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MannaPro® Kid Goat Milk Replacer – Part 2. Reflections on the product.

Some who read the lab and performance tests presented in Part 1 for MannaPro® Kid Goat Milk Replacer may ask *"…OK, lots of interesting data, but what does it all mean for wildlife formula?"* Or they may ponder *"…Is it a close match to cottontail or tree squirrel milk since it is made for goats?"*

To restate some of the introductory information from Part 1, MannaPro® Kid Goat Milk Replacer is one of many specialized substitute milk formulas produced by Manna Pro Products, LLC. formed in 1985. As the successor to Carnation Company Milling Division, the company has deep roots and connections to some of the feed industry pioneers, with a 178-year history of manufacturing and marketing diversified animal feed. The company produces many feed products for both the livestock and domestic animal market. MannaPro® Kid Goat Milk Replacer is a cow-milk based product that is manufactured and sold for goat kids.

The label shows that it contains probiotics for goat kids, delivered through a separately manufactured product called Opti-Gut™. The company's website describes Opti-Gut™ as a *"…natural probiotic to support the health of all types of animals, including horses, dairy cows, beef cattle, pigs, poultry, and fish. It's also perfectly safe for pets. Opti-Gut™ uses powerful, high-strength multi-strain microbials to replenish animal gut flora and improve nutrient absorption. It's one of the Biolink4Plants range of products based on powerful, biological stimuli that are effective, safe to use, and good for the environment…"*

Overall impressions of the product

1. Since the product is specifically formulated for young and growing domestic goats, a perfect match to milk of a wild species (such as tree squirrels or cottontails) is unlikely. Although targeted for goats, the product is whey protein-based from cow's milk, rather than goat's milk. The lipid source is (generic) animal fat, which typically falls to the low end

of the animal feed spectrum. While the whey is very easily digestible, the presence of animal fat could easily result in digestive issues. Hotter water (130-140°F) is needed to liquify the fat. The animal fat may cause palatability issues depending on the grade of the fat and any rancidity onset. It does include added probiotics via the inclusion of Opti-Gut™ which will be discussed later.

2. The protein and fat concentrations (23% and 26% respectively) are remarkably low, compared to milk compositions of most wildlife species. This results in very high carbohydrate concentrations that are likely disqualifiers for many wild mammal species. Examples are provided below.

3. Overall ash content (dietary minerals) is relatively high at 7.71%, when compared to other milk replacers used for wildlife. Calcium and Phosphorus concentrations are acceptable, as is the Ca:P ratio.

4. Consistency is finely textured and non-sticky. This results in a +2 to -5% average error rate when measuring by volume (scooping). Weighing the powder eliminates this needless error.

5. Outstanding reconstitution performance when initially mixed, but improves by ≈60% when allowed to rest 8 hours after mixing and before feeding. Wetting and sinking performance was excellent (in less than 5 minutes). Hand stirring/whisking for 5 minutes successfully submerged any surface film powder and dispersed most of the dry powder. [Some of the dry animal fat particles that may be <125μm in size would likely need water temps at 130-140°F to fully liquify and reconstitute.]

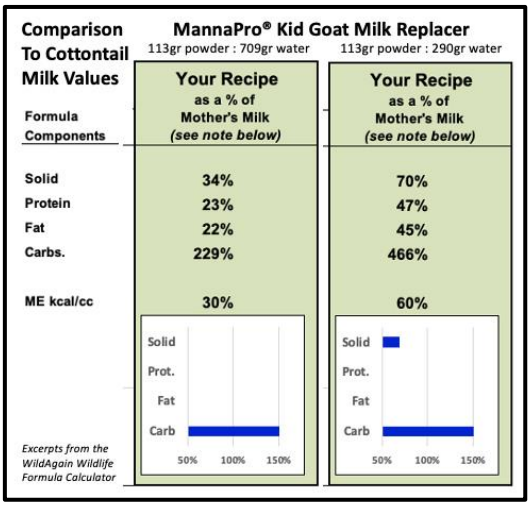
6. The product appears to be extremely shelf stable. It tested with a Peroxide Value of 'not detected' at 23 months post manufacture, indicating virtually no presence of rancidity. The instructions do not indicate that refrigeration is required after opening (only to store in a cool dry place in an airtight container). However, it is advisable to store any high-fat content milk replacer (once opened) in the refrigerator or freezer to prevent the onset or progression of rancidity.

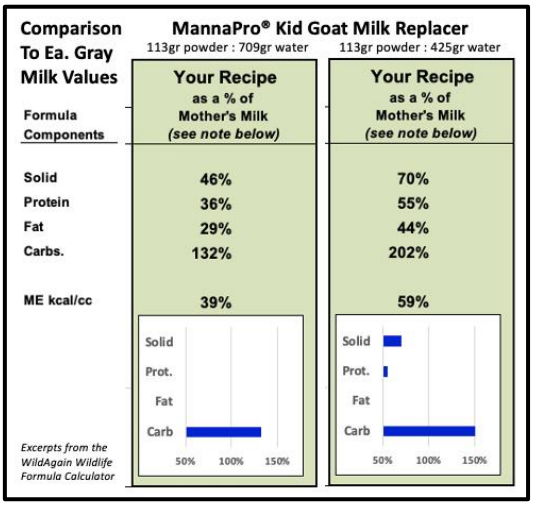
How it compares to cottontail and squirrel milk – Overall major components

Since the goal is to use the product in the construction of a suitable substitute milk replacer, one must know the composition of the major nutritional components of a species milk. While studies of wild mammal milk analysis can be found in scientific research publications, another way for wildlife rehabilitators to quickly access the studies of species-specific nutrition profiles and other resources is to visit WildAgain's formula and feeding section (https://www.ewildagain.org/wildlife-formula-and-feeding). Over 90+ research studies are included for wild mammal species worldwide.

WildAgain's Wildlife Formula Calculator includes major components by species (such as cottontails, tree squirrels, and others), either by particular scientific study or an average of several studies for that species. These are pre-loaded and are accessible via an easy drop-down menu. There is also an option for the user to input published milk composition studies for other species, when using the WildAgain Formula Calculator to compare formula recipes to the species' milks, such as the snowshoe hare or blacktailed jackrabbit.

The diagrams at right show how two different recipes (using only the dry powdered product mixed with water) compare to cottontail rabbit and eastern gray squirrel mothers' milk when using the WildAgain Wildlife Formula calculator.





The left green shaded columns are comparisons using the powder:water ratio as suggested by the manufacturer (basically a 1 : 3.5 ratio). The right shaded green columns are comparisons using less water in each case to achieve a level of 70% total solids, which is a successful target range for formulas made with powdered milk replacers.

The 1 : 3.5 ratio falls unacceptably short of matching the cottontail rabbit mother's milk. Total solids are only one-third; protein and fat are less than a quarter; and carbohydrates are over twice what is needed. This is an extremely unbalanced recipe for cottontails. Boosting the total solids to 70% doubles the protein and fat (yet still under 50%) but also doubles the carbohydrates to over 4.5 times mother's milk. These two recipes would disqualify MannaPro® Kid Goat as a single product formula for cottontails.

A similar result is seen for eastern gray tree squirrels, with only slightly higher values. Even in the right column where 40% less water is used in the recipe, protein and fat concentrations are still unacceptably low, with carbohydrates over twice what is needed.

Even if MannaPro® Kid Goat was used in a blended formula recipe to capture the benefits of being whey protein-based, it would likely yield a recipe that is unacceptably high in carbohydrates for most species.

Comparison to cottontail milk fatty acids – Caprylic (C:8) and Capric (C:10)

Research into cottontail milk shows that it contains a remarkably high concentration of the medium chain triglycerides (MCT) of Caprylic (C:8) and Capric (C:10) fatty acids. Research has

shown that these two fatty acids provide quickly digestible and utilizable energy for young rabbits, as well the benefit of antimicrobial properties.

The diagram at right (which shows the same two recipes as discussed above, comparing to cottontail milk) highlights how the MCT concentrations compare. It quickly becomes obvious that the product provides only 80-90% of the required MCT fatty acids. If used as a single product or in a blend, supplementation of additional MCT oil would be required, such as a blended C:8/C:10 supplement.

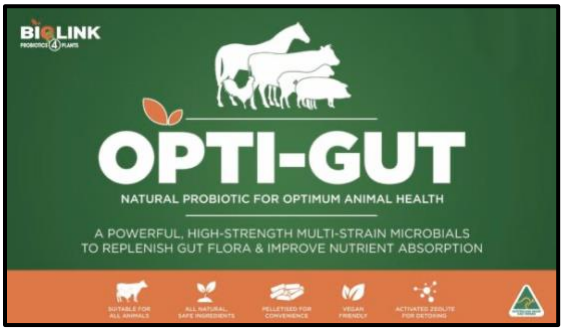
[*Note: Recipes shown above are for illustrative purposes only and are <u>not</u> meant to be recommendations from WildAgain for cottontail formulas.*]

Comparison To Cottontail Milk Values	MannaPro® Kid Goat Milk Replacer 113gr powder : 709gr water	113gr powder : 290gr water
Formula Components	Your Recipe as a % of Mother's Milk *(see note below)*	Your Recipe as a % of Mother's Milk *(see note below)*
Solid	34%	70%
Protein	23%	47%
Fat	22%	45%
Carbs.	229%	466%
ME kcal/cc	30%	60%

	Target range ≈ 70%	
Caprylic Acid (C:8)	4%	8%
Capric Acid (C:10)	3%	6%
Total C:8 + C:10	**7%**	**14%**

Probiotics – supplemented with Opti-Gut™

The gastrointestinal microbiome is composed of many varieties and numbers of essential microbes, such as healthy bacteria. While some of the microbes are similar among species, others are different in variety and amounts. These microbes are key for digestion, immune system and more.



As shown in the image of the product bag, Opti-Gut™ is included to support gut health and digestion. Opti-Gut™ is a product made by BioLink4Plants, an Australian company. The company's website indicates the product contains mill mix, fulvic, microbes and activated zeolite. It is described as using powerful, high strength multi-strain microbials to replenish gut flora and improve nutrient absorption. The humic and fulvic acids, and activated zeolite are described as helping stabilize the animal's intestinal flora, improve feed efficiency, detoxifying the liver, and boost immunity and brain function. These ingredients aim to optimize the pH in the animal's body to neutralize harmful free radicals. The description says it has anti-viral properties to help with skin conditions and is a versatile nutritional supplement suitable for horses, cows, sheep, goats, pigs, dogs, and fish.

The label describes this specific probiotic formulation specifically for use with livestock. As such, its suitability and benefits for use with small wild mammals is uncertain.

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.

Modifications for wildlife use. MannaPro® Kid Goat Milk Replacer is developed and sold for use with kid goats. It contains 23% protein, 26% fat and other nutrients. All other mammal species milks have a different % composition of protein, fat, carbohydrates, kcals, etc. Rehabilitators should review published scientific milk composition analysis studies for their species. Recipe modifications are generally needed in order 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.

Modifications through blended formulas. 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

MannaPro® Kid Milk Replacer is manufactured and sold for young kid goats. Use in wildlife rehabilitation would be considered an off-label use. Opti-Gut™ is a naturally formulated probiotic for use primarily with commercial livestock and other domestic animals.

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.

References

Skfiivanov. V., M. Marounek: Effects of Caprylic Acid on Performance and Mortality of Growing Rabbits. Acta Vet. Brno, 2002 71: 435-439.

Anderson, Sadler, Knauer, Wippler, & Marshall. 1975. Composition of cottontail rabbit milk from stomachs of young and directly from gland. J Dairy Sci 1975 Oct; 58(10):1449-52

Opti-Gut™ informational brochure
https://biolink4plants.com.au/wp-content/uploads/2022/08/BioLink-OptiGUT-Brochure.pdf

Chaucheyras-Durand, Lallemand; and H. Durand. 2008. Probiotics in animal nutrition and health.
https://www.wageningenacademic.com/doi/epdf/10.3920/BM2008.1002