

Doctor B's BARF & Toxoplasmosis

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Introduction

Ignorance is bliss – so 'they' say! Sometimes the less we know, the happier we are. Ignorance can most definitely be a source of bliss when it comes to the subject of parasites in raw foods, particularly if those parasites also happen to be zoonoses (*a 'zoonosis' is an infection or infestation that is shared between humans and animals*). And toxoplasmosis is a particularly nasty zoonosis.

The parasite which causes the disease toxoplasmosis is called *Toxoplasma gondii* (*T. gondii*). This disease can affect both cats and their human owners. However, many people who own cats, feed cats or live with cats have never even heard of this parasite. And if they have, heard of it, they have no idea of its significance, including the possibility that it could affect their lives – and NOT in a nice way.

Toxoplasmosis is a Nasty Disease in Humans

Toxoplasmosis is not a disease to be taken lightly. It can produce a variety of problems in humans.

1. Women infected during early pregnancy may pass the parasite to their unborn child. In the newborn, brain abnormalities such as microcephaly (brain smaller than normal) or hydrocephalus (water on the brain) may be seen.
2. In toddlers when infected with the parasite, meningoencephalitis (inflammation around the brain) or jaundice with enlarged liver and spleen can occur.
3. In older children, toxoplasmosis can cause eye problems such as chorioretinitis (inflammation within parts of the eye), which can cause vision loss to varying degrees, including complete blindness.
4. Where *Toxoplasma* is acquired by older humans, with a mature and fully functional immune system, it is usually symptomless. If symptoms do occur they usually include fever, enlarged lymph nodes, headache, muscular pain (myalgia) and fatigue. Recovery is to be expected, except in immunocompromised individuals where fatal encephalitis may ensue.

Further bad news is that recent research suggests that a significant cause of schizophrenia in adult humans may be prior exposure to toxoplasmosis (with or without clinical disease/symptoms).

Given the potential severity of the disease, two questions are often asked in relation to feeding raw meat to cats:

Firstly, Should Pregnant Women Feed Raw Meat to Their Cats?

The obvious answer is to say no. *However, that may not necessarily be the case. Read on to understand why!*

Secondly, Should we Test Meat for Toxoplasmosis?

Is it worthwhile testing raw meat (that is, meat destined to be fed to cats in its raw state) for the presence of toxoplasmosis? *Sounds like a good idea? But is it? Apart from the cost, the answer is probably not. Again, read on to understand why!*



Toxoplasmosis - Some Basic Facts

A Food-borne Disease

Toxoplasmosis is one of the most common food-borne diseases in humans; it is mostly acquired when undercooked meat (particularly lamb, goat and pork), or unwashed or poorly washed fruit and vegetables are eaten or where the water supply is contaminated with cat faeces.

Worldwide Occurrence

Toxoplasmosis is an extremely common parasitic disease, with large percentages of the world's population being infected. The *Toxoplasma* organism is found in most places that man inhabits, and more so in warm temperate climates. The link in the chain that is additionally required (usually) for this parasite to be endemic is the presence of domestic, feral or wild cats. The term *usually* is used because the close proximity of cats is not necessarily required, as contaminated raw meat and vegetables can be transported long distances!

For those people who don't wish to continue to read this entire article, the key point is that Doctor B's BARF is highly unlikely to be a source of *Toxoplasma* infection

The good news is that raw food, properly sourced and handled (such as Doctor B's BARF), should pose no threat to humans and their domestic pets. There are a number of reasons for this as you will see, however, the most important is that **Doctor B's BARF is a frozen product** and adequate freezing KILLS *T. gondii*! By the time Doctor B's frozen BARF product reaches the consumer (your cat!), it has been frozen long enough and at a sufficiently low temperature to kill any *Toxoplasma* organisms that may have been present in the product.

Acquiring Toxoplasmosis

Infection in any host, including the cat, other mammals, cold blooded animals and man occurs following the ingestion of either:

1. faeces from a cat suffering from clinical intestinal toxoplasmosis;
2. animal products containing *Toxoplasma* cysts; or
3. contaminated food and/or water.

"Infected" Meat Products

In western society, most infections with *Toxoplasma* in humans are the result of eating **undercooked** pork or lamb. The pig or sheep has been infected by eating food contaminated with faeces from a cat infected by *T. gondii*.

Food and Water Contamination

Apart from infected meat products the other significant sources of toxoplasmosis include drinking **water** contaminated by cat faeces or eating **food** that has been contaminated with cat faeces. In other words, eating unwashed or improperly washed salad vegetables or fruit is a significant cause of toxoplasmosis in humans. A similar situation exists with food producing animals such as goats, sheep, pigs etc. Here, infection with the organism *T. gondii* is more often caused by the ingestion of contaminated food not by any form of direct transmission from a cat, as discussed above.



From the human perspective, the biggest risk is to those who enjoy 'rare' meat with freshly harvested and minimally washed salad vegetables.

There is a relatively high level of asymptomatic chronic infection (microscopic tissue cysts of toxoplasmosis) in any meat derived from animals and birds. This includes meat that has passed the most rigorous of meat inspections. So caution is warranted if consuming undercooked or totally uncooked meat.

Other Sources of Infection

- Milk from actively shedding goats may be a source of infection for infants if fed to them.
- In production animals (sheep, goats, pigs and rarely cattle), toxoplasmosis is associated with stillbirths and abortions. These infected tissues (the placenta and foetus) can be source of infection for humans, cats, dogs and wildlife.
- Latent toxoplasmosis may become active because of the development of other disease problems or with corticosteroid therapy – anything which suppresses the animal's immune system, such that it can allow the *Toxoplasma* organisms to proliferate.
- "Organic" foods can be problematic. Interestingly (sadly perhaps?), the possibility that the meat may contain tissue cysts of toxoplasmosis is much greater where the food source is "organic". That is, raised under so-called "natural" conditions - without the assistance of chemical pesticides, parasiticides etc. Additionally and in part due to the management procedures involved in their production, "organic" meat products are more likely to be exposed to faecal contamination by cats.

The Role of Climate

In high rainfall areas with warm temperatures and plenty of cats, the incidence of tissue cysts increases. It also increases with more intensively managed livestock (feedlots) compared to rangeland stock because of the presence or use of cats to control rodents. In Australian aboriginals, there is a greater incidence of infection amongst those that eat the traditional diet of wallaby, bandicoot and pig. This problem relates to the presence of feral cats and undercooked meats.

People at Risk

The two categories of people who are at the greatest risk from the *Toxoplasma* organism are:

- Babies in the womb during the first trimester of pregnancy, where the mother has never been exposed to *T. gondii*;
- People with HIV, undergoing therapy with immunosuppressive drugs or with any other form of significant immunosuppression.

The accidental ingestion of *T. gondii* does NOT in the majority of cases cause clinically significant toxoplasmosis.

As you will see shortly, most healthy humans with normal immune competence are able to deal with this organism without developing any (or only very mild) symptoms of toxoplasmosis. Alternatively, even if they have had clinical signs, after exposure, they become immune for life (as is the case with many "childhood" infections such as measles or mumps etc).

More good news (for Australians) ...

Clinical toxoplasmosis is extremely uncommon in humans in Australia. Further good news is that approximately 20% – 30% of the general population (including pregnant women) have been exposed to the *Toxoplasma* organism and have developed a good immunity.

These can be people who have either owned or lived near or in some way been involved with cats or more likely, people who have had previous exposure to the organism through the consumption of undercooked meat or faecally contaminated food. Because these people have recovered from (or never even developed symptoms of) the disease, they have become resistant to further infection.

Equally good news is that there is a very low rate of congenital (prenatal) infection reported in Australia.

Animals at Risk



Hay and grain contaminated with cat faeces are likely sources of toxoplasmosis for livestock.

Active infection with clinical disease can be seen in cats, dogs, guinea pigs, birds, sheep, goats and pigs. Secretions from such animals that are actively shedding the organism can be a source of infection for vets, farmers, lab workers, park rangers etc.

While poultry (and even raw eggs) can be a source of infection, this is uncommon to rare, particularly in relation to commercial production. It is far more likely with backyard poultry production.

Toxoplasma gondii – in Detail

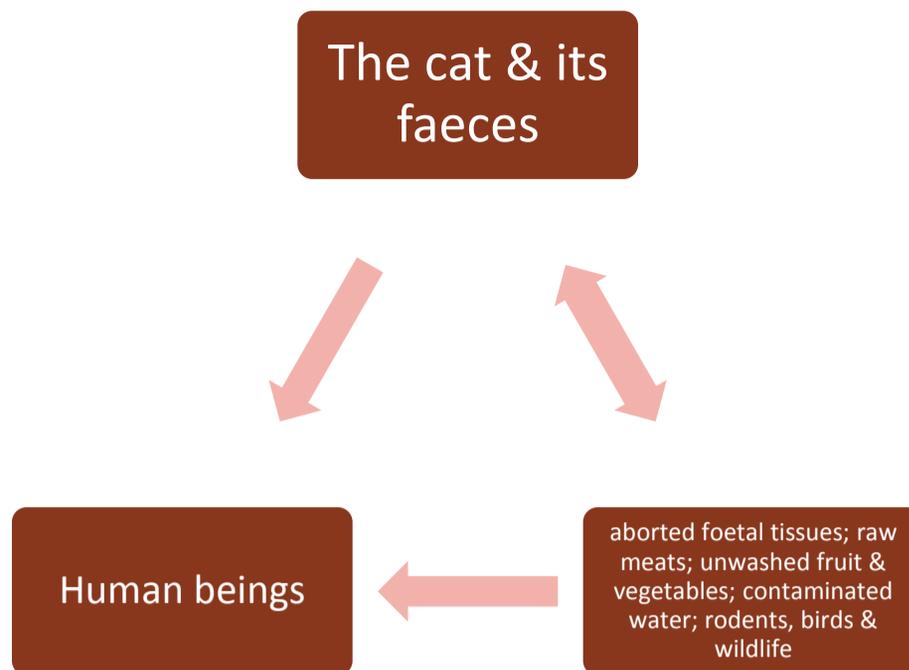
Toxoplasmosis is a parasitic disease or clinical condition caused by a single celled organism (a protozoan) called *Toxoplasma gondii*. *T. gondii* belongs to a group of protozoa called coccidia. The coccidia are all parasitic protozoa and must invade the cells of multicellular animals in order to survive and reproduce. Most coccidia use just one animal species as their host, where they can cause significant disease. But *Toxoplasma gondii* is capable of invading, living multiplying and causing disease in a multitude of hosts including sheep, goats, dogs, cattle, fish, reptiles, amphibians, birds and humans.

This means that for humans, there are many sources of infection with toxoplasmosis. However, there is only primary host for *T. gondii*: the cat.

Cats become infected with toxoplasmosis in three ways:

1. Kittens can be infected in-utero via their mother (pre-natal infection).
2. After they are born (post-natal infection), kittens can become infected with toxoplasmosis by eating food contaminated with the faeces of other cats – often from their mother; occasionally their littermates.
3. When a naive cat eats another infected animal (such as a rodent or bird) that contains this organism in their tissues. This is an important source of infection for many cats.

In fact, any animal can be infected by all three routes. However - always keep in mind that cats are the central player in this disease process



Toxoplasma gondii Life Cycle

Most animals kept as pets are susceptible to infection but only cats are directly responsible for environmental contamination and continuing the cycle of infection to humans and other animals through faecal shedding of *T. gondii*.

The cat is the only species in which *Toxoplasma* can reproduce sexually to produce brand new organisms; the cat is known as the definitive host. Other hosts are known as intermediate or accidental hosts. Within these hosts, *T. gondii* can only bud off to reproduce exact copies of itself (asexual reproduction).

Sexual Reproduction of *T. gondii*

Toxoplasma organisms can only reproduce sexually within the cells that line the intestines of their definitive host – the cat. In most instances this will NOT be a mature cat, it will be a kitten. Once this has occurred, these cells lining the intestinal wall ‘burst’ to release egg-like forms known as oocysts. These oocysts are actually quite harmless when first they pass out in the cat’s (usually kitten’s) faeces. They must go through a process of sporulation (or activation) in order to become infective. This process occurs over the following few days after they are passed in the cat’s faeces. Therefore, cleaning up cat faeces as soon as it has been ‘deposited’ can significantly reduce the likelihood of contracting these parasites from your own cat.

This process of sporulation or activation or transforming to an infective form occurs more rapidly in warm weather. In this infective form, these sporulated oocysts can become quite resistant to the environment and can resist heat and drying out or desiccation for some time (years in fact!).

It is this long-lived infective form of *T. gondii* that can be found on or in anything that is contaminated with cat’s faeces (vegetables for example). In this form, they can infect any warm blooded creature including humans which happens to ingest them.

Asexual Reproduction of *T. gondii*

The asexual part of the life cycle occurs in the tissues (other than the intestines) of any host, not just a cat. This is because the *Toxoplasma* organism can invade, live in and multiply in cells of skeletal muscle, heart muscle and nervous tissue in a cat, dog, cow, human, goat, chicken or reptile etc. It is in these tissues that the *Toxoplasma* organism undergoes asexual reproduction, a simple cell division to produce exact copies of itself. This can be either a slow process or a rapid process.



If it is a slow process, the resultant form of *T. gondii* is called a “**bradyzoite**” (“brady” means slow), but if it is a rapid process, the resultant form of *T. gondii* is called a “**tachyzoite**” (“tachy” means rapid). There are differences between the two which are important.

Tachyzoites will form following ingestion of ...

1. Animal tissue infected with *T. gondii*; or
2. Food or water contaminated with cat faeces (containing infective *T. gondii* oocysts).

The infective units of *T. gondii* enter the bloodstream (from the intestines) and from here have the potential to infect cells of the muscle, heart, nervous tissue or foetal tissue. In these cells, *T. gondii* undergoes repeated cell divisions until the infected cell fills with parasites and bursts, releasing the tachyzoites. These can now invade other cells. In the case of foetal tissue, abortion of the foetus follows, with the foetal tissue being highly infectious.

In the case of *Toxoplasma* invading muscle (including heart muscle) and nervous tissue, there is usually no obvious sign of a problem. This is because in most instances, the tachyzoites are quickly and efficiently removed by the host’s immune system. Where some of these **tachyzoites** evade the immune system, they will infect adjacent cells and form **bradyzoites**.

These bradyzoites wait patiently in the “hope” that this piece of muscle or nervous tissue will be eaten by another warm blooded creature thus maintaining the infection.

When the host’s immune system is strong, it slows the (asexual) reproductive process down. As a result, **tissue cysts** are formed which then contain the form of *Toxoplasma* known as bradyzoites – which divide very slowly. These bradyzoites will usually survive in the host (which can be any of mammals, fish, reptiles, amphibians and birds) for all of its life, and in the case of production animals, even afterwards, in their meat.

Tissue cysts filled with bradyzoites are the area of concern to the person who questions the wisdom of feeding raw meat to their cat - in case the cat is infected by this practice, then the human subsequently contracts the disease from their cat.

But bear in mind that most people are at a greater risk from undercooked meat and raw fruit and vegetables and that most cats have already been infected, especially hunters.

In other words, feeding raw meat or not feeding raw meat to a cat makes little difference to the overall cycle of disease.

All the risk lies in the cat’s faeces. This is the basic source of infection and all cats pass faeces, making owning, living near or having anything to do with cats a potential risk! But remember, you do not even have to live near a cat to be infected. Faecal contamination of the food we eat or even the water we drink can originate a long way from home.

It should be assumed that where there are cats, that those cats are already infected with Toxoplasmosis! This is particularly so if the cat has any sort of access to the outdoors, where it will follow its natural instinct and hunt rodents, birds etc (all of which are likely sources if infection).



The Human Risk of Toxoplasmosis from Kittens or Uninfected Adults

The first time a kitten or a naïve adult cat (albeit these are rare!) eats tissue cysts, in about 50% of cats, around three days later, the cat sheds millions of oocysts in the faeces. This only happens once in the cat's lifetime; the first time it is exposed. And as noted, it does not occur in all cats – many healthy kittens (or adult cats) with a strong immune system are able to resist the sexual form of the life cycle of *T. gondii* and will never shed oocysts. Of those that do shed, they only do so for a short period of time - around a week at the most. In general (see below for exceptions), any further ingestion of tissue cysts after the initial exposure will not result in oocyst shedding because the cat's immune system will not allow it.

If the cat's first exposure to *Toxoplasma* is via ingestion of oocysts (as found on food contaminated with another cat's faeces) rather than tissue cysts, the cat produces far fewer oocysts compared to when tissue cysts are eaten. In addition, rather than taking three days, it usually takes three or more weeks before those oocysts are produced. However, they are shed for a longer period – several weeks.

Oocyst shedding is usually a once in a lifetime affair for cats

This is important. For the most part, individual cats will only shed oocysts once in their life and that period will only last for - at the most – a few weeks and may be as short as a few days. It is **part** of the reason that feeding raw meat to cats is rarely a problem. *Repeat exposure to the Toxoplasma organism will not result in any further shedding due to the cat's strong immune response.*

However, there are some exceptions to this. These include when the cat is on very high doses of immunosuppressive medications (such as corticosteroids) or when the cat is in the later stages of a severe immunosuppressive disease such as FIV (Feline Immunodeficiency Virus) or FeLV (Feline Leukemia Virus).

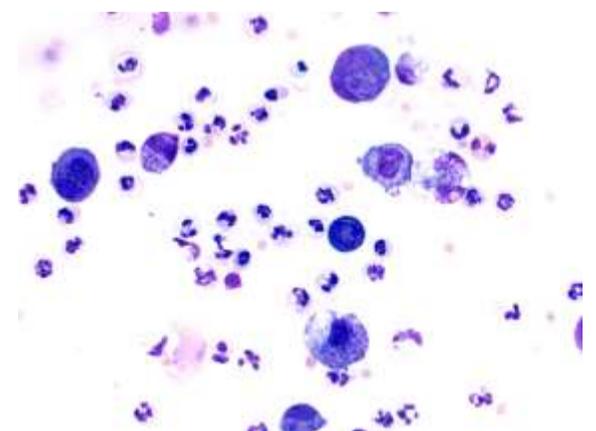
For this reason it is not usually necessary to remove mature cats from the environment of pregnant or immunosuppressed humans. In addition, remember that even where cats are shedding oocysts, human infection is unlikely if the cat's faeces are removed from the environment daily. Further precautions involve the use of gloves and masks, together with the use of boiling water to sterilise litter trays etc.

Toxoplasmosis in Cats

Clinical Signs

While living and multiplying in the cat, *T. gondii* may cause health problems; almost always in young kittens.

- Where the infection is confined to the cat's digestive tract, the illness is usually mild or inapparent, with no associated illness. However in rare cases, haemorrhagic enteritis with vomiting and diarrhoea can occur. This can be so severe that that it is fatal to the kitten if it is unwell with a depressed immune system.
- Where the *Toxoplasma* organism invades other tissues in the cat, the clinical signs of disease can be much more severe. The infected cell is destroyed and the clinical signs seen depend on which tissue is involved. That is, liver or heart or kidney or brain or lung etc. For example, toxoplasmosis of the lungs will result in coughing and difficult breathing. There can be a multitude of clinical signs including weight loss, joint pains, anorexia, jaundice, eye problems, fever, lymph node enlargement, nervous signs, all depending on which tissues are involved.



- Once the clinical signs have subsided, the host is left with tissue cysts. The presence of tissue cysts will not usually cause clinical signs (disease) although they may result in immune-mediated reactions. The major problem with this condition is that the treatment involves the use of immunosuppressing (high) doses of corticosteroids. As mentioned previously, this treatment may result in activation of the tissue cysts followed by clinical signs and oocyst shedding.

Diagnosis

This is difficult because there is no definitive test. However, a blood test to detect antibodies, together with supportive clinical signs, the exclusion of other causes together with a good response to appropriate treatment can lead to the tentative diagnosis of toxoplasmosis.

Treatment

Cats suspected to have toxoplasmosis can usually be treated successfully by a veterinarian using a prescription antibiotic such as clindamycin. Trimethoprim-sulpha drugs (also prescription) can be useful in cats with nervous system signs. The use of these medications can also reduce the number of oocysts the cat sheds.

Summary: Reducing the Risk of Toxoplasmosis in Humans

Returning to the question of feeding raw meat to a cat and the potential risk to humans, and particularly pregnant women.

The risk to humans from feeding raw meat even to a naïve cat or kitten can be avoided with a few simple precautions:

1. Freeze the meat prior to feeding it to the kitten

Properly freezing meat will kill any infective tachy- or bradyzoites.

2. Immediately clean up cat faeces

Any newly produced oocysts must undergo a period of maturation (known as sporulation) in order to become infective. Cat faeces should be immediately removed after being passed and correctly disposed of to avoid this.

3. Healthy adult cats rarely shed oocysts

If the cat in question is well, and is not being treated with immunosuppressive drugs, it is unlikely to shed any oocysts following the ingestion of any tissue cysts that may be present in the raw meat. This is even more likely if the cat hunts or has been fed raw meat for some time as the cat is likely immune to *Toxoplasma*.



Because infective oocysts may survive in the environment for years, human infection with toxoplasmosis is more likely to occur following ingestion of infected raw unwashed vegetables, contaminated drinking water or contact with faecally contaminated soil etc rather than directly from cats.

Humans at greatest risk include those with a lack of immunocompetence, such as:

1. HIV / AIDS

2. Cancers

3. Immunosuppressive therapy

4. **Pregnancy** - involves physiological immunosuppression of the mother and immune naivety of the foetus.

In these cases, the following are prudent recommendations:

- **Freeze meat for cats** at -18 to -20°C for one week minimum and preferably two weeks. Cysts can remain viable in refrigerated meat for a variable amount of time (5 days or more in lamb and up to 2 months in pork). Cysts are less likely in beef or kangaroo meat, but there is still a risk, so all meat should be frozen prior to feeding to a cat.
- **Don't allow cats to hunt or stray.** Cats can have outdoor areas that are attached to the house and wildlife are prevented from entering.
- **Faeces should be removed from the cat's litter-box daily** – ideally by someone other than the immunosuppressed person. The contents should be flushed or burnt.
- **The litter-box should be cleaned daily** with scalding water (it is also an excellent idea to use a litter-box liner). Again, ideally this should be done by someone other than the immunosuppressed person. Oocysts can be destroyed by boiling water or incineration. They are susceptible to 1% aluminium hydroxide for 10 mins but resistant to sulphuric, nitric and acetic acids, formalin and ethanol.
- If it is necessary for the immunosuppressed person to come into contact with potentially infectious materials, they should **always wear gloves**, for example when working with cat faeces/litter or soil or when handling tissues or actively infected animals, placental material or foetal material.
- **Protect mucous membranes** from exposure to infective material (e.g. wear a mask).
- **Wash hands with hot soapy water** after handling potentially infective material, before and after food preparation, and before eating.
- **Food preparation areas and utensils and cutting equipment** should be thoroughly cleaned of all meat residues and washed with boiling water.
- **Children's play areas** (e.g. sand boxes) should be kept covered.
- **Potential transport hosts** for *Toxoplasma* such as flies and cockroaches should be eliminated.



Conclusion: answering the questions...

Is the meat used in Doctor B's BARF tested for the presence of Toxoplasmosis?

The answer is – no, it is not. Such a test would be prohibitively costly for no good reason. Because our meat is frozen at -18 to -20°C for more than a week, any risk of viable tissue cysts is negated.

Should a pregnant woman feed Doctor B's BARF to her cat or cats?

This MUST be a decision that each individual makes - based on both the facts and medical advice. At the very least, a pregnant woman who has any contact with cats should discuss this issue with her medical advisor and that should include a titer test for toxoplasmosis antibodies to determine her immune status to this potentially devastating disease.

Doctor B's BARF - the healthy choice for cats!

