Evaluation of Milk Urea Nitrogen Levels on Bulk Tank Milk and Individual Cow Milk

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Introduction

There are two purposes of this research: 1) to evaluate the repeatability, precision and accuracy of milk urea nitrogen levels (MUN) using an infrared test, the Fossomatic 4000 MilkoScan analyzer (Foss 4000) at the Prince Edward Island Milk Quality Laboratory (PEIMQL), compared with an enzymatic reference method conducted at the laboratory of the Ontario Dairy Herd Improvement Corporation (ODHIC); and 2) to determine the representativeness of bulk-tank MUN (BTMUN) as a herd representation of the MUN levels.

Materials and Methods

For repeatability testing, 200 composite milk samples from individual cows were collected by random sampling from routine work at the PEIMQL. Each milk sample was split to create two identical replicate samples measured twice at the PEIMQL. All samples were analyzed using the Foss 4000.

For precision and accuracy testing, 161 cow milk samples were randomly selected to represent a large number of herds, and a broad range of MUN concentrations. All samples were preserved with Bronopol tablets to inhibit growth of bacteria and yeast. Each milk sample was divided into paired duplicate samples. One of each of the duplicate samples was analyzed for MUN (mg/dl) using the infrared test (Foss 4000) at the PEIMQL. The second of each of the duplicate samples was analyzed for MUN (mg/dl) using an enzymatic method (Eurochem CL 10) at the laboratory of the Ontario Dairy Herd Improvement Corporation.

For BTMUN representativeness testing in 195 herds in PEI, bulk milk samples were tested for MUN every fortnight over a one year period. During this year, all herds had all cows tested monthly for MUN. Herd average MUN levels were calculated for each month and compared to the BTMUN closest to it in time.

Agreement between the two tests, between repeat samples, and between BTMUN and herd average MUN were assessed using two methods: calculation of the concordance correlation coefficient, and a graphical procedure proposed by Bland and Altman (1995).

Results and Conclusions

The MUN concentrations from the infrared method had a slightly higher mean (13.78), but significantly lower standard deviation (4.63) than by the enzymatic method (mean = 13.73 and SD = 4.84)($P < 0.05$). The enzymatic assessment had a higher minimum (4.5) and maximum (29.1) MUN value when compared with the infrared test minimum (4.1) and maximum (26.3). The concordance correlation coefficient from comparison-two test, repeatability and comparison of bulk milk and herd average were 0.972 (95% CI= 0.964-0.980), 0.983 (95% CI = 0.978-0.988) and 0.798 (95% CI 0.777-0.808), respectively. The mean difference between the two tests, repeatability and bulk milk comparison were 0.05 mg/dl (SD. = 1.18), 0.29 mg/dl (SD = 0.49), and 0.19 mg/dl (SD = 1.82), respectively. The 95% confidence limits (lower and upper limits of agreement) for the mean different of all were -2.287 and 2.185 mg/dl, -0.681 and 1.269 mg/dl, and -3.766 and 3.375 mg/dl, respectively. The CV for the Foss 4000 was 2.2%.

Overall, we conclude that the repeatability, precision and accuracy of the Foss 4000 was excellent, but BTMUN was only moderately correlated with herd average MUN.

References

Bland and Altman: Comparing methods of measurement: why plotting difference against standard method is misleading. *The Lancet*; 346:1085-1087, 1995.