

The Potential to Alleviate Negative Energy Balance in Holstein Dairy Cows by Modulating Milk Glucose, Plasma Glucose, and Plasma Insulin through Feeding Yeast Culture and Propionibacteria

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Introduction

High production dairy cows require increased dietary nutrients to meet energy needs associated with prenatal calf development and increased glucose partitioning for lactation. Because both calf development and mammary functions are largely dependent on glucose for energy requisites, energy for cow maintenance must be derived from other sources, such as protein, and reserves in the form of triglycerides. If mobilization of alternative energy sources is deficient in meeting the cow's maintenance needs, the animal may enter a state of negative energy balance (NEB), resulting in a loss of body condition, milk production capacity, and in severe cases, become ketotic. Supplemental feeding of yeast cultures and Propionibacteria may aid in enhancing ruminal fermentation for the production of propionic acid, a major precursor for gluconeogenesis.

Materials and Methods

To determine the effect of supplemental feeding of Diamond V-XP Yeast Culture alone or in combination with Propionibacteria strain P169 on plasma insulin and glucose levels and milk glucose concentrations, 31 primiparous (PP) and multiparous (MP) Holstein cows were fed one of three dietary treatments between -2 week prepartum to 30 week postpartum: 1) Control (n = 10), fed a corn silage-based total mixed ration (TMR); 2) XPY (n=11), fed Control TMR plus Diamond V-XP Yeast Culture (XPY) at 56 g/head/day; and 3) XPY+P169 (n = 10), received Control TMR plus XPY plus Propionibacteria strain P169 (at 6 x 10⁹/head/day). Milk samples during sequential p.m. and a.m. milkings were collected during a two week period (weeks 23 and 24 of lactation)

from all cows, and blood samples were collected hourly during a 16-hour post-feeding interval during week 27 of lactation from only MP cows.

Results

Milk glucose was affected (P<0.01) by dietary treatment such that both PP and MP cows fed XPY+P169 had 28% greater (P<0.05) milk glucose levels than Control cows, and 32% greater milk glucose than XPY-fed cows. Diurnal plasma glucose concentration was not affected by diet. Plasma insulin concentration was affected (P<0.01) by dietary treatment and time. Plasma insulin concentration in cows fed XPY+P169 had 34% and 30 % greater (P<0.01) plasma insulin concentrations than cows fed Control and XPY, respectively. Although 16-hour post-feeding fluctuations in plasma glucose did not significantly differ among Control, XPY and XPY+P169 groups, the lack of a detectable increase in glucose may be due, in part to the fact that insulin concentrations increased faster in XPY+P169 fed cows.

Significance

Glucose and insulin responsiveness to XPY+P169 supplementation suggest that supplementation may have enhanced gluconeogenesis and increased glucose uptake by the mammary gland. The increased insulin concentration in the plasma in XPY+P169 fed cattle reflect lower lipolysis of triglycerides and indicate cattle with a better energy balance. The XPY+P169 supplementation may provide an alternative to maintaining energy balance in the pre-fresh and early lactation dairy cow.