Level of organochlorine pesticides in fish species from Lake Hawassa in the Ethiopian Rift-Valley (2009–2010) and implications in dietary exposure

Ermias Deribe Weldemariam

Date: September/2013
Outline of the Presentation

Part 1: Introduction
Part 2: Field Work
Part 3: Laboratory Work and Statistical Analysis
Part 4: Summary of the Results
Part 5: General Conclusions and Recommendations
Part 1: Introduction

What are Organo Chlorine Pesticides (OCPs)?

OCPs are some of the most hazardous substances released into the environment by humans and grouped under the group persistent organic pollutants:

- Persistent nature
- Lipophilic
- Accumulate in the food chain
- Long range transport
- Toxic
OCPs includes most compounds banned under the Stockholm Convention:

- Aldrin
- Dieldrin
- Chlordane
- DDT
- Endrin
- Heptachlor
- Mirex
- Toxaphene
Presence of OCPs in Ethiopia:

a) Pesticides Use in Ethiopia
   • Pesticides were first imported to Ethiopia in the 1960s
   • Pesticides import data shows that pesticide use in the country is increasing
   • The control of vectors diseases, agricultural and forestry pests

b) Expansion of glass houses
   • Began in 1984 and has recently been expanded rapidly

c) Formulation of DDT in Ethiopia
   • Signed SC May 2002 and ratified it in January 2003
   • The Adami Tulu Pesticide Processing Plant
   • Stopped using now

Photos: James Gathany
d) Obsolete pesticides in Ethiopia

- Africa has accumulated an estimated 50,000 tonnes of obsolete pesticide stocks over a period of four decades (FAO, 1999b).
- Ethiopia is burdened by the problem of obsolete pesticide stocks (Israel D. and Mohamed A., 2008).

Photos: B. Davis
Objectives:

1. To determine the level of OCPs in fish species in Lake Hawassa.

2. To assess the possible exposure of OCPs associated with the consumption of contaminated fish from the lake.
Study Area
Exposure Assessment

✓ Exposure was quantified: (LED and PDI) :

\[ \text{[contaminants]} \times \text{Daily Food intake} \times \text{Body wt. in kg} \]

✓ The result compared with the exposure limit:
  - RfD (USEPA)
  - PTDI (JECFA: the Joint WHO/FAO Expert Committee on food additive)
Diet and trophic position of the fish
# Diet of the Studied Fish

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Main Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>O. niloticus</em></td>
<td>Herbivorous (Algae)</td>
</tr>
<tr>
<td><em>C. gariepinus</em></td>
<td>Omnivorous /Piscivorous (Large individuals include fish)</td>
</tr>
<tr>
<td><em>B. intermedius</em></td>
<td>Omnivorous (Large individuals include fish)</td>
</tr>
</tbody>
</table>
• *B. intermedius* occupy the highest trophic level in the food chain of the lake Hawassa
Human health risk assessment of OCPs in fish consumption
## OCPs in *B. Intermedius* exceeds the limit

<table>
<thead>
<tr>
<th>OCPs</th>
<th>Fish species</th>
<th>RfD (μg kg⁻¹ day⁻¹)</th>
<th>Estimated dose (μg kg⁻¹ day⁻¹)</th>
<th>Hazard index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0-1yrs</td>
<td>1-11yrs</td>
<td>Adult</td>
</tr>
<tr>
<td>ΣDDT</td>
<td><em>O. niloticus</em></td>
<td>0.5</td>
<td>0.281</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td><em>C. gariepinus</em></td>
<td>0.5</td>
<td>0.274</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td><em>B. intermedius</em></td>
<td>0.5</td>
<td>1.121</td>
<td>0.374</td>
</tr>
<tr>
<td>ΣChloridane</td>
<td><em>O. niloticus</em></td>
<td>0.06</td>
<td>0.002</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td><em>C. gariepinus</em></td>
<td>0.06</td>
<td>0.003</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td><em>B. intermedius</em></td>
<td>0.06</td>
<td>0.010</td>
<td>0.003</td>
</tr>
<tr>
<td>ΣEndosulfan</td>
<td><em>O. niloticus</em></td>
<td>0.05</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>C. gariepinus</em></td>
<td>0.05</td>
<td>0.011</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td><em>B. intermedius</em></td>
<td>0.05</td>
<td>0.116</td>
<td>0.039</td>
</tr>
</tbody>
</table>
Part 5: General Conclusions and Recommendations

• The food chain in Lake Hawassa is relatively short and, combined use of GCA and SIA identified 2–3 trophic levels in the fish community.

• DDTs, endosulfans and chlordane were OCPs detected in the fish species from the lake. DDT was the predominant contaminant detected.

• Consumption of large fish from the higher trophic level (e.g. *B. intermedius*) from L. Hawassa may expose consumers to possible health hazards.

• Children and pregnant women of the local community, especially the local subsistence fishermen and their families are the most vulnerable population sub-group.

• A further detailed dietary survey is required to assess the health risk from OCPs in relation to contaminated fish consumption in the study area.
Thank You