

Factors Causing Gastrointestinal Problems in Juvenile Wild Mammals in Rehabilitation

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Rehabilitators report that juvenile mammals in rehabilitation often develop adverse gastrointestinal conditions, especially stool problems. This paper identifies some common factors affecting gastrointestinal health of wild mammals. Many of the causes of gastrointestinal upset are listed below in a convenient format for quick reference. A later paper will focus on ways to prevent problems and resolve them if they occur.

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

It is quite easy for gastrointestinal problems to develop in juvenile mammals in rehabilitation – and very 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 much sugar, the mammal's gastrointestinal disturbance can become more severe, deteriorate quickly, and be more difficult to identify and resolve. While gastrointestinal problems in juvenile mammals are rarely related to infections that require antibiotics, this is possible and should be confirmed with culture and sensitivity analyses prior to beginning any antibiotic treatment.

Challenges with identifying problems and causes

Many factors contribute to the challenges of identifying and addressing health problems in wild animals. Wild creatures hide problems and weakness so as to not appear vulnerable. Signs of their deteriorating health may be subtle and difficult to notice. Also, wild animals 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 appetite, activity level, comfort, and frequency or process (normal versus slow digestion; voluntary, involuntary, gushing defecation). Or the product (feces, stool) could change, such as color, shape, texture, amount or volume.

Abstract: Gastrointestinal problems are, unfortunately, quite common in young wild mammals in rehabilitation. This paper describes challenges with identifying problems. It also identifies over 75 common causes, including health conditions, husbandry, medical practices, diet, feeding practices, and more.

Key words: Wildlife digestive problems, digestive disorders in wild orphans, digestive disorders in wild animals, diarrhea in wild mammals, diet problems in wildlife, young wild mammal gastrointestinal upset, gastrointestinal disorders in captive wild mammals, gastrointestinal disorders in rehabilitating mammals.

Natural history is another challenge. Anatomy and physiology, key components of natural history, can be very different. What is considered good care for one type of animal may be different and even cause problems for another. For example, squirrels and rabbits are both small mammals, but have significantly different gastrointestinal systems. The stomach size of juvenile opossums and lagomorphs are larger than many other species. Mammal species have different milk compositions – with substantially different levels of solids, proteins, fats, carbohydrates and more. The species suckle their mothers for different lengths of time. The species are dependent on their mothers for different lengths of time. Gastrointestinal function and diets also are affected by the age of the animal (infant, juvenile nursing its mother, juvenile consuming mother's milk as well as solid foods, weaned juvenile and adult).

Species eat different foods. Plus, the young and adult animals often eat different foods – which also may affect digestion and elimination. The season of the year and animal's activity level also can affect the gastrointestinal function, such as with the hibernating chipmunk, woodchuck or bear. Some species have low levels of endoparasites that are not harmful for the animal – unless the level becomes excessive, whereas other species may be harmed by the endoparasites. It is challenging for the rehabilitator to be familiar with the natural history of the many mammal species and understand the impacts on the gastrointestinal function and health.

Less knowledgeable, skilled or experienced caregivers, whether rehabilitators, staff, volunteers or even veterinarians, may miss early signs of gastrointestinal upset, especially if they are not familiar with the specific stool for the species, age of the animal, types of food consumed, effects of diets and feeding frequency, and so forth. They may not be aware of potential reasons for such problems,

especially those related to rehabilitation or veterinary practices. This can result in the conditions worsening before they are noticed and then be more difficult to correct. The same can happen with multiple caregivers, especially when they are less informed about rehabilitation and wild mammal 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.

Maintaining accurate, descriptive, complete and frequent documentation on individual animals and their care is another consideration. Rehabilitators need to be aware of the animal's condition and any changes. Effective documentation can help identify possible causes of illness, such as an increase in feeding amount, feedings that were too close together, a new medication, or addition of a new food. If the signs, whether subtle or obvious, are not noticed, documented and then monitored, caregivers may not be aware of the condition and change – and if it causes an improvement or deterioration. Recordkeeping also helps the rehabilitator know if the problem has resolved itself, the duration and direction of change, treatments that may have been effective, like reducing the amount fed at a time or the number of feedings per day, outcomes, and any recurrence. A lack of effective and timely recordkeeping can cause the rehabilitator to miss key signs, possible causes, changes in the condition and results of treatments.

Be alert to early signs of potential problems

Know what is normal and expected for the species, especially as it relates to energy, growth, fur, and general well-being. Also be familiar with obvious gastrointestinal symptoms such as change in appetite, change in stool (color, shape, texture, odor, volume and amount) and bloat. When first noticing conditions that seem slightly different from healthy animals of the same age, the rehabilitator must be aware of the animal's previous gastrointestinal function, and what does not seem 'exactly right,' to be able to immediately try to identify the cause. Start by considering simple, common causes or problems, such as overeating or a change in diet.

Monitor animals closely and often. Be alert for minor and subtle changes that may suggest early problems developing. Such monitoring helps identify a single factor that may have caused the change. How is the appetite? Does the animal seem to have digested the previous meal? Is it hungry or still 'full' from the previous meal? Notice the condition of the abdomen and compare it to other animals of similar age. Is it normal, extended, firm, 'hard,' squishy and so forth? Consider the stool amount, color, texture, odor. Does the animal pass stool at a normal rate for the species, like around the time of feedings or when active? Does the animal seem comfortable when defecating, or is there evidence of pain? Familiarity with natural history

and knowing what is 'normal' is essential. One can also compare the animals to others of the same species and general age.

Monitor weight gain. Weigh the juvenile mammals 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

- In general, the young animals will grow each day.
- It is not a cause for concern if an animal does not gain one day since it may have a growth spurt and gain more the next day.
- However, if the animal's 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 whether the diet and amount of food are appropriate for size, age and health of the animal. Are the feeding amounts and feeding frequency correct for this species? Could this animal have endoparasites (e.g., giardia, coccidia, roundworms, hookworms, whipworms)?

Symptoms of gastrointestinal problems, such as diarrhea, rarely develop instantaneously. Rather, it often takes at least 24-72 hours for a sick animal to develop full-blown diarrhea. It also takes time to correct diarrhea. That said, stool problems develop over several stages. Normal stool is firm, odorless and either dark gold or brownish black depending on age of the animal and its diet. A lighter colored stool that becomes less formed and 'stickier' is a sign of a developing problem. Feces which are much less formed and more like paste are evidence of further deterioration, and liquid, involuntary diarrhea is often end stage disease. 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 products such as Albon® or Ponazuril for coccidia and Panacur® for giardia.

Do not assume antibiotics are needed. Antibiotics are used to treat bacterial infections. Gastrointestinal problems in wild mammals are, however, more likely to be caused by endoparasites or rehabilitation practices, such as overfeeding, inappropriate diet, or inadequately dissolved milk replacement formula, and less likely to be bacterial infections. Addressing the cause of the problem, such as feeding an appropriate amount of food or using milk replacement formulas allowed to fully dissolve over 8 hours, often quickly resolves the problem.

Irritation and inflammation of the gastrointestinal tract that has continued over multiple days, however, could result in diarrhea and bloat and possibly an imbalance

of the normal intestinal bacterial populations. Such conditions still may resolve when the cause, such as overfeeding or endoparasites, is corrected. The administration of an appropriate probiotic, such as *Saccharomyces boulardii*, also may help rebalance the gut flora, reducing the detrimental bacteria, and help heal the gastrointestinal tract. It should be noted that while providing a probiotic twice a day can be very beneficial, too many daily doses of probiotics cause a different type of gastrointestinal bacterial imbalance. A culture confirming specific bacteria should be performed prior to selection and administration of antibiotics for gastrointestinal conditions – after working through the steps to correct the cause of the problem.

Some common factors known to cause gastrointestinal problems in wild mammals

Health conditions prior to admission to rehabilitation

- Mother mammal's health was compromised due to such things as injury, extremely heavy parasite load, illness, toxins, or dehydration that results in weakened health for her offspring.
- Young 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 mammal 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 either directly or indirectly.
- Stress and fear.
- Pain.
- Young who have nursed off of a dead mother, which is common with opossums.

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 animals 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's solution or Normosol-R®.
- coccidia, giardia, roundworms or other endoparasites.
- The juvenile mammal 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 gastrointestinal tract due to soft stool continuing over 3 days.
- Bacterial infection in abdomen or gastrointestinal 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.
- Eruption of new teeth (teething), including premolars and molars.
- Stress and fear.
- Pain.

Medical practices

- Antibiotics that disrupt and/or destroy good gut flora (e.g., Baytril®, Bactrim®, sulfamethazine)
- Use of medications that are contraindicated in the species or age animal that may cause or aggravate gastrointestinal conditions (i.e., gastroenteritis, bloat, diarrhea, hemorrhage). Medications that are commonly used and effective with domestic species may cause problems in some wildlife species, such as penicillin based drugs (e.g., Amoxicillin®, Clavamox®), Tetracycline®, and Metacam® when administered to rodents and lagomorphs.
- 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 wild mammals when problems continue or the animal's health deteriorates if the 'easy solutions' do not resolve the problem.
- Problems after surgery and anesthesia.

Diet and feeding practices

- Milk replacement powder is mixed with something other than water (e.g., Lactated Ringer's solution (LRS), Pedialyte®, fruit juices).
- Formula is fed when the animal is cold.
- Formula and/or solid food is introduced to a dehydrated animal.
- Formula is too cool or cold when fed.

- Inappropriate foods are introduced (e.g., citrus fruits, cow's milk).
- A milk replacer that does not meet nutritional needs is used.
- Foods are inappropriate for the age of the animal.
- Formula or foods with too many fats, sugars and/or carbohydrates are used.
- Overfeeding.
 - o Too much formula is given per feeding.
 - o Too many feedings are attempted per day.
- Feedings are too close together.
- New foods are added too fast.
- Formula is used that is overly concentrated or rich.
- Multiple new foods are 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 rehydrated or dissolved when it is fed due to not using warm enough water for mixing and feeding it before it is ready (i.e., less than 4 hours after mixing) (Waiting 8 hours is preferable).
- Animal is fed more solids than it can fully digest.
- Or animal is not fed enough formula or solids.
- Rapidly increasing the number and volume of foods.
- Inadequate nutrition causing diarrhea and other GI disorders related to starvation.

- Method of mixing formula results in many air bubbles that when swallowed may cause bloat. Suckling on an empty feeding utensil, such as a syringe or nipple on a nursing bottle.

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 improper storage, reheating, etc.
- Product is contaminated (e.g., toxins, metals).
- Quality control problems.

Further actions

Place animals with heath 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 inadequately dissolved, 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's solution. Again, remember to use isotonic fluids by themselves and not mix with milk replacement products since that increases the ratio of salts and can cause more dehydration.

Maintain clean bedding and cage. Very young juvenile mammals defecate small, firm, shaped stool when manually stimulated after a feeding. Older juvenile mammals defecate as they move around their cages.

Mammals with soft stool or diarrhea may soil the bedding and cage more often, especially when their defecation is involuntary. 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 frequently, several times each 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. Placing cages and bedding outdoors in the sunshine can help dissipate odors and kill bacteria.

Provide animals with stool problems a pile of soft, light colored fabric for bedding, such as 3 or 4 t-shirts,

Tips on Feeding Amounts

Weigh the animal several times a week using an accurate gram scale. Weigh at the same time of day. If the animal is weighed at different times of the day, the results will not be consistent.

Record the weights of each individual.

Be familiar with the amount of food that the wild animal may comfortably consume and digest. This means knowing stomach size, age, feeding frequency, and composition of the diet.

The stomachs of many juvenile wild mammal species in North America hold about 5% of the total body weight measured in grams – and that is the amount given per feeding until eating solids (not just chewing or nibbling solids). Depending on the species, the amount of formula fed at a feeding may increase to 7% of body weight in grams when the young animal is mainly eating solids and is given a single formula feeding per day during the weaning period.

The stomach size of young opossums and lagomorphs (e.g., rabbits, hares) is larger and able to hold 10% of their body weight per feeding. Ruminants also have larger stomach capacities.

instead of a nest box or hammock which are more difficult to clean and access. Cages, cage furnishings, water bottles and so forth should be cleaned and disinfected regularly.

Clean off any soft stool or diarrhea that sticks to or smears on the animal'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 the animal'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 endoparasites are common, especially in compromised or stressed animals, consider having fecal tests performed and treating for these endoparasites. Again, remember that since 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 mammals 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 their weight gain and growth. Providing extra feedings is not the solution. Rather, ensure that they have a healthy and nutritious diet, are fed the appropriate amount and number of feedings – and appreciate that the growth is steady and gradual.

Weigh compromised animals daily to help monitor changes and be able to adjust. While it may seem counterintuitive, if there is still concern about a juvenile mammal that seems smaller in size for its age and it still has soft stool, consider the cause may be overfeeding and that reducing one feeding may improve digestion, stop the stool problems, and help compromised mammals gain weight.

Preventing and reducing gastrointestinal disorders for wild mammals in rehab

There are obviously many factors that can affect wild mammal gastrointestinal health. This paper provides a checklist of common factors to consider when confronting gastrointestinal problems in juvenile mammals in rehabilitation, many of which are influenced by rehabilitation practices. Further reading and communication with rehabilitators and veterinarians knowledgeable about and experienced with the wildlife species in rehabilitation can help identify factors, prevent and reduce problems, and identify effective 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 wild mammals in rehabilitation. Continually seeking and sharing information will help the rehabilitators and the wild mammals in their care.

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