Dairy cow nutrition in the transition period

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SUFFOLK
INTRODUCTION

Most production diseases occur in the transition period, from three weeks before calving to three weeks post calving. Therefore the nutrition and management of dairy cows throughout the lactation cycle, but particularly in the transition period has an enormous influence on their health status and productivity. Not only that, nutrition in the transition period has a major influence on subsequent fertility. The monitoring of specific aspects of dairy cow nutrition is an essential part of herd health management plans to try and minimise production related diseases and at the same time improve the health, welfare and profitability of the herd. The aim is to monitor and then identify any risk factors responsible for increases in disease and poor performance. Once these risk factors have been identified, both short term and long term strategies should be put in place to rectify any nutrition or management issues underlying the risk factors. Finally, monitoring needs to be continued to assess the impact or efficacy of any changes put in place and adapt them as necessary on an ongoing basis. Ideally the whole approach to a herd health plan needs the combined involvement of the farmer, vet, and nutrition advisers.

TRANSITION COW HEALTH PERFORMANCE

Somewhat surprisingly, the incidences of production diseases are similar to those seen decades ago and remain unacceptably high.[1] If incidences of production diseases on a dairy unit exceed suggested targets then there is a strong indication for a thorough investigation of the herd's nutritional status. Table 1 summarises these targets (adapted from Mulligan 2012)1.

Table 1 Disease rate indicators for investigating nutritional status

Clinical Condition	Incidence rate at which nutritional investigation indicated
Milk fever	>0-5%
Hypomagnesaemic tetany	>0%
Clinical ketosis	>0-5%
Left displaced abomasum	>0-3%
Right displaced abomasum	>1%
Low milk fat syndrome Milk fat ,2.5%	>10%
Retained placenta	>10%
Lameness	>15%

The pattern of production diseases gives an indication as to which area of nutrition may be at fault. For example, a high incidence of lameness is more indicative of rumen acidosis, whilst a high rate of displaced abomasum could be due to a problem with subclinical ketosis and or hypocalcaemia. It's been proposed that the key areas to monitor are negative energy balance, body condition score record analysis, calcium status, rumen health, trace elements and antioxidant status.[1]

NEGATIVE ENERGY BALANCE AND KETOSIS

A negative energy balance arises when output exceeds input and is most likely to occur during the transition period.[2] The prevalence of clinical ketosis is reported to be less than 2%, however the subclinical form, usually defined as blood beta-hydroxybutyrate BHBA levels of over 1200 µmol/l, has been found to have an average prevalence of around 30% of cows in the UK.[3] Subclinical ketosis is known to suppress the immune system[4] and act as a gateway to several other production diseases. Raised blood ketones are associated with a three to eight times increase in the risk of a displaced abomasum,[5] a doubling in the risk of a retained placenta,[6] three times the risk of metritis6 and a six times increase in the risk of developing cystic ovaries.[7] Fertility is adversely affected, with cows taking on average 22 days longer to return to oestrus[8] and milk production can be reduced by as much as 300kg in the following lactation.[9] Probably one of the most startling figures is a doubling in the risk of culling in the first 60 days post calving for affected cows.[10] High rates of these diseases should prompt and investigation into the occurrence of subclinical ketosis in the herd.

One of the most important criteria of adequate feed intake is avoiding the over conditioning of dry cows (see below). Disease indicators (see Table 1) of negative energy balance include high incidences of ketosis, retained placenta, displaced abomasum, high milk fat to milk protein ratios (>1.5), low milk protein percentage (<3%), low milk yields, poor reproductive performance.[2] A very useful strategy for monitoring negative energy balance is to look for the incidence of subclinical ketosis. Blood levels of -hydroxybutyrate BHBA or non-esterified fatty acids NEFA can be measured from a sample of at risk cows. More recently a cow side milk test, Keto-test™, Elanco Animal Health, has become available. For herd monitoring, 12 cows in the transition period should be

tested. This number of animals will give an accurate reflection of the prevalence of subclinical ketosis (defined as milk BHBA levels exceed 100µmmol/l). If 25% of the cows are positive, then this is an 'alarm' point at which management intervention is strongly recommended.[11] There are many management issues that can lead to inadequate feed intake and predispose to a negative energy balance. Body condition score targets can be suggested by comparing farm records. Evaluate dry cow and early lactation cow feed intake to see if it matches energy demands, and inspect milk records to assess energy balance according to days in milk. It is worth checking cows have access to ample feed and that it is actually available ad-lib. Ensure there is enough trough space, evaluate home grown forage, and look at the pasture to see if it is over grazed or if local weather and soil conditions are adversely affecting the pasture quality and quantity.

BODY CONDITION SCORE BCS

BCS at various times through the lactation cycle is probably the most important aspect of dairy cow management that facilitates a healthy transition from gestation to lactation.[2] Suggested BCS scores are shown in Table 2 (from DairyCo, Feeding Factsheet 4 – Body condition Scoring BCS http://www.dairyco.org.uk/resources-library/technical-information/feeding/feedingplus-factsheet-4-body-condition-scoring-(bcs)/) where one is emaciated and five is over-fat.

Table 2 Suggested BCS for dairy cattle from DairyCo

Stage of Cycle	Target BCS Range
BCS at calving	2.5 – 3.0
BCS at 60 days post calving	2.0 - 2.5
BCS 100 days before drying off	2.5 – 3.0
BCS at drying off	2.5 – 3.0

Dairy cows that are over conditioned, (with a BCS of over four), have a much greater reduction in their feed intake immediately pre-calving, compared to cows with a lower BCS. Generally speaking there appears to be several benefits to health and reproduction when cows have a lower BCS at drying off and at calving, without any noticeable effect on milk production.[2]
BCS should be measured by examination, rather than just visual assessment. Cows ideally should be scored at each time point in Table 2, and the average score for each group of cows at the time points also calculated. The proportion of cows that differ markedly from the average BCS of their group is also worth noting for future reference.

MILK FEVER AND SUBCLINICAL HYPOCALCAEMIA

These are defined as total blood calcium levels less than or equal to 2.0mmol/l. On average 5-10% of dairy cows suffer from milk fever whilst the incidence rate of subclinical hypocalcaemia has found to be as high as 40%.[10] Both forms are associated with an increased risk of mastitis, retained placenta, endometritis, slower uterine involution, delayed first ovulation after calving, ketosis, displaced abomasum and reduced gastrointestinal motility.[2] Therefore increased incidences of these conditions suggests there may be a calcium problem in transition cows.
BCS again plays a major role in the monitoring and prevention of milk fever, as over-conditioning at calving increases the risk of developing the condition. There are several strategies used to try and prevent hypocalcaemia. These include feeding restricted calcium pre-calving (less than or equal to 30g/day) to activate homeostatic calcium absorbing mechanisms in the gut and bone, diets low in potassium (less than or equal to 1.8%), or diets with added anionic salts. Levels of magnesium in the diet also play a crucial role in preventing milk fever and pregnant cattle can be fed a magnesium concentration of 0.4% of dry matter. High phosphorus levels have also been associated with milk fever therefore dietary levels should be kept at no more than 0.3%. All these strategies can be assessed by taking blood samples from cows calved within the previous 24 hours, to check that calcium levels are over 2.0mmol/l.[2]

RUMEN HEALTH

Sub-acute rumen acidosis, SARA, has been linked to laminitis, erratic food intake and milk yield, loose faeces, poor condition scores in lactating cows, low milk fat syndrome, caudal vena cava syndrome, displaced abomasum and ulceration and immune-suppression. SARA can be monitored by looking at the incidences of these associated conditions as well as rumen fluid analysis. An increase in the incidences of these conditions is suggestive of a herd SARA problem. Other indicators include less than 80% of resting cows ruminating;

lactating cows with loose faeces, 10% of mid lactation cows with milk fat concentrations equal to or below 2.5%. Management issues to check are adequate levels of dietary fibre, and if levels of total concentrate or cereals are too high, and whether there is enough trough space.

TRACE ELEMENT AND ANTIOXIDANT STATUS

Trace element deficiency may manifest in individual cows as classic clinical signs, although herd problems related to deficiencies may occur in their absence. This is because levels of elements for optimal immune function can be above those required for clinical signs. Monitoring usually relies upon assessment of the dietary levels compared to targets and local trace element knowledge. In addition marker animals, fed on home grown forage or pasture only (e.g. heifers) can be blood sampled along with groups of lactating cows and dry cows for further information on trace element status. Liver biopsies are particularly useful for copper deficiency detection.

CONCLUSION

The monitoring of both clinical and subclinical production diseases in transition cows is a key strategy to recognising when herd health targets are being missed and for detecting nutritional (and some management) problems that can be rectified. Continuous monitoring is important to measure the results of any changes put in place. Criteria for assessing BSC, energy balance, calcium, rumen function and trace elements can be easily implemented in most cases with good herd record keeping and judicious use of sampling subgroups of cows at different stages of the lactation cycle. These measures provide an opportunity to further improve herd health, welfare and productivity.

REFERENCES

1. Mulligan FJ. A herd health approach to dairy cow nutrition and production diseases of the transition an early lactation dairy cow. XXVII World Buiatrics Congress 2012
2. Mulligan FJ, O'Grady LO, Rice DA, Doherty ML. A herd health approach to dairy cow nutrtition and production diseases of the transition cow. Animal reproduction Science 2006;96:331-353
3. Macrae AI et al. Prevalence of clinical and subclinical ketosis in UK dairy herds 2006-2011. World Buiatrics Congress, Lisbon, Portugal 2012
4. Grinberg, Elazar, Rosenshine, Shpigel. ß-Hydroxybutyrate abrogates formation of bovine neutrophil extracellular traps and bactericidal activity against mammary pathogenic Escherichia coli. Infec. and Immun. 2008; 76:2802-2807
5. Duffield. Impact of hyperketonemia in early lactation dairy cows on health and production. J. Dairy Sci. 2009;92:571–580
6. Leblanc. Peripartum serum vitamin E, retinol, and beta-carotene in dairy cattle and their associations with disease: J. Dairy Sci. 2004; 87:609–619.
7. Dohoo. Subclinical ketosis prevalence and associations with production and disease. Can. J. Comp. Med 1984;48: 1-5.
8. Walsh R.B., Walton J. S. et al. The effect of subclinical ketosis in early lactation on reproductive performance of postpartum dairy cows J. Dairy Sci. 2007;90: 2788-2796.
9. LeBlanc S. Integrating metabolic & reproductive health in dairy cows, Keynote lecture, World Buiatrics Congress, Lisbon, Portugal 2012.
10. Leblanc. Monitoring metabolic health of dairy cattle in the transition period. J. Repro. Dev 2010; 56:S29-S35
11. Keto-test™ data sheet 2013, Elanco Animal Health

Reader Questions and Answers

A NEGATIVE ENERGY BALANCE IS MOST LIKELY TO ARISE:

a) Post-calving
b) One week pre-calving
c) During the transition period
d) With chronic lameness

A HIGH INCIDENCE OF LAMENESS IN A HERD CAN BE INDICATIVE OF

a) Rumen acidosis
b) Hypocalcaemia
c) Subclinical ketosis
d) Trace element deficiencies

RAISED BLOOD KETONES ARE ASSOCIATED WITH

a) 3 to 8 times increased risk of displaced abomasum
b) 2 times increase in the risk of retained placenta
c) 3 times increase in the risk of metritis and reduced fertility
d) B + C
e) All the above

THE IDEAL BODY CONDITION SCORE BCS AT CALVING SHOULD BE

a) 2.0 to 2.5
b) 2.5 to 3.0
c) 1.5 to 2.0
d) 3 to 3.5

THE SUBCLINICAL INCIDENCE OF HYPOCALCAEMIA CAN BE AS HIGH AS

a) 5 to 10%
b) 30%
c) 40%
d) 50-60%