Assessment of the DVE/OEB system for protein evaluation in ruminants

G. van Duinkerken[1], A. Bannink[1], M.C. Blok[2], J.W. Cone[3], J. Dijkstra[3], S. Tamminga[3] and A.M. van Vuuren[1]

[1]*Wageningen UR Livestock Research, Edelhertweg 15, 8219 PH Lelystad, The Netherlands*
[2]*Product Board Animal Nutrition, Stadhoudersplantsoen 12, 2517 JL The Hague, The Netherlands*
[3]*Animal Nutrition Group, Wageningen University, Marijkeweg 40, 6709 PG Wageningen, The Netherlands*

Introduction

The DVE/OEB_{2010} system (Van Duinkerken et al., 2011) for protein evaluation in ruminants is an update of the DVE/OEB_{1994} system (Tamminga et al., 1994). In the DVE/OEB_{2010} system more detail and differentiation is included concerning representation of chemical components in feed, rumen degradation characteristics of these components, efficiency of microbial protein synthesis and the fractional passage rates. Both systems were assessed for their ability to predict milk protein yield (**MiP**).

Material and Methods

A meta-analysis was performed to compare observed and predicted values for MiP, based on 39 treatment means originating from 7 experiments with a total of 310 dairy cows involved. Experiments are described in detail by Van Duinkerken et al. (2008). The prediction of MiP from DVE available for MiP was based on Subnel et al. (1994). For the DVE/OEB_{1994} system and the DVE/OEB_{2010} system, the amount of DVE available for MiP (g/d) was calculated (**DVE_{1994}MiP** and **DVE_{2010}MiP**, respectively). DVE_{1994}MiP was calculated as the difference between the DVE_{1994} intake and the DVE requirements for maintenance, gestation, deposition (Tamminga et al., 1994) and juvenile growth (CVB, 2007), increased with the DVE available from body protein mobilization (Tamminga et al., 1994). DVE_{2010}MiP was calculated as the difference between DVE_{2010} intake and the DVE requirements for maintenance, gestation (Van Duinkerken et al., 2011) and juvenile growth (CVB, 2007). An additional scenario was studied, viz. an adapted approach for calculation of DVE_{2010} available for MiP, applying the corrections for body protein balance originating from the DVE/OEB_{1994} system. Furthermore, an additional scenario was evaluated by assuming that for situations with OEB < 0 g/d (occurring in 5 out of the 7 experiments), the DVE intake is decreased with 0.65 g DVE/g OEB below zero. The mean squared prediction error (**MSPE**) was calculated and decomposed into errors in central tendency (**ECT**), errors due to deviation of the regression slope from unity (**ER**), and errors due to the disturbances or random variation (**ED**), all according to Bibby & Toutenburg (1977). The square root of MSPE was calculated and expressed as a fraction of the observed mean.

Results and Discussion

The observed versus predicted MiP is displayed in Figure 1, whereas the MSPE and its decomposition for all six studied scenarios are given in Table 1. The lowest MSPE was found for the DVE/OEB_{1994} system after correction for negative OEB. Correction for negative OEB reduced the MSPE for both systems. The MSPE for the DVE/OEB_{2010} system was further reduced when, on top of the correction for negative OEB, a correction for body protein balance was taken into account. For the DVE/OEB_{1994} system, the ECT forms the largest contribution to the MSPE (larger than the contribution of ER and ED), whereas for the other five scenarios the ER is the main component of the MSPE, indicating that the prediction accuracy is deviating depending on the MiP level. It should be considered that the DVE/OEB system as such is not a “response system”, meaning that it is not designed to predict MiP, but to determine protein requirements. If energy or specific nutrients other than ileal digestible protein are limiting milk protein synthesis, than MiP will tend to be over predicted by the DVE/OEB system.

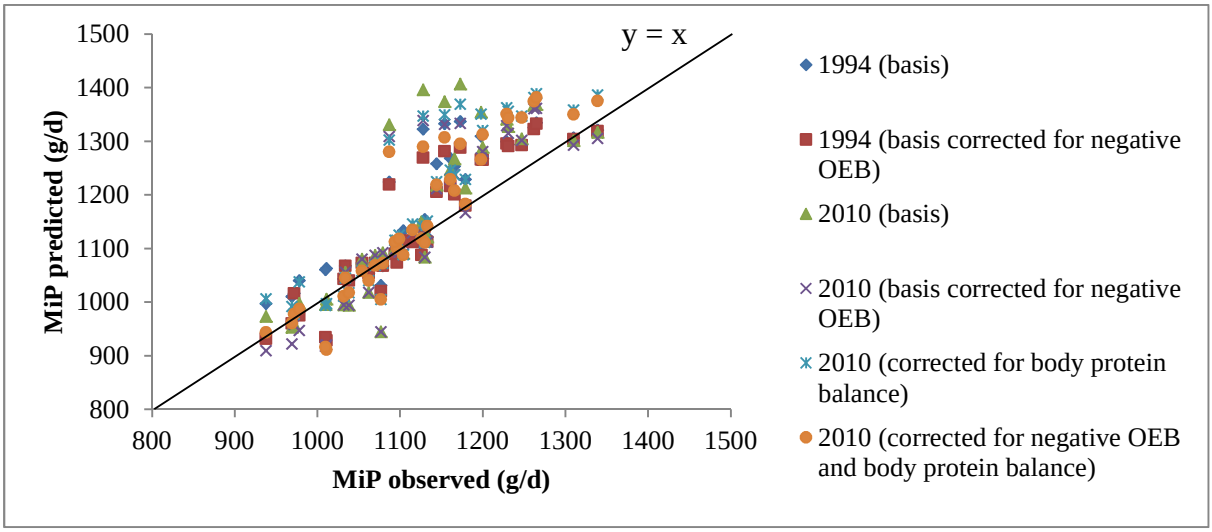

Figure 1. Observed versus predicted milk protein yield (MiP) according to (1) the DVE/OEB$_{1994}$ system (basis 1994; Tamminga et al., 1994), (2) the DVE/OEB$_{1994}$ system corrected for negative OEB, (3) the DVE/OEB$_{2010}$ system (Van Duinkerken et al., 2011), (4) the DVE/OEB$_{2010}$ system corrected for negative OEB, (5) the DVE/OEB$_{2010}$ system corrected for body protein balance and (6) the DVE/OEB$_{2010}$ system corrected for both negative OEB and body protein balance.

Table 1. Mean square prediction error (MSPE), square root of MSPE (rMSPE), and decomposition of MSPE into errors in central tendency (ECT), errors due to deviations in regression slope (ER), errors due to disturbances (ED) and r^2 for predictions of milk protein yield (MiP) using the (1) DVE/OEB$_{1994}$ system (Tamminga et al., 1994), (2) DVE/OEB$_{1994}$ system corrected for negative OEB, (3) DVE/OEB$_{2010}$ system (Van Duinkerken et al., 2011), (4) DVE/OEB$_{2010}$ system corrected for negative OEB, (5) DVE/OEB$_{2010}$ system corrected for body protein balance and (6) DVE/OEB$_{2010}$ system corrected for both negative OEB and body protein balance.

System	**1**	**2**	**3**	**4**	**5**	**6**
MSPE (g/d)	5408	3217	9476	6829	8419	5772
rMSPE (fraction of mean observed)	0.066	0.051	0.087	0.074	0.082	0.068
ECT (fraction of MSPE)	0.43	0.16	0.22	0.09	0.37	0.21
ER (fraction of MSPE)	0.20	0.40	0.49	0.59	0.41	0.55
ED (fraction of MSPE)	0.38	0.44	0.29	0.32	0.22	0.24
r^2	0.77	0.84	0.70	0.76	0.80	0.85

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