WildAgain Wildlife Rehabilitation, Inc. Evergreen, Colorado.

Tailspring Puppy and Kitten Milk Replacers – Part 2. Reflections on the products.

Some who read the lab and performance tests presented in Part 1 for the Tailspring Milk Replacers may ask *"OK, lots of interesting data, but what does it all mean for wildlife formula?"* Or they may ponder *"Why are rehabbers considering if it's made from goat milk?"*

To restate some of the introductory information from Part 1, Tailspring Milk Replacers are relatively new animal milk replacer products produced by Meyenberg. Founded in 1934, the company has made a variety of goat milk based human grade food products, ranging from whole milk, low-fat milk, cheese, evaporated milk and powdered goat milk products. In early 2021, the company introduced Tailspring, a pet food brand. Tailspring produces and markets goat milk puppy and kitten milk replacers, in both liquid and powdered form. Products are available directly from the company's website, various online retailers, and smaller local stores that carry specialty pet food products.

Cow (bovine) milk is the source of most dairy products, since it is produced in larger volumes, more easily available and less expensive. Goat's milk is the second most common type of dairy (milk) product – but less available and often more expensive. As a milk, goat milk has some similarities to cow milk – and some differences, such as different nutrition composition levels and digestibility. As such, goat's milk is often marketed and suggested for digestive sensitivities; for very young, developing GI systems; and animals in stressful environments. The following is a listing of some of the characteristics that beneficially differentiate goat milk from cow's milk:

Enhancing digestion

- Smaller sized fat globules (with higher homogeneity and greater surface area).
- Better fat utilization due to twice as many medium chain fatty acids (MCFA).
- Favorable αs1-casein to αs2-casein ratio (less gastrointestinal allergenic inflammation).

- Lower concentration of lactose.
- Higher overall dietary mineral levels with higher bioavailability.

Enhancing digestive health

- Contains 250-300 mg/l oligosaccharides (4-5x than in cow's milk). While oligosacchrides are a type of carbohydrate, they are indigestible. They act like a prebiotic and support epitherial and microbiome development and health. They also aid in the reduction of intestinal inflammation and protect intestinal flora against pathogens (e.g., Escherichia Coli).
- Higher conjugated linoleic acids (CLA's) for immune stimulation and growth promotion.
- MCFA have been shown to possess antimicrobial properties.

While goat milk is not a 'match' to the exact nutrition composition of any of the wild mammal milks, some wildlife rehabilitators may consider it an option to be part of a 'blend' when making a substitute mammal milk formula.

Overall impressions of the product(s)

Attractive characteristics

1. Goat milk based with all the benefits listed above (versus cow milk based).

2. Human grade ingredients. Much higher quality than 'feed' grade used for animal foods.

3. Very simple formulation: goat milk, safflower oil, few additives, no preservatives.

4. Reconstitution efficiency of powder to liquid form is Best-in Class. This does require a thorough 5-minute mechanical dispersal (whisk/stir) and an 8-hour rest prior to use.

5. Shelf-stability is remarkable, with very low peroxide value (PV) test results at over 18 months post-manufacturing. Indicates *very low* presence of rancidity onset.

6. Mixed formula can be refrigerated for up to 48 hours (per label).

Less attractive characteristics

7. Expensive when compared to other milk replacers. Availability in only one (small) size package. which limits economy pricing of larger containers that are offered by competitor products.

8. While overall ash (dietary minerals) is very acceptable in the 5-7% range, calcium concentration in the Puppy product is relatively low at .77% (with > 1.0% preferred).

9. Outstanding reconstitution results do require more than an instant *"… mix powder with warm water…blend or shake vigorously…".* As mentioned above, extra effort and planning is required to achieve a superior result of a smooth, reconstituted formula (see note below).

10. Moisture content is relatively high for powdered milk products at +/- 9% in both products, well above the Guaranteed Analysis of < 5%. Human grade ingredients and more strict packaging requirements likely reduce the concern for bacterial growth that can result from a higher moisture content.

11. Purchase of the product needs to be planned well in advance since it has *not* been available at many local stores or even online. It is difficult to predict ease of availability if demand significantly increases due to rehabilitators choosing to add it to ingredients used in blended formulas.

12. As with any goat milk-based replacer, Tailspring milk replacer powders and prepared formulas have a slightly different odor than other milk replacers with a bovine base. The different odor does not mean it is bad or spoiled, but just different (some refer to it as a 'goaty odor'). The higher concentration of short and medium chain fatty acids give goat milk and cheese its distinctive smell. As a result, animals fed goat's milk-based products may have slightly different and noticeable characteristics in stool and urine. This may include stool that is slightly darker, shinier, and more dense, and urine with a stronger odor.

[**Note on reconstitution.** This product mixes differently than other products, producing a thicker and 'creamier' consistency. Extra steps are required and are worth the effort to achieve a better result. Mixing in a container with a wider top opening (e.g., 8" diameter mixing bowl vs 4") helps improve wetting and sinking, providing a larger area for the powder to contact the water surface to begin wetting. Allow a full 5 minutes for wetting and sinking, even though sinking is limited. Follow with vigorous mechanical dispersal using a wire whisk to submerge and push the powder into the water with a full 5-minute stir until thoroughly mixed and no 'settled' thick cream/paste/clumps are left on the bottom.

Like many other milk powders, allowing to rest for at least 8 hours in the refrigerator makes the formula significantly more reconstituted and digestible. After removing enough formula for the next feeding from the refrigerator, whisk/stir for 1-3 minutes to complete the final reconstitution. Then warm to feeding temperature.]

Side-by-side comparison to PetAg®'s goat milk-based replacers

Some rehabilitators may have considered or used PetAg® goat's milk replacers in the past (for example, Goat's Milk Esbilac (GME)® and Goat's Milk KMR®). For comparative purposes, the following table presents a side-by-side view of the primary ingredients of the Tailspring and PetAg® milk replacer products.

While all 4 products profiled include whole goat milk, the PetAg® products also include cow-sourced protein in the form of casein and dried whey protein concentrate. By comparison, the added protein in the Tailspring products is all goat sourced. The added fat content is achieved

	Puppy Formulations		Kitten Formulations	
	Tailspring Puppy Milk Replacer	PetAg® (2022) Goat's Milk Esbilac® (GME)®	Tailspring Kitten Kitten Milk Replacer	PetAg® (2022) Goat's Milk KMR®
Primary Ingredients				
[Goat sourced]	Dried whole goat milk	Vegetable oil	Dried whole goat milk	Dried whole goat milk
[Cow sourced]	Safflower oil	Dried whole goat milk	Dried goat milk protein	Casein
	Dried goat milk protein	Casein	Safflower oil	Vegetable oil
		Dr. whey protein concentrate		Dr. whey protein concentrate
		Dried goat milk protein		Maltodextrins
		Dried corn syrup		
Secondary Ingredients				
Number added	14	32	14	37
Fermentation Products				
Number added	none	7	none	7
Guaranteed Analysis				
Minimum Protein/Fat (%)	33/40	33/40	42/25	40/28
Actual as tested	33/39	33/41	44/27	40/32
Ash (Dietary Minerals)				
Total (All minerals) (%)	5.08	3.83	6.89	4.65
Calcium (%)	0.77	1.04	0.95	0.96
Phosphorus (%)	0.65	0.67	0.87	0.65
Fatty Acid Profile (% Total Fat)				
Saturated (%)		24	40	30
Mono-unsaturated (%)	*(Awaiting lab results)*	33	10	32
Poly-unsaturated (%)		44	50	38

in Tailspring with safflower oil, which accounts for the high percent of Oleic acid (C18:1 *cis*) in the fatty acid profile. As a mono-unsaturated fat, Oleic acid helps to balance the high level of saturated fats normally present in goat milk. PetAg® uses 'vegetable oil' which can be a combination of various plant-based oils which results in a more even ratio between mono- and poly-unsaturated fat in their products.

The next chart displays some of the differences in the physical characteristics between the two manufacturers, in terms of shelf-stability, consistency of the powder, and reconstitution properties. Shelf stability shows stark differences, with Tailspring showing almost no evidence of rancidity onset at - or even past - its 24-month shelf life. GME® demonstrates very poor stability, which is concerning. While the Goat's Milk KMR® shows acceptable stability at 75 days post manufacture, more tests need to be performed in the 18-24 month timeframe post manufacture.

	Puppy Formulations		Kitten Formulations	
	Tailspring Puppy Milk Replacer	PetAg® (2022) Goat's Milk Esbilac® (GME)®	Tailspring Kitten Kitten Milk Replacer	PetAg® (2022) Goat's Milk KMR®
Shelf-stability				
Based on PV tests	Excellent	V. poor / concerning	Excellent	Excellent*
Sample age at testing	575-640 days	210-230 days	610-760 days	*only 75 days
Weight (Grams/US TBSP)	8.0	7.0	7.5	8.0
Scooping error				
High value (%)	3.7	8.6	4.0	8.7
Low value (%)	-6.2	-7.1	-4.0	-13.8
Reconstitution				
Wetting and sinking (5 min.)	Partial	Very good	Poor	Very good
Dispersal efficiency ***(Smaller numbers are better)***				
(Dry powder (%) retained by sieves)				
As instant mix (no rest)	0.0	24.0	6.4	4.0
After 8 hour rest	0.0	1.0	0.6	0.9

The constitency of Tailspring powder is loose and unconsolidated, but not quite as 'sticky' as the PetAg® products. This results in less variance in weight when scooped by volume. Measuring by weight is still optimum to completely eliminate this source of error in formula preparation.

Tailspring shows very poor to only partial wetting and sinking during preparation, so a full 5-minute mechanical dispersal (whisk/spoon) is required to force-sink and more fully wet the powder. Prepared as an instant mix, the 4 powders range from 0 – 24% of the powder remaining dry and retained by the test sieves. All 4 powders show excellent final dispersal with 1.0 % or less of the dry powder trapped by the sieves - when prepared according to mixing guidelines and allowed to rest 8+ hours – which is of significant benefit to the animals consuming it.

Prebiotics are included

Recent research has shown the importance of oligosaccharides in mammal milks (an indigestible carbohydrate that functions like a fiber) in the critical support of intestinal health, microbiome, and immune system. There are a very limited number of oligosaccharides naturally present in cow's milk in general, and they are also lacking in most manufactured powdered milk replacers (for both human and animals). Since oligosaccharides are not produced in the volumes desired for milk replacers, manufacturers use an indigestible fiber that functions in a similar manner, called prebiotics. Many manufacturers add various types of prebiotics of different types are some milk replacers to presumably achieve those functions.

The prebiotics are often sourced from various types of plant fibers, such as powdered cellulose, oat fiber and gum arabic. Research continues focusing on the effectiveness and safety of prebiotics with various ages and species consuming foods with prebiotics.

Whole goat's milk has been found to have more oligosaccharides than cow's milk. Some people choose to use goat's milk or goat-based replacers to feed a 'natural' source of oligosaccharides - rather than cow-based milk replacers that include the addition of plant-based prebiotics. That said, research continues to assess the overall efficacy of the natural goat's milk oligosaccharides with other species, as well as availability and cost. Plus, a few wildlife rehabilitators are considering supplementing milk replacers with one or more other prebiotics and avoiding those that have been assessed as unsafe for infants.

While Tailspring is produced from whole goat's milk and presumed to include some natural oligosaccharides, it includes a small amount of with gum arabic, which does not have documented safety concerns for use with human infants (though published research seems lacking for use with wild mammal infants). [While some of the other prebiotics have been included in other powdered milk replacers for animals and are assumed safe by the manufacturers, some of those additives have been banned from use with human infants, such as guar gum.]

***

Disclosures

Tailspring Milk Replacers are manufactured and marketed as complete milk replacers for puppies and kittens.

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

Hotchkiss, Arland, et al. 2011. Intestinal Infections and Prebiotics: the role of oligosaccharides in promoting health. Journal of Functional Foods. https://www.researchgate.net/publication/260020065_Intestinal_Infections_and_Prebiotics_The_Role_of_Oligosaccharides_in_Promoting_Health/link/54c7ed5c0cf22d626a379f35/download

Quinn, Erinn, Lokesh Joshi, and Rita Hickey. 2020. Symposium review: Dairy Derived oliogosacchrides-their influence on host-microbe interactions in the gastrointestinal tract of infants. Journal of Dairy Science. Https://www.journalofdairyscience.org/article/S0022-0302(20)30128-4/pdf

Walsh, Clodagh, et al. 2020. Human milk oligosaccharides: shaping the infant gut microbiome and supporting health. Journal of Functional Foods.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7332462/pdf/main.pdf