How To Do The Modified McMaster Fecal Egg Counting Procedure

The most common and efficient way to obtain fecal egg counts for sheep, goats, young cattle and horses is to use the Modified McMaster Test. This is a flotation test that separates parasite eggs from debris based on density; the eggs float to the surface of the counting chamber. This test uses a special microscope slide with a grid, which makes counting easier (Figure 1).

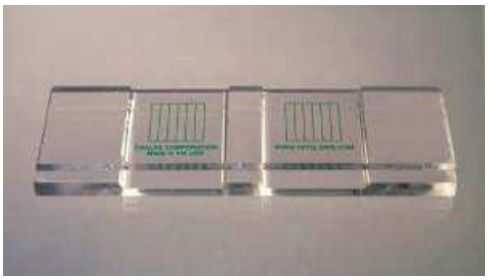


Figure 1. McMaster microscope slide.
www.vetslides.com

Manure and flotation fluid is measured and mixed and only a small portion of the total mixture is counted. A calculation is performed to determine the number of eggs/gram in the manure. This technique can be used to count strongylid (also called strongyle or trichostrongyle) eggs, including those of the barber pole worm (*H. contortus*).

This information sheet will describe the supplies needed and the procedure for the Modified McMaster Test for fecal egg counting as it relates to small ruminant parasite management. View our demonstration video on fecal egg counting for more information on how to do this procedure. View our information sheet, *Why Do Sheep and Goat Fecal Egg Counts* for more information on using and interpreting fecal egg counts. These resources can be accessed from our website, ***http://web.uri.edu/sheepngoat*.**

Reference: Zajac, A.Z., Conboy, G.A., 2012, Veterinary Clinical Parasitology 8th Edition, 8-11.

Fecal Egg Counting Supply List:

- Scale to weigh fecal sample. Scale must weigh in 0.1 gram increments; a digital kitchen scale could be used.
- Two paper or plastic cups, at least 5 ounces
- Fecal flotation solution (can be Fecasol®, a commercially available solution, sugar solution, or a saturated solution of pickling salt (NaCl) or Epsom salts (MgSO4) - see procedure notes on how to make this solution.)
- Dispenser bottle, measuring cup or large syringe for measuring flotation solution
- Tongue depressor / craft stick or spoon for mixing
- Straining technique – this can be a tea strainer; unfolded gauze 4" X 4" pads or squares; or cheese cloth cut into squares (6" squares preferred)
- 2-chamber McMaster slides. See procedure notes for more information including suppliers.
- 1 ml syringe, or eye dropper, or transfer pipette for filling slide
- Compound microscope with internal light source, moveable stage and 4X and 10X objective lenses. A binocular microscope is more comfortable than a monocular scope, but not essential.
- Timer

Fecal Collection Supply List:

- Exam gloves (powder free is best)
- Labels (1" x 3") to identify sample
- Permanent marker
- KY Jelly / lubricant
- Container with cooler/ice packs
- Refrigerator

Collecting a fecal sample:

1. Put on a clean glove. Apply a nickel size amount of water or water-based lubricant to index and middle fingers.

2. Insert index and middle fingers into the rectum of the animal, one finger at a time. No need to go very deep. Spread fingers to allow air into the rectum. The air duplicates fullness in the rectum and a wave of muscular movement will often move feces out into your hand.

3. Remove ~4 grams of fecal matter. A good sized adult pellet is about 1 gram.

4. Peel the glove off your hand keeping the fecal sample encased within it.

5. Squeeze as much air as possible out of the glove. Twist the wrist portion of the glove and fasten with a label (farm and animal ID) making sure the label sticks to itself, as it won't stick to the glove. You can also twist and tie off the glove and label the glove itself with an indelible marker.

Store the sample in the refrigerator until it can be analyzed (the sooner the better, but samples can be stored in the refrigerator for a week). If you are collecting many samples at one time, have a cooler with ice on hand to keep the samples cool until you can get them into a refrigerator.

Don't use this collection method to sample very young animals. If you can't insert your fingers don't force them. Another option is to collect a sample **immediately** after it has been naturally deposited by the animal. Rectal fecal sample collection is most successful when the animals have been resting for a while, so if you need to pen them up to do the collection, let them rest there for a couple of hours before collecting the samples if possible.

View the fecal egg counting video for a demonstration. The video can be accessed from our website, ***http://web.uri.edu/sheepngoat*.**

Performing fecal egg count test:

1. Label two cups with animal ID as well as farm ID (if needed).

2. Tare one labeled cup on scale.

3. If manure is pelleted, crush the pellets in the glove and knead the manure in glove to mix. Cut off fingertip of glove containing feces to access fecal pellets, making sure to leave label intact.

Step 3. Kneading manure in glove to mix fecal sample.

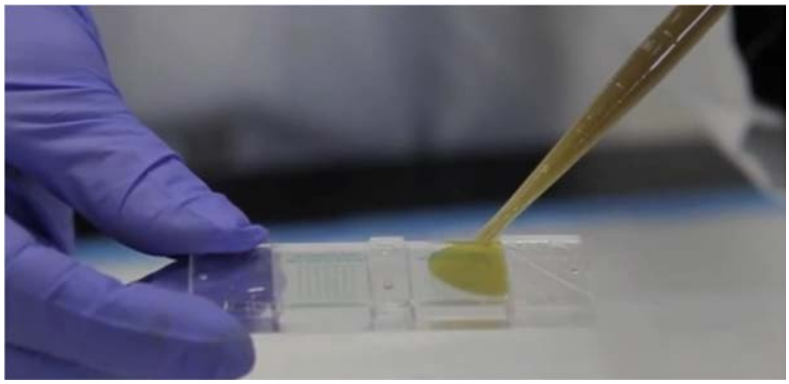
4. Measure two grams of fecal pellets into cup on scale.

5. Dispense 28 ml flotation solution into the cup, mix and let soak for approximately 5 minutes. *See following notes on flotation solution for how to make up your own saturated salt solution.

6. Once you are confident in the procedure you can weigh out multiple samples, add flotation solution and mix until 6-10 samples are set up.

7. Return to the first sample and mix again. Place tea or fabric strainer on top of the second cup (don't stretch fabric tight across the cup). Pour the mixture of feces and flotation solution through, pressing fluid through with the tongue depressor.

8. **Immediately**, fill both chambers of the McMaster slide using a transfer pipette, eye dropper, or syringe. If large bubbles are present, empty the slide and refill. Even if a large bubble is not actually under the grid, the slide should be refilled. Fill the entire chamber, not just the area under the grid.

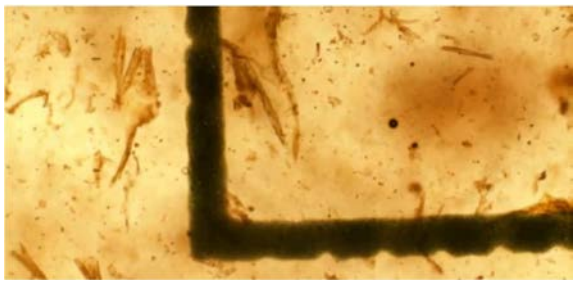


Step 8. Filling the first chamber of the McMaster slide using a transfer pipette.

9. Set slide aside for at least 5 minutes to allow parasite eggs to float to the surface. Read slides within about an hour of filling the slide. If slides are left too long, fluid evaporates and salt crystals form.

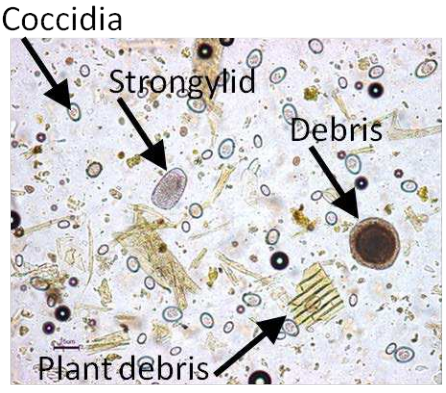
10. Place McMaster slide onto the microscope stage.

11. Bring the grid lines on the McMaster slide into focus using the low power (4X) objective and the coarse adjust knob. Turn to the 10X objective and refocus grid lines using the fine adjust knob. You can also focus on the air bubbles.



Step 11. Bringing the grid lines on the McMaster slide into focus.

12. Count all eggs inside of the grid areas using the 10X objective (include eggs on the grid line if greater than ½ of egg inside grid) in both chambers.



13. Always start at the same point on the McMaster slide (for example, top left or bottom right). That way, you won't lose track of whether you have counted only one or both chambers.

14. Count only strongylid eggs (oval shaped, ~80-90 microns long). Quantify *Nematodirus* eggs separately as they can be clearly distinguished. Other parasites present should be recorded and may be counted if desired, but numbers are often difficult to interpret. *See the parasite egg identification section of this fact sheet for photos (pages 7 and 8).

15. Count both chambers. Total egg count:
(chamber 1 + chamber 2) * 50 = eggs per gram (EPG)

This multiplication factor of 50 is specific to the ratio of feces (2 grams) to flotation solution (28 ml) described in this procedure. Each egg observed represents 50 eggs/gram therefore, this procedure will not detect fewer than 50 eggs/gram, which is equivalent to seeing one strongylid egg on the McMaster slide.

Be consistent:
Many laboratories perform this test and you may see slight variations in the procedure described. **The important thing is to always perform the test the same way each time—consistency is critical in order to monitor your animals over time or test the efficacy of drug treatment.**

Additional notes on procedure:

Flotation solution:
The following commercial solutions are commonly used by labs and can be obtained through your veterinarian:

Fecasol® - Vetoquinol, **www.vetoquinolusa.com**; Phone: 800-267-5707
Feca Med - Vedco Inc., Saint Joseph, MO, **www.vedco.com**; Phone: 816-238-8840

You can make up your own saturated salt solution using regular salt (sodium chloride) or Epsom salts (Magnesium Sulfate). A sugar solution is also available, but it is very viscous and sticky and results in difficult clean-up.

The approximate amounts of salt and water needed are provided on page 6. Add more salt as needed to fully saturate the solution. Add and mix the salt to lukewarm tap water until some of the salt no longer dissolves (the solution is saturated). Let it sit overnight. The amount of salt it takes to saturate the solution is affected by temperature, so the final test is to be sure you always see some un-dissolved salt at the bottom of your container. Pickling salt works better than table salt for making this solution because table salt contains anti-caking agent that doesn't dissolve and may mislead you into thinking that the mixture is saturated.

Sodium chloride (pickling salt):
Approximately 180 grams per 500 mls of water.
¾ of a cup of salt to 1 pint (16 ounces) of water – this would do about 16 fecal samples

Magnesium sulfate (Epsom salts):
Approximately 125 grams per 500 mls of water.
½ cup of salt to 1 pint (16 ounces) of water – this would do about 16 fecal samples

McMaster Slide:
The following are two U.S. Suppliers of this slide:

Chalex Corporation, 5004-228th Ave SE, Issaquah, WA, 98029.
Phone: 425-391-1169; **www.vetslides.com**

FEC Source, P.O. Box 601, Banks, OR 97106
Phone: 844-838-7543; **www.fecsource.com**

Video available: view our video which provides step-by-step instructions and commentary on how to perform the Modified McMaster fecal egg counting procedure. This includes instruction on using a microscope and information on parasite egg identification. The video can be accessed from our website, ***http://web.uri.edu/sheepngoat*** and can also be viewed directly from the URI YouTube channel page **(UniversityOfRI):** ***https://www.youtube.com/watch?v=ZZQymZKe_hs*****.**

Parasite Egg Identification: The following two pages show the microscopic appearance of stronylid eggs, as well as other types of parasites, air bubbles and other material (such as plant material) commonly contained in sheep and goat fecal samples. These are also covered in detail on the video.

Parasite Egg Identification: Common Parasites in Small Ruminant Fecal Samples

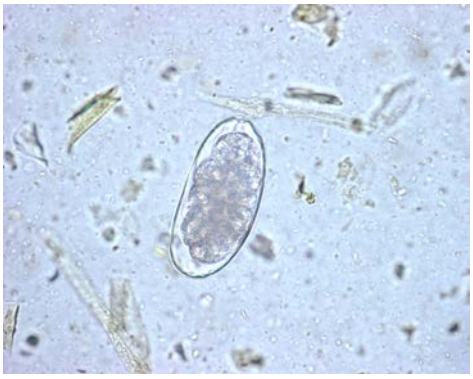


Figure 1. Strongylid egg

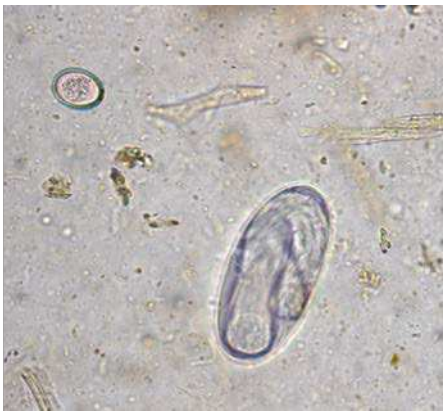


Figure 2. Larvated strongylid egg. These may be seen in old fecal samples

Figure 3. *Nematodirus* egg

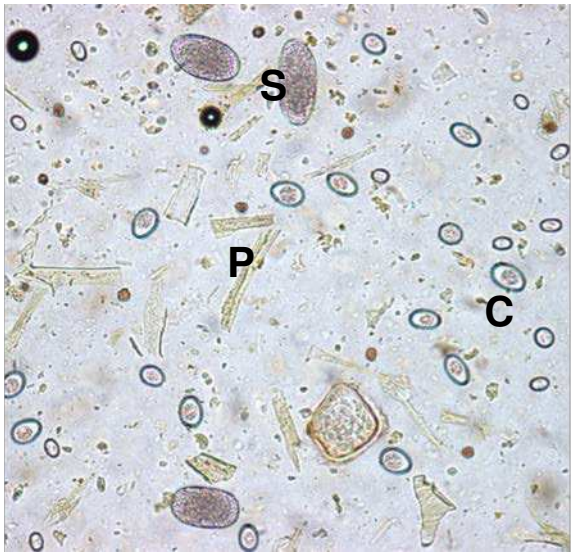


Figure 4. Strongylid egg (S), coccidia oocysts (C) and plant debris (P). Note size differences between eggs and oocysts.

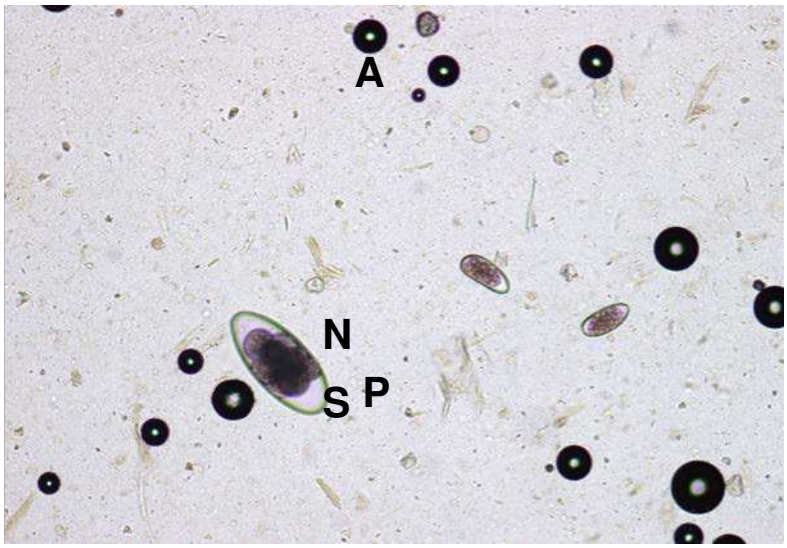


Figure 5. *Nematodirus* (N) and strongylid (S) eggs. Note size difference between eggs. Also note the presence of air bubbles (A).

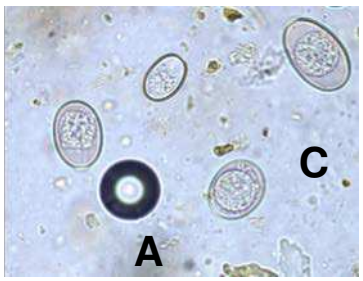


Figure 6. Coccidia oocysts (C) and air bubble (A). Small ruminants are infected with several different species of coccidia that vary in size.

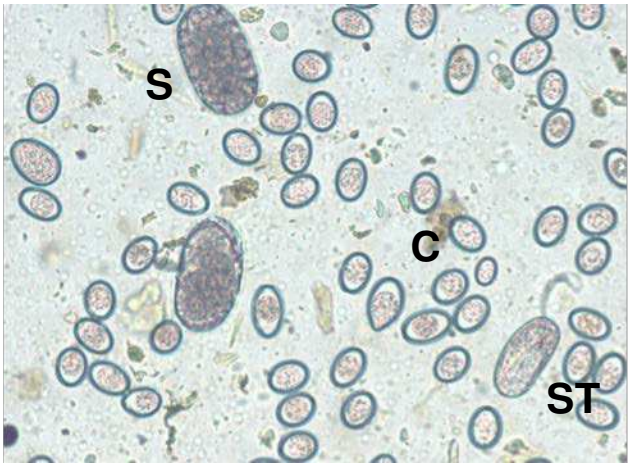


Figure 7. Strongylid (S) eggs and *Strongyloides* (ST) egg and coccidia (C) oocysts. Note size difference between eggs. *Strongyloides* eggs are larvated in fresh feces, strongylid eggs are not.

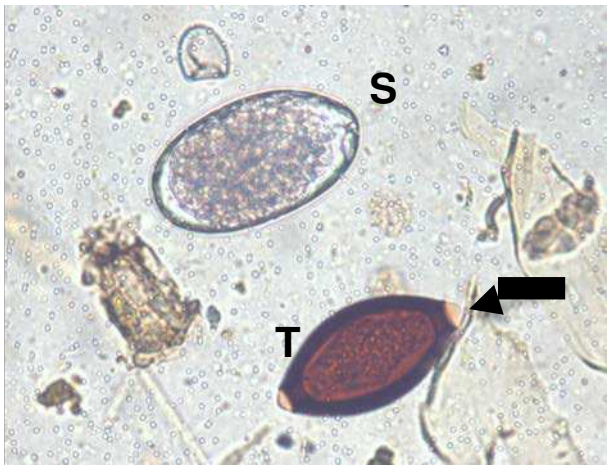


Figure 8. Strongylid (S) and *Trichuris* (T) eggs. Note similarity in size. *Trichuris* eggs have two distinctive polar plugs (arrow).

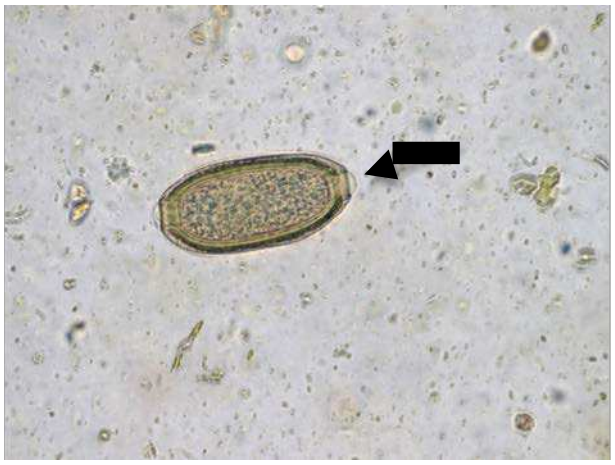


Figure 9. *Aoncotheca* egg. This egg looks like *Trichuris*, has polar plugs (arrow) like *Trichuris* but is about one- third smaller and is an uncommon finding.

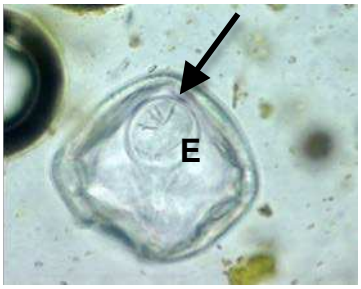


Figure 10. *Moniezia* (tapeworm) egg. These eggs contain a small round embryo (E) with hooks (arrow). The embryo is difficult to see at 10X power. Eggs may appear square or triangular. The presence of the embryo distinguishes the egg from some confusing plant debris (see Figure 4).

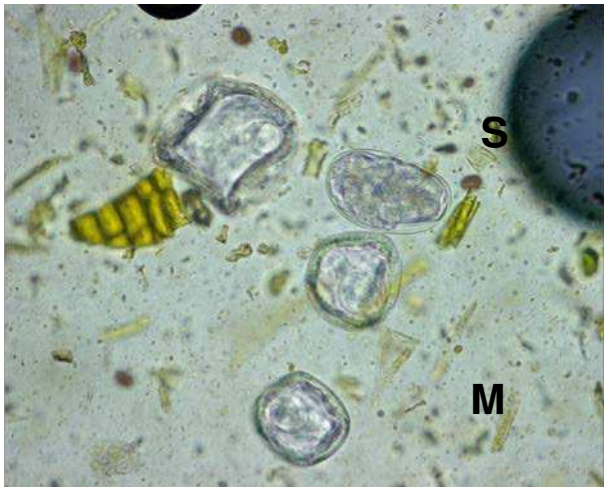


Figure 11. Strongylid (S) and *Moniezia* (M) eggs. Note similarity in size.

Photos: Anne Zajac, DVM, Ph.D. Parasitologist, Virginia-Maryland Regional College of Veterinary Medicine / Virginia Tech

For more information including our information sheet, *Why Do Sheep and Goat Fecal Egg Counts* and our demonstration video on fecal egg counting, visit our website at ***http://web.uri.edu/sheepngoat*.** The video can also be viewed directly from the URI YouTube channel page **(UniversityOfRI): *https://www.youtube.com/watch?v=ZZQymZKe_hs*.**

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