Parasites in food chains

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Microsporidia in the Animal to Human Food Chain: An International Symposium to Address Chronic Epizootic Disease

9 August 2015 at University of British Columbia, Vancouver
Outline

1. Diseases in complex food production systems
2. Selected parasites in food chains
3. The global burden of foodborne parasitic diseases
4. Approaches in assessing and managing risks from foodborne parasitic diseases
1. Foodborne diseases

High-income countries
• 70% deaths >70 years
• Non-communicable conditions
• Roughly 15% illness caused by 4 FBD

Low-income countries
• 40% deaths <15 years
• Communicable diseases
• Diarrhoea top 10 killer
1. Foodborne diseases

Organic/extensive farming

(c) Nick Taylor, University of Reading/UK & Jonathan Rushton, Royal Veterinary College/UK
1. Foodborne diseases

Retrieved from: https://www.youtube.com/watch?v=1XBwjoQsOEeg

taeniasis, toxoplasmosis
Chagas disease
2. Selected parasites in food chains

- Intestinal protozoa
- Intestinal nematodes
- Foodborne protozoa
- Foodborne trematodes
- Foodborne nematodes
- Foodborne cestodes


2. Selected parasites in food chains - intestinal protozoa

- **Giardia, Entamoeba spp.**
  - Americas
  - Source: drinking water
- **Cryptosporidium spp.**
  - Africa
  - Immunocompromised
  - Source: water, fruit, raw vegetables

Source: Eckert et al. (2005)
2. Selected parasites in food chains - intestinal nematodes

- *Ascaris lumbricoides*
  - Neglected tropical disease
  - Source: water, soil, pigs?
2. Selected parasites in food chains - foodborne protozoa

- **Toxoplasma gondii**
  - 2 human pathogen development stages
  - Sources: water, soil, cat litter; undercooked meat
  - Maternal infection, immunocompromised
  - Livelong infectivity
2. Selected parasites in food chains - foodborne trematodes

- **Fasciola** spp.
  - Source: water, plants

- **Opisthorchis** and **Chlonorchis** spp.
  - Source: freshwater fish
  - Severe sequelae
2. Selected parasites in food chains - foodborne cestodes

- Potentially fatal
- **Taenia** spp.
  - Source: Taeniasis vs. NCC
  - NTD imported to N. America
- **Echinococcus** spp.
  - Source: water, fruit, raw vegetables
  - Canadian dogs
2. Selected parasites in food chains - foodborne nematodes

- *Trichinella* spp.
  - Direct foodborne parasitic disease
  - Source: undercooked pork and game meat
3. The global burden of foodborne parasitic diseases

Common metric:

Years of life lost to premature death + Years lived with disability = Disability Adjusted Life Year (DALY)

- YOPI

Retrieved from: http://www.who.int/gho/hiv/hiv_013.jpg?ua=1

DALYs per 1000 births due to congenital toxoplasmosis.

3. The global burden of foodborne parasitic diseases

<table>
<thead>
<tr>
<th></th>
<th>possible global burden (DALYs)</th>
<th>animal health costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>intestinal protozoa:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Giardia, Entamoeba and Cryptosporidium</em> spp.</td>
<td>$? \times 10^5-10^6$</td>
<td>unknown, but likely to be high</td>
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<tr>
<td><strong>intestinal nematodes:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Ascaris lumbricoides</em></td>
<td>$1.3 \times 10^6$</td>
<td>likely high if infective for pigs</td>
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<td><strong>foodborne protozoa:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Toxoplasma gondii</em></td>
<td>$2-8 \times 10^6$</td>
<td>possibly substantial</td>
</tr>
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<td><strong>foodborne trematodes:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Fasciola, Opisthorchis, Clonorchis</em> spp.</td>
<td>$&gt;0.5 \times 10^6$</td>
<td>animal fasciolosis is very high</td>
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<td><strong>foodborne nematodes:</strong></td>
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<td></td>
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<tr>
<td><em>Trichinella</em> spp.</td>
<td>$?$</td>
<td>control programs are a large financial burden</td>
</tr>
<tr>
<td><strong>foodborne cestodes:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Echinococcus</em> spp.</td>
<td>$2-5 \times 10^7$</td>
<td>US$2 \times 10^9$</td>
</tr>
<tr>
<td><em>Taenia solium</em></td>
<td>$2-5 \times 10^6$</td>
<td>unknown</td>
</tr>
<tr>
<td><strong>for comparison:</strong></td>
<td></td>
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<tr>
<td>HIV</td>
<td>$59 \times 10^6$</td>
<td></td>
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<tr>
<td>malaria</td>
<td>$34 \times 10^6$</td>
<td></td>
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<tr>
<td>tuberculosis</td>
<td>$34 \times 10^6$</td>
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</tbody>
</table>

Possible magnitude of annual global burden of selected foodborne parasitic diseases (adapted from Torgerson et al., 2011)
4. Approaches in assessing and managing risks from foodborne parasitic diseases

1. OneHealth/Ecohealth concepts

2. Integrated value chain research

3. Participatory epidemiology
Integrated value chain assessment

R4D integrated to transform selected value chains in targeted commodities and countries.

Value chain development team + research partners
CAC framework for food safety risk analysis, adapted by ILRI/BMZ Safe Food, Fair Food project (2008-2011)
Asante sana!

- CGIAR Research Program on Agriculture for Nutrition and Health (A4NH), led by the International Food Policy Research Institute
- CGIAR Research Program on Livestock and Fish, led by the International Livestock Research Institute
- Local and international research and investment partners
- OECD Trade and Agriculture Directorate for travel funding and SIP organizing committee for facilitation

Better lives through livestock

www.ilri.org
References

1 WHO (2007) First formal meeting of the Foodborne Disease Burden Epidemiology Reference Group (FERG); Implementing Strategy, Setting Priorities and Assigning the Tasks, 180WHO Library.
6 Krause/Hendrick, ed. (2010) Zoonotic pathogens in the food chain, CABI.
32 ILRI/CIAT/ICARDA/WorldFish (2011) More Meat, Milk, and Fish by and for the Poor (CGIAR Research Program 3.7): A proposal submitted to the CGIAR Consortium Board by ILRI on behalf of CIAT, ICARDA and WorldFish.,