Meta-analysis of the effects of dietary sugar on intake and productivity of dairy cattle

C. F. Vargas[1], C. D Reinhardt[1], J. L. Firkins[2], B. J. Bradford[1].

[1]Kansas State University, Manhattan

[2]The Ohio State University, Columbus

A meta-analysis was performed to determine the possible effects of dietary sugar on feed intake and milk production in lactating dairy cattle. The database used in this analysis included 18 treatment comparisons from 10 studies reported between 1985 and 2011. Treatment comparisons were used only if 1) either sucrose (n=9) or molasses (n=9) replaced corn grain without adding fat, and 2) sugar added by treatment ranged from 2 to 5% of DM. In addition, 1 study was excluded because the SD for DMI response was more than twice the mean SD across studies. The meta-analysis included studies analyzed by both fixed effects and mixed effects statistical models. To account for the differences in SEM reported for treatment means by these approaches, studies with repeated measures that used a mixed effects model were re-analyzed to estimate fixed effects model SEM; this approach allowed for consistent weighting across studies. The meta-analysis was conducted using a random effects model. First, responses to sucrose and molasses were compared using Cochran's Q statistic, and no evidence for heterogeneity across sugar sources was found in either DMI (P = 0.25) or ECM (P = 0.59) responses. Therefore, different sugar sources were pooled for the remaining analyses. In the final data set, ECM and DMI responses to added sugar were moderately correlated (r = 0.68, P < 0.001). No evidence of publication bias was observed for DMI, although for ECM, the trim and fill method suggested that 2 additional studies with negative responses would be required to generate a normal response distribution. The combined data included in this analysis showed that the addition of sugar tended (P = 0.07) to increase DMI by 0.38 kg/d (95% confidence interval: -0.04 to +0.80 kg/d). On the other hand, no effect was detected for ECM (P = 0.34; 95% confidence interval: -0.29 to +0.85 kg/d). In summary, results of this analysis suggest that the addition of 2 to 5% dietary sugar may promote small increases in DMI, but do not consistently increase ECM in lactating dairy cattle.

Key words: molasses, sucrose, lactation, dry matter intake