Effects of choline and rumen protected choline (Reashure) on energy-related biochemical metabolites of lactating dairy cows

Abdolhakim Toghdory
Member of young researchers club, Islamic Azad university of Iran, Gorgan branch
Toghdory@yahoo.com

Taghi Ghoorchi
Associate prof., of Gorgan university of Agricultural Sciences and Natural Resources

Abbasali Naserian
Associate prof., of Ferdowsy University of Mashhad

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Introduction

Choline is a quasi vitamin that has a variety of functions in mammalian metabolism

**Choline functions:**

As the predominant phospholipids contained in the membranes of all cells in the body (as Phosphatidyil choline)

A component of the neurotransmitter acetyl choline

As a direct presource to betaine in methyl metabolism
Why choline is necessary for dairy cow?

Because:

Dietary choline availability in ruminants is low.

Output of methylated components in milk is high.

Choline and phosphatidyl choline content of plants is relatively small.

Ruminal degradation of choline and phosphatidyl choline is extensive.

Intestinal supply of choline is not enough to meet tissue requirements.
The role of choline on dairy cow metabolism

Choline plays a major role in metabolism, particularly in lipid transport. It is a lipotrophic agent because of its ability to prevent or correct excess fat deposition in the liver generally arising as a result of its dietary deficiency.

Impaired triacylglycerol secretion to VLDL is considered a major cause of fatty liver in dietary choline deficiency.
Body fat, NEFA, Blood, Glucose and ketone bodies, VLDL, Milk fat, Mitochondria, Liver, NEFA, Triglyceride, Choline
Methane Digestion & Absorption by protozoa

Choline in the rumen

Degradation by rumen microorganism (80-95%)

Diphosphoglyceride

Free choline

Methane

Digestion & Absorption by protozoa

Degradation of protozoa in the rumen (65%)

Pass to small intestine (35%)

5-20%

Why Rumen protected choline?
Materials and Methods
1- Animals and management:

Eight Holstein cows from a herd were selected for the 84- days experiment.

Eight days before the experiment, cows were moved from the herd to individual tiestalls.

Cows were provided with rations twice daily
2- Experimental design and dietary treatment:

Cows arranged with in a change over design with four periods of 21 days (14 days for adaptation and 7 days for data collection).

Experimental treatments:
1) Control (without choline)
2) Rumen unprotected choline (50 g per day)
3) Rumen protected choline (25 g per day)
4) Rumen protected choline (50 g per day)
3- Blood sampling and analysis:

Blood samples from coccygeal vessels were collected.

The samples analyzed for determine glucose, triglyceride, cholesterol, BUN, VLDL, LDL and HDL concentration.
Results and Discussion
Blood metabolites such as glucose and triglyceride were not affected by treatments, but triglyceride level showed tendency to increase by RPC level. This results agree with the result of Erdman et al., (1984) that reported blood serum TG was not affected by choline, whereas had a low increase in blood serum TG, but was not significant.
Also, there were no any significant difference between choline treatment in cholesterol and BUN levels, that agree with the result of Bindel et al. (2000) that observed numerical decreases in plasma NEFA in response to choline supplementation, but no response in plasma cholesterol, glucose, or insulin. The response of dairy cattle to supplemental choline has been attributed to its role as a lipotropic agent that can play a valuable part in decreasing liver adiposity, which is frequently observed in the periparturient period.
Level of HDL decreased by unprotected choline, but rumen protected choline had no significant effect on HDL levels, also concentration of LDL and VLDL levels between the treatment were same. As in nonruminant species, esterified triglyceride can be export from the liver as VLDL, but the rate of this process is limited in ruminants compared with other species.
Conclusion

The results discussed above suggested that choline and rumen protected choline don’t have any positive effect on some blood metabolites of dairy cows in early lactation.