

## Milk Replacer Update January/February, 2011

This update discusses research on commercial powdered milk replacer products and issues in wildlife rehabilitation from 2010 through January 2011, as well as a few of the broader issues about milk replacers that have prompted a variety of results and opinions. It also reviews an example of a newly developed 'formula recipe' that rehabilitators have found to be effective during 2010, including possible reasons for its success and implications for other 'recipes.'

### Solubility tests on PetAg® and Fox Valley® milk powders

WildAgain continues to perform extensive solubility tests on approximately 50 different milk replacer powder products and lots (packages), including Esbilac®, KMR®, Fox Valley® products and the Zoologic® Milk Matrix line of products. Solubility tests will continue as new lots are manufactured and distributed.

The results showed that **all of the milk replacer powders tested were more completely hydrated and dissolved and created a more uniform liquid (milk) that was much more digestible when allowed to 'rest' in the refrigerator for at least 4 hours, and preferably 8 hours, after they were mixed with water.** Photos and more information on solubility tests for specific milk powders are provided by product at <http://www.ewildagain.org/Milk%20Replacers/Powdered%20milk%20replacer%20tests.htm> and [http://www.ewildagain.org/Milk%20Replacers/hydration\\_time.htm](http://www.ewildagain.org/Milk%20Replacers/hydration_time.htm)

Those making the formulas at least 4 hours in advance report that the animals eating the more completely dissolved formulas are healthier and growing better. Rehabilitators report that adjusting to this new routine of making the formula in the evening for use the next day has been easier than they expected. Initial concerns about a delay in having formula available for new arrivals have not been a problem since many new admissions need to be treated for dehydration before being fed a full strength formula.

Additionally, the solubility tests also showed that mixing the milk replacers with much warmer water (in the range of 160-175°F), improved the hydration and dissolving of the powders, with the exception of some of the cans of KMR® manufactured since September 2010 (check info on the individual lots). More information on the effect of water temperature is available at [http://www.ewildagain.org/Milk%20Replacers/hydration\\_time.htm](http://www.ewildagain.org/Milk%20Replacers/hydration_time.htm).

### Supplemental fats used in formulas for wild mammals

The milk composition of many wild mammals shows the need to supplement more fats and calories in the formulas than is contained in many of the commercial milk replacers. As a result, rehabilitators add supplemental fats. An article on options and impacts of the various products is available at [http://www.ewildagain.org/Nutrition/esbilac\\_and\\_cream.htm](http://www.ewildagain.org/Nutrition/esbilac_and_cream.htm).

As a result of the above mentioned article and other concerns, an increasing number of rehabilitators are adding heavy whipping cream to milk replacer formulas as supplemental fat. The wild orphans have been able to easily digest the fats and have shown excellent healthy growth and development when the heavy whipping cream was added to the appropriate formula composition and the formula was prepared according to the modified mixing instructions described above (ensuring the milk powders were fully dissolved).

Rehabilitators recently reported that cans of MultiMilk® lot H1730U with an expiration date of 2012 contained dark particles dispersed throughout the powder and that the powder had an offensive odor. A certified independent lab tested one can and revealed an extremely high peroxide level of 115 (peroxide values of over 10 are considered rancid and consumption is not recommended). While rancid products often have an 'off-odor', a product that has been rancid for a while can lose the strong offensive odor and the rancidity be less obvious by scent.

#### Update highlights

- Solubility tests reveal similarities
- Lab test results
- Mineral variations make a difference
- Milk composition varies
- Probiotics twice a day
- Nutrition calculator makes recipe comparisons easier
- More resources

Photos of the foreign particles in MultiMilk® posted to the right. While the origin and nature of these particles is yet unknown, the randomly sized flecks in the MultiMilk® are speculated to be undissolved minerals as PetAg has suggested in response to one distributor's questions. Should this be the case, then the larger particles will likely not dissolve in an 'instant-mix' method as suggested by PetAg, and would leave the resulting formula deficient in required mineral levels. If warmer water is used and the formula is allowed to rehydrate for several hours (a more complete dissolution), then the resulting formula could reach toxic levels for one or more minerals contained in the larger clumps or particles. Either result would be harmful to young animals. MultiMilk®, especially lot H1730U, should be checked for any foreign particles and any 'off' odor. Immediately notify PetAg with any questions or concerns about the MultiMilk®.



An alert on this MultiMilk® lot number, with the lab analysis, has been posted on [EwildAgain.org](http://EwildAgain.org).

Like many rehabilitators, WildAgain used MultiMilk® as a supplemental fat source for wild mammal milk formulas for many years. WildAgain stopped using MultiMilk® in 2009 after developing concerns that the young wild orphans were having difficulty digesting the animal fat (lard) in the MultiMilk®. WildAgain has joined the group of rehabilitators using heavy whipping cream as the fat supplement for the milk formulas and agrees with the extremely positive evaluation made by other rehabilitators.

### Tests at a certified independent lab continue to reveal concerns

WildAgain continues to have independent component analysis tests conducted on new lots of milk replacer powders at a certified independent laboratory. All previous and new test results on specific product lots by different manufacturers are available at

<http://www.ewildagain.org/Milk%20Replacers/Powdered%20milk%20replacer%20tests.htm>.

### Esbilac® powder

Although 2 years have passed since PetAg® changed the manufacturing process and ingredients in powdered Esbilac® in December, 2008, certified independent lab tests show the powder nutrient composition is still inconsistent between lots made on different days. The Esbilac® powder has generally met the Guaranteed Nutritional Analysis (GNA) of minimums and maximums as indicated on results of individual lot test results at <http://www.ewildagain.org/Milk%20Replacers/Powdered%20milk%20replacer%20tests.htm>

The levels of carbohydrates, vitamins and minerals in Esbilac® powder have generally decreased in concentration and continue to fluctuate. For example, in the Typical Nutritional Analysis (TNA) of Esbilac® powder HY1240EY, the carbohydrate percentage was 18.1%. Later in the year, the Esbilac® lot HY1440EY showed the calculated carb level to have dropped to 6.4%, and a couple of months later, lot HG2080E had risen slightly to 8.4%. Comparisons of the TNA's for lots made throughout 2010 indicate similar significant variations in proteins, calcium, and phosphorus.

The calcium:phosphorus ratio in the Esbilac® powder has generally remained in the target range. However, the concentration of calcium had declined significantly, from 1.77% in Esbilac® lot 0759E, to 0.89% in lot 1639E and 0.91% in lot HG2080E. Animal nutritionists have preferred the calcium level to be at a minimum of 1.0%.

For those rehabilitators working with small rodents such as tree and ground squirrels, the amount of manganese continues to be lower than the minimum level established for lab rats in the *Nutrition Requirements for Laboratory Animals* (1995) published by the National Research Council.

Zoologic milk matrix powders®

In 2009, PetAg® advised rehabilitators to use the Zoologic® Milk Matrix products for wild mammals. The company emphasized that Esbilac® had been developed specifically for puppies and KMR® for kittens – even though those products were marketed to wildlife rehabilitators for years. PetAg indicated that the Zoologic® milk powders were manufactured “as they always have been.” WildAgain arranged for several Zoologic® powders to be independently tested. The test results of Zoologic® 33/40 lot HJ3130ZE met the GNA.

However, the certified independent lab tests showed that Zoologic® 42/25 lot HJ3140ZF contained levels of protein and fat inconsistent with the GNA. At WildAgain’s request, the lab repeated the tests and confirmed the results had 15% less protein and 60% more fat than indicated in the GNA. In addition to being posted on [ewildagain.org](http://ewildagain.org), the test results were immediately communicated to PetAg.

Fox Valley Animal Nutrition®

Test results on Fox Valley Animal Nutrition® 32/40 show that they continue to meet the proteins, fats, and kcals of the GNA. However, for those working with small rodents, the dietary copper levels continue to be 60% below the minimum level established for lab rats in the *Nutrition Requirements for Laboratory Animals*. Depending on the severity, copper deficiency can cause slow growth and delay development. Further research suggests that this deficiency may be compensated in regions or municipalities with small amounts of copper in their water supply, either due to local water composition or because of the use of older copper pipes.

**Mineral variations**

Tests by the certified independent laboratory revealed that while most milk powders showed similar levels of minerals, others were noticeably different. As a result, WildAgain wanted to confirm that the milk replacer powders were within a desired range of concentration for the various minerals. While information on mineral requirements is limited for

Product	Calcium	Phosph.	Magnes.	Sodium	Potass.	Iron	Mangan.	Copper	Zinc
New Esbilac®	OK	OK	OK	OK	OK	OK	LOW	OK	OK
Old Esbilac®	OK	OK	OK	OK	OK	OK	LOW	OK	OK
GME®	OK	LOW	OK	OK	OK	LOW	LOW	OK	OK
ZMM 3340®	OK	OK	OK	OK	OK	OK	OK	OK	OK
FxVly 3240®	OK	OK	OK	OK	OK	OK	OK	LOW	OK
FxVly 2050®	OK	OK	OK	OK	OK	OK	OK	LOW	OK
JustBorn®	OK	OK	OK	OK	OK	OK	OK	OK	OK
21CentPup®	OK	OK	OK	OK	OK	OK	OK	OK	OK

many wild species, the *Nutrient Requirements for Laboratory Animals* does have considerable information on the nutritional needs of laboratory rabbits and rodents. This information can be used as a general guideline for nutritional requirements for cottontail rabbits, tree squirrels, chipmunks and other rodents. That same document also describes potential consequences of mineral deficiencies and excesses (toxicity).

The tested lots of Esbilac® powders manufactured since 2008 met many of the mineral minimum requirements specified in *Nutrient Requirements for Laboratory Rodents* for lab rats when mixed 1:2 with water. However, the level of manganese in Esbilac® powders has been consistently below the minimum for rodents when mixed according to the label (1:2 with water). Keep in mind that PetAg® developed Esbilac® for puppies – and the manganese level may be acceptable for puppies and possibly some other species.

Similarly, while many of the nutrients in Fox Valley Nutrition Day One® powders meet many of the minimum nutrient requirements for lab rats when mixed according to the label, the level of copper has been extremely low (more than 60% below the minimum) and was even lower in the most recent test. Deficiencies in copper can affect growth, development and energy. While this information was communicated to Fox Valley Animal Nutrition in 2009 and again in 2010, they are still considering the levels.

The chart to the right compares mineral requirements of several milk powders (when mixed 1:2 with water) to the guidelines for laboratory rodents specified in the *Nutrient Requirements for Laboratory Animals*. Similar charts and comparisons are useful for species other than rodents.

Just as with deficiencies, mineral excesses may have significant adverse effects on animal health. As a result, use caution when adding 'extra' of any mineral or ingredient to make up the deficit since too much also can cause problems. The independent tests showed none of the milk powders contained any of the macro and micro minerals in concentrations that approached toxic levels.

<u>Species</u>	<u>Source</u>	<u>Solids %</u>	<u>Protein %</u>	<u>Fat %</u>	<u>Carbs %</u>	<u>Kcals/cc</u>
Eastern Cottontail	Jenness & Sloan	36.1	12.5	17.9	1.0	2.2
Eastern Cottontail	Oftedal	35.2	15.8	14.4	2.7	2.0
Eastern Gray Squirrel	Shaul	27.6	9.2	12.6	3.4	1.6
Eastern Gray Squirrel	Nixon & Harper	25.4	9.0	12.1	3.0	1.6
Raccoon	Shaul	12.0	4.0	3.9	4.7	0.7
Raccoon	Jenness & Sloan	N/A	6.1	4.2	4.8	0.8
Opossum	Barker et al	23.2	11.3	8.4	1.6	1.4
Opossum	Jenness & Sloan	24.4	4.8	7.0	4.1	1.0
Red Fox	Oftedal	18.1	6.7	5.8	4.6	1.0
Bobcat/Lynx	Jenness & Sloan	18.5	10.2	6.2	4.5	1.2
Striped skunk	Oftedal	30.6	9.9	13.8	3.0	1.8

There are many challenges with balancing levels of minerals, combining them with other ingredients, and more. This is a very complex and sensitive issue – and needs more research. An example of how rehabilitators are addressing this is discussed below.

WildAgain believes that the emerging information about mineral levels in the milk replacer powders and local water supplies may be one of the factors that influences the region by region effectiveness of the milk replacers.

### Milk composition varies

It is well understood that mammal species produce milk for their young. However, we have found that many rehabilitators are less familiar with the significant variations in the milk compositions that exist between species and where to find that information. One source for the milk composition of many commonly rehabilitated species in North America that is easily available to rehabilitators is NWRA's *Principles of Wildlife Rehabilitation*, 2<sup>nd</sup> ed.

The chart below, compiled from the *NWRA Principles of Wildlife Rehabilitation*, provides a quick comparison of how some of the mothers' milks are different. These levels can provide a general direction for rehabilitators seeking to create a formula recipe that is fairly close to the nutritional needs of the species even if some of the research studies show some different results.

### Considering modifying the recipes to meet composition and mineral needs

Here are four examples of formula recipes that were calculated in the nutrition calculator as they meet nutritional needs of squirrels. **The different products and 'recipes' in the columns are compared to the average results of the research studies for Eastern Gray Squirrel milk composition analyses – and the information on mineral levels.**

	Esb2010	FV32/40	FV20/50	Esb+FV32/40 +.25 HWC
Solids	60%	67%	66%	68%
Protein	66%	73%	52%	67%
Fats	56%	60%	72%	70%
Carbs	70%	75%	74%	70%
Kcals	60%	65%	68%	74%
Copper	in range	low	low	in range
Manganese	low	in range	in range	in range

You will notice that the formulas

referenced in the chart below do not reach 100% of the solids, proteins, or fats when compared with mothers' milk. The commercial products are not as evenly matched and digestible as the mothers' milk that has evolved over time. Experience has shown that it is not unusual for formulas made with commercial milk replacers to benefit from having approximately 30% additional water than the mothers' milk to aid digestion (this has the effect of lowering the total solids to around 60-70% of mother's milk as shown in the chart below). Adding one or at times two extra feedings per day can increase the amounts of solids, proteins and fats to match the total daily calorie and nutrient requirements. Two decades of experience with this approach has shown that when those percentages are in the 65-75% range that the squirrels have seemed healthy and developed well, when combined with a feeding regimen that meets the animal's needs.

The first (yellow) column in the chart below used an average of Esbilac® powder lot numbers from 2010 (it is more accurate to use individual lot number if available) mixed with 1 part powder and 2 parts water.

The second (green) column is Fox Valley's Day One® 32/40 mixed with 1 part powder and 2 parts water.

The third (blue) column is Fox Valley's Day One® 20/50 with 1 part powder and 2 parts water.

The fourth (orange) column shows how some rehabilitators have combined Esbilac® powder and Fox Valley Day One® 32/40 to balance minerals and other needs for juvenile squirrels (they mixed 1 part Esbilac® powder, 1 part Fox Valley Day One® 32/40 powder, 4 parts water – and ¼ part of heavy whipping cream).

Many rehabilitators reported juvenile squirrels did well when fed the Esbilac® recipe above; others did not. Some preferred using the Fox Valley 32/40® or 32/50® (recipe above) with squirrels; others reported slower growth - which they thought might be related to low copper or protein. Rehabilitators using the combined Esbilac® and Fox Valley Day One® on 500+ squirrels reported consistent positive results with a variety of species. Many other recipes were tried with widely varying results.

**These are just examples of options since we do not believe we have enough data over a long enough period to make a recommendation for any product or recipe for wild mammal species.** That said, we are intrigued with the increasing number of rehabilitators reporting excellent results from selectively combining products to meet the species' needs.

Also remember the WildAgain Nutrition Calculator only helps with math – it is still essential to have the background knowledge about the species' needs and products, and check performance!

Many factors besides the milk replacer brand or product affect development and health of the animal, including composition, ingredients, minerals, solubility, feeding practices, parasite control, water and other considerations. These are some of the reasons rehabilitators see different results.

### **Changes in Esbilac® and KMR® ingredients and mixing instructions**

PetAg® reported it changed several ingredients in Esbilac® in 2008 to improve the product. Changes were made to KMR® in 2010. Since the FDA allows manufacturers up to 6 months to update labels, the list of ingredients on the packages may not be as current as customers expect.

The mixing instructions on the label may result in a formula digestible for the animals for which the product was developed, such as puppies and kittens. However, solubility tests showed the powders were more uniformly dissolved and better digested by wild mammals when allowed to 'rest' 4 to 8 hours after being mixed.

In 2010, the USFDA published guidelines on using milk replacers on its website. The guidelines advise consumers to follow the manufacturers' instructions and to not mix other products with milk replacers. But because milk replacers are not developed to meet the needs of a single wildlife species, the health and survival of the animal requires the rehabilitator to modify the formula recipe. As a result, rehabilitators have questioned the FDA website, at least as to how the guidance applies to wildlife rehabilitation

<http://www.fda.gov/AnimalVeterinary/SafetyHealth/ProductSafetyInformation/ucm217650.htm>.

Additional considerations for mixing the milk powders is available at <http://www.ewildagain.org/Nutrition/Esbilac%20Tips%20for%20Wildlife.htm>.

### **Probiotics are helpful**

As mentioned in a related article, it can be helpful to add probiotics to formula. The probiotics should only be added to the formula used in 2 feedings per day in order to avoid reducing diversity of gut flora by overpopulating the gastrointestinal tract with a couple of strains of bacteria that are in the full batch of formula. That means not adding the probiotics to the full batch of formula when it is made. More info on probiotics is available at [http://www.ewildagain.org/Nutrition/mammal\\_nutrition\\_resources.htm](http://www.ewildagain.org/Nutrition/mammal_nutrition_resources.htm).

### **An easy tool for comparing formula recipes**

Another source of information on milk composition and an easy-to-use tool to compare recipes to species' needs is WildAgain's Nutrition Calculator. At the request of rehabilitators, the Nutrition Calculator was recently (late 2010) expanded to include products from multiple milk replacer manufacturers to allow users to quickly compare recipes directly to species needs without having to perform the math.

In Step 1, rehabilitators select from 50 different milk products from different manufacturers (e.g., PetAg, Fox Valley), and even cow and goat milk on a drop-down menu. In Step 2, the user can select volumes of the recipe based on parts or weights, such as 1 part Fox Valley 32/40 and 2 parts water. In Step 3, the user can further select the species and research study for which they want to compare the formula recipe. Then rehabilitators can consider how formula recipes meet the needs of the species before trying it with the animals. The downloadable Nutrition Calculator (which runs on Microsoft EXCEL®) and tips on using it are available at <http://www.ewildagain.org/Nutrition/calculatorlink.htm>.

### **Expanded mammal nutrition resources (including videos by mid-Feb) at [www.ewildagain.org](http://www.ewildagain.org)**

WildAgain continues to post extensive mammal nutrition resources, test results on numerous milk replacers, and more that we hope the wildlife rehabilitation community will find useful. We hope that increasing our individual and collective understanding of and experience with products and recipes, and sharing information on these *and the results* will lead to more effective rehabilitation practices and fewer health problems with wildlife in the rehabilitation community. Updates and training materials, including presentations and video tutorials, will continue to be posted on [www.ewildagain.org](http://www.ewildagain.org).

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### **Authors**

Allan and Shirley Casey, co-founders of WildAgain Wildlife Rehabilitation, Inc. in Colorado, have been licensed rehabilitators since 1986. The Caseys conduct research on a variety of rehabilitation related subjects, including nutrition, wildlife health, rehabilitation regulations, and trends. They have written 100+ articles for rehabilitation and veterinary publications, as well as the *Squirrel Rehabilitation Handbook*. [www.ewildagain.org](http://www.ewildagain.org). The Caseys have no affiliation with any milk replacer company.