114. Effect of grazing and feeding management on milk mineral concentrations

Conference or Workshop Item

Accepted Version

Dr Sokratis Stergiadis[1*], Dr Nanbing Qin[1], Mr Gergely Faludi[2], Dr Stephane Beauclercq[1], Mr Joe Pitt[1], Dr Natasa Desnica[3], Dr Asta Petursdottir[3], Mr Eric Newton[1], Mr Angelos Angelidis[1], Prof Ian Givens[1], Dr David Humphries[1], Dr Helga Gunnlaugsdottir[3], Dr Darren Juniper[1].
[1]University of Reading, Reading, Berskhire, UK. [2]Szent Istvan University, Keszthely, Hungary. [3]Matis, Reykjavik, Iceland. *corresponding author: s.stergiadis@reading.ac.uk

Effect of grazing and feeding management on milk mineral concentrations

Application. Pasture intake and non-Holstein genetics were negatively correlated with milk I, Mn, and Cu, and positively correlated with milk Ca and P; but other feeds and mineral supplementation also influenced milk mineral concentrations.

Introduction. Milk is a good source of minerals (Ca, Mg, P and K) and trace elements (I, Se, Zn), which are essential for optimum health (Gaucheron, 2005). Pasture intake may increase milk Ca and P concentrations but decrease Cu and Se concentrations, although pasture composition, plant maturity, and animal/environmental factors will also have an effect (Alothman et al., 2019). This study aimed to (i) investigate the milk mineral concentrations in herds with different pasture intakes, and (ii) assess the relative impact of individual feeds.

Material and methods. Bulk-tank milk samples (n=359) were collected monthly (over 12 months) from 30 dairy farms, and animal diet and breed were gathered via questionnaire. Three groups of 10 farms represented contrasting grazing management between April-September: high pasture intake (HP; 28-65% DMI), standard pasture intake (SP; 5-18% DMI), outdoors with low/limited pasture intake (LP; 0-3% DMI). Milk mineral concentrations were determined using ICP-MS. Analysis of variance by linear mixed effects models used pasture intake (HP, SP, LP), months (12 months), and their interaction as fixed factors. Farm ID was used as a random factor. A multivariate redundancy analysis (RDA; CANOCO 5) assessed the relative impact of breed and feeds on milk mineral concentrations.

Results. When compared with HP and LP farms, milk from SP farms contained significantly less Ca (-50 mg/kg and -45 mg/kg, respectively) and P (-25 mg/kg and -29 mg/kg, respectively) (Table 1). The RDA indicated that pasture intake and non-Holstein genetics were negatively correlated with milk I, Mn, and Cu, and positively correlated with milk Ca and P. Grass/grass-clover silage and dry-straights were positively correlated with I, Mn, Cu, Mo, Zn and negatively correlated with Na. Intakes of maize silage, blends, moist by-products, oils and minerals were negatively correlated with Mn, Cu, Mo, Zn, Ca and P. Milk from low/no grazing periods contained, on average, more I (+21.1%), Mn (19.5%), Cu (+16.9%), Zn (+6.1%) and Mo (+5.5%), than milk produced from the grazing season, although between-month differences were not always significant.

Table 1. Effect of grazing management on milk mineral concentrations

Major minerals	HP	SP	LP	SE	P-value	Trace elements	HP	SP	LP	SE	P-value
Ca (mg/kg milk)	1015.7[a]	966.2[b]	1010.8[a]	9.77	0.001	Cu (ug/kg milk)	62.1	61.9	58.4	3.52	0.815
K (mg/kg milk)	1364.8	1352.5	1380.1	12.74	0.246	I (ug/kg milk)	301.8	314.4	384.2	21.21	0.626
Mg (mg/kg milk)	95.5	95.4	97.4	1.03	0.511	Mn (ug/kg milk)	54.2	49.4	43.4	8.53	0.460
Na (mg/kg milk)	341.6	340.8	348.7	5.01	0.652	Mo (ug/kg milk)	62.2	59.5	61.2	2.55	0.713
P (mg/kg milk)	799.7[a]	774.8[b]	803.8[a]	8.37	0.045	Zn (mg/kg milk)	5.07	5.07	5.1	0.21	0.989

HP, high pasture intake (28-65% DMI); SP, standard pasture intake (5-18% DMI); LP, outdoors with low/limited pasture intake (0-3% DMI). Significant differences were declared at P<0.005. Means with different lower case letter are significantly different according to Fischer's least significant difference test (P<0.05).

Conclusions. Cow diet, which affects mineral intakes, and breed, which may affect mineral utilisation, had significant effects on milk mineral concentrations. The overall effect of grazing management was not significant, but seasonal variation and correlations between pasture intake and mineral concentrations illustrate a potential effect of grazing on milk mineral concentrations.

Acknowledgements. Authors acknowledge financial support from EIT Food, the innovation community on Food of the European Institute of Innovation and Technology (EIT), a body of the EU, under the Horizon 2020, the EU Framework Programme for Research and Innovation (activities/projects: NMR MIRACLE 19118/19118-20/20095, INSPIRE 20092); and EIT Food's Regional Innovation Scheme Talents. Special thanks to dairy producers who assisted with data/sample collection.

References.

Alothman et al. (2019). Foods 8:350.
Gaucheron, F. (2005). Reproduction, nutrition, development 45:473.