

Cryptosporidium and Zoonoses

Extracts from Nibblers online discussion group

Some of you are aware of the difficulties that Cryptosporidium (a protozoan parasite of cattle, sheep and other wild mammals) causes for grazing in some areas, i.e. it is a zoonosis that can cause quite large outbreaks of diarrhoea in people when associated with contamination of water supplies (e.g. in North Wales last year I think). Hence water companies are not keen on grazing in certain catchments and when present impose conditions on their tenants (e.g. Forest of Bowland).

I would suggest that is something that all grazing sites with public access should be aware of, but minimising risks of this and other faecal borne zoonoses like E.coli and Salmonellosis comes down to basic personal hygiene, washing facilities (e.g. on open farms), advice and guidance to public (e.g. don't pet / feed animals and always wash your hands before eating , drinking, smoking etc) and separating livestock areas from picnicking areas etc.

Google search revealed some work in the US looking at development of a vaccine. I emailed the vet involved and he says that some companies are interested but at present I do not know what the situation is, i.e. is their something being worked on. I will phone him and see if I can get any more info and will publicise later.

I am also working on collating some guidance on zoonoses, but in the meantime if not already doing so, have a think about your grazing system! I personally don't think we need over react to this as there are far bigger risks out there, but still need to give it some thought. If anyone has anything that they think would help me please could you let me know. I have some info from HSE and VLA

regards

Jim

Jim

Some Wessex Water staff recently told me that they were no longer allowing grazing of catchment land for surface storage supplies because of cryptosporidium concerns. I think these sites were on Exmoor in particular. We haven't yet been stopped from grazing a chalk downland reserve that is also a catchment site presumably because it is deep borehole extraction, but they did not allow us to try Barrier H on the ragwort rosettes by spot spray on basis of unknown risk to water quality.

John Davis

[Cryptosporidium and Giardia](#) **Summary**

Cryptosporidium and Giardia are protozoan parasites that can both cause

gastrointestinal illness in animals and humans. Infected cattle, sheep and humans excrete vast quantities of the environmentally resistant form of the organism, i.e. Cryptosporidium oocysts or Giardia cysts. The oocysts and cysts can persist in the environment for weeks and in some circumstances months.

Waterborne outbreaks of cryptosporidiosis and giardiasis are well documented and generally occur when there are large numbers of (oo)cysts in the water sources and there has been a breakdown in water treatment at the works.

Legislation

The following Regulation contains legislation with regards to Cryptosporidium in water supplies:

The Water Supply (Water Quality) Regulations 2000

The PCV for Cryptosporidium oocyst concentrations in supply, as determined by continuous monitoring, is less than 1 oocyst per 10 litres.

There is no Prescribed Concentration or Value for Giardia in the Water Supply (Water Quality) Regulations (2000), but there is a general clause that states that water must not contain any element, organism or substance at a concentration which would be detrimental to public health.

Introduction

Cryptosporidium and Giardia are not bacteria or viruses, but protozoa that can cause gastrointestinal illness in animals and humans. They do not multiply in the environment and can only grow in the animal host. The environmentally resistant forms of the organisms are Cryptosporidium oocysts and Giardia cysts.

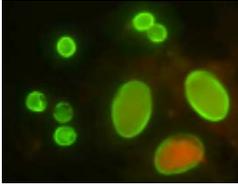
(Oo)cysts of both Cryptosporidium and Giardia arise in the water cycle as a result of deposition of faecal material primarily from animals but also from infected humans and are regularly found in wastewater. Oocysts of Cryptosporidium are approx. 4 to 6 microns in diameter and the cysts of Giardia are slightly larger, between 8 and 10 microns.

Cryptosporidium

Cryptosporidium was first described in 1907. However, it has only been apparent since 1976 that the parasite is a human pathogen. Several species exist but only Cryptosporidium parvum is known to be infective in humans. A large waterborne outbreak of cryptosporidiosis in Swindon and Oxford in 1989, in which 516 people became infected, led to the formation of the Badenoch Expert Committee to investigate the implications of Cryptosporidium to the water industry. The largest waterborne outbreak of cryptosporidiosis occurred in Milwaukee, America with an alleged 400,000 people infected.

Giardia

is also a protozoan parasite of which several species exist. More than one species is infective in humans including *Giardia duodenalis* and *Giardia intestinalis* (the latter previously referred to as *Giardia lamblia*).



Cryptosporidium & Giardia stained with FITC as viewed by fluorescence microscopy. Giardia are the larger of the two

Occurrence

In the US, various surveys have found *Cryptosporidium* oocysts in between 9% and 100% of samples from a variety of sources associated primarily, but not exclusively, with surface waters. Oocysts were even found in pristine sources which had little or no human activity, restricted access, no agricultural activity and no impacting sewage discharges. Oocyst concentrations ranged from 2 to 240 per litre.

In the UK, the most extensive survey followed the original Badenoch report. *Cryptosporidium* oocysts were often present in surface waters but occurred less frequently in ground waters. The oocyst concentrations and percentages of positive samples were less than found in the US.

Giardia spp. are the most frequently isolated enteric protozoa from populations worldwide and the most common pathogenic parasite in the USA. *Giardia* is the most commonly identified aetiological agent in US waterborne outbreaks and it has been estimated that 60% of all *Giardia* infections in the US are acquired through contaminated water. The UK's lower incidence may be explained by the absence of beavers: in the US giardiasis is sometimes referred to as "beaver fever" because the animal acts as a reservoir for contaminating water sources.

A study of a Scottish surface water source and its potable water supply identified *Giardia* in cysts in 85% of 26 source water samples (0.008-0.18 cysts/l) and in 10 (19%) of 52 treated water samples (0.009-0.018 cysts/l).

Health effects

Cryptosporidiosis

In healthy individuals, cryptosporidiosis is self-limiting diarrhoea, which may be triggered when viable oocysts are ingested. The incubation period is between 2 days and 1 week. In addition to the diarrhoea which is watery and accompanied by abdominal cramps,

other less common symptoms include: nausea, vomiting, fever, headache and loss of appetite. The incubation period can vary but the onset of symptoms will usually be apparent within 1 to 12 days after exposure with an average of about 7 days: the illness lasts up to two weeks.



The health risk associated with ingesting water with low numbers of *Cryptosporidium* oocysts is currently unknown. Several questions still remain to be answered including:

- -whether the low number of oocysts found in drinking water is sufficient to cause illness
- -whether immunocompromised individuals are susceptible to lower numbers
- -whether different strains of *Cryptosporidium parvum* have different virulence and infectious dose characteristics.

A recent healthy human volunteer study suggested a median infectious dose of 132 oocysts although risk-modelling studies have suggested some people could become infected by a dose of one oocyst. The disease can be passed from human to human or from animal to human. To reduce spread and the risk of secondary cases careful attention should be paid to hygiene. Immunocompromised people such as people taking immuno-suppressive drugs or with HIV or AIDS may not be more susceptible to initial infection by *Cryptosporidium*. However, if they do contract the illness it can be severely prolonged and life threatening.

No specific anti-microbial therapy has yet been proved curative although there have been encouraging reports about paromomycin decreasing oocyst excretion, lessening the diarrhoea and improving the clinical well being of patients. Other anti-microbials which have shown some activity include azithromycin and spiramycin.

Giardiasis

Giardiasis can be asymptomatic but is generally associated with a variety of intestinal symptoms such as chronic diarrhoea, abdominal cramps, fever and fatigue. The incubation period ranges from 5 to >25 days with a median of 7 to 10 days. The illness can be treated with drugs; metronidazole and tinidazole are the drugs of choice.

Specific Outbreaks

Cryptosporidiosis

In the USA there have been five documented waterborne outbreaks. The most recent of which, during 1993 in Milwaukee, infected an estimated 403,000 of the total exposed population of 800,000.

Investigation of this outbreak revealed the treatment plant had been experiencing problems managing the use of a different coagulant. Turbidimeters were not being used

and coagulant doses were not being correctly adjusted. This, in addition to heavy rainfall and snow run-off led to the ineffective treatment of source water. This allowed *Cryptosporidium* to pass through the treatment plant and into the community supply. Three further outbreaks have recently been reported with one, in Las Vegas, claiming the lives of several AIDS patients.

There have been several waterborne outbreaks in the UK. The biggest being in Swindon and Oxford where 516 became infected, from an exposed population of over 700,000. The suspected cause was an overwhelming of the filtration process by high oocyst concentrations in source water following heavy rain. Recycling filter backwash water was considered to have contributed to the problem by concentrating the oocysts in the filter media; the oocysts eventually broke through into the final water. This outbreak led to the formation of the Badenoch Expert Committee which produced two reports and made a range of recommendations aimed at minimising the potential for future waterborne outbreaks of cryptosporidiosis.

Giardiasis

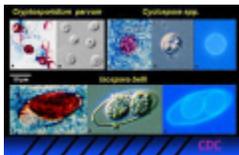
In the US, over the last few decades, there have been more than 100 water-borne outbreaks of giardiasis whereas in the UK, only three outbreaks have been reported over a similar time period: the most recent of which occurred in south Worcestershire from November 1991 to April 1992.

This outbreak was confined to a small village supplied from a private supply. Thirty-one episodes of giardiasis were experienced by 28 patients whose ages ranged from less than one to 73 years old: the total population of the village was about 200. During the same period in the previous year there were no cases, neither were there cases in the areas surrounding the village.

There have been no recorded outbreaks of giardiasis in the United Utilities region.

Other Protozoan pathogens

The main protozoa which have been linked to waterborne disease are *Cryptosporidium* and *Giardia*. However, in recent years *Cyclospora* and *Microsporidium* spp. have been implicated in outbreaks of gastrointestinal illness.



Cyclospora cayentanensis is a coccidian parasite that can cause prolonged watery diarrhoea in humans. Between 44 and 66 cases of illness associated with *Cyclospora* are reported to the Communicable Disease Surveillance Centre (CDSC) each year with peak numbers in June and July. These are mainly reported in people who have recently travelled abroad. A US outbreak was linked to raspberries imported from Peru that had been washed in contaminated water. There have been no reported waterborne outbreaks in the UK. Conventional water treatment should remove *Cyclospora* oocysts

from the raw water.

Microsporidia are protozoa which are opportunistic pathogens and have the potential to be waterborne. The two main species of concern are *Enterocytozoon bieneusi* and *Encephalitozoon intestinalis*. Both cause diarrhoea in immuno-compromised individuals. Due to the relatively recent identification of these organisms as human pathogens and the inadequacies of detection methods no waterborne outbreaks have been confirmed.

Summary

Cryptosporidium and *Giardia* are disease-causing protozoa that affect the digestive system. *Cryptosporidium* has become, arguably, the most important new contaminant for control in the UK. *Giardia*, does not yet appear to have reached the same degree of interest, due to the low incidence of giardiasis in the UK with only three incidents of waterborne giardiasis reported in recent years

Cryptosporidium oocysts and *Giardia* cysts are often present in surface waters, primarily as a result agricultural run off containing faecal material. Whilst *Giardia* cysts have limited sensitivity to chlorination, *Cryptosporidium* oocysts are not sensitive to chlorination and can only be removed by filtration. Boiling water is the most effective method of killing both organisms. In healthy individuals, cryptosporidiosis is a self-limiting disease lasting on average 7 days. It is characterised by watery diarrhoea and abdominal cramps. The illness can be severely prolonged and life threatening in immuno-compromised individuals such as those with AIDS.

Giardiasis is generally associated with a variety of intestinal symptoms such as chronic diarrhoea, abdominal cramps, fever and fatigue and usually lasts between 7 and 10 days.

Above document from Kate Snow

Jim

I had a detailed discussion with our local HSE officer about this particular issue. His view was very sensible in that he felt that if the public choose to visit a nature reserve it is the same as visiting any area of the countryside and the public are responsible for the risks they take. I did, nevertheless, start adding a line on our grazing signs advising the public that no handwashing facilities are available on site and they should not picnic in grazing areas etc, but I stopped doing it as there is only so much info the public will read and there is also the issue of admitting some sort of liability.

I do feel that there is a need to advise pregnant women if there are lambing ewes present though.

Cathy

I did a short literature search on this a few years ago and concluded that the large majority of outbreaks in humans were connected with leaks from slurry tanks associated

with intensive cattle or pig farming - I could not find a single example relating to sheep. The implication seems to be that there is only a public health problem where animals (and their dung) are kept in close proximity to each other (in barns/sties/milking parlours etc). In open countryside under extensive grazing there really does not seem to be a problem - though an interesting thought has just popped in; badgers create latrines, dung is concentrated in these latrines and badgers do carry *Cryptosporidium*. Oh there is just too much to worry about - nothing is certain except, of course, death. Oh irony!

Tim Beech

Natural England
