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UNDERSTANDING THE ROLE OF PROTECTED CHOLINE TO REDUCE KETOSIS AND SUPPORT TRANSITION COWS



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The onset of lactation is a critical period in high performing dairy, and good management during the transition period is important to prepare the cow for a productive lactation. Nutritional adaptations can help for a good start.

FAT METABOLISM IN COWS

At the end of gestation and after calving, every cow experiences a negative energy balance. As a result, they will use their body reserves and break down fat (and muscle) tissue as source of energy. When fat is mobilized from the adipose tissue (see Figure 1), the triglyceride structure is broken down and NEFA's (Non Esterified Fatty Acids) are transported through the blood to the liver where they are further metabolized.

The capacity of the liver for creating energy by complete oxidation of NEFA's is limited. If oxidation is not complete, ketones are formed, which will appear in the blood, urine and milk. High ketone levels can result in clinical disease (clinical ketosis) with symptoms of decreased feed intake, milk drop, weight loss and nervous signs. More common is the subclinical presentation of ketosis: ketone levels are elevated but clinical symptoms are less obvious. Subclinical ketosis is often a herd problem and leads to important economic losses due to reduced milk yield and reproductive results, but also by direct costs associated with the higher susceptibility to diseases.

NEFA's can also be removed again from the liver in the form of VLDL (Very Low Density Lipoproteins). Choline is essential for the synthesis of VLDL and therefore plays a crucial role in fat metabolism. If the transport out of the liver is unsuccessful, accumulation of fat leads to fatty liver disease and impaired liver function.

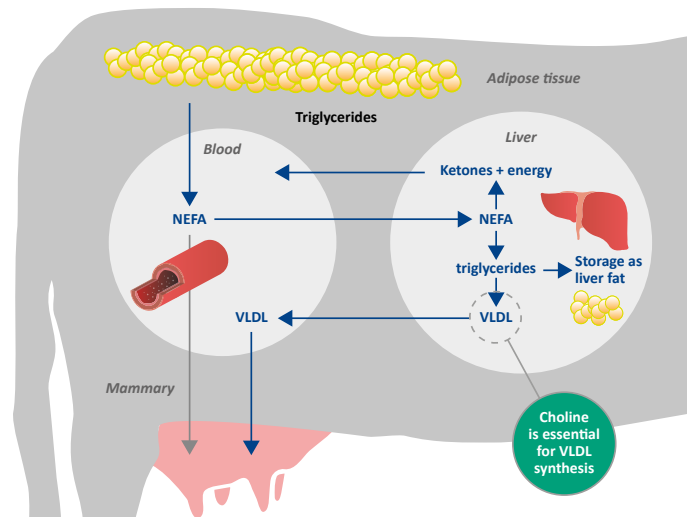


Figure 1: Fat metabolism in the dairy cow

CHOLINE CAN BE OF HELP

Because choline is so important in the synthesis of VLDL and as a methyl donor, a good choline supply is required for an optimal working of the liver and health of transition cows.

Choline is not considered as an essential nutrient in the diet of cows. However, if the metabolism is very fast, typically for high producing cows in beginning of lactation, endogenous choline production might be inadequate. In this case, supplementation of bioavailable choline can optimize the (liver) metabolism and maximize milk production. Both prevalence of (subclinical) ketosis and of fatty liver disease can be reduced with the preventive use of protected choline chloride, reducing costs caused by these metabolic diseases.

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ONLY BIOAVAILABLE WHEN PROTECTED AGAINST RUMEN DEGRADATION

When choline chloride is added to the feed, the present microbiota in the rumen degrades it almost completely. This means unprotected choline will not be bioavailable for the ruminating cow and is useless to support its metabolism. To bypass the rumen, choline chloride can be protected by a layer of fatty acids. Rumen microbes are then incapable of digesting this fatty acid layer, and only in the small intestine, the digestive lipase enzymes break down the protection and release choline available for absorption and support of the animal's metabolism.

Attention should be paid to the quality of the coating, as there is a lot of difference amongst products in protection of the choline chloride against rumen degradation and in release at intestinal level (see Figure 2).

POSITIVE EFFECTS IN DAIRY COWS

Trials with optimally protected choline chloride in dairy demonstrate a reduction of subclinical ketosis on herd level, measured by lower ketones in milk or urine. Cows after calving show an improved and faster recovery. Also, the loss in body condition score of supplemented cows seems less severe. As a result, milk yield improves, with up to 10% increase in milk production. Moreover, a reduction of the "fat% minus protein%" up to 30% could be seen in some trials, which is indicative for a reduced risk on (subclinical) ketosis. These findings are in line with published results showing that the use of protected choline chloride is a preventive measure for avoiding ketosis and fatty liver syndrome around calving.

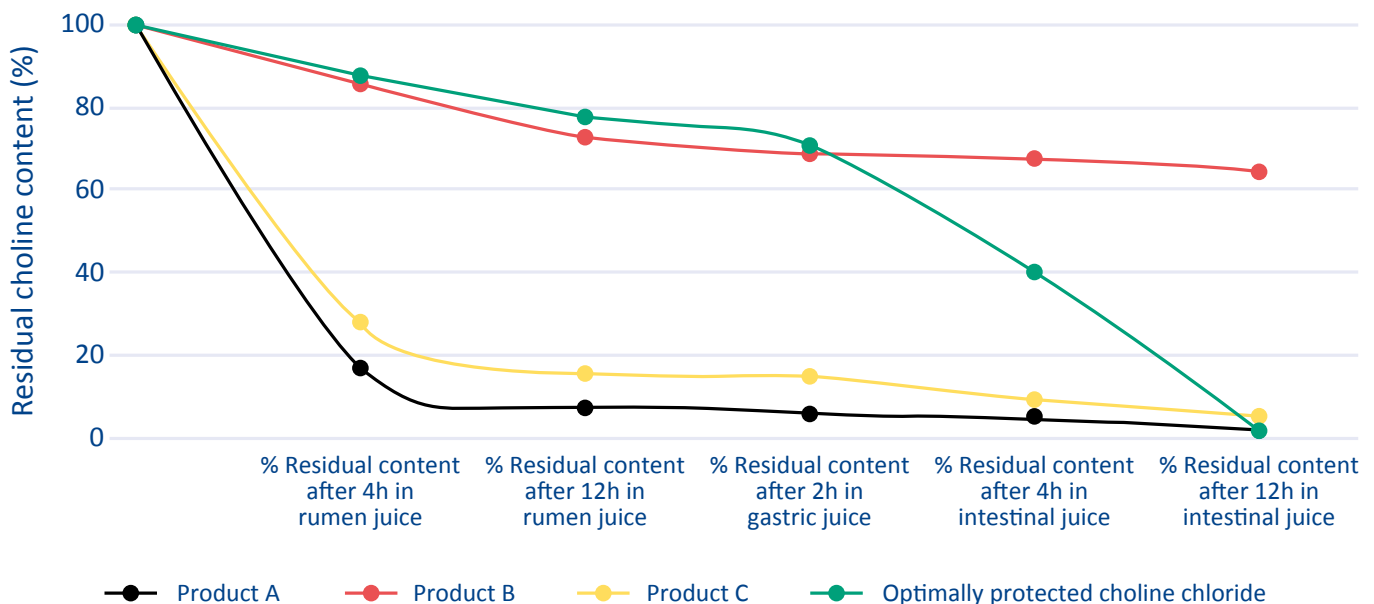


Figure 2: In vitro rumen stability and intestinal release of protected Choline chloride products

TAKE-HOME MESSAGE

Choline chloride has proved to have beneficial effects, but only if it is well protected against ruminal degradation. Supplementation leads to higher milk yield and prevents metabolic disorders like ketosis and fatty liver. In nutritional strategies to lower problems in transition cows, protected choline certainly deserves its place.