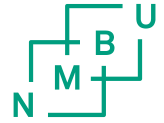


The Impact of Foodborne Parasitic Diseases on Human Health

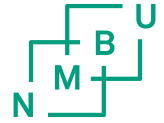
Lucy Robertson, Parasitology, Faculty of Veterinary Medicine,
Norwegian University of Life Sciences, Ås, Norway

Parasites – the neglected pathogens



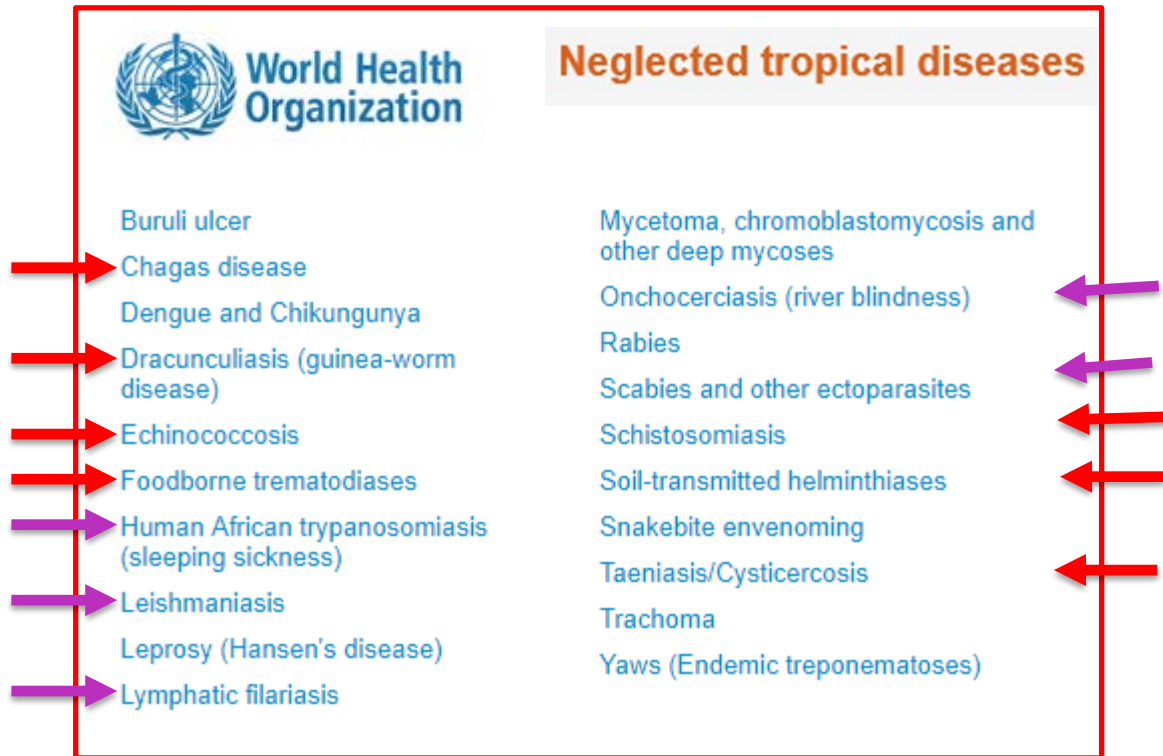
- ▶ Generally, foodborne illness is equated with acute enteric disease – usually bacterial
- ▶ Some foodborne parasites can result in acute enteric disease.
- ▶ Others may result in acute, non-enteric illness
- ▶ Many more have a more insidious, long-term effect that can have a profound impact on human health, including fatalities
- ▶ Important that the impact of parasites – the neglected pathogens – is not overlooked.

Parasites – the neglected pathogens

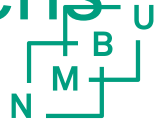


20 NTD

- 2 viral
 - 5 bacterial or fungal
 - 1 non infectious
 - **12 parasitic**
- Of the 12 parasites, most (7) can be transmitted via food and/or water



Parasites: a plethora of foodborne pathogens



Protozoa (single-celled)

Enteric

- ▶ *Cryptosporidium* spp.
- ▶ *Cyclospora cayetanensis*
- ▶ *Entamoeba histolytica**
- ▶ *Giardia duodenalis*

Systemic

- ▶ *Toxoplasma gondii*
- ▶ *Trypanosoma cruzi*
(Chagas Disease)

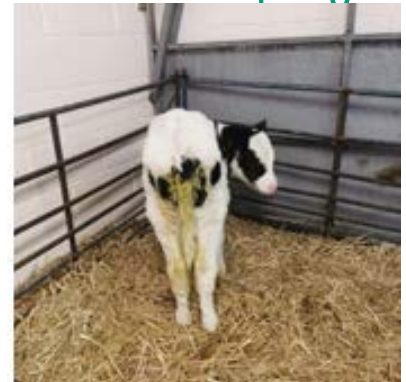
Worms and flukes

- ▶ *Echinococcus granulosus*
- ▶ *Echinococcus multilocularis*
- ▶ *Taenia saginata*
- ▶ *Taenia solium* (inc. cysticercosis)
- ▶ Anisakidae
- ▶ *Ascaris*
- ▶ *Toxocara* spp.
- ▶ *Clonorchis* & *Opisthorchis*
- ▶ *Fasciola* and *Fasciolopsis*
- ▶ *Paragonimus* spp.
- ▶ Small intestinal flukes

Foodborne parasites: acute enteric disease

▶ ***Cryptosporidium***

- ▶ Several species that may infect humans
- ▶ Most common: *C. hominis* and *C. parvum*
- ▶ *C. hominis* more important in African and Asian countries
- ▶ *C. parvum* is zoonotic – important cause of acute diarrhoea in calves.
- ▶ Transmission routes: water, food, direct (hand-to-mouth).
- ▶ Foodborne outbreaks reported in Europe & N. America – waterborne more common.
- ▶ Transmission route not always obvious (days between infection and symptoms).
- ▶ Unexpected leading cause of paediatric diarrhoea in GEMS countries (2nd most common; Kotloff et al^a); also associated with increased mortality in children < 2 years
- ▶ Including effect of growth faltering – increased DALY burden by 153% on top of acute effects (Khalil et al^b).
- ▶ Treatment options limited; nitazoxanide not licensed for very young (< 1 year) or immunosuppressed.



▶ ^aKotloff et al. :Lancet 2013 Jul 20;382(9888):209-22.

▶ ^bKhalil et al. Lancet Glob Health 2018 Jul;6(7):e758-e768

Foodborne parasites: acute non-enteric disease

▶ *Trypanosoma cruzi*

- ▶ Cause of Chagas Disease (often fatal)
- ▶ Around 7 million affected globally - largely limited to Latin America
- ▶ Previously considered to be almost entirely vectorborne (reduviid bugs)
- ▶ Not included in FERG-1
- ▶ Increasing reports of foodborne transmission, including extensive outbreaks.



Reduviid bugs (*Rhodnius prolixus*) – nymphs and adults From Wikimedia Commons, the free media repository



Açaí (palm berry) juice extractor in the streets of Belém, next to Ver-o-Peso market.

From Wikimedia Commons, the free media repository

Foodborne parasites: acute non-enteric disease



▶ *Trypanosoma cruzi*

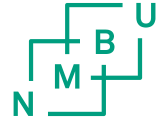
- ▶ Vectorborne route - largely associated with long-term effects (acute effects: usually mild – sometimes including fever)
- ▶ Foodborne route – both acute and long-term effects, with notably higher morbidity and mortality than vectorborne infection.
- ▶ Foodborne route - acute disease: fever (100%). Myalgia, headache, leg and/or facial oedema, pericardial effusion, abdominal pain.
- ▶ Cardiac arrhythmias, congestive heart failure that may progress to cardiogenic shock, pericardial effusion, and pleural effusions
- ▶ May result in mortality.
- ▶ Various reasons suggested for greater clinical severity with oral infection:
 - ▶ higher dose, greater infection efficiency, treatment less effective, more virulent subtype
- ▶ Health burden higher for foodborne infection than vectorborne.

Foodborne parasites: long-term sequelae



Parasite	Long-term / chronic symptoms
<i>Toxoplasma gondii</i> (subtype dependent)	Uveitis, myalgia, psychiatric issues, reactivation and transplacental transmission
<i>Trypanosoma cruzi</i>	Long-term cardiac or gastrointestinal dysfunction
<i>Echinococcus granulosus</i>	Depends on hydatid location: liver - abdominal pain, nausea, vomiting; lung - chronic cough, chest pain
<i>Echinococcus multilocularis</i>	Hydatid cysts metastasise to different locations - weight loss, abdominal pain, general malaise, hepatic failure
<i>Taenia solium cysticercosis</i>	Headaches, seizures; confusion, balance problems, brain swelling, and excess fluid around the brain
<i>Ascaris lumbricoides</i>	Significant nutritional & growth deficits; impaired cognitive development
<i>Toxocara spp.</i>	Inflammatory responses: generalised lymphadenopathy, granulomatous hepatitis, endomyocarditis, asthma
<i>Clonorchis & Opisthorchis</i>	Hepatobiliary inflammation, especially periductal fibrosis, often leads to cholangiocarcinoma (bile duct cancer)
<i>Paragonimus spp.</i>	Resembles chronic bronchitis or tuberculosis - coffee-colored sputum, chest pain and/or shortness of breath

Conclusions



- ▶ **Foodborne parasites – important and often neglected**
 - ▶ A huge diversity of protozoa, worms and flukes
 - ▶ The human burden is high - but parasites are often overlooked
 - ▶ Clinical disease can be acute enteric or acute systemic
 - ▶ Also associated with numerous serious long-term or chronic conditions
 - ▶ For many diseases, symptoms are severe and potentially fatal
 - ▶ Often associated with disadvantaged communities
 - ▶ FERG should provide an evidence-based picture of the burden
 - ▶ Should assist in reminding us of the importance of these often-overlooked pathogens and providing focus for interventions.

- ▶ **Thank you for your attention**
- ▶ **Many thanks to the WHO Foodborne Disease Burden Epidemiology Reference Group (FERG)**
- ▶ **Parasitic Diseases Task Force (PDTF)**

