# Parasitology

## COCCIDIA OOCYST COUNTS

**Species:** Bovine, canine, feline, avian, porcine

**Specimen:** Faeces

**Container:** Plastic pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Samples may be refrigerated prior to transport

**General information about the disease:** Coccidia of domestic animals are relatively host and organ specific. Those associated with enteric infection belong to the *Eimeria* and *Isospora* genera. Enteric coccidiosis is typically a disease of intensively managed, young animals. The economic cost of coccidiosis in the food animal species is considerable, manifested in mortality, morbidity, subclinical disease, and the cost of management. They are mainly related to malabsorption induced by villus atrophy, anaemia, hypoproteinaemia, and dehydration due to exudative enteritis and colitis.

**General information about when this test is indicated:** Investigation of enteric disease, ill thrift, and production loss in production, companion, and captive wildlife species and to aid prevention and treatment decisions. Oocysts are reported using a semi-quantitative system (negative to ++++).

**Comparison with other related tests:** Coccidia oocyst counts are included in the calf scour 4-8 week panel and the dog and cat diarrhoea panel

## CRYPTOSPORIDIUM ANTIGEN ELISA

**Species:** Cattle, sheep, goats, dogs, cats

**Specimen:** Faeces

**Container:** Plastic pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Samples may be refrigerated for up to 7 days prior to testing. Freezing is possible for longer term storage but test sensitivity is lost.

**General information about the disease:** *Cryptosporidium* is a small apicomplexan protist, found on the surface of epithelium in the gastrointestinal, biliary, and respiratory tracts of mammals, birds, reptiles, and fish. The disease in mammals is generally enteric, while respiratory infection is more significant in birds. *Cryptosporidium parvum* is parasitic in ruminants and *C. canis* and *C. felis* occur in dogs and cats respectively. All are potentially zoonotic and may be associated with contamination of water sources and food products. Cryptosporidiosis particularly occurs in neonates and the immunocompromised. It results in intestinal villus atrophy with lesions most significant in the distal small intestine. It is an important component of undifferentiated neonatal diarrhoea in calves and frequently occurs concurrently with other agents.

**General information about when this test is indicated:** Diarrhoea investigations, particularly in calves and other young animals

**Comparison with other related tests:** Cryptosporidium antigen ELISA is included in the calf scour <1 week panel, the calf scour 1-4 week panel, the cryptosporidium-giardia combined ELISA test, the small

animal diarrhoea panel, and the small animal mini parasitology panel. Cryptosporidia may also be detected by acid fast staining of faeces.

## CRYPTOSPORIDIUM OOCYST DETECTION

**Species:** Cattle, sheep, goats, dogs, cats

**Specimen:** Faeces (minimum 0.5g)

**Container:** Plastic pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Samples may be refrigerated if there is any delay in sending to the laboratory (e.g. over weekend)

**General information about the disease:** *Cryptosporidium* is a small apicomplexan protist, found on the surface of epithelium in the gastrointestinal, biliary, and respiratory tracts of mammals, birds, reptiles, and fish. The disease in mammals is generally enteric, while respiratory infection is more significant in birds. *Cryptosporidium parvum* is parasitic in ruminants and *C. canis* and *C. felis* occur in dogs and cats respectively. All are potentially zoonotic and may be associated with contamination of water sources and food products. Cryptosporidiosis particularly occurs in neonates and the immunocompromised. It results in intestinal villus atrophy with lesions most significant in the distal small intestine. It is an important component of undifferentiated neonatal diarrhoea in calves and frequently occurs concurrently with other agents.

**General information about when this test is indicated:** Diarrhoea investigations, particularly in calves and other young animals. Cryptosporidia oocyst numbers are scored using a semi-quantitative system (- to ++++) similar to that used for coccidia oocysts.

**Comparison with other related tests:** Cryptosporidia may also be detected using an antigen ELISA on faeces.

## CYATHOSTOME LARVAE DETECTION

**Species:** Horses

**Specimen:** Faeces (5g)

**Container:** Plastic pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Sample may be refrigerated if transport is delayed

**General information about the disease:** Cyathostomin (small strongyle) larvae migrate deep into the mucosa or submucosa of the equine large bowel (mainly cecum and ventral colon) to moult and develop. Third or fourth stage larvae may undergo hypobiosis persisting in nodules in the bowel wall. Emergence of the larvae (sporadically or synchronously) causes significant mucosal damage and eosinophilia, resulting in diarrhoea and protein-loss. Horses >1-year-old are affected, typically in late winter, spring, and summer when larvae emerge.

**General information about when this test is indicated:** Investigation of diarrhoea and ill thrift in horses and evaluation of drench efficacy and parasite control programs

## FAECAL EGG COUNTS – COMPOSITE

**Species**: Cattle, sheep

**Specimen:** 2-4g faeces per animal

**Container:** Plastic pottle

**Collection protocol:** Collect samples directly from rectum of animal (not from the ground unless freshly passed onto clean yard). Sample from 10-15 animals per group. Equal volumes of faeces may be pre-bulked or sent individually.

**Special handling/shipping requirements:** Submit fresh or store in a refrigerator* until transport to a laboratory. Do not freeze.

*It is important that faecal samples for larval cultures are not refrigerated at all. In cases where both FECs and larval cultures are required on the same set of samples it is recommended that a sub-sample be removed from each individual sample and pooled. The individual samples for FEC can be refrigerated while the pooled sample should be clearly identified as being for larval culture and kept at room temperature.

**General information about the disease:** Grazing ruminants in New Zealand are rarely free of worm infection, though effects on stock health and productivity vary widely. Clinical effects of enteric parasitism include ill thrift, diarrhoea, anaemia, and death in severe cases. The degree of damage is influenced by the numbers and identities of the parasites present, host age, immunity, general health, and nutrition.

**General information about when the test is indicated:** Composite FECs are used to give an overview of the gastrointestinal nematode parasite status of a flock or herd. Indications include monitoring the effectiveness of control programmes, assisting in drench decision-making, and helping to identify the causes of scouring and wasting. They can also be used as a common pre-treatment control group for faecal egg count reduction tests.

**Comparison with other related tests:** FECs provide little information on the identity of the worm genera represented. This can be overcome by the use of faecal larval cultures in conjunction with FEC. FEC and larval culture are both necessary for the calculation of faecal egg count reductions to determine drench resistance. Total worm counts on abomasal and small intestinal contents can provide more accurate information on parasite burden than FECs. Serum pepsinogen may be used as an estimate of abomasal ostertagiasis in young cattle.

# FAECAL EGG COUNTS – INDIVIDUAL

**Species**: Cattle, sheep, horses, camelids, deer, dogs, cats, birds

**Specimen:** 2-4g faeces per animal

**Container:** Plastic pottle

**Collection protocol:** Collect samples directly from rectum of animal (not from the ground unless freshly passed onto clean yard)

**Special handling/shipping requirements:** Submit fresh or store in a refrigerator* until transport to a laboratory. Do not freeze.

*It is important that faecal samples for larval cultures are not refrigerated at all. In cases where both FECs and larval cultures are required on the same set of samples it is recommended that a sub-sample be removed from each individual sample and pooled. The individual samples for FEC can be refrigerated while the pooled sample should be clearly identified as being for larval culture and kept at room temperature.

**General information about the disease:** Grazing ruminants in New Zealand are rarely free of worm infection, though effects on stock health and productivity vary widely. Clinical effects of enteric parasitism include ill thrift, diarrhoea, anaemia, and death in severe cases. The degree of damage is influenced by the numbers and identities of the parasites present, host age, immunity, general health, and nutrition.

**General information about when the test is indicated:** FECs are used to monitor the effectiveness of worm control programmes, help in the differential diagnosis of cases of scouring and ill thrift, aid drench decision-making, and investigate suspected drench resistance.

Any statement regarding significance of FECs will only be a guide. Interpretation must take into account the age, class, origin, state of nutrition, environment, stage of season, and concurrent disease state of infected animals.

SHEEP

FECs provide a relatively robust estimate of worm burdens in sheep and goats, especially those in the first year of life. An exception applies in the case of *Nematodirus* infections, where limited reliance should be placed on egg counts for diagnostic purposes. A FEC of 500 eggs per gram is generally considered high enough to require treatment in order to limit pasture contamination and subclinical disease. Treatment may be advisable at lower counts depending on the circumstances.

CATTLE

FEC in cattle are considered more variable and of less diagnostic value than those in small ruminants due to the stereotypic suppression of *Ostertagia* ovulation as host immunity develops. However, *Ostertagia* infections rarely occur in isolation and *Cooperia* and *Trichostrongylus* egg production may not be affected by host immunity to the same degree. Consequently, in mixed infections, FECs may still provide useful guidelines regarding herd parasite status, especially in cattle less than 18 months old. FECs in older cattle are frequently unreliable unless a breakdown in host immunity reveals high FECs. In cattle, a FEC of 150-250 is generally considered high enough to require treatment. Clinically affected cattle with diarrhoea often have >1,000 epg.

HORSES

FECs are only an approximate guide to worm burden. Clinical history and knowledge of seasonal pattern of parasites in specific geographical regions will assist in interpretation of FECs. The following FECs may indicate clinical disease:

Up to 15 months of age – 100 eggs per gram

2-year-old – 200 epg

2-6-year-old – 400 epg

>6-year-old – 600 epg

**Comparison with other related tests:** FECs provide little information on the identity of the worm genera represented. This can be overcome by the use of faecal larval cultures in conjunction with FEC. FEC and larval culture are both necessary for the calculation of faecal egg count reductions to determine drench resistance. Total worm counts on abomasal and small intestinal contents can provide more accurate information on parasite burden than FECs. Serum pepsinogen may be used as an estimate of abomasal ostertagiasis in young cattle. FEC is part of the small animal diarrhoea panel (FEC, coccidia, *Campylobacter, Salmonella, Giardia*, and *Cryptosporidium*).

# FLUKE (TREMATODE) EGG COUNTS - INDIVIDUAL

**Species:** Cattle, sheep

**Specimen:** Faeces (minimum 3g)

**Container:** Plastic pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Samples may be refrigerated if there is any delay in sending for analysis (e.g. over weekend)

**General information about the disease:** Fascioliasis in grazing ruminants in Australasia is caused by the trematode *Fasciola hepatica.* Infection occurs in wet, swampy areas and irrigated pastures. The fluke requires an intermediate host in the form of snails in the *Lymnea* genus. Development of eggs through to the infective metacercarial stage occurs mainly in spring and summer and the adult flukes live in the bile ducts. Disease may be acute or chronic, but mostly presents as ill thrift, loss of production, and anaemia in autumn and winter.

**General information about when this test is indicated:** Investigation of production loss, ill thrift, and anaemia in grazing ruminants in fluke risk areas. Fluke risk areas include the North Island, and the north and west of the South Island.

**Comparison with other related tests:** In addition to fluke egg counts, a liver fluke ELISA is available to test individual serum samples, pooled serum samples, and bulk milk tank samples, and may be more useful for screening groups of animals.

# GIARDIA ELISA

**Species**: Feline, canine

**Specimen**: Faeces

**Container:** Sterile pottle

**Collection protocol:** Collect faecal sample either per rectum or once passed

**Special handling/shipping requirements:** Standard

**General information about the disease:** The combined cryptosporidia and Giardia antigen ELISA identifies both these enteric pathogens. The ELISA detects cryptosporidia and the generic GA 65 antigen released by the Giardia trophozoite when it encysts, rather than relying on the presence of the trophozoite or cyst.

**General information about when this test is indicated:** In animals with non-responsive chronic diarrhoea

**Comparison with other related tests:** A dual test involving cryptosporidia as well. More sensitive than flotation techniques.

# PARASITE LARVAL CULTURE AND RECOVERY

**Species:** Cattle, sheep

**Specimen:** Faeces (3-5g)

**Container:** Pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface

**Special handling/shipping requirements:** Submit samples fresh. It is important that faecal samples for larval cultures are NOT refrigerated. In cases where both FECs and larval cultures are required on the same set of samples, it is recommended that a sub-sample be removed from each individual sample and pooled. The individual samples for FEC can be refrigerated while the pooled sample should be clearly identified as being for larval culture and kept at room temperature.

**General information about the disease:** Grazing ruminants in New Zealand are rarely free of worm infection, though effects on stock health and productivity vary widely. Clinical effects of enteric parasitism

include ill thrift, diarrhoea, anaemia, and death in severe cases. The degree of damage is influenced by the numbers and identities of the parasites present, host age, immunity, general health, and nutrition.

**General information about when this test is indicated:** Apart from those of *Nematodirus, Strongyloides,* and *Trichuris,* the similarities in size and appearance of most strongyle eggs found in domestic livestock makes differentiation largely impossible. Their third stage (infective) larvae are sufficiently distinct to allow differentiation to at least the generic levels. Faecal culture allows eggs to hatch and develop to the third larval stage. It may be necessary to identify which species are present because some are more pathogenic than others and for drench resistance testing purposes.

**Comparison with other related tests:** Larval culture may be combined with composite or individual faecal egg counts in faecal egg count reduction testing for the purposes of estimating drench efficacy against parasites. In the future larval cultures may be replaced by faecal PCR enabling a more rapid turnaround time (see PCR section).

# LUNGWORM LARVAE DETECTION

**Species:** Cattle, deer, horses

**Specimen:** Faeces (minimum 5g)

**Container:** Pottle

**Collection protocol:** Directly from rectum or freshly passed sample from clean surface.

**Special handling/shipping requirements:** Samples may be refrigerated if there is any delay in sending for analysis (e.g. over weekend).

**General information about the disease:** *Dictyocaulus viviparus* is a common and important cause of respiratory disease in cattle in cool seasonal climates. Calves in their first grazing season are most at risk, though clinical disease may occasionally occur in adult cattle that have had insufficient exposure to develop immunity. Clinical signs range from a soft husky cough to fatal dyspnoea. Adult nematodes inhabit the large bronchi. Eggs are embryonated when laid and hatch rapidly. First stage larvae are coughed up, swallowed, and expelled in the faeces. *Dictyocaulus arnfieldi* is mainly a lungworm of donkeys but is an occasional cause of chronic coughing in horses. *Dictyocaulus eckerti* causes lungworm disease in deer.

**General information about when this test is indicated:** Investigation of respiratory disease in farmed cattle and deer, horses and donkeys.

# TAENIA OVIS ELISA

**Species**: Canine

**Specimen**: Serum

**Container**: Plain (red top) or gel tube

**Collection protocol**: Venepuncture

**Special handling/shipping requirements:** Standard

**General information about the disease:** *Taenia ovis* is the tapeworm parasite responsible for ovine cysticercosis (sheep measles). *Taenia ovis* is the subject of a national eradication campaign in New Zealand. A serological ELISA test was developed in New Zealand to supersede the need to purge and test dogs.

**General information about when this test is indicated**: If a problem with ovine cysticercosis has been detected in an area, dogs can be bled to detect infected individuals.

# WORM COUNTS

**Species:** Cattle, sheep, deer, goats

**Specimen:** Tied off abomasum (for abomasal worm count); tied off proximal 10 meters of small intestine (for SI worm count); tied off cecum and colon to 25cm below spiral colon (for LI worm count).

**Container:** Secure, leak-proof container (e.g. plastic bucket with lid)

**Collection protocol:** Harvest organs at necropsy, tying off proximally and distally to prevent loss of contents.

**Special handling/shipping requirements:** Submit samples fresh in securely sealed container (e.g. bucket with sealed lid).

**General information about the disease:** Grazing ruminants in New Zealand are rarely free of worm infection, though effects on stock health and productivity vary widely. Clinical effects of enteric parasitism include ill thrift, diarrhoea, anaemia, and death in severe cases. The degree of damage is influenced by the numbers and identities of the parasites present, host age, immunity, general health, and nutrition.

**General information about when this test is indicated:** Post-mortem worm counts are used to determine the numbers and identities of gastrointestinal worm burdens in grazing ruminants. The procedure provides a more direct quantification of worm burden than FEC but is more costly and time consuming. Because the level and composition of worm infection may vary considerably between individuals, worm counts need to be performed on several animals in order to obtain meaningful information on the parasite status of the herd or flock as a whole.

In cattle and probably deer, worm counts should ideally include digestion or prolonged saline/water soaking of the abomasal mucosa, particularly in animals >1-year-old. This helps to detect early 4$^{th}$ stage larvae of *Ostertagia* and helps in the diagnosis of type II ostertagiasis, as well as allowing improved quantification of *Trichostrongylus axei,* which may remain adhered to the mucosa after washing.

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