

## SUBSTITUTE MILK FORMULAS – WHAT WENT WRONG IN 2019?

By Shirley & Allan Casey

*(This article discusses some of the medical issues seen in 2019 attributable to substitute milk formula; probable causes; and suggested preventative strategies for 2020. More thorough discussion of this issue is posted at WildAgain Wildlife Rehabilitation Inc's website: www.ewildagain.org. © 2020 Shirley and Allan Casey. Reprinted with permission.)*

During the summer of 2019, some rehabilitators reported some of the wild mammals fed substitute milk formula made with Esbilac® developed a remarkably high number of unexplained medical problems, particularly very young squirrels and opossums. They were using the same feeding and rehab practices that had previously been effective. They reported that the younger squirrels and opossums had gastrointestinal problems and slower weight gain. Some opossums were less mobile, had malformed bones, and developmental delays. The squirrels developed unexpected bumps on bones, and then non-traumatic fractures. WildAgain conducted interviews with 100+ rehabilitators around the country at home-based, centers or networks, and surveys at 3 rehab conferences. Rehab records, photos, veterinary reports, radiographs, necropsy reports and more were reviewed. More medical issues were identified, as well as a general timeline of progression of symptoms, as depicted in the chart below. Some of the young squirrels and opossums recovered, while others died or were euthanized due to the severity of the problems.

Health Conditions & Stages (after admission)		
<p><b>Early (≈ week 1)</b></p> <ul style="list-style-type: none"> <li>• Slow weight gain.</li> <li>• Ravenous appetite (if not tube fed).</li> <li>• GI problems.               <ul style="list-style-type: none"> <li>• Diarrhea</li> <li>• Slow transition to formula.</li> </ul> </li> <li>• Thinner than normal</li> </ul>	<p><b>Mid (≈ week 2)</b></p> <ul style="list-style-type: none"> <li>• Low weight gain.</li> <li>• Slower growth, incl. body mass. Stunted.</li> <li>• Delayed development: activity, elimination, grooming, coat/fur, dentition, etc.</li> <li>• Chilled quickly, &amp;/or difficulty maintaining heat.</li> <li>• Less active &amp; slower than normal. Lethargic. Weaker. Limited mobility.</li> <li>• Bumps on limbs</li> </ul>	<p><b>Later (≈ week 3+)</b></p> <ul style="list-style-type: none"> <li>• Malformations:               <ul style="list-style-type: none"> <li>• Skull,</li> <li>• Limbs,</li> <li>• Chest</li> </ul> </li> <li>• Bone problems: fractures, joint problems, weak bones.</li> <li>• Reluctance to eat.</li> <li>• Dark abdomens in a few.</li> </ul>

The adverse effects of the formula related problems appeared to develop and progress over different timeframes and affected different systems/organs. Rehabilitators know that wild mammal babies fed an inappropriate formula may develop GI problems and dehydration quickly in a few days. GI problems may be accompanied by slow weight gain that becomes more noticeable after 2-7 days. Other problems caused by formula may be very gradual and be less noticeable since they are internal – but importantly affect critical growth, development and physiological functions. For a single caregiver it can be difficult to notice gradual symptoms and subtle changes in such tiny animals. For multiple caregivers (changing shifts of staff/volunteers) it can be almost impossible.

## Formula adjustments and generally reported outcomes

Rehabilitators worked to identify and resolve obvious problems by first ruling out factors that cause such problems, such as rehab practices (e.g., feeding amounts and frequencies), parasites, etc. Then, some adjusted their recipes and amounts, formula preparation methods, and milk powder ingredients, and consulted veterinarians and other rehabilitators. Here are some of the formula adjustments and general outcomes:

- 1.) Esbilac® as the sole diet. Some stayed with a 1:2 Esbilac:water recipe. Mostly unsuccessful outcomes.
- 2.) Esbilac® blended with other milk replacers. Markedly improved success.
- 3.) Esbilac® with heavy whipping cream. More successful outcomes, if started on this diet initially.
- 4.) Esbilac® blended with other milk replacers with added fat. Generally normal health/development, few issues.
- 5.) Calcium supplementation. To address suspected Metabolic Bone Disease. Often unsuccessful results.

## A confluence of possible contributory causes

Since WildAgain had conducted extensive research on milk replacer issues in 2009-11, some rehabilitators asked for help reviewing the current problems, then identify the possible causes and solutions. In addition to interviews and reviewing rehab and medical records, WildAgain gathered 100+ samples of milk replacer powder products (PetAg® and Fox Valley Animal Nutrition) from rehabilitators around the U.S., and some directly from retail distributors. The samples were sent to a certified independent laboratory for proximate analysis (Moisture, Protein, Fat, Ash) and dietary mineral assays (Calcium, Phosphorus, etc.). Additional tests were conducted on selected samples (particle size, peroxide values (rancidity), heavy metals, reconstitution efficiency, etc.). Labels, ingredients and guaranteed analysis from 2018-19 production lots were reviewed and compared with production lots as far back as 2006. Publications on milk composition and analysis, milk powder production methods, nutrition benefits and functions, and effects of substitute formulas on animal health were also reviewed.

While uncertainties still remain, the data collected and analyzed on Esbilac® powder, spanning 45 lot samples from 2006-2019, provided considerable insight into what likely happened, involving *multiple* contributing factors. This confluence of the items below likely caused a tipping point not seen as widespread in prior years.

- 1.) Lower Calcium concentration. Lab tests showed that the Ca levels, on average, have dropped 10% versus ten years ago. It is now averaging 1.1% (dry matter basis).
- 2.) Dicalcium Phosphate (DCP) ingredient issues. PetAg® disclosed that a supplier had provided a DCP powder size less finely milled than in the past. Still digestible by puppies (intended use), it appeared more difficult for

smaller wildlife species to digest. This exacerbated the already lower concentrations, risking hypocalcemia (Ca deficit), explaining some of the observed symptoms above.

- 3.) Calcium supplementation. Intending to address suspected low Ca concentrations, various forms of supplementation were pursued. This may have risked hypercalcemia (Ca excess), causing some of the other symptoms discussed above, and serving to disrupt a delicate Ca:P ratio.
- 4.) Lower fat concentration. Lab tests showed that the fat levels, on average, have dropped 12% versus ten years ago. The guaranteed minimum is 40%, but the fat content now average 36.5% and some lots tested as low as only 30% (dry matter basis).
- 5.) Lower energy (kcal) content. Since fat provides more kcals than the proteins and fats combined, a lower fat concentration will result in lower calories provided to a growing animal.
- 6.) Esbilac as the sole diet. PetAg® represents "...intended for intermittent or supplemental feeding only." This direction seems warranted given most of the issues enumerated above.

**Looking forward to 2020 – suggested preventative strategies**

PetAg® has already committed to improving the DCP in Esbilac® in production after October 1, 2019. Try to buy lots produced with lot numbers 2739E (273<sup>rd</sup> day of 2019) and later. There are other simple steps rehabilitators can take to address or at least mitigate the issues listed above, including:

- 1.) Consider blending milk replacer products. The benefits of blending products become apparent in the inset chart. When Esbilac® was blended with either Fox Valley 32/40 or 20/50 the resulting amounts of calcium and phosphorus were higher in 2019. The Ca:P ratio improved to a more acceptable range of around 1.5. The

	Dry matter basis		
	(Average values for 2018-19)		
	Esbilac®	FV 32/40	FV 20/50
Ca (%)	1.12	1.53	1.93
P (%)	0.82	0.97	1.20
Ca:P	1.36	1.57	1.61
Fat (%)	36.5	36.1	47.7
Low value	30	31	46

chart shows that even with blending, all of the products shown are testing below their guaranteed minimums for fat content. When extra fat (e.g., heavy whipping

cream (HWC)) was added to the formula recipe (in the appropriate amount) in order to better match the milk composition for species being fed, the increased fat also raised the kcals to more appropriate levels, and further increased both calcium and phosphorus amounts. Ca supplementation seems unnecessary when they were blended. Rehabilitators who blended Esbilac® and Fox Valley powders in 2019 – and added the appropriate amount of fat (e.g., HWC) reported fewer cases of even minor problems – and those animals tended to recover quickly. Blending and not relying on ANY one product

seems a reasonable strategy to mitigate deficits of any single product.

- 2.) As just mentioned, matching a formula recipe to mother’s milk provides a nutritional balance more suited to a specific species. While the match using manufactured products will never be perfect, constructing a recipe that proportionately meets mother’s milk composition is advisable. The Nutrition Calculator at ewildagain.org provides user-friendly drop-down menus for 1) selecting a species milk composition, 2) selecting from preloaded milk replacers (values based on lab tests), and 3) then comparing the composition of that recipe to mother’s milk. This simply “runs the numbers” which must be adjusted based on the animal’s response to the formula and overall growth and health.
- 3.) Further ways to improve formula results are to consider changes in measuring techniques and reconstitution procedures. Another article in this issue of *Release* discusses the benefits of weighing ingredients rather than scooping by volume. WildAgain’s prior suggestions for optimum reconstitution of milk powders may be changing, based on current testing. Temperature of water and hydration (resting) times seem to now be more specific and tailored to individual products. Results will be posted at ewildagain.org when available. In the meantime, tests have shown that allowing the dry powder to attain room temperature prior to mixing with water is much better than powder taken straight from the refrigerator or freezer. Plus, adding the powder to the water (not the other way around), allows for a more complete ‘wetting’ of the dry powder to aid reconstitution.

**Closing thoughts**

Hopefully PetAg® has already fulfilled their commitment to address the DCP - and many of the rehabilitator strategies described above will make 2020 a more successful year. Time will tell. The easiest way to know, and to know early in the season, is for rehabilitators to share approaches and results – good or bad. That is the way the formula problems became more widely known, discussed and solutions pursued in 2019. Let’s keep connecting and working together for the animals and rehabilitation community.

For more resources, please visit [www.ewildagain.org](http://www.ewildagain.org), which includes educational information on the nutritional components of powdered milk replacers and formulas (descriptions, comparing test results, published resources), independent lab tests, and Nutrition Calculator (free downloadable spreadsheet).

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