Epidemiology of *Opisthorchis felineus* in the European Union

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**World distribution and human prevalence of Opisthorchidae**

- Main zoonotic species:
  - *Opisthorchis felineus*
  - *Opisthorchis viverrini*
  - *Clonorchis sinensis*
- Global estimated prevalence (WHO, 1995):
  - 1.2 million with *O. felineus*
  - 9 million with *O. viverrini*
  - 7 million with *C. sinensis*

**Natural cycle of *Opisthorchis felineus***

- Definitive hosts: fish-eating mammals including humans
  - Adult hermaphrodite worms in the bile ducts
- First intermediate hosts: freshwater snails of the genus *Bithynia*
  - Larval stages of redia, sporocysts, and cercariae in the
- Second intermediate hosts: freshwater fish of the family Cyprinidae
  - Larval stage of metacercariae in the muscles

**Adult worms of *O. felineus* in vitro**
**Adult worm of *O. felineus* in vitro**

**Morphology of *O. felineus* larval stages**
- freshwater snails of the genus *Bithynia*
  - sporocysts
  - redia
  - cercariae
- freshwater fish of the family Cyprinidae (e.g. tench, *Tinca tinca*)
  - metacercariae

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**O. felineus in final and intermediate hosts of central Italy lakes**

<table>
<thead>
<tr>
<th>Snail (<em>Bithynia</em> sp.)</th>
<th>Trasimeno</th>
<th>Bolsena</th>
<th>Vico</th>
<th>Bracciano</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.3%</td>
<td>-</td>
<td>-</td>
<td>1.2%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trench (<em>Tinca tinca</em>)</th>
<th>43%</th>
<th>74%</th>
<th>28%</th>
<th>95%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cats</th>
<th>40%</th>
<th>36.6%</th>
<th>-</th>
<th>73.3%</th>
</tr>
</thead>
</table>

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**Metacercariae in fish of northern Italian lakes**

<table>
<thead>
<tr>
<th>Lake</th>
<th>Maggiore</th>
<th>Iseo</th>
<th>Garda</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Opisthorchis felineus</em></td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><em>Metorchis bilis</em></td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Echinostoma</em> sp.</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><em>Holostephanus dubinini</em></td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Diplostomum</em> sp.</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

*Zoonotic trematodes
**Non-zoonotic trematodes
## Detection of *O. felineus* in the EU before and after 1962*

<table>
<thead>
<tr>
<th>Country</th>
<th>Up to 1962</th>
<th>From 1962</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Animals</td>
<td>Humans</td>
</tr>
<tr>
<td>Austria</td>
<td>cat</td>
<td>not reported</td>
</tr>
<tr>
<td>France</td>
<td>cat, fox</td>
<td>not reported</td>
</tr>
<tr>
<td>Germany</td>
<td>cat, fox, fish</td>
<td>yes</td>
</tr>
<tr>
<td>Greece</td>
<td>cat</td>
<td>yes</td>
</tr>
<tr>
<td>Hungary</td>
<td>cat</td>
<td>not reported</td>
</tr>
<tr>
<td>Italy</td>
<td>cat, dog, rabbit</td>
<td>not reported</td>
</tr>
<tr>
<td>Lithuania</td>
<td>cat, fish, snail</td>
<td>yes</td>
</tr>
<tr>
<td>Netherlands</td>
<td>cat, dog, fish</td>
<td>not reported</td>
</tr>
<tr>
<td>Poland</td>
<td>cat, grey seal, fish</td>
<td>yes</td>
</tr>
<tr>
<td>Portugal</td>
<td>n.a.</td>
<td>not reported</td>
</tr>
<tr>
<td>Romania</td>
<td>cat, dog, pig, fish, snail</td>
<td>yes</td>
</tr>
<tr>
<td>Spain</td>
<td>fish</td>
<td>yes</td>
</tr>
</tbody>
</table>

*Erhardt et al. 1962

## Opistorchis felineus infections in humans of Italy - 1

<table>
<thead>
<tr>
<th>Year</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of fish consumption</td>
<td>restaurant</td>
<td>restaurant</td>
<td>private home</td>
<td>restaurant</td>
<td>private home</td>
</tr>
<tr>
<td>Fish species</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
</tr>
<tr>
<td>Fish origin</td>
<td>Trasimeno lake</td>
<td>Trasimeno lake</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
</tr>
<tr>
<td>No. infected persons</td>
<td>2</td>
<td>8</td>
<td>20</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>No. of hospitalized persons</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>symptomatic/asymptomatic</td>
<td>1/1</td>
<td>0/8</td>
<td>11/9</td>
<td>1/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Treatment</td>
<td>no</td>
<td>no</td>
<td>20</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

## Opistorchis felineus infections in humans of Italy - 2

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2011</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of fish consumption</td>
<td>catering</td>
<td>unknown</td>
<td>restaurant</td>
<td>unknown</td>
<td>restaurant</td>
</tr>
<tr>
<td>Fish species</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
</tr>
<tr>
<td>Fish origin</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
<td>Bracciano lake</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
</tr>
<tr>
<td>No. infected persons</td>
<td>31</td>
<td>1</td>
<td>60</td>
<td>1</td>
<td>76</td>
</tr>
<tr>
<td>No. of hospitalized persons</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>symptomatic/asymptomatic</td>
<td>24/31</td>
<td>1</td>
<td>49/11</td>
<td>1</td>
<td>59/12</td>
</tr>
<tr>
<td>Treatment</td>
<td>31</td>
<td>1</td>
<td>21</td>
<td>1</td>
<td>76</td>
</tr>
</tbody>
</table>

From 2003 to 2011 a total 207 *O. felineus* infections occurred in Italy

## Outbreaks for tench consumption at the Trasimeno lake

- 2/2003
- 8/2005
Outbreaks and single cases for the consumption of tenches fished in the Latium region

- 20/2007
- 2/2008
- 2/2008
- 1/2009
- 31/2009
- 1/2010
- 1/2011
- 7/2011
- 1/2011

- Latina 2
- Milan 1
- Modena 4
- Orvieto 2
- Perugia 3
- Rome 5
- Siena 3
- Verona 1
- Viterbo 43
- Aosta 45
- 14 other Italian localities
- 1 Netherlands

Outbreak of December 2009

- Fish from the Bolsena lake

Outbreak of July 2010

- Tartare of orange flavored marinated carp, pink pepper, and dill on Mirepoix of vegetables

Human symptomatology of opistorchiasis

- Signs and symptoms:
  - fever, nausea, abdominal pain, myalgia, asthenia, headache, diarrhea
  - incubation period: from 2 weeks to 2 months
  - about 1/3 of infected persons are asymptomatic
  - in symptomatic persons, signs and symptoms disappear within 2 months
  - in chronic infections: portal hypertension, cholangitis, cholangiocarcinoma

- Laboratory features:
  - leucocytosis up to $29.8 \times 10^3/\mu L$
  - eosinophilia up to 65%
  - liver enzymes (AST/ALT mU/mL) up to 315/899*
  *(normal values 5-46/7-56 mU/mL)*

triphasic CAT
Treatment of *O. felineus* infections

- **First choice**
  - praziquantel, 25 mg/kg *per os* tid, for 1 day

- **Second choice**
  - albendazole, 10 mg/kg *per os*, for 7 days
    - albendazole failure has been observed in about 1/3 of the patients

Detection of *O. felineus* in intermediate hosts

- Metacercariae in fish muscles
  - by muscle compression (trichinoscopy)
  - by digestion (as for *Trichinella*)
- Metacercariae identification
  - by morphology
  - by PCR

- Larval stages (sporocyst or redia) in snails
  - by snail dissection under a microscope
  - by homogenization of the snail body and PCR

Detection of *O. felineus* infection in final mammalian hosts

- Parasitological detection
  - detection of parasite eggs in faecal samples
  - the eggs measure 25-35 x 15-17 µm
    (e.g., a *Giardia* cyst measures 11-14 x 7-10 µm)
- Serological detection
  - ELISA tests have been developed for humans and carnivores (foxes, cats) using excretory/secretory antigens from adult worms in vitro
- Molecular detection
  - on faecal samples by PCR

Prevention of *O. felineus* infection in humans and pets

- Metacercariae may be killed by:
  - cooking at 70°C in the core of the fish product for 1 min
  - freezing at
    - -10°C in the core for 5-70 days (related to fish size)
    - -28°C in the core for 24 h
  - by irradiation at 0.15 kGy
- the consumption of raw fish frozen in a home freezer could be at risk
- fishermen, restaurant owners, etc. should avoid to spread uncooked fish in the environment or in not controlled garbage
- EU legislation
  - fish consumed raw shall be frozen in advance according to the EU Regulation (CE) 853/2004
Thank you for your attention