IC in the summer, 3 × lowered ($P < 0.01$) GLC AUC and NEFA AUC from 0 to 30 min than 2 ×; and LOW with 2 × lowered NEFA AUC from 0 to 60 or 0–120 min than LOW with 3 ×, both of which were similar to HIGH regardless of FF (FF × FR: $P = 0.04$). During IC in the winter, 3 × lowered ($P \leq 0.03$) GLC AUC from 0 to 60 or 0–120 min compared with 2 ×, and HIGH calf with 3 × had lowest decrement of NEFA and greatest AUC from 0 to 30 or 0–60 min than other TRT (FF × FR: $P \leq 0.04$). In conclusion, increasing FF from 2 to 3 × /d reduced pancreatic INS secretion but improved INS dependent GLC uptake in both summer and winter, but the inhibitory effect on lipolysis was inconsistent between seasons.

**Key Words:** calf, season, metabolism

### 339 Effects of milk replacer feeding rate and frequency on basal metabolism and abomasal emptying of dairy calves during summer and winter.


To examine the effect of milk replacer (MR) feeding rate (FR) and frequency (FF) on basal metabolism and abomasal emptying, Holstein calves (n = 48/season) were enrolled at 7 d of age during summer (June to Aug, BW = 40.64 ± 0.65) and winter (Nov to Jan, BW = 41.86 ± 0.75). Within season, calves were randomly assigned to 1 of 4 treatments in a 2 × 2 factorial arrangement including 2 FR (0.68 [LOW] or 0.79 kg of solid/d [HIGH] of milk replacer (MR)) and 2 FF (2 × [0700 and 1600 h] or 3 × [0700, 1600, and 2200 h]). Calves were managed similarly and housed in polyethylene hutches with sand bedding. Milk replacer (12.5%) was fed until d 42 when FR was reduced by 50% and fed 1 × /d (0700 h) for 7 d. The ambient temperature averaged 23.3 ± 2.4°C for summer and 10.5 ± 5.5°C for winter. Plasma was collected weekly at 1400 h to analyze metabolites and insulin. Acetaminophen (ACE, 50 mg/kg of BW) mixed with MR were fed to a subset of calves (0700 h, n = 10/treatment/season) on d 21. Plasma was collected at −15, 15, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 420, and 480 min relative to feeding to analyze ACE. The time for plasma ACE to reach maximum (Tmax) was used to evaluate the abomasum emptying rate. Data were analyzed using the mixed procedure of SAS. During summer, feeding HIGH increased plasma glucose and decreased β-hydroxybutyrate (BHB) compared with LOW (P ≤ 0.03), and feeding 3 × decreased plasma insulin but increased BHB compared with 2 × (P ≤ 0.02). In the winter, feeding HIGH increased plasma glucose concentration compared with LOW (P = 0.04) and feeding 3 × reduced plasma insulin and nonesterified fatty acids concentrations (P ≤ 0.01) relative to 2 ×. Tmax of calves fed 2 × was longer (P < 0.01) than 3 × during summer (233 vs. 172 min) and winter (252 vs. 188 min). In conclusion, increasing FF accelerated abomasal emptying and reduced insulin release in both seasons, but FF affected basal metabolites inconsistently between seasons. Feeding higher amounts of MR consistently increased plasma glucose but only decreased BHB during summer.

**Key Words:** calf, metabolites, season

### 340 Can the threshold on absolute fat residual improve the reliability of milk mid-infrared-predicted traits without using reference values? L. Zhang*, C. F. Li*, F. Deharen*, C. Grelet†, F. Colinet‡, N. Gengler, Y. Brostaux§, and H. Soyeurt, 1TERRA Teaching and Research Centre, University of Liège-Gembloux Agro-Bio Tech, Gembloux, Belgium, 2Hebei Livestock Breeding Station, Shijiazhuang, China, 3Valorisation of Agricultural Products Department, Wallon Agricultural Research Centre, Gembloux, Belgium.

Many traits are currently predicted using milk mid-infrared (MIR) spectrometry. However, those predictions can be erroneous for many reasons such as wrong milk collection, bad storage, inappropriate spectrometers.
management or calibration equation. Comparing predictions and reference values allows detecting those problems. However, preparing and analyzing reference samples are expensive, time consuming and sometimes difficult, especially for indirect traits like CH$_4$. Therefore, it is relevant to develop approaches based on predictions to detect abnormal values. This work attempted to study the interest of using a threshold of absolute fat residual to detect abnormal MIR predictions. A total of 346,818 milk MIR records were collected from Chinese Holstein cows and analyzed by Bentley FTS spectrometers. The fat content predicted by the manufacturer model being corrected for the bias and slope were assumed to be the control value. From standardized spectra, a second fat content was externally predicted. The working hypothesis is that this content as only based on spectral data will reflect problem/noise present in the spectral data. The absolute residual fat was calculated as the absolute difference between internal and external predictions of milk fat content. The improvement of reliability was assessed using the difference of root mean square error (RMSE) before and after applying a threshold of 0.3 g/dL of milk for the fat residual. RMSE differences for protein, monounsaturated (MFA), saturated (SFA), and unsaturated (UFA) fatty acids were 0.003, 0.023, 0.014, and 0.024 g/dL of milk, respectively. The correlation coefficient between the internal and external predicted phenotypes nearly stayed constant: 0.96, 0.95, 0.97 and 0.95 for protein, MFA, SFA, and UFA, respectively. The use of a threshold based on milk fat residual allowed detecting abnormal predictions but as those values were not so frequent, RMSE and correlation values were not deeply impacted. This cleaning is therefore of interest for dairy herd improvement organizations to ensure the quality of their MIR spectral database.

Key Words: milk components, MIR, prediction reliability

Assessment of within- and between-day variability of individual cow milk urea nitrogen. K. F. Reed* and E. M. Wood, Cornell University, Ithaca, NY.

Milk urea nitrogen (MUN) is a non-invasive metric that has potential to inform cow nutrition and reproduction management decisions because of its demonstrated relationship to plasma urea nitrogen and urinary urea nitrogen. However, before recommendations for individual cow management decisions based on MUN can be developed, we need to understand the extent to which this metric varies within and between days. Previous work suggests PUN/MUN measurements taken within the same day could differ by ≥2 mg/dL but the authors are not aware of any estimates of between day variation in individual cow MUN. Thus, our objective is to estimate the within day and between day variability of MUN throughout lactation. Milk samples were collected 3 x per day for 7 consecutive days from 16 multiparous cows at 2 periods in lactation (average DIM 40, 140). Samples were preserved and refrigerated before they were sent to a commercial lab for midinfrared spectroscopy analysis of MUN within 48 h. We fit linear mixed models of indidual cow MUN observations averaged daily (Mod1) and from each milking (Mod2) including random effects for day and cow within period. A fixed-effect parameter for the change in CP content of the diet between periods was included in both models. In addition, the fixed-effect of milking time was include in Mod1. Parameter estimates in the table indicate average MUN in P1 was similar for both models (~8.2 mg/dL, $\beta_0$) with about 1 mg/dl change for each percentage point change in diet CP (% DM, $\beta_{CP}$). Estimates for the random effects of cow and day were also similar between models and suggest that MUN samples taken from the same cow on different days is ~1 mg/dL with 40% (Mod2) and 50% (Mod1) of the variation attributable to the cow. The fixed effect of milking time suggests the 2nd milking (M2) is expected to be 0.44 mg/dL higher than the 1st (M1) and 3rd (M3) milking ($\beta_{M2}$).

Key Words: MUN, variation

Table 1 (Abstr. 341). Parameter estimates (SD) of linear mixed model results

<table>
<thead>
<tr>
<th>Model</th>
<th>$\beta_0$ (SD)</th>
<th>$\beta_{CP}$ (SD)</th>
<th>$\beta_{M2}$ (SD)</th>
<th>$\beta_{M3}$ (SD)</th>
<th>$\sigma_{Cow}$</th>
<th>$\sigma_{Day}$</th>
<th>$\sigma_{Res}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mod1</td>
<td>8.35 (0.298)</td>
<td>1.05 (0.387)</td>
<td>0.880</td>
<td>0.500</td>
<td>0.439 (0.0947)</td>
<td>0.0403 (0.0963)</td>
<td>0.909</td>
</tr>
<tr>
<td>Mod2</td>
<td>8.20 (0.306)</td>
<td>1.07 (0.391)</td>
<td>0.439 (0.0947)</td>
<td>0.0403 (0.0963)</td>
<td>0.909</td>
<td>0.503</td>
<td>0.975</td>
</tr>
</tbody>
</table>