



WildAgain Wildlife Rehabilitation, Inc. Evergreen, Colorado.

Zoologic® 42/25 – Part 2. Reflections on the product and comparison to the newly (2022) reformulated KMR®.

Some who read the lab and performance tests presented in Part 1 for the recent testing of Zoologic® 42/25 may ask “...OK, lots of interesting data, but what does it all mean for wildlife formula?” Or they may ponder “...isn't this just the same as KMR® but with a different label?”

There are plenty of reasons to take a fresh look at Zoologic® 42/25 milk replacer powder, even though there seem to have been only very small changes in recent years.

Many rehabilitators want a deeper understanding of (and more detailed test results of) a product that has been used successfully in substitute milk formula recipes for many years. They may want to know how those results compare with other products, especially a “close cousin” product, KMR®, also manufactured by PetAg®. Are there some key differences between the two products that provide differing benefits with wildlife? One notable difference between Zoologic® 42/25 and KMR® is that Zoologic does NOT include any disclosed prebiotics or probiotics.

Some rehabilitators are seeking and considering new research and insights about species milks. This could include choice of milk powders, ingredient considerations, and strategies to improve effectiveness with animal development and health (e.g., oligosaccharides, microbiota). Others are exploring ways to blend powders and other ingredients to arrive at a closer match to species' milks. In fact, Zoologic® 42/25 was initially developed and marketed to be part of blended formulas to match species milks. Some may want to understand more about how the product performs when reconstituted from a powder to a liquid. They may be interested in learning techniques to potentially improve effectiveness with the animals, such as with modified mixing and reconstituting protocols. Others are wondering about growth or health issues with the young mammals on formula, and strategies to improve animal health – even with a product seemingly ‘unchanged’ for many years. In summary, there are many reasons rehabilitators are evaluating their practices, even with products they and others have used with confidence for years.

Key highlights of Zoologic® 42/25

1. No apparent change in the product formulation in 10+ years. Still based on cow milk. [Fats](#) still from vegetable oil. [Protein](#) primarily from casein. [Dietary minerals](#) still present in acceptable

concentrations. No prebiotics or probiotics are disclosed on the label, although fiber tested at 1.6% concentration, with no apparent source listed on the label. Concentrations of fat and protein in Zoologic® 42/25 are different from KMR® since the new formulation of KMR® (2022) is now 40/28.

2. Fat level adheres to the [Guaranteed Analysis-GA](#) minimum values, but protein, moisture, and fiber are all out of specification versus the GA. The [WildAgain Formula Calculator](#) now contains these new values from the 2022 test sample in the drop-down menu to assist in reviewing prior formula recipe calculations.
3. Texture continues to be a very loose, fluffy, and sticky consistency as in prior years, and similar to other PetAg® powdered milk replacers, including the new KMR® formulation (2022). This still results in [measurement error when measuring by volume \(scooping\)](#). Weighing the powder eliminates this needless error.
4. Since high protein milk powders, such as casein, generally have [poor reconstitution properties](#), it is surprising that this product demonstrated significant wetting and sinking in <5 minutes, when adding the powder to the warm water (in that order as directed by the label and following WildAgain's test protocol) when reconstituting the powder to a liquid. A very thorough 5-minute hand whisk/stir is still required to fully submerge and separate the unwetted powder that settles to the bottom. While the powder then appears visually to be completely dispersed, it is still **not** completely reconstituted at this point, with almost 2% of the powder remaining dry. Fortunately, the product shows a ≈80% improved reconstitution when allowed to rest in the refrigerator for eight hours prior to use.

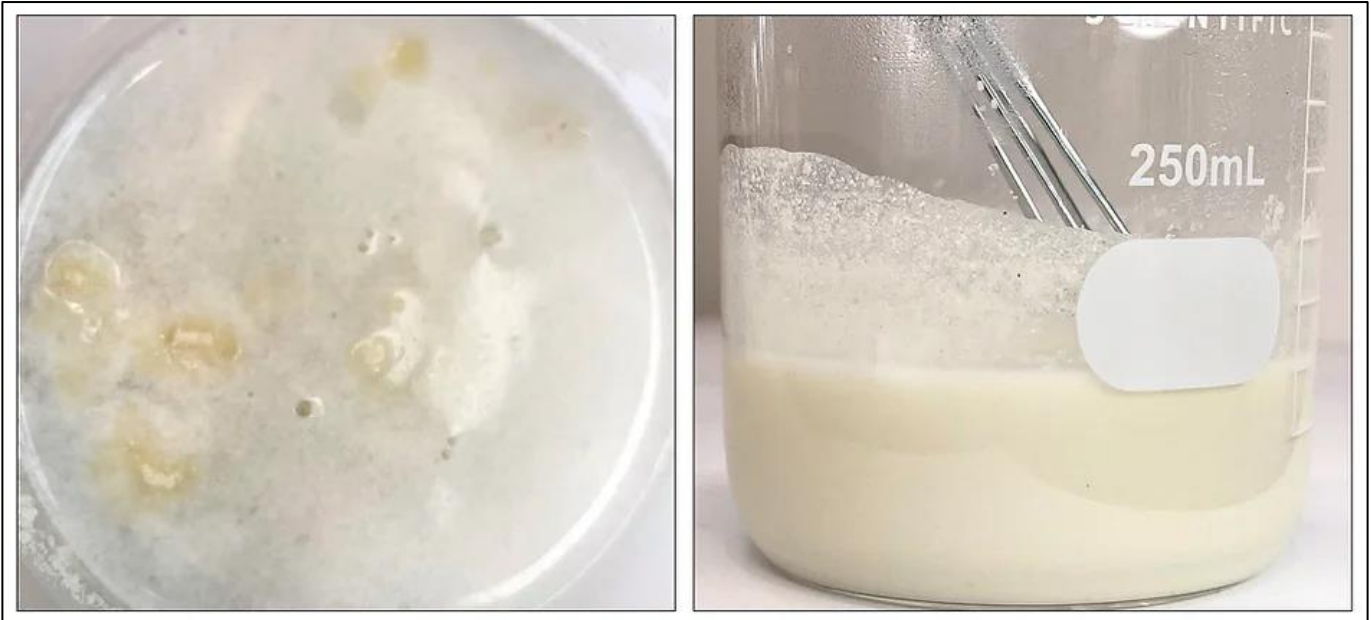
Reminder to recalculate existing formula recipes

Since the lab tests show slight changes in the proximate analysis (proteins, fats, carbs), it continues to be advisable to recalculate prior formula recipes that incorporate Zoologic® 42/25 as a sole milk replacer product or in combination with others in a blended recipe. The [WildAgain Formula Calculator](#) now contains these new values from the 2022 test sample in the drop-down menu to assist in reviewing prior formula recipe calculations.

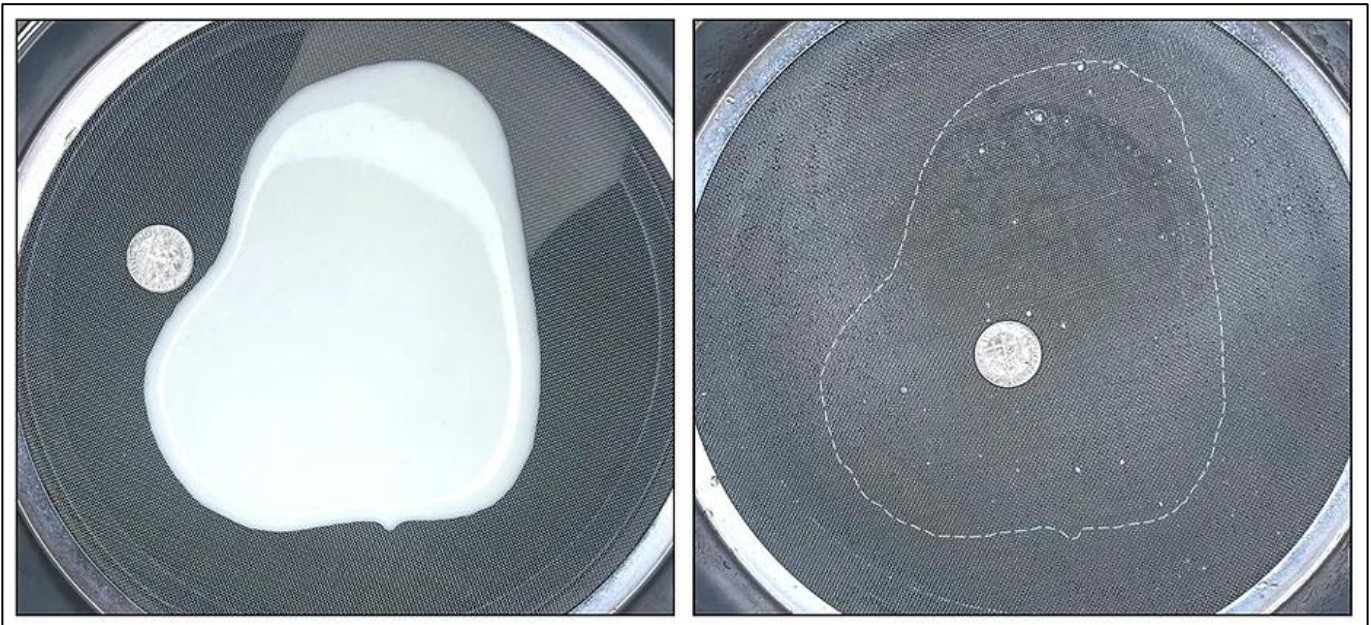
Reconstitution far exceeds KMR®, but *neither is a quick "...mix, stir and feed..."*

None of the milk replacers tested by WildAgain prove to be 'instant mix' formulations, as is suggested on the product labels. While the idea of user convenience is appealing, it consistently fails to provide a final liquid formula that is acceptably free of only minimal amounts of residual dry powder. Additional steps are required to achieve a more complete reconstitution.

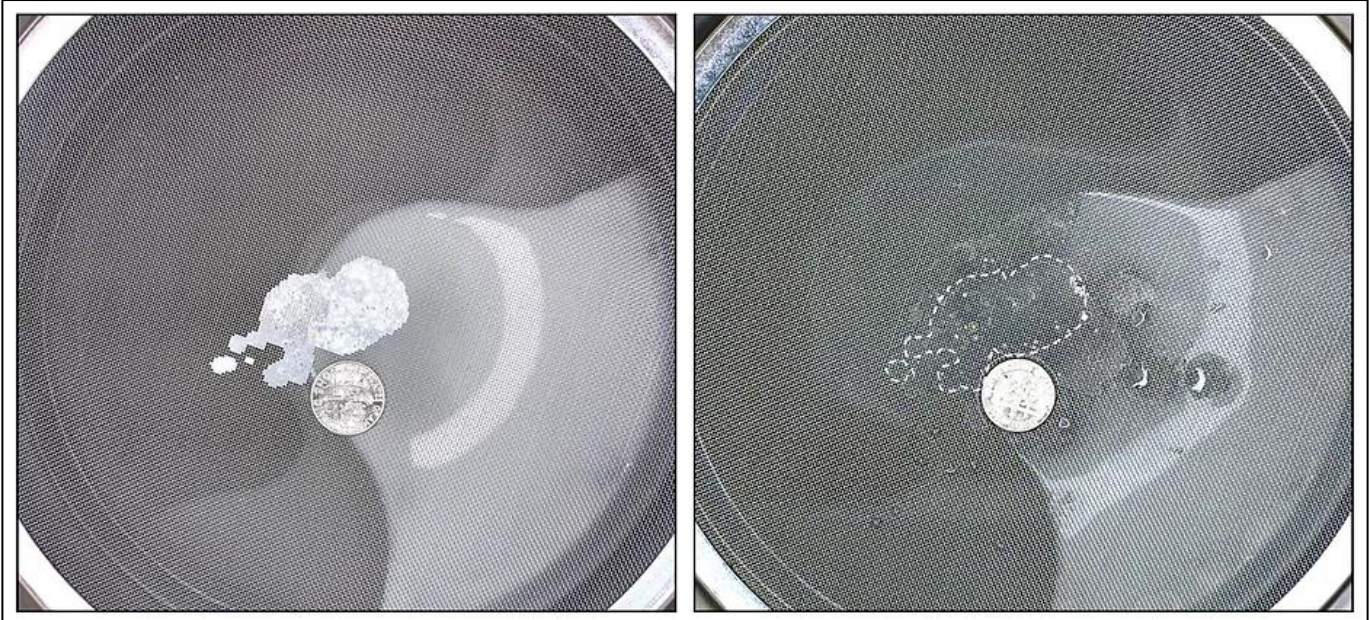
As shown in the following pair of images, the formula appears to be completely wetted with remarkably few dry powder particles after allowing the powder to wet for 5 minutes (left image). Almost all of the surface wetting had taken place in about 30 seconds, with the submerged clumps of powder beginning to disperse. The sample was given a full 5-minute hand whisk to achieve a very smooth, cream-like liquid with no visual clumps of dry powder remaining (right image).



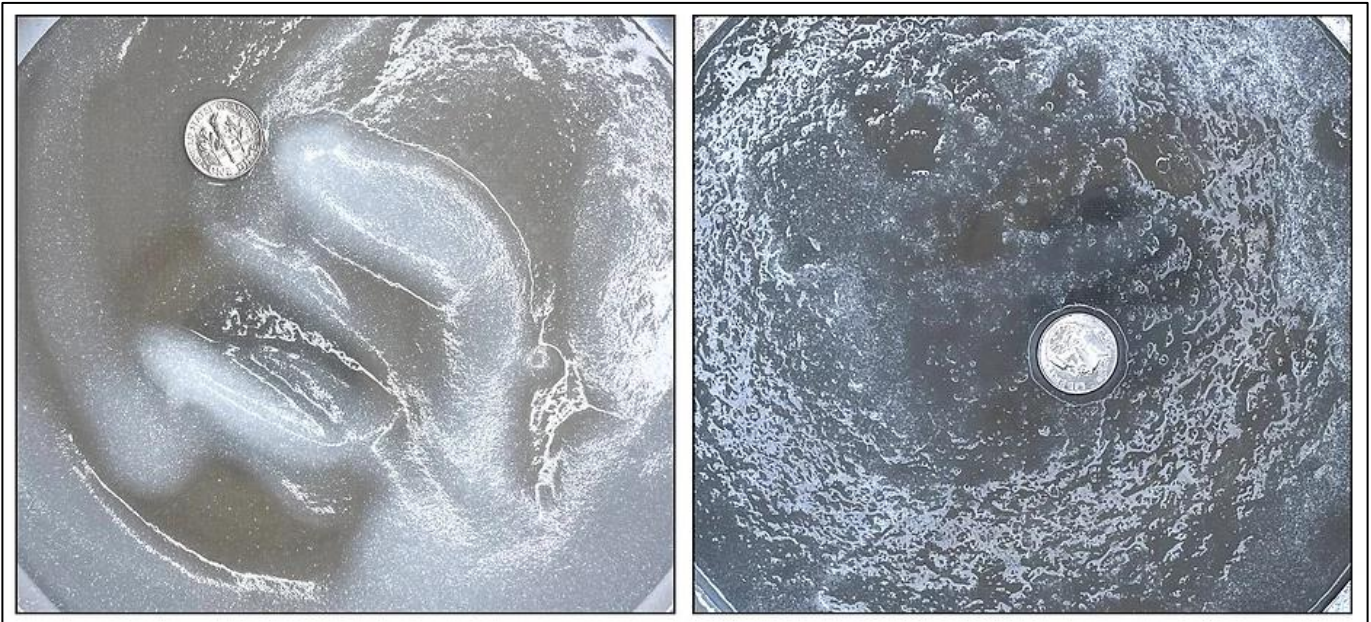
The next pair of images show the result of immediately pouring the prepared formula on to the $500\mu\text{m}$ sieve (left) and then spraying with water to break the surface tension of the liquid (right). It shows that only a very small amount of powder has remained dry and not begun the full dispersal and dissolution process. The amount retained by the sieve accounts for about .33% of the original powder in this test.



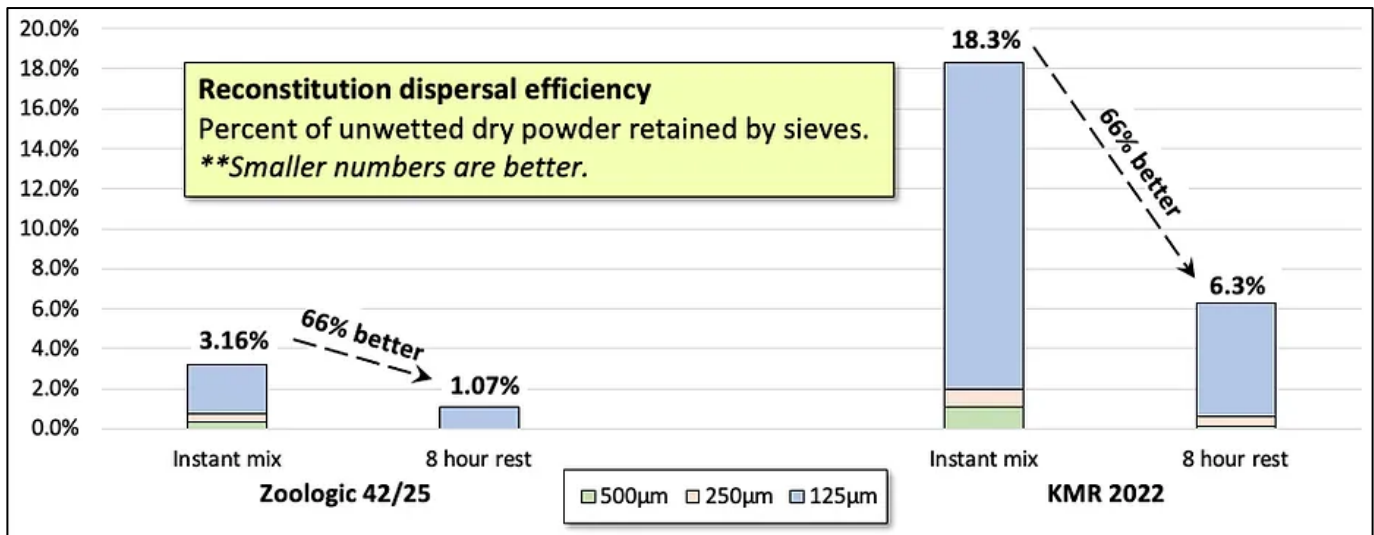
The next pair of images show the result of pouring the prepared formula, but this time after a full 8-hour resting period in the refrigerator, prior to the pour on to the $500\mu\text{m}$ sieve (left) and then spraying with water to break the surface tension of the liquid (right). This shows the significant improvement ($\approx 96\%$) in reduction in unwetted powder, helping to achieve a more complete dispersal and dissolution process. The amount retained by the sieve accounts at this point amounted to only a trace, or less than .01%.



The two pairs of images shown above can be somewhat misleading, in that they both imply very little unwetted powder remains for both the instant mix example as well as the 8-hour rest example when using the largest sieve (500 μ m in size). However, the smallest sieve at 125 μ m shows substantial differences. As shown in the next pair of images, a fair amount of sludge is retained by the two sieves (the instant mix to the left; the 8-hour to the right). While this sludge is still present, the rest period decreases the amount of sludge retained by the sieve on the right by 58%.



As these test results confirm, the most critical and final step in [reconstituting the powder to a liquid](#) (after wetting, sinking and stirring/whisking), is [an 8-hour resting period](#) following preparation (mixing) to final use (feeding). Testing found that this improves final reconstitution by $\approx 66\%$ for Zoologic[®] 42/25. In terms of comparing the reconstitution properties to KMR[®], the following chart shows the relative performance of the two products. Although the KMR[®] showed the same 66% improvement after 8 hours, the



reconstitution still resulted in over 6% of the original powder remaining unwetted and in particle sizes exceeding 125µm in size.

Effective reconstitution affects the amount of nutrition available, digestibility and more. There are several steps involved in [reconstitution – including wetting, sinking, stirring, and resting](#). It may take a little planning and time to prepare the formula in advance and allow it to rest in the refrigerator for 8 hours. However, doing so can significantly affect and improve the health, growth, and development of the wild orphan mammal.

To summarize the steps of effective reconstitution: (1) add the powder to warm water and allow up to 5 minutes to wet and sink, (2) hand stir or whisk until no dry clumps of powder are visible, (3) allow the prepared formula to rest in the refrigerator for 8 hours prior to use.

The product label indicates no *added* probiotics or prebiotics.

Research is expanding at an increasing rate on understanding and describing the critical importance of the microbiome (collection of microorganisms in a singular environment, like bacteria in the gastrointestinal tract) and microbiota (the wider community of microorganisms and the *entire* habitat). This research has expanded the understanding of the many important aspects and processes of digestion, health, growth, development and much more in humans and other species. While early research placed considerable focus on the bacteria in the gastrointestinal tract, it has significantly expanded beyond the study of the bacteria in the GI tract to many more aspects. This growing understanding of the microbiome promotes potential uses of select probiotics and prebiotics.

Probiotics. Some manufacturers have begun incorporating several “beneficial bacteria” into milk replacers for human infants and mammal species to support the microbiome in the form of *probiotics*. Zoologic® 42/25 does *not* include probiotics.

Some rehabilitators are using targeted strategies, including reintroducing, supplementing, and balancing the specific gut microbiome of the species. These practices include the use of transfaunation and inoculants.

Prebiotics. Mammal milks include both digestible and indigestible carbohydrates. Oligosaccharides, one of the indigestible carbohydrates, have many essential functions: providing a protective barrier for the epithelial lining in the GI system (and helping protect it from pathogens), immune development, microbiome support, digestion, aiding gastrointestinal motility, and serving as ‘food’ for essential GI microbiome. Since whole liquid milk ingredients include some oligosaccharides (though limited in cow milk), it is possible that dried skim milk included as an ingredient in Zoologic® 42/25 may provide some level of oligosaccharides in the powder.

Since commercial production of milk-based oligosaccharides has not been available with animal milk replacers, indigestible carbohydrates (some of which are called *prebiotics*) have been manufactured from plants (in the form of fibers) to serve that function. These have recently been added to several milk replacer formulations. While the Zoologic® 42/25 lab test indicates 1.6% of fiber is present, no *added* prebiotics are specifically disclosed on the label. Some rehabilitators have recently begun blending other milk replacers that include *prebiotics* with Zoologic® 42/25 in an attempt to increase the milk-based oligosaccharides (e.g., Tailspring milk replacers) and concurrently achieving a closer overall match of nutritional composition to the species’ milk.

The product label description intends blending with other Zoologic® products

The Zoologic® 42/25 label indicates “...[Zoologic®] Milk Matrix 42/25 may be used alone or blended with other powders in the Zoologic® Milk Matrix family to formulate a milk replacer with nutrient levels that closely match a species’ natural milk.” It further suggests powder:water mixing ratios for various species including leopard, lynx, jaguar, bobcat, and raccoon. Those suggestions seem to imply that the indicated ratios will equally and completely meet the nutritional needs of each of those species. [Published scientific milk composition analyses for those species](#) show the mothers’ milks are usually different enough to *not* be fully met by a single product in any ratio with water. Thus, the recommended 1:2 formula recipes could possibly serve as a starting point to create a suitable recipe (alone or [blended with other milk powders and fats](#)), but should be validated with the published studies. The WildAgain Wildlife Formula Calculator can assist with these calculations.

Storage

The Zoologic® 42/25 sample that was tested demonstrates questionable shelf-stability, testing at a PV=28.3 at 306 days since manufacture, which is [above established guidelines for edible oils \(<10\)](#). This is surprising given the past trend of acceptable PV levels in several Zoologic® samples tested over the last several years. Close attention to product freshness and proper handling and [storage](#) remains a key defense in order to prevent the onset of rancidification. Proper storage protocols generally include refrigeration (or freezing) of the powder in airtight containers and away from sunlight and oxygen (excess air). The label suggests “...storing unopened powder in a cool, dry place, with previously opened packages refrigerated for up to 3 months, or frozen for up to 6 months to preserve freshness.”

Other factors that can affect success of any powdered milk replacer product

Product quality, availability, and costs. Availability and the ease of obtaining a product may be factors – but will vary depending on things such as manufacturing capacity, supply chain issues, distributors, storage, and shipping. Quality control is another factor – and, as with all products, continues to deserve

monitoring by the end user in its performance with the wild mammal orphans. Cost of the product is certainly another factor that will influence purchase and usage over other similar milk replacers.

Effective rehabilitation practices are always important (e.g., hydration, providing supplemental heat for neonates or those with compromised health, minimizing stress, treating parasites, keeping accurate and thorough daily and records).

Effective feeding practices. Feed considering the appropriate amount and frequency for the species (e.g., do not over- or underfeed during a 24-hour period) and use clean and appropriately-sized feeding utensils. Equally as important is monitoring stool - frequency, amount, and consistency. This can provide direct clues as to whether the milk replacer (product and formula recipe) is working successfully with the specific species, age, developmental level, and overall health of the animal.

Adjusting formula recipes to match the species milk. Zoologic® 42/25 is a milk replacer powder marketed and labeled for use with a variety of species, and to be used as a blended powder with other Zoologic® products. These and all other mammal species' milks have a percentage of protein and fat different than '42/25,' as well as different requirements of carbohydrates, kcals, etc. than this product may provide. Rehabilitators should review published scientific [milk composition analysis studies for their species](#). Recipe modifications are generally needed to create a closer match to the milk of the wild mammal species in their care. Calculating formulas for different species can be a complex and time-consuming exercise – consider using the Wildlife Formula Calculator.

Creating recipe adjustments through blended formulas. As confirmed by the package label, many times, matching mother's milk can be more closely achieved by blending several milk replacer powders and possibly adding other ingredients. Since individual powdered milk replacer products will reconstitute in slightly different ways, specific blending protocols should be followed to do so effectively and safely. This means reconstituting each powder individually and combining only after each has fully reconstituted in liquid form. ([Mixing Guide](#))

More. Stay alert to and consider expanding research related to nutrition, health and more that can affect these topics, such as microbiome, glycans, oligosaccharides, manufacturing changes.

Disclosures

Zoologic® 42/25 is a powdered milk replacer [part of PetAg®'s Zoologic® Milk Matrix family of products] which is manufactured and marketed for use with wildlife in rehabilitation, zoos and other settings requiring supplemental substitute milk replacer formulas.

Product assays performed by the independent lab, as presented in Part 1, and referred to here in Part 2, adhere to the *Official Methods of Analysis of AOAC INTERNATIONAL* (Association of Official Analytical Chemists) and the *Official Methods and Recommended Practices of the AOCS* (American Oil Chemists Society).

The authors have no conflicts of interest with the independent lab, or any of the products or manufacturers discussed in this article.

Resources

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