META-ANALYSIS OF THE EFFICACY OF YEAST IN IMPROVING MILK PRODUCTION IN LACTATING DAIRY COWS

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ABSTRACT

The objective of this study was to use meta-analytic methods to estimate the effect of diamond yeast on milk production in lactating dairy cows. Forty two published journal articles on effect of yeast on milk production in lactating cows were identified using Google search engine. Eight separate studies met the criteria for inclusion in the meta-analysis. Data for each trial were extracted and analyzed using Open MEE software. Estimated effect size of yeast was calculated for milk yield (MY), milk fat (MF), milk protein (MP) and milk lactose (ML). The overall pooled estimate for milk yield was 0.395 kg/d, with a 95% confidence interval (CI) from 0.138 to 0.651 and the pooled estimate for MF was 0.282% with a 95% CI from 0.039 to 0.525. The pooled estimates for MP and ML were 0.915% and -0.183% with a 95% CI from -0.882 to 2.712 and -0.619 to 0.253, respectively. The analysis of MY (I^2 = 8.26%) showed a low level of heterogeneity as did MF (I^2 = 4.4%). MP had high level of heterogeneity (I^2 = 97.5%), while ML had moderate heterogeneity (I^2 = 45.69%). Yeast use in lactating cow significantly improved milk yield and milk fat but had no significant effect on milk protein and milk lactose.

Keywords: yeast, meta -analysis, lactating dairy cow.

INTRODUCTION

Yeast products are commonly added in diets of animals to enhance productivity. It is believed that yeast products affect the rumen microbes, causing changes in ruminal volatile fatty acid production that result in increased milk production measures from lactating dairy cows (Putnam *et al.*, 1997). Despite numerous studies on the effects of feeding yeast products, the results of these studies in lactating dairy cows appear to be inconclusive. Some studies have identified significant effects on milk production (Ramsing *et al.*, 2009); others reported a trend in production (Dann *et al.*, 2000) or no significant effects (Schingoethe *et al.*, 2004). Nutritionists and dairy farmers need to ascertain the efficacy of these yeast products on milk production to make appropriate decisions about the use of these products in their management systems. One possible source of variability is that this individual studies may have lacked sufficient sample size and consequently statistical power to demonstrate differences in the production measures. Meta-analysis has been proposed as a method to obtain useful summary estimates of effect, especially when numerous small studies have been conducted in different study locations by different researchers using different study designs that, when considered individually, may not provide conclusive evidence of effect (Lean *et al.*, 2009). The purpose of this study was to review critically all relevant research specific to diamond yeast product and to estimate its effect on milk yield, milk fat, milk protein and milk lactose of lactating dairy cow using meta-analytic methods.

MATERIALS AND METHODS

Literature searches were performed using Google search engine, with the words "yeast," "cows," and "lactation. Forty two published studies were screened for inclusion in the meta-analysis using standardized criteria. To be included in the meta-analysis, studies must have been conducted with diamond yeast and must have included a positive control group and randomized treatment assignment. It must have been conducted in lactating dairy cow. Output variables extracted for meta-analysis on dairy performance included MY, MF, MP and ML. Studies must have reported results of at least one of the output variables of interest, along with a measure of variance (standard error or standard deviation) or a *P*-value for comparison of effects between treatment and control groups. Data were collated from the eligible studies reporting the effect of diamond yeast culture on production outcomes. Finally, a database was created from eight published journal articles (Alskaikh *et al.*, 2002; Cooke *et al.*, 2007; Erasmus *et al.*, 2005; Kamande *et al.*, 2005; Lehloenya *et al.*, 2008; Ramsing

et al. 2009; Schingoethe *et al.*, 2004; Robinson and Garrett, 1999). Statistical analysis was conducted on the extracted production data using OpenMEE Software. Between-study variability compared with within study variability was evaluated using the I^2 statistic (Higgins *et al.*, 2003).

RESULTS AND DISCUSSION

The overall pooled estimate for milk yield and milk fat were 0.395 kg/d and 0.282% with a 95% confidence interval (CI) from 0.138 to 0.651 and 0.039 to 0.525, respectively (Table 1). The pooled estimates for MP was 0.915% with a 95% CI from -0.882 to 2.712 while the pooled estimate for ML was -0.619 to 0.253. The results of the forest plots of MY (kg/d), %MF, % MP and ML are presented in Figures 1, 2, 3 and 4, respectively. The analysis of MY (I^2 = 8.26%) showed a low level of heterogeneity as did MF (I^2 = 4.4%) (Figures 1 and 2). Figure 3 showed that MP had high level of heterogeneity (I^2 = 97.5%) and while ML had moderate heterogeneity (I^2 = 45.69%). Analysis for heterogeneity is important in meta-analysis, because it tests the amount of variance within the group of studies compared with the within-study variation. A high I^2 suggests the difference between individual study outcomes is greater (or more variable) than expected. Excess variation may indicate that more than one outcome is being measured and thus it may not be appropriate to combine the studies for an average effect. The difference in treatment response may actually be caused by differences due to other factors, including breed responses such as Jersey versus Holstein, type of ration fed, delivery method of the ration, or stage of lactation. The results indicate that milk yield is increased, as well as milk fat..

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Table 1. Estimated effect of yeast on milk yield (kg/d) and milk components in lactating cows in all the studies

	Estimate	95% Confidence interval	Standard error	p-value
Milk yield, kg/d	0.395	0.138 - 0.651	0.131	0.003
Milk fat, %	0.282	0.039 – 0.525	0.124	0.023
Milk protein, %	0.915	-0.882 – 2.712	0.917	0.318
Milk lactose, %	-0.183	-0.619 – 0.253	0.222	0.410

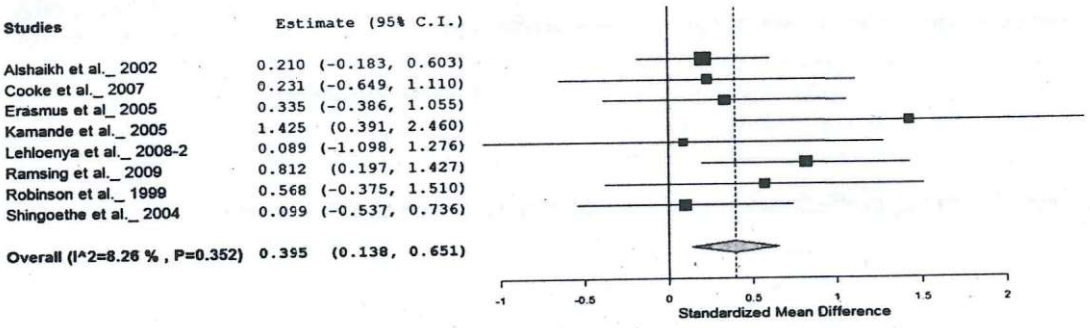

Figure 1. Forest plot of random effects standardized mean difference for milk yield.

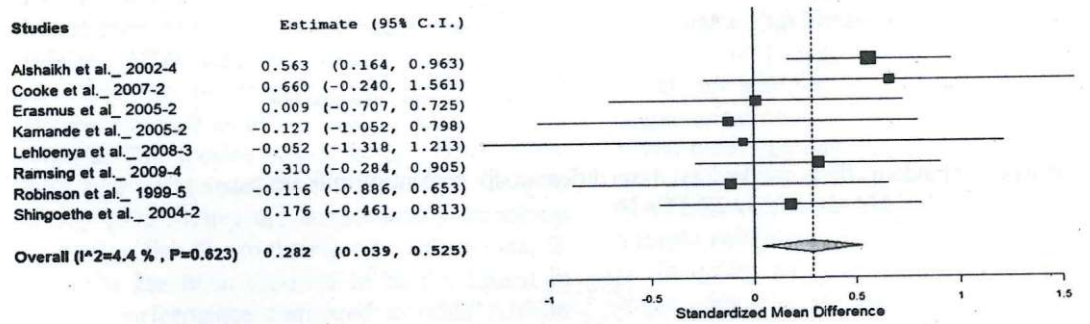

Fig. 2. Forest plot of random effects standardized mean difference for percentage milk yield.

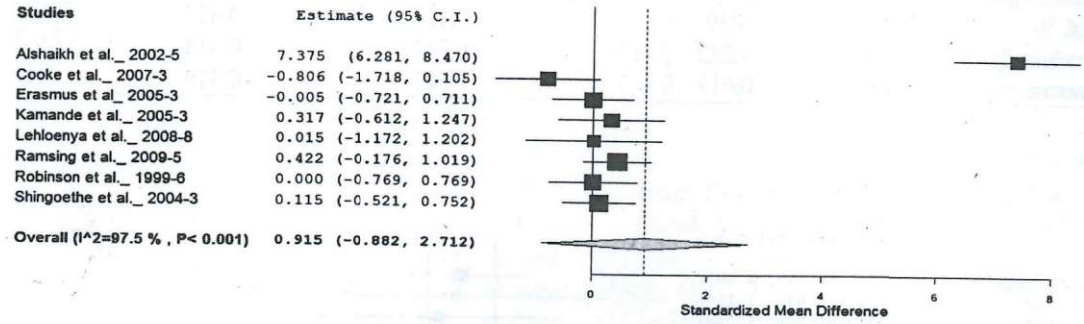

Fig. 3. Forest plot of random effects standardized mean difference for percentage milk protein.

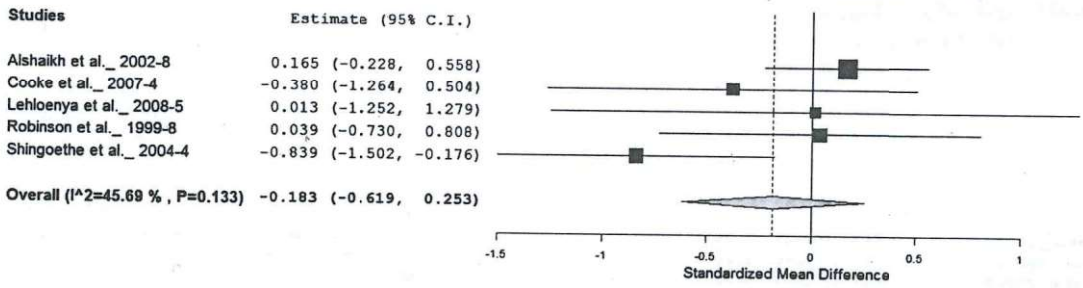

Fig. 4. Forest plot of random effects standardized mean difference for percentage milk lactose.