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# *ReaShure*®

Precision Release Choline

Balchem Research Summary

*In Vitro* Trial Measures Valido® Feed Stability and Rumen Protection

A summary of a study conducted by G. Aines, Ph.D. and Kari Estes, M.S. | Balchem Corporation, New Hampton, NY USA

## Background

Encapsulating a nutrient is a relatively easy task, but creating one that effectively delivers a nutrient to the cows is very difficult. Numerous companies have recently entered the market with claims that their products are just as good as the industry leaders. However, most of these claims are simply unsubstantiated by peer reviewed animal trials.

To be effective, an encapsulated nutrient must first be tough enough to withstand the rigors of mixing, transportation and storage. It then must be able to protect the nutrient from degradation by rumen microbes. Finally, the encapsulated nutrient needs to be engineered to release the nutrient in the small intestine where it can be absorbed and utilized by the animal. Failure to navigate even one of these steps can render a product ineffective.

The ultimate measure of performance for an encapsulated nutrient is the cost per unit of bioavailable nutrient that it delivers to the animal. Bioavailability is a function of feed stability, rumen protection, and intestinal digestibility.

Measuring and evaluating the bioavailability of an encapsulated nutrient is best done in controlled *in vivo* experiments. Today only a few encapsulated products have been adequately evaluated and characterized using this methodology.

In general, *in vivo* experiments can be expensive and time consuming while *in vitro*, laboratory-based methods can be a quicker and less expensive option. However, *in vitro* procedures are limited in the information they provide and are only a simulation of what takes place in a cow.

## Objective

This paper will evaluate the relative ability of ReaShure® (28.8% choline chloride; Balchem® Inc., New Hampton, NY) and Valido® (25.0% choline chloride; Cargill® Inc., Minneapolis, MN) to withstand the rigors of being mixed with typical feed grade minerals and then survive degradation in a simulated rumen environment.

## Method

ReaShure and Valido were both obtained from an unopened bag sourced commercially for use in the experiment and no special handling was applied.

The mineral blend consisted of coarse limestone (45%), sodium bicarbonate (44%), magnesium oxide (10%) and soybean oil (for dust control, 1%). Ten pounds of either ReaShure or Valido were mixed for 3 minutes with 90 lbs. of the mineral blend using a small batch mixer fitted with paddles and two ribbons (see Figure 1). Each product was tested in triplicate batches (three 100 lb. batches). Following mixing, each batch was sampled and analyzed for rumen stability using an *in vitro* assay that consisted of a buffered solution with lipase enzymes. Choline release was measured at 4, 8 and 10 hr. of incubation in the *in vitro* solution. Non-mixed, original samples were also tested in the same system to determine choline release at each time point.

**Figure 1.**

Small batch paddle and ribbon mixer used in the experiment.



## Results

Figure 2 shows the percent of choline remaining from ReaShure and Valido following either the 3-minute mixer test or not being mixed at all. When compared to the non-mixed samples, Valido had less choline remaining after being mixed. This suggests that Valido incurred damage from the minerals/mixer which compromised its ability to adequately protect the encased nutrient. Eight hours is generally accepted to be the retention time in the rumen for these types of products. At 8 hr. of incubation, roughly 30% of the choline chloride content of Valido was remaining whereas the mixed product had only 9% remaining. On the contrary, ReaShure was more resilient to mineral/mixer damage and had a similar stability value between being mixed versus unmixed (85% and 88%, respectively).

These results suggest that even before mixing Valido provides very little protection against rumen degradation, as only 30% percent of the choline was stable in the simulated rumen environment before it could even get to the small intestine for absorption. Mixing the product in a mineral mix only exacerbated the problem with only 10% of the choline remaining after 8 hrs.

## Conclusions

An effective encapsulated nutrient must possess three vital characteristics.

- Remains intact during mixing, transportation and storage.
- Protects the nutrient from degradation by rumen microbes.
- Releases in the small intestine where it is absorbed.

Due to the high degradability of raw choline in the rumen, it is critical that choline is well protected from the abrasive nature of feed mixing as well as being protected from the harsh rumen environment so that it is available for small intestine digestion and utilization by the cow.

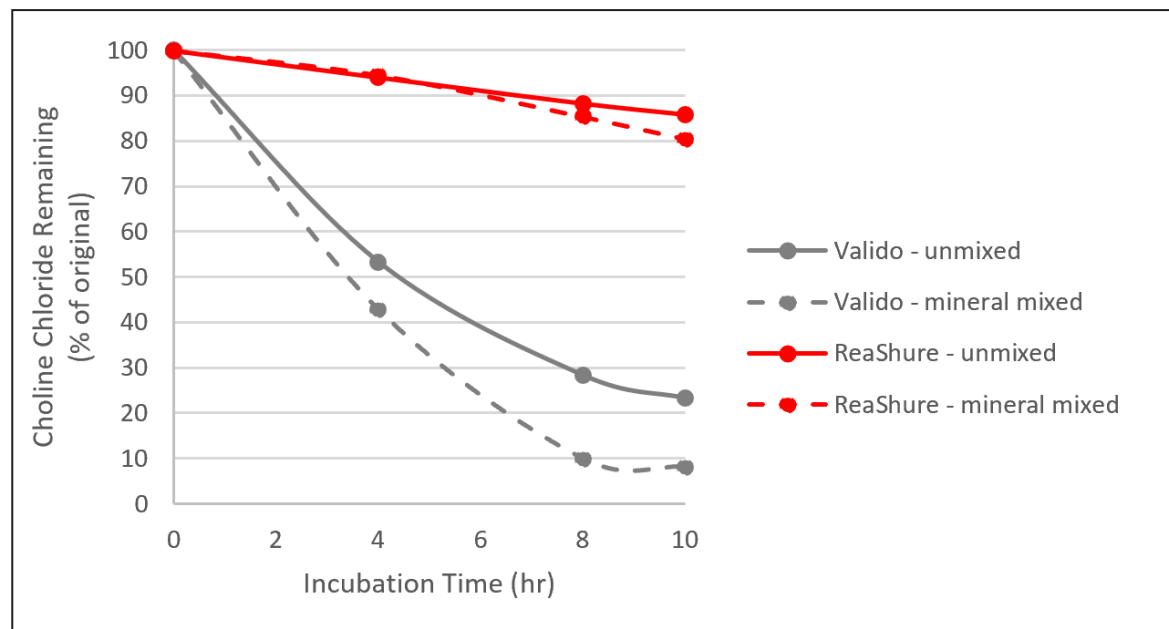
This trial attempted to simulate both feed stability and rumen protection *in vitro* and the Valido product failed to provide adequate or acceptable results for either criteria.

Without adequate protection, there could potentially be very little to no choline arriving at the small intestine and ultimately absorbed by the cow.

In this simulation study, only 10% of the Valido choline would have theoretically been available for absorption by the cow.

**Figure 2.**

*In Vitro* Rumen Stability of ReaShure® and Valido® following either a three-minute mix in mineral blend or not being mixed at all.





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