- WP6: Improvement of detection methods
- WP7: Interventions in the food chain

Tools

- WP3: Sample and Data management
- WP1: Project Management

Monitoring

Targeted End Users

- WP9: Risk Communication

Knowledge transfer Foreground-dissemination

Traslational Research Models with a best-value for money approach
**DELIVERABLES (34: 50% PU):**

- Risk Assessment (56%): evidence-based (high quality results)
- Integrated Tools (20%) marketed aligned (technology push vs. market pull)
- Exploitation Plan (24%): IPR valorization instruments

**OTHER DISSEMINATION PRODUCTS**

- Catalogue of technological results
- Training workshops (diagnostic tools and operating strategies)
- Short-term stages (industry, administration staff)
- Work with media professionals (discussion panels)
- Specific events (e.g., 9 ISFP 2015; ComNet;…)
- WEBSITE...
1. We identified and characterised species and populations of zoonotic nematode parasites infecting fish lots from different EU areas.
2. We developed new genetic markers for genotyping *Anisakis* species.
3. We established genes and designed primers/probes to be used as “DNA barcodes”.
4. We gathered genetic variability data of parasites populations to be correlated to their infestation levels in order to establish scientific bases for molecular epidemiological studies of each parasite species and their populations in different geographical areas.
QRA model for raw/marinated (anchovies) in Spain: 8,000 cases/year
QRA model for undercooked (hake, cod): in preparation
1. Other anisakid apart from *Anisakis* spp. have zoonotic and allergenic capacity
2. *Anisakis* spp. allergens were found in aquaculture and canned products
3. IgE sensitization to *Anisakis* allergens maintains over time

**EMERGING:**
1. New countries with reported cases of anisakiasis (Croatia, Portugal)
2. UNDIAGNOSED, UNREPORTED: Allergy to *Anisakis* spp. has been reported to be the most important hidden food allergen in the adult population suffering acute urticaria and anaphylaxis (Añíbarro, Seoane, & Múgica, 2007; M. Teresa Audicana & Kennedy, 2008; Del Pozo et al., 1997).

**SUBCLINICAL SENSITIZATION (0.4-22% Spain): REAL CONCERN!!!!!!**

Thousands to millions of healthy individuals may have IgE sensitization to *Anisakis* spp. This finding suggests previous SUBCLINICAL or UNDIAGNOSED ANISAKIASIS
Improvement of detection methods for the industry

Improvement of the visual inspection scheme for detection by the UV press-method (spectral computing)

Implementation of molecular methodology based on **Real Time-PCR** to detect parasites and/or their traces in fishery products.

**Ring Trial** involving at least five experienced laboratories to evaluate reproducibility of the test/s and reliability of data produced by each laboratory

**Beta-testing** of validated detection methods at industrial level

**Fast shotgun proteomic approach**

**ANIMALS**

**DNA**

**PROTEINS**

ISO/NP 23036-1(E)
ISO TC 34/SC 9/WG 8

Microbiology of the food chain — Methods for the detection of Anisakidae L3 larvae in fish and fishery products — Part 1: UV-press method

NP stage
Interventions in the food web to inactivate parasites


Inactivation under novel freezing systems (PSF, CAS), and other treatments like high hydrostatic pressure, low voltage current, modified atmosphere packaging, electrolyzed-oxidizing water, radiofrequency, ultrasonic waves. Optimization of the conditions in terms of quality of the product will be evaluate by Vibrational spectroscopy (Fourier Transform (FT)-infrared and FT-Raman) and Low Field Nuclear Magnetic Resonance (LF-NMR).

Application of specific treatments to reduce or inactivate the allergenic capacity. Strategies to eliminate the allergens (e.g. selective precipitations) or reduce their activity (e.g. by crosslinking to other proteins present such as in industrial processes used to elaborate surimi gels). Efficiency of the selected treatments will be assessed by immunoblotting using sensitized-patient’s sera.
Dissemination, Tech transfer, Consulting (2015-18...)
What’s coming next in Risk Assessment of Fish Parasites?

new scientific challenges for Anisakids: RISK MATRIX

road-mapping the VISIBLE parasites of concern

“The dirty list” for PARASITES in seafood
Food safety and quality issues, and market perception
Last issue on RISK COMMUNICATION:

In Spain, a WORKING GROUP for managing the risk posed by parasites has been created, leaded by the Ministry. This group includes policy-makers, the National Authority, and the Fishing/Food sector (tech centers in subcontracting). Scientists have not been invited for advice in risk management.

Our questions for EFSA are:

- Who is responsible for risk communication in a member state?
- Is it desirable to communicate to consumers the risk assessment results before they have been managed?
- As scientists, if we accept the invitation send by mass media to participate in risk communication is it IMPERATIVE to agree the message with the Authority/Administration/Sector before being communicated?
Thank you!

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Annex

The PARASITE project focused mainly on anisakid nematodes. We have placed less emphasis on trematodes and cestodes because, although zoonotic flatworms infect freshwater fish in many parts of the world, consumption of freshwater fish in the EU is relatively low and localised.

The CRLP has reported that, in the EU, the only parasites transmitted to humans through consumption of freshwater fish are the trematode *Opisthorchis felineus* (responsible for around 180 infections due to consumption of marinated tench fillets, mainly in Italy, since 2003) and the cestode *Diphyllobothrium latum* (the etiological agent of about 80-90 infections per year in the EU due to the consumption of raw or undercooked fillets of several perch and salmon species, mainly in Estonia, Finland, France, Italy, Lithuania, Poland and Romania).