

Factors Causing Gastrointestinal Problems in Juvenile Squirrels

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Squirrel rehabilitators report that gastrointestinal conditions, especially stool problems, often occur in juvenile squirrels. This article identifies some common factors affecting squirrel gastrointestinal health. Many of the causes of gastrointestinal upset in squirrels are listed below in a convenient format for quick reference. A later article will focus on ways to prevent problems and resolve them if they occur.

Gastrointestinal health of juvenile squirrels can be affected by the mother's health; the reason that the animal is admitted to rehabilitation (e.g., orphaned and dehydrated, injury, wounds, toxins); the condition of animal when admitted for care; rehabilitation practices; medications; diet; feeding practices; and much more. It is important to consider the possibility of all causes when deciding on how to resolve current and prevent future problems.

It is quite easy for gastrointestinal problems to develop in juvenile squirrels in rehabilitation – and more challenging to prevent or correct these problems. Any of the factors listed below can cause symptoms of gastrointestinal problems, such as poor appetite, bloat, soft stool, diarrhea or constipation. If several factors are involved, such as overfeeding in amount and frequency, endoparasites, and a diet with too many sugars, the squirrel's gastrointestinal disturbance can become more severe, deteriorate quickly, and be more difficult to identify and resolve. While gastrointestinal problems in juvenile squirrels are rarely related to infections that require antibiotics, this is possible and should be confirmed with culture sensitivity analyses prior to beginning any antibiotic treatment.

Challenges with identifying problems and causes

It is challenging to identify health problems in wild animals. Wild creatures hide problems and weakness so as to not attract predators. Signs of their deteriorating health may be subtle and difficult to notice. Also, wild animals clearly are unable to describe health problems in human language. While later stages of gastrointestinal symptoms may be more obvious and easier to detect than some other health conditions, the initial signs may still be gradual and subtle, such as a change in the shape or stickiness of stool pellets.

Less knowledgeable, skilled or experienced caregivers, whether rehabilitators, staff, volunteers or even veterinarians may miss early signs of gastrointestinal upset. This can result in the problems getting worse before they are noticed. This can result in serious problems that are more difficult to correct. The same can happen with multiple caregivers, especially when they are less informed about rehabilitation and squirrel health, as well as with rehabilitators working to provide care for a large number of animals and having very limited time to monitor individual animals.



Be alert to early signs of potential problems

Know what is normal and expected as it relates to energy, growth, fur, and general well-being, as well as obvious gastrointestinal symptoms such as appetite, stool color, shape, texture, odor, and amount, and bloat. When you first notice things that seem abnormal, unexpected or somehow 'just not exactly right', try to identify the cause. Start by considering simple, common causes or problems.

Monitor animals closely and often. Be alert for minor and subtle changes that may suggest early stages of problems developing. Such monitoring helps identify a single factor that may have caused the change.

Monitor weight gain. Weigh the juvenile squirrels regularly, at least several times a week. They should gain weight on a regular basis. Growth rates may vary depending on the species and health of the animal, but in general the squirrel rehabilitator will see squirrels weighing:

- 15-50 grams gaining about 1-2 grams per day
- 50-150 grams gaining about 2-3 grams per day
- 150-350 grams gaining 3-7 grams per day, but possibly up to 10 grams a day for larger tree squirrels.
- It is not a cause for concern if a squirrel does not gain one day since it may have a growth spurt and gain more the next day.
- However, if the growth rate is slower than an average expected rate for the species, especially over several days, evaluate what is going on and adjust accordingly. Consider such things as coccidia, giardia, feeding amounts, and so forth.

Gastrointestinal problems, such as diarrhea, rarely develop instantaneously. Rather, it often takes squirrels 24-72 hours to develop full-blown diarrhea. It also takes time to correct diarrhea. That said, stool problems in juvenile squirrels generally occur in stages. Normal stool is round, firm, odorless and either dark gold or brownish black depending on age and diet. A lighter colored squirrel stool that becomes less round and formed, 'stickier' is becoming a problem. Squirrel stool that becomes more like paste is further deteriorating, and then to liquid, involuntary diarrhea. Recovery follows the same stages in reverse – and may take about the same time as it took for the problem to develop.

Conduct or have a veterinary clinic conduct fecal tests. This is a rather quick and easy way to identify parasites. Since some parasites, such as Coccidia, may be difficult to see on a fecal examination, the veterinarian may initiate treatment with Albon® for Coccidia and Panacur® for Giardia. Refrain from automatically giving antibiotics for diarrhea since these will probably be ineffective and may exacerbate the problem.

Some common factors known to cause GI problems in squirrels

Health conditions prior to admission to rehabilitation

- Mother squirrel's health was compromised due to such things as injury, extremely heavy parasites, illness, toxins, or severe drought that results in weakened health for her offspring.

- Young squirrels with a mother with health problems and/or without care for a longer time likely have more ectoparasites and endoparasites than normal and arrive in a weakened condition.
- Fed by the rescuer (wrong formula, cold animal, etc.). This is a common problem.
- Wounds and injuries.
- Bacterial infections.
- Viral infections are less common, but can occur and may spread quickly.
- A juvenile squirrel that was left alone for several days and is too young to eliminate stool or urine may have or develop higher levels of bacteria and possible infections in their gastrointestinal tract.
- Juvenile was exposed to toxins or poisons.
- Stress and fear.
- Pain.

Husbandry

- Inadequate quarantine (e.g., space, caging, number of days).
- Inadequate parasite control and/or prevention.
- Unsanitary feeding utensils, cages, bedding, facility, and so forth with exposure to bacteria, parasites, etc.
- Cage density (i.e., number of squirrels in cage for cage size).
- Contamination and transfer of parasites by people, cages, bedding, etc.
- Contaminated water.
- Stress (e.g., capture, handling, noise, strong odors, change of caregivers).
- Inappropriate items in the cage that cause problems when chewed and ingested.

Health

- Not hydrated completely on arrival and started on food/formula too quickly.
- Not hydrated with isotonic products, such as Lactated Ringer Solution.
- Coccidia, Giardia or other endoparasites.
- The juvenile squirrel does not defecate completely or regularly due to lack of or inadequate manual stimulation of genitalia.
- Not noticing symptoms or problems in early stages when problems are beginning.
- Irritated GI tract due to soft stool continuing over 3 days.
- Bacterial infection in abdomen or GI tract that developed in rehabilitation.
- Viral infection that developed in rehabilitation.
- Injury to abdomen.
- Gut flora is out of balance for more than several days.
- Stress and fear.
- Pain.



Firm, round, gold-colored stool from a healthy juvenile Fox Squirrel on milk replacement formula.

Medical practices

- Antibiotics that disrupt and/or destroy good gut flora (e.g., Baytril, Bactrim, SMZ, TMS)
- Use of medications that are contraindicated in squirrels or rodents that may cause or aggravate GI conditions (i.e., gastroenteritis, bloat, diarrhea,

hemorrhage) including penicillin based drugs (e.g., Amoxicillin, Clavamox, Penicillin), tetracyclines, and Metacam.

- Incorrect dosages or length of time that medications are administered.
- Not treating parasites with correct medications, dose, length of treatment.
- Too frequent administration of probiotics to rebuild gut flora (i.e., more than twice a day).
- Not consulting a veterinarian who is familiar with treating rodents when problems continue or deteriorate if the 'easy solutions' do not resolve the problem.
- Problems after surgery and anesthesia.

Diet and feeding

- Milk replacement powder is mixed with something other than water (e.g., Lactated Ringer Solution (LRS), Pedialyte, fruit juices).
- Fed formula when animal was cold.
- Formula and/or solid food was introduced to dehydrated animal.
- Formula was too cool/cold when fed.
- Fed wrong foods (e.g., citrus fruits, cow's milk).
- Fed a milk replacer that does not meet nutritional needs.
- Fed formula or foods with too many fats, sugars and/or carbohydrates.
- Overfeeding.
 - o Fed too much formula at a feeding.
 - o Fed too many times a day.
- Feedings were too close together.
- New foods added too fast.
- Fed formula that was overly concentrated or rich.
- Adding higher percentage of fats to formula for very young squirrels. As a general rule, juvenile squirrels without fur on their abdomen are not able to digest extra fats in MultiMilk® or whipping cream.
- Multiple new foods added at one time.
- Milk replacement powder is not refrigerated or stored properly.
- Formula is reheated after it was initially warmed.
- Inaccurate measuring (milk replacement powder, water, etc.).
- Formula is not fully dissolved when it is fed.
- Squirrel is given more solids than it can fully digest.
- Not fed enough formula or solids.
- Fed solids that are too rich, which may include some nuts and seeds.
- Rapidly increasing the number and volume of foods.
- Method of mixing formula results in many air bubbles that when swallowed may cause bloat.

Tips on Feeding Amounts

Weigh the squirrel using an accurate gram scale several times a week. Record the results.

As a general rule, as juvenile squirrel's stomach may hold about 5% of body weigh measured in grams – and that is the amount fed per feeding until eating solids (not just shredding or nibbling); the amount of formula fed at a feeding increases to 6% of body weight per feeding and reduces to 3 formula feedings per day when eating solids well and climbing well enough to climb upside down on top/roof of cage; when on one formula per day and eating solids great, increase amount of formula fed to 7% of body weight.

Milk replacement products

- Product does not meet nutritional needs for the species.
- Source and quality of ingredients.

- Fats are not digestible.
- Product has too many fats.
- Product has too much sugar.
- Bacteria in the formula due to storage, reheating, etc.
- Product is contaminated (e.g., toxins, metals)
- Quality control problems.

Other suggestions

Place animals with health problems in a smaller cage to help limit their activity and energy expenditure. This may reduce the chance of their developing other problems and direct their energy to healing.

Provide supplemental heat for all compromised animals, such as those with GI symptoms. This means having the bedding at least partially on a heat source rather than using a hammock or hanging nest.

Ensure good hydration. If the animal has difficulty staying hydrated, try to identify the reason, such as soft stool, diarrhea, formula that is too concentrated (i.e., not diluted properly), too few feedings, inadequate amount of formula, or a fever due to infection. Consider providing a small amount of additional isotonic fluids between feedings, such as Lactated Ringer Solution (LRS). Again, remember to use isotonic fluids by themselves and not mixed with milk replacement products since that cause more dehydration.

Maintain clean bedding and cage. Very young juvenile squirrels defecate small, firm round stool when manually stimulated after a feeding. Older juvenile squirrels defecate as they move around their cage. Squirrels with soft stool or diarrhea may soil the bedding and cage more often. In addition to being unclean and having an offensive odor, such stool spreads bacteria, parasites, and so forth. Depending on the severity of the problem, the bedding, and even the cage, may need to be cleaned several times a day. After shaking off and disposing of any solid stool, wash soiled bedding in hot water with a safe detergent and bleach, and rinse thoroughly. Provide squirrels with stool problems a pile of soft, light colored fabric for bedding, such as 3 or 4 t-shirts, instead of a nest box or hammock which are harder to clean and access. Cages, cage furnishings, water bottles and so forth should also be cleaned and disinfected regularly.

Clean off any soft stool or diarrhea that sticks to or smears on the squirrel's skin, fur, rectum or genitals before it dries. Feces stuck to these areas may cause fecal burns, skin tears or genital injuries that are painful and can become infected. Use warm water to clean any of the soft feces off of the squirrel's skin, fur, anus or genitals.

Start with simple fixes, like removing a new food, making sure the formula was measured and mixed correctly, and temporarily diluting formula. Knowing that coccidia and giardia are common, especially in compromised or stressed squirrels, consider having fecal tests performed and treating for these endoparasites. Again, remember that since squirrel gastrointestinal conditions are more likely caused by factors other than infection, antibiotics are generally not needed for stool problems.

Avoid the temptation to provide extra formula feedings for squirrels that are sick or smaller in size than they should be for their age and development. Providing an 'extra' formula feeding may result in overfeeding, which can cause soft stool, and hinder digestion, preventing them weight gain and growth. Make sure they eating a nutritious diet and healthy, and are growing steadily. Weigh such compromised squirrels daily to help monitor changes and be able to adjust. While it may seem counterintuitive, if you are still concerned about a juvenile squirrel that seems smaller in size for its age and it still has soft stool, consider reducing by one feeding may improve digestion, stop the stool problems, and help compromised squirrels gain weight.

Conclusion

There are obviously many factors that can affect squirrel gastrointestinal health. This article provides a checklist of common factors to consider when confronting gastrointestinal problems in juvenile squirrels in rehabilitation. Further reading and communication with experienced rehabilitators can help identify factors and possible solutions.

As rehabilitators know, there have been and continue to be developments in knowledge and practice that can help prevent and resolve gastrointestinal problems in squirrels in rehabilitation. Continually seeking and sharing information will help the rehabilitators and the squirrels in their care.

Resources

- Aiello, Susan and Asa Mays. 1998. *Merck Veterinary Manual*, 8th edition. Merck and Company, Inc.: Whitehouse Station, N.J.
- Casey, Allan. 2002. Mammal Nutrition: How Cookbooks Can Be Harmful. *Wildlife Rehabilitation*, Vol. 19. NWRA Symposium: Selected Papers. NWRA, St. Cloud, MN.
- Casey, Shirley and Allan Casey. 2003. *Squirrel Rehabilitation Handbook*. WildAgain Wildlife Rehabilitation, Inc., Evergreen, CO.
- Casey, Shirley and Allan Casey. 2003. *Squirrel Rehabilitation Handbook*. WildAgain Wildlife Rehabilitation: Evergreen, CO. Available at www.ewildagain.org
- Casey, Shirley and Mackenzie Goldthwait. 2003. "Gastrointestinal conditions in squirrels: the scoop on poop." *Squirrel Rehabilitation Handbook*. WildAgain Wildlife Rehabilitation, Evergreen, CO.
- Casey, Shirley. 2009. "Ten Common Causes of Stool Problems in Juvenile Squirrels." www.ewildagain.org
- Harkness, John and Joseph Wagner. 1989. *The Biology and Medicine of Rabbits and Rodents*, 3rd edition. Lea and Febiger: Philadelphia, PA.
- Hillyer, Elizabeth and Katherine Quesenberry. 1997. *Ferrets, Rabbits and Rodents: Clinical Medicine and Surgery*. W. B. Saunders: Philadelphia, PA.
- Laber-Laird, Kathy, Michael Swindle, and Paul Flecknell. 1996. *Handbook of Rodent and Rabbit Medicine*. Permagon: Tarrytown, NY.
- Moore, Adele and Joosten, Sally. 2002. *NWRA Principles of Wildlife Rehabilitation*, 2nd Edition. NWRA, St. Cloud, MN.

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