Twelve Common Causes of Stool Problems in Squirrels

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Abstract: Stool problems are very common in young squirrels in rehabilitation. Familiarity with common causes allows the rehabilitator to prevent or reduce the occurrence, severity and duration, and resolve problems quickly and easily, often without requiring medical treatment. This paper describes twelve frequent causes of such conditions.

Key words: Squirrel digestive problems, digestive disorders, gastrointestinal disorders and upset, diarrhea, stool, feces, overfeeding, endoparasites, diet problems, rodent digestive disorders

Introduction

Stool problems are, unfortunately, a very common occurrence in squirrels in rehabilitation. Predictably, discussions of stool problems often jump immediately to treatment, with little if any discussion of cause. This paper focuses further upstream in the rehabilitation process, with an examination of common causes, since this knowledge can help prevent such problems or effectively resolve them in the very early stages, often without the squirrel needing any medical treatment. Effective and prompt prevention of more common causes means the squirrels stay healthier and recover faster, which is good for the squirrels. It also means less work, time, and stress for the caregiver working with ill animals, as well as reduced cost of medications.

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Attention to Early Clues

Before considering problems, it is good to start with a review of what is healthy and normal in a squirrel (Casey and Goldthwait 2003). Squirrels that are consuming milk replacement formula produce firm, virtually odorless, small, round or slightly oblong, gold–colored pellets (Figures 1 and 2). Juveniles or adult squirrels eating solids also have round, odorless, firm stool, but dark brown or black in color (Figure 3).

Growth rates are another key clue to the health state in the digestive process (Casey and Casey 2003). While younger tree squirrels may gain one to two grams a day, juveniles with the eyes open should be gaining about three to five grams per day depending on species and age. If weight is not gained at this average rate, the rehabilitator needs to recognize this as a possible concern, identify the cause, and address the problem. Activity levels, size, and general health are also important considerations.

While some rehabilitators use the word diarrhea to describe any stool softer than normal, diarrhea actually refers to liquid, watery feces with few if any solids and defecation often is involuntary with a strong odor. Chronic diarrhea also can stress the immune system, especially for a very young animal. Squirrel stool that is softer than normal, such as formed and 'soft' or unformed but 'paste–like' is more accurately referred to as just that, 'soft stool'—and *not* diarrhea!

It is extremely rare for squirrels with firm, round, normal color, and odorless stool to immediately develop involuntary liquid diarrhea. Squirrel stool is more likely to change gradually through several stages. The sequence commonly moves from normal stool described above, through the stages described below.

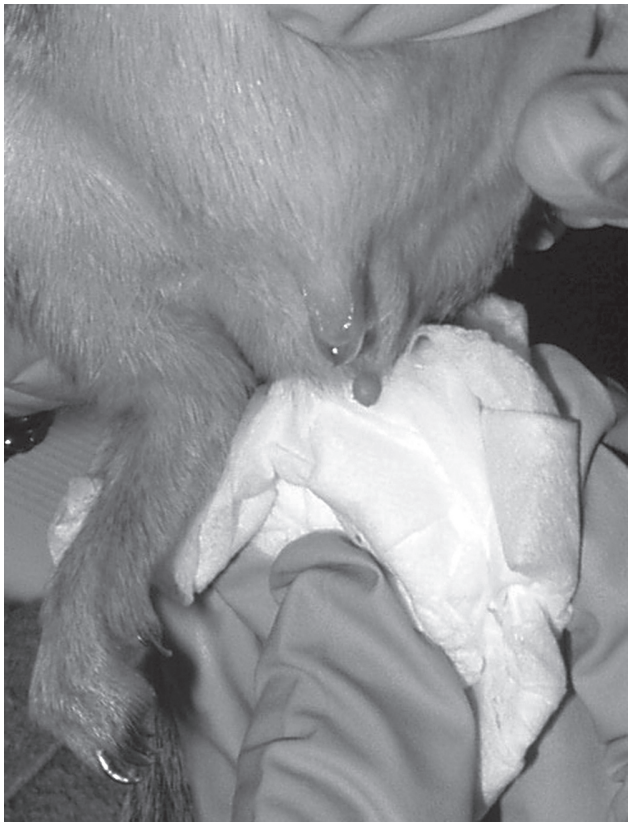

Figure 1. Normal stool of juvenile squirrel fed milk replacer formula and not yet eating solids tends to be a dark gold color. Photo by Allan Casey.

- to softer, slightly sticky, and somewhat lighter in color;
- to much softer, but still formed, with some offensive odor present;
- to very soft paste–like solids that flatten quickly but are still voluntary;
- to a very liquid paste, may be either voluntary or involuntary, with prominent offensive odor;
- to finally, involuntary liquid with little solids, otherwise called diarrhea (Figure 4).

As mentioned above, soft stool is likely to have stronger odor than normal feces, which is often noticeable when entering the room where squirrels are confined. If a squirrel develops soft stool, prompt identification of the cause and immediate remedial action usually can reverse the problem quickly and prevent the problem from progressing into more serious diarrhea.

Squirrels with diarrhea are more compromised and are likely to dehydrate without extra hydration with isotonic fluids such as lactated Ringer's solution. They need to be confined in a smaller cage and given supplemental heat to reduce energy expenditure.

Other conditions may develop as a result of severe and continuing diarrhea, such as prolapsed rectum, secondary infections (respiratory, renal, etc.), renal failure, and nutritional deficiencies.

Commmon Causes

Familiarity with common causes of squirrel stool problems can help rehabilitators prevent many of the possible causes and resolve them quickly and easily by adjusting rehabilitation practices, often without any medical treatments whatsoever! Extensive communication with rehabilitators and veterinarians has revealed frequent causes of squirrel stool problems. The following twelve causes begin with those that are very common, including overfeeding, endoparasites, inappropriate or inadequate diet, and improper preparation of milk replacement formulas.

Overfeeding. Most squirrels eat enthusiastically. Many will overeat unless the amount of formula, as well as solids, is controlled. Squirrels that overeat may develop digestive disturbances, including stool problems, when unable to fully digest the amount of food consumed.

Figure 2. Stool of a juvenile squirrel eating solids and milk replacer formula is darker brown or black. Photo by Allan Casey.

Figure 3. Normal stool of four species of squirrel: left to right, eastern gray, Abert's, fox, and golden–mantled ground squirrel, weaned juvenile and adult. Dime in photo illustrates approximate stool size. Photo by Allan Casey.

Until young squirrels are close to weaning age, the stomach capacity can comfortably and effectively digest a volume of formula measured in cubic centimeters (ccs) equal to about five percent of the body weight measured in grams (g) per feeding. In other words, a healthy 100 g squirrel can comfortably consume, digest, and utilize about 5 ccs of formula per feeding. Giving juvenile squirrels more than the stomach capacity (5% of weight) at a feeding likely will result in overfeeding, and they often will develop soft stool. If overfed frequently, they can develop diarrhea.

If the squirrel's stool becomes sticky, soft, and lighter yellow, but improves slightly when there is a longer period between feedings, overfeeding may be the reason. Weigh the squirrel every couple of days with an accurate gram scale to confirm the amount that should be fed. Ensure all caregivers feed the appropriate amount and do not overfeed.

Juvenile squirrels close to weaning (climbing well, jumping accurately, hanging from top of cage) may comfortably digest a larger volume approaching six to seven percent of body weight in formula per feeding, but may develop soft stool if fed more than this amount. If soft stool occurs, confirm squirrels are being fed an amount appropriate (based on weight) and then consider reducing daily feedings of milk replacer formula by one feeding a day, such as from four feedings a day to three, or possibly to feeding less per feeding, back to the five percent amount.

Overfeeding also can occur when the cumulative total amount of food per day exceeds the squirrels' ability to digest the food as a result of too many feedings per day. Ideally squirrels should have time to digest most of the previous meal before being fed again. Check frequency of feeding to ensure they are receiving enough feedings, but not too many. If feeding frequency seems to be the problem, decrease daily feedings by a single milk replacer formula feeding to see if the stool firms.

In some cases, the number of feedings per day may be appropriate for the age of the squirrel, but if feedings are timed too frequently or too close together, it does not allow the squirrel to fully digest the previous meal. In such cases, the squirrel may have soft stool for some of the day and normal stool for the remainder. Feedings that are too close together are considered a type of 'overfeeding' and may be remedied by spacing the feedings more evenly over a day. For example, a squirrel that is fed formula five times a day should have feedings three to four hours apart, but no closer together than two and a half hours. A squirrel fed four times a day would have feedings no closer than three hours, preferably about four hours apart.

In addition to overeating formula, a squirrel old enough to chew and eat solid foods may eagerly consume and overeat more of those than can be easily digested, including rodent chow. It may develop bloat, pass lienteric (undigested) stool as well as diarrhea, and have rectal prolapse. Such overeating may occur if large amounts of food are placed in the cage

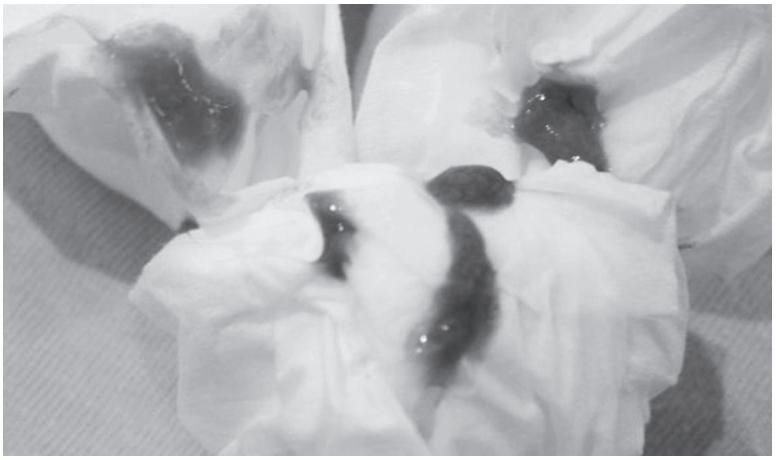

Figure 4. Diarrhea from a juvenile squirrel can be caused by overfeeding of formula and solids, inappropriate diet, endoparasites, and more. Photo by Teri Muzik.

at one time or if one or more of the squirrels in a cage dominates another and consumes considerably more food than cagemates. Placing a smaller amount of solid foods in the cage two or three times per day instead of a large amount once a day can reduce such problems. Using a high quality, balanced and fresh rodent chow helps ensure appropriate nutrition (Casey and Casey 2003; Casey 2005). Ensure that an appropriate amount of rodent chow is fed in order to achieve good nutrition, growth, activity, size, and health, but not so much as to cause gastrointestinal disorders or inappropriate weight gain or loss.

A few rehabilitators concerned over a squirrel smaller than others of the same age have tried to increase weight by offering an extra feeding per day. Unfortunately, this often results in overfeeding and soft stool instead of weight gain. The rehabilitator needs to consider the reason for the smaller size and determine if that needs to be addressed. It is possible that the squirrel arrived smaller due to being part of a large litter or being without food for a longer time and needs more time with a good diet to 'catch up' to others of the same age.

Recent changes in some milk replacement formula products, recipes, and preparation methods that allow more complete reconstituting and dissolving have affected the digestibility and utilization of formulas. Some rehabilitators report that the squirrels are growing well and progressing slightly faster in the weaning with formulas that seem to be more digestible and better utilized. Consequently, rehabilitators following a feeding schedule previously used concluded that they were overfeeding, and needed to reduce by a single daily feeding slightly faster than in the past, which resolved digestive issues.

Endoparasites. Squirrels are hosts to many different endoparasites and there are some endoparasites considered 'normal' residents in the squirrel gastrointestinal tract, which usually do not cause problems at 'low' levels and while the squirrel is otherwise healthy. However, an overgrowth of these endoparasites can develop and result in stool, growth, and other problems when a squirrel is under stress from injury, dehydration, shock, capture, or captivity. Thus it is important to minimize stressors and reduce potential for overgrowth of these endoparasites, which can cause diarrhea. A heavy load of endoparasites in the feces of squirrels in rehabilitation also increases the potential for transmission to other squirrels confined in the same cage, and their developing an overgrowth of the same endoparasites.

Coccidia is a common endoparasite in squirrel gastrointestinal tracts. While not problematic at low levels, it may cause problems at higher levels. Squirrels with coccidiosis may alternate with normal stool one day with soft, yellow stool the next day or two, and then back to what appears normal. Squirrels with coccidiosis may have stool that appears normal, but a slower growth rate than normal. Coccidia and endoparasites in general do not always show up on a fecal exam. Coccidiosis is commonly treated with sulfadimethoxine (Albon®, Pfizer Animal Health, New York, NY). Since an overgrowth of coccidia is extremely common in juvenile squirrels that arrive in a compromised condition (dehydrated, debilitated), some rehabilitators and veterinarians administer sulfadimethoxine as standard rehabilitation practice if squirrels show slow growth and intermittent soft stool.

Giardia, another endoparasite, may cause squirrels to develop diarrhea that has mucus with green color tint, and a particularly strong and distinctive odor. Squirrels with giardia also tend to have slower growth rates. Giardia has been treated with fenbendazole (Panacur®, Merial Ltd., a Sanofi Company, Duluth, GA), as well as other products.

If rehabilitators follow initial quarantine protocols and isolate affected squirrels, as well as follow effective sanitation procedures, they can help prevent other squirrels in care from getting endoparasites and developing problems.

Inadequate or Inappropriate Diet. Most squirrels admitted to rehabilitation are juveniles of an age that would still be suckling the mother. Since there are no commercial sources of squirrel milk, rehabilitators prepare milk replacement formula based on the nutritional needs of these young squirrels. Using an effective and proven commercially available milk replacement product, or combination, can prevent many digestive and nutritional based disorders. If it is suspected that the formula may be causing stool problems, there are a number of actions a rehabilitator can consider.

Research the milk replacement product and how the wet matter composition, once mixed with water, matches the needs of squirrels (Moore and Joosten 2002; Casey and Casey 2011a, 2011b). The commercially available milk replacement products vary widely by manufacturer and intended use. Do not assume that just because the manufacturer says it is

for wildlife or displays a photo of a squirrel on the package label that the product fully meets the species nutritional needs. Consider the ingredients, such as preservatives that increase shelf life, or 'filler' ingredients that may increase calories or modify the composition, but may not be very nutritional or digestible. Recognize that, from time to time, manufacturers can and do change production methods, ingredients, sources of ingredients, recipes, and more. While some manufacturers may immediately reflect changes and accurately list ingredients on the label, US Food and Drug Administration allows pet food manufacturers a grace period of six months to update any new ingredients to be listed on the label.

Additionally, rehabilitators can review extensive milk replacement product research that includes independent test results and comparative analysis (Casey and Casey 2010; Casey and Casey 2011a, 2011b). An online nutrition calculator and video tutorials also allow rehabilitators to quickly and easily compare replacer formula recipes to published squirrel milk composition research (Casey 2011).

Talk with experienced rehabilitators who have a proven track record of raising healthy squirrels with consistently good growth rates, healthy digestion, and good stool. Ask detailed questions about the formula used, results (growth rate, activity, pelage), frequency and type of problems, number of squirrels rehabilitated, and so forth. Serious and thoughtful questions are a helpful way to learn and evaluate options, and should not be avoided due to concern that the questions could be considered intrusive or critical.

Rescuers often feed squirrels an inappropriate diet, such as cow's milk. If the rescuer fed the squirrel a couple of inappropriate diet feedings, then rehydrating and gradually introducing the appropriate diet may allow the squirrel's stool to normalize quickly. Gradual introduction suggests the first couple of feedings only be an isotonic fluid and then start diluted formula that builds up to full strength over 24– to 48–hours as the squirrel's stool improves.

Some fruits, vegetables, nuts, and seeds also may cause digestive difficulties, whether due to the item being a food squirrels generally would not eat in the wild (e.g., lettuce, tomatoes, oranges), or an excessive amount of an item they might opportunistically eat in a small amount for a few weeks of the year (e.g., strawberries, raspberries, pecans, walnuts). Remember the quantity of a food that seems very small to a rehabilitator or volunteer, such as a one–inch piece of strawberry or half a pecan, actually may be the same size as a juvenile squirrel's entire stomach—and a young squirrel may devour the whole piece at one time.

If it appears that solid foods caused the problem, remove the potential problem item. Consider diluting the formula for a feeding or two to provide extra hydration and let the squirrel's gastrointestinal tract stabilize before returning to full strength. Introduce only a single new food item to the diet at a time then wait a day or two to ensure this food did not cause a problem before considering another new food.

Using a quality diet is essential. While some diet problems may show up immediately as stool problems, in other cases the consequences of poor diets may not show up until weeks or months later, and may be more serious than minor stool problems, such as those resulting in metabolic bone disease.

Milk Powder Not Reconstituted or Dissolved. Many rehabilitators use commercially available dried powdered milk replacements that are reconstituted with warm water prior to feeding. Manufacturers' instructions on the milk replacement products indicate that they may be fed immediately after mixing with water.

WildAgain Wildlife Rehabilitation Inc., recently conducted research on milk replacement powders used with wild mammals. WildAgain's extensive solubility tests show that while many of the formulas made with these products are marketed and labeled as instant–mix may initially look like milk (a white opaque liquid) upon mixing, the powders are in fact only in a light suspension and not fully reconstituted or dissolved, until after the mixed formula is allowed to rest in a refrigerator for at least four and preferably eight hours after mixing. In addition, most of the powders reconstituted more effectively when water added to the powder was around 175° F (79.4° C) instead of just warm tap water, which is usually around 125° F (51.7° C). The water should not be boiling since that temperature may damage vitamins.

While inadequately reconstituted and dissolved formula may appear to be liquid milk, the dry particles can cause diarrhea in several ways. Young squirrels, like many other young mammals, have less efficient gastric acid and enzymes. If fed inadequately dissolved powder in a formula, the dry powder particles move through the stomach directly into the small intestine. The powder particles are unable to be fully digested by the animal resulting in inadequate nutrition even though fed the 'correct' calculated and measured amount. A squirrel with inadequate

nutrition may develop diarrhea, called 'starvation stool.' Additionally, the chemical properties of milk products are an excellent medium to grow bacteria, which may grow quickly in the poorly dissolved milk powders in the squirrel's small intestine, resulting in inflammation and infection that causes bloat and diarrhea.

The squirrel that is fed inadequately reconstituted and dissolved powder in a formula multiple times per day, and over multiple days, is more likely to develop chronic diarrhea. Preparing milk replacement powders with hotter water and allowing a longer resting time before feeding the formula has been shown to improve digestibility and reduce the risk of problems.

Inaccurate Measurement. Inaccurate measurement of powdered milk replacers and water can result in formula with inappropriate proportions and cause digestive upset. Inaccurate measurement can occur due to inconsistent measurement by different people preparing formula and measuring in different ways (powder heaped in measuring implement vs. leveled, etc.), as well as inaccurate measurement such as confusing teaspoon with tablespoon.

Another much less obvious problem can be caused by milk replacement powder settling in the package container, resulting in compaction at the bottom and lighter particles at the top. This easily and adversely affects density of powder in a measuring utensil as the rehabilitator gradually uses and withdraws container contents over several days or weeks. A simple solution for this is to turn the milk replacer container over several times before using powder for formula preparation in order to reduce compaction and ensure even distribution of contents such as vitamin and mineral additives. Strive for accurate and consistent measurements.

Unbalanced Gut Flora. A normal, healthy gastrointestinal tract has a variety of healthy resident bacteria that support digestion. If the squirrel has soft or watery stool due to any cause or is taking antibiotics to destroy harmful bacteria for any purpose (cat bites, abscesses), the beneficial gut bacteria is also likely to be off–balance. Consider supplementing or replenishing with probiotics or an inoculant (made from the stool of a healthy adult squirrel that has been confirmed parasite free). Probiotics only should be provided twice a day (Casey and Fedchak 2010).

Saccharomyces boulardii, a nonpathogenic yeast strain classified as a probiotic, has proven highly effective in both preventing and treating unbalanced gut flora in humans—as well as in squirrels—and is available online, in pharmacies, and health food stores. The cost of *Saccharomyces boulardii* varies based on brand name, with one of the most well–known names, Florastor® (Biocodex, Beauvais, France), significantly more expensive than other labels, such as Jarrow (Los Angeles, CA). *Saccharomyces boulardii* comes in capsule form, does not need refrigeration, and like other probiotics is administered in liquid only twice daily. Rehabilitators open a capsule, sprinkle a few 'grains' into warmed formula, and stir to dissolve.

Not Using Water to Mix Formula. Commercial milk replacement powders are formulated to be mixed with water—period. Unfortunately, a popular practice of mixing commercial milk replacers with other products that include sodium, such as lactated Ringer's solution, Normasol–R® (Abbott Animal Health, Abbott Park, IL), and Pedialyte® (Abbott Laboratories, Columbus, OH), inadvertently increases the level of sodium and other electrolytes in the formula. This higher sodium level in formula can pull fluids into the intestine from surrounding tissue, resulting in more water in the stool, and actually cause dehydration.

Feeding When Dehydrated. Many squirrels are admitted into rehabilitation with mild or moderate dehydration. An animal must be fully hydrated in order to effectively digest and absorb nutrients in formula or other foods. Feeding a squirrel any food, whether formula or solids, before it is hydrated causes it to pull body fluids into the gastrointestinal tract as it attempts to digest the food. This can result in more watery stool—and possibly further dehydration.

Generally, the first step in rehydrating a squirrel is to provide one or two feedings consisting solely of an isotonic fluid such as lactated Ringer's solution or Normasol–R®. Then the squirrel is started on milk replacement formula that is more dilute than normal, achieving full strength over four to six feedings as the animal reaches normal hydration. This allows the squirrel to rehydrate while starting to get some nutrients and adjust to the new diet. Experienced squirrel rehabilitators report that young squirrels often can and need to be on full strength formula within about 24 hours after admission, especially infants.

Rapid Diet Change. The composition of milk provided by a lactating mother changes gradually over lactation—not drastically over only a couple of feedings. Juvenile squirrels eating solids generally are eating tree cambium and buds, and some other plant materials. Since these almost weaned squirrels are not going far from the nest, they may nibble on these solids from only a couple of different sources and eat pretty much the same basic foods each day with very little change.

When the diet for juvenile squirrels is changed significantly over a very short time, stool problems often result. The solution is to add new items to the diet very gradually and only one item at a time. If problems occur, remove the new item and introduce it much slower the next time, or do not add it at all. Adding new items to the diet or making other diet changes when the squirrel's stool has not been normal for several days generally causes a mild problem to become more severe. Rapid and large increases in the amount of formula or other foods may cause stool problems even though these foods were previously tolerated in small amounts.

Indigestible Fat. Formulas made with milk replacement powders provide a good base for formulas, but do not by themselves fully meet the nutritional composition needs of juvenile squirrels. Rehabilitators must add a small amount of supplemental fats to adjust the milk replacer to more fully match the mother squirrel's milk. It is essential to select fats that are more easily digestible, such as heavy whipping cream.

Some supplemental fats added to milk replacement formulas contain lard (rendered pork fat), such as PetAg's MultiMilk® (Hampshire, IL), which is more difficult to digest. Additionally, since lard has a melting point of 109° F (42.8° C), if formula is not mixed and maintained while being fed at a temperature above that level, the lard quickly solidifies in the formula. Since feeding a formula that is 109° F (42.8° C) is too hot for a squirrel to eat, rehabilitators feed at a lower temperature. However, the lard will not be in liquid form at the lower temperature. If a rehabilitator chooses to use a product that contains lard, it is not added to the formula until the squirrel is older and the digestive system has developed enough to digest it (i.e., after a juvenile squirrel has fur on the abdomen).

Some solids also have high percentages of fat and can cause gastrointestinal upset especially when fed in large quantities, including some nuts and even some of the rodent chows. The 'breeder' rodent chows have a higher fat content designed for rapid growth and weight gain, and should be avoided in favor of a complete life cycle or balanced rodent chow.

Formula Storage. Unopened commercial milk replacement powders should be stored in a cool environment, generally 70° F (21° C) or less, to prevent both degradation of vitamin potency and onset of rancidity. Shelf life of unopened containers also can be extended if refrigerated or frozen. Once opened for use, the container or product must to be kept refrigerated or frozen until completely used.

Manufacturers' instructions indicate milk replacement powder should be used within 24–hours of preparation into formula and the liquid should be kept refrigerated during that time. Other dairy experts suggest that formulas made with milk replacement powders may be refrigerated and used over a two– or three–day period, which allows for a more fully reconstituted powder in the formula (Wisconsin Center for Dairy Research, Madison, WI).

When preparing a feeding, the required amount of prepared formula should be removed quickly from the refrigerated storage container without contaminating milk in the container. Formula that has been withdrawn is then warmed to about 98° to 102° F (37°–39° C) before feeding the squirrels. Do not chill and reheat formula previously warmed for feeding since that can result in bacteria development.

Milk powders can become rancid when exposed to air or heat. Rancid powders often have a distinctively strong odor. Rancid or spoiled milk replacement formulas or spoiled food can cause stool problems. If an unusual odor is detected when first opening a container of milk powder, the manufacturer or distributor should be contacted immediately (with product name and lot number) for possible return of the product and to request a fresh replacement.

Stress. Squirrels, like other wild species, can develop gastrointestinal disorders and other health problems due to stress induced by the captive environment. Squirrels have very sensitive hearing, so noises that may not seem loud to humans may be major stressors, including normal conversation, ringing telephones, rattling cages, and other animals (a room full of baby birds begging for food).

Since squirrels have an acute sense of smell, odors, however strong or faint, are serious stressors. Examples of stressful odors include cleaning agents, perfumed soaps or lotions, scented laundry detergent on bedding, odors from predators, or even the odor of urine or feces in dirty cages.

Movement and activity by humans or other animals can be stressors. This includes sound, sight, odor, and proximity to any possible predator, wild or domestic. Frequent handling, examinations, capture, escape and chase in a rehabilitation room, pain, and more can cause stress. It is critical to understand what factors are stressors and work to prevent or minimize them for the animal.

Conclusion

In summary, the factors described above are common and often preventable causes of soft stool and diarrhea in juvenile squirrels. Paying close attention to these factors helps prevent health problems, allows more normal growth and development, and provides a higher quality of life for squirrels in rehabilitation. This reduces the need for medical care, including medications, fluids, and more intensive monitoring. This helps the rehabilitator minimize costs, time, and effort spent working with debilitated animals. Plus, preventing health problems caused by rehabilitation practices helps the animal and reduces rehabilitator stress and burnout.

Literature Cited

Casey, Allan. 2003. Selection and Use of Commercially Available Rodent Chow Products. *Squirrel Rehabilitation Handbook* 3rd edition. WildAgain Wildlife Rehabilitation, Inc: Evergreen, CO.

Casey, Allan. 2005. Selection Criteria for Rodent Chow Products. *Wildlife Rehabilitation Today.* Coconut Creek Publishing Company. Pompano Beach, FL.

Casey, Allan. 2011. Nutrition Calculator. Available from: <http://www.ewildagain.org/Nutrition/Milk%20replacers%20for%20wildlife.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Casey, Shirley, and Mackenzie Goldthwait. 2003. Gastrointestinal Conditions in Squirrels: The Scoop on Poop. *Squirrel Rehabilitation Handbook* 3rd edition. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Casey, Shirley, and Allan Casey. 2003. *Squirrel Rehabilitation Handbook* 3rd edition. WildAgain Wildlife Rehabilitation, Inc: Evergreen, CO.

Casey, Shirley and Allan Casey. 2011a. Milk Replacer Update. Available from: <http://www.ewildagain.org/Milk%20Replacers/Milk%20Replacer%20Update%20Jan%202011.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Casey, Shirley, and Allan Casey. 2011b. Powdered Milk Replacers: Test Results and Tips for Use. Available from: <http://www.ewildagain.org/Milk%20Replacers/Powdered%20milk%20replacer%20tests.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Casey, Shirley, and Allan Casey. 2010. Manufacturing Changes for Esbilac® Powder Affect Wildlife Rehabilitators. Available from: <http://www.ewildagain.org/Nutrition/Esbilac%20Manufacturing%20Changes.htm>.

Casey, Shirley, and Jean Fedchak. 2010. Quick Tips for Using Probiotics with Wildlife in Rehabilitation. <http://www.ewildagain.org/Nutrition/mammal_nutrition_resources.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Moore, Adele, and Sally Joosten (editors). 2002. *NWRA Principles of Wildlife Rehabilitation,* 2nd Edition. National Wildlife Rehabilitators Association: St. Cloud, MN.

Wisconsin Center for Dairy Research. 2009. Madison, WI. Personal communication. Website: <http://www.cdr.wisc.edu/>.

Resources

Aiello, Susan, and Asa Mays, editors. 1998. *Merck Veterinary Manual,* 8th edition. Merck and Company: Whitehouse Station, NJ.

Casey, Shirley, and Allan Casey. 2009. Supplementing Commercial Milk Replacers with Whipping Cream for Juvenile Wild Mammals. Available from: <http://www.ewildagain.org/Nutrition/esbilac_and_cream.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Casey, Shirley, and Mackenzie Goldthwait. 2009. Factors Causing Gastrointestinal Problems in Juvenile Squirrels. Available from: <http://www.ewildagain.org/pubs/factors_affecting_gi_problems_in.htm>. WildAgain Wildlife Rehabilitation: Evergreen, CO.

Kotowska, M. et al. 2005. *Saccharomyces bolardii* in the Prevention of Antibiotic Associated Diarrhea in Children: A Randomized Double–blind Placebo–controlled Trial. *Ailmentary Pharmacology and Therapeutics*. 21(5): 583–590.

Surawicz, Christina, et al. 1989. Prevention of Antibiotic–associated Diarrhea by *Saccharomyces boulardii*: A Prospective Study. *Gastroenterology*. 96: 981–988.