A preliminary stock and flow model to support dairy herd management

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Dynamic modelling in dairy farming might help to predict future farm performances and support the decision making process. This work defined a preliminary dynamic structure aimed to minimise the system complexity and to outline the modelling of a given Mediterranean dairy herd and its milk deliveries. The modelling process had the objective to accurately predict farm output over time. The modelling process followed a System Dynamics approach and included: (1) a preliminary farm survey to gather technical info and data; (2) the development of a Stock and Flow model on Vensim® (Ventana, Inc), to mathematically and graphically simulate the dynamic connections among variables; (3) the model evaluation against farm records. The survey provided aggregated monthly records, from Jan 2015 to Dec 2018 (4 years), of consistency, feed supply, milk deliveries, reproduction indexes, mortality and health of herd categories. Average farm characteristics in the same period consisted of 1,154±58 milking cows, 205±35.7 dry cows, 1,375±45.2 heifers whereas dry matter intake (DMI) and milk yield were on average equal to 24.2±2.4 and 34.0±3.4 kg/d per head, respectively. The model included 25 variables distributed on a closed aging chain of 4 stocks (replacement heifers and open, pregnant and dry cows) and the respective flow rates of calving, breeding, drying off and culling. Initial settings were based on farm values observed in Jan 2015. Two farm inputs (monthly average of consumed feed from lactating cows and conception rate) were included as exogenous variables resulting of fundamental relevance in model predictions. The simulation showed a good accuracy in predicting the oscillating seasonal pattern of historical farm records of milk deliveries. Cow consistency and milk deliveries were predicted with a RMSPE of 3.5 and 7.2% of observed values (being 57 and 68% due to random variability of data), with high accuracy (Cb=0.90 and 0.97), with good precision (r^2=0.68 and 0.72), and with a satisfactory concordance correlation coefficient (0.74 and 0.82), respectively. Further modelling effort should focus on whether variables affecting intake and reproduction at herd level.

Indicators of body fat mobilisation of lactating beef cows under short nutritional challenges

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The aim of this study was to investigate the metabolic adaptation of lactating beef cows to short periods of undernutrition, and assess the accuracy of different indicators of fat mobilisation. The response of 16 Parda de Montaña adult suckler cows to a 4-day energy restriction was analysed in months 2 and 3 post-calving. Prior to restriction and after the challenge, the cows received a diet meeting 100% of their energy requirements (7.0 kg DM hay + 2.7 kg DM concentrate), and during the 4-day challenge the diet met only 55% of requirements (6.2 kg DM hay). With d0 as the start of restriction, on days d-2 (basal phase), d4 (challenge) and d8 (refeeding) several traits were recorded. Cows were body condition scored (BCS, 1-5 scale) and subcutaneous fat thickness was measured by ultrasound in the sacral area (BFT), at the P8 rump site (P8) and at the 13th thoracic vertebra (T13). Plasma was collected for the analysis of β-hydroxybutirate (BHB) and non-esterified fatty acids (NEFA) resulting from fat lipolysis, and malondyaldehide (MDA), a product of lipid peroxidation. A mixed model with month, phase and its interaction as fixed effects and cow as the random effect was used. Thus the BCS and BFT were not affected by month or phase (P>0.05). Both P8 and T13 decreased from month 2 to 3 (P<0.001) and P8 also decreased from the basal to the refeeding phase (P<0.01). Hence, except for P8, external measurements of fat thickness only reflected changes in the long term. The metabolites were affected by the interaction between month and phase. The response to changes was immediate in month 2, but in month 3 the difference among phases was less intense in NEFA (P<0.001) and MDA (P<0.01), and tended to be inexistent for BHB (P=0.06). These are good indicators of lipid mobilisation under a negative energy balance in the short term, especially in early lactation. The individual variation of the adaptive ability of cows remains to be analysed.

Session 34. Genetics poster session

Date: Thursday 3 December 2020; 9.00 – 12.45
Chair: Strandberg

Poster Session 34

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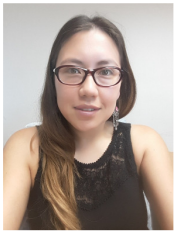
INDICATORS OF BODY FAT MOBILIZATION OF LACTATING BEEF COWS UNDER SHORT NUTRITIONAL CHALLENGES



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Extensive suckler cow farms: large variations in the quantity and quality of available food

AIMS: Investigate the metabolic adaptation of lactating beef cows to short periods of undernutrition, and assess the accuracy of different indicators of fat mobilization

MATERIALS AND METHODS

16 Parda de Montaña adult suckler cows

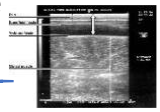
4-day energy restriction (55%) in months 2 and 3 post-calving.

	BASAL (4 d)	CHALLENGE (4 d)	REFEEDING (4 d)
Period:			
Diets:	**100%** : 7.0 kg DM hay + 2.7 kg DM concentrate	**55%**: 6.2 kg DM hay	**100%** : 7.0 kg DM hay + 2.7 kg DM concentrate

Measurements:

External measures of fatness

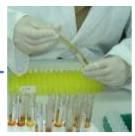
- Body condition score (**BCS):** 1-5 scale
- Subcutaneous fat thickness
  - backfat (**BFT**)
  - P8 rump site (**P8**)
  - 13th thoracic vertebra (**T13**)



ULTRASOUND

Metabolites related to fat mobilization

- β-hydroxybutyrate (**BHB**)
- Non-esterified fatty acids (**NEFA**)
- Malondialdehyde (**MDA**)

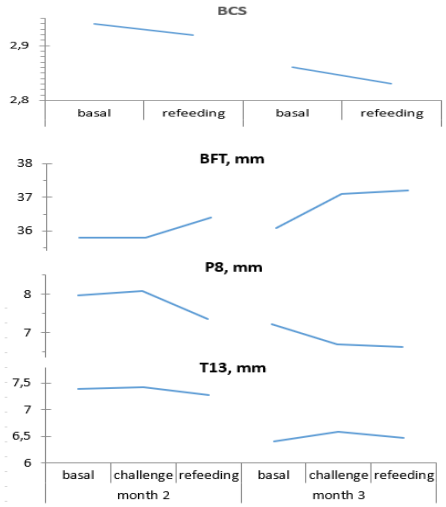


PLASMA

Statistical Analysis: Linear mixed models (R software). Fixed effects: Month & Period, Random effect: Cow.

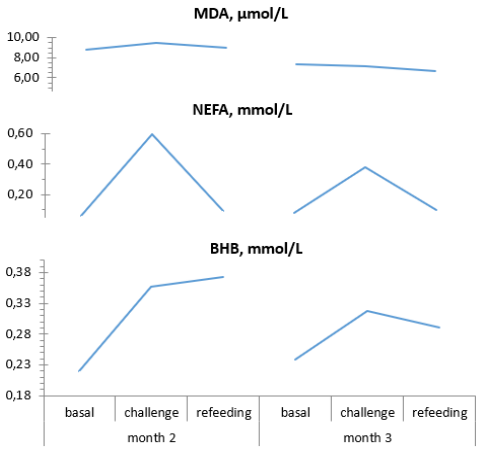
RESULTS

External measures of fatness



- BCS, BFT not affected by month or phase (P>0.05).
- P8, T13 decreased from month 2 to 3 (P<0.001).
- P8 decreased from basal to refeeding phase (P<0.01).

Metabolites related to fat mobilization



- Immediate response to changes in month 2.
- Less intense difference among phases in month 3: NEFA (P<0.001), MDA (P<0.01), BHB (P=0.06).

CONCLUSIONS

- External measurements of fat thickness, except for **P8**, only reflected changes in the long term.
- **NEFA and BHB** are good indicators of lipid mobilization under a negative energy balance in the short term, especially in early lactation of suckler cows.

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