lose 25% of their energy as carbon dioxide, methane and heat on average (Hungate, 1966; Czerkawski, 1986).

In other words, 1 lb. of sugars will provide only 75% of the ME of 1 lb. of lactic acid. Starch ME depends on the proportion fermented versus digested in the small intestine as well as the total tract digestibility. If starch is fermented by microbes, energy will be lost to the animal (Figure 2). If starch is digested to glucose in the small intestine, it will provide nearly the same amount of ME as lactate on a pound-for-pound basis.

While theoretical differences exist in the ME value of starch depending on whether it’s absorbed as VFA or glucose, research has been able to detect differences in animal performance based on these alternative metabolic pathways (Nocek and Tammenga, 1991; Huntington et al., 2003). Total tract neutral detergent fiber (NDF) digestibilities range from 35% to 60% of the silage and no impact on the energy content of the silage and no impact on the available energy in the ration. In CPMDairy 3.0, lactic acid is part of the CHO A1 silage acid pool, and varying its content with corresponding changes in sugars or starch has no impact on the energy content of the silage or the ration. In NRC 2001, lactic acid is implicitly modeled as part of the total digestible non-fiber carbohydrate (NFC) pool, with the same digestible energy and net energy of lactation as NFC. Accordingly, varying lactic acid content with sugar or starch will not change the energy content of the silage significantly.

Thus, none of these models captures the theoretically higher energy in lactic acid as compared to fermentable carbohydrates. On a theoretical basis, lactate provides 33% more ME than fermentable carbohydrates. Current ration formulation software packages do not account for the difference in ME content between lactic acid and fermentable carbohydrates; however, the underestimation of lactic acid’s energy content is not likely to have a significant impact on total ME availability.

In summary

On a molar basis, lactic acid has half the energy of glucose, but on a weight basis, it has the same energy. Ruminant animals lose, on average, 25% of the energy in feed carbohydrates during the rumen fermentation. On a theoretical basis, lactate provides 33% more ME than fermentable carbohydrates.

References


