



Vitamin D levels in cattle – time to look again?

TEAGASC research is looking at whether recommendations on vitamin D supplementation need to change in light of new information on its role in immune function.

It's not just humans that benefit from a day in the sun: cows do too. The role of vitamin D in improving bone development has long been established, but more recently its role in boosting immune function has also come to light (pun intended). Although sunshine was known to be beneficial for the treatment of TB back in the 19th century, it wasn't until 2006 that scientists identified that the beneficial effects were due to increased vitamin D. It is now thought that vitamin D activates innate immune defences while minimising damaging inflammation. The principal source of Vitamin D comes via the skin from the sun, but supplementation is also routinely recommended in cattle diets – both in milk powder and in rations – without hard data on circulating levels in cattle under Irish conditions. Furthermore, supplementation guidelines were developed to avoid clinical deficiency symptoms but may need to be updated in light of the immune functions that this important vitamin is now known to have. Recent work in the USA contends that a blood concentration of 30ng/ml of 25(OH) vitamin D is required to meet calves' developmental needs, as well as to provide immune support in times of disease challenge.

Results from recent research conducted in Teagasc, Grange, led by Dr Kieran Meade, have shown that Irish dairy calves don't meet this threshold until about five months of age (Figure 1). This could mean that there is a window where calves could be susceptible to disease.

Teagasc research shows that the levels of vitamin D climb when the calves are out at pasture but reduce significantly once daylight hours lessen and cattle are housed, particularly under a low concentrate supplementation system such as is practised in Ireland.

Vitamin D for disease resistance

It is commonly known that prospective mothers isolate themselves from the herd or flock to give birth. This is thought to be an evolutionary strategy to avoid predation but it also reduces the exposure of the newborn to pathogens. This isolation is not always possible with modern farming practices.

The current focus of this work, in collaboration with other research institutes, is the investigation of how this level of vitamin D affects disease susceptibility, and whether supplementation can alter disease outcomes.

Therefore, in combination with disinfection measures at calving, we need to find alternative means to boost the disease resistance of the neonate.

Milk is also a poor source of vitamin D, so low vitamin D levels are not confined to the artificially reared dairy calf; our research shows that levels are low in suckled beef calves too. There are a number of factors that contribute to lower vitamin D levels such as indoor calving, extended periods of housing, and low levels of concentrate supplementation. Teagasc research shows that the levels of vitamin D climb when the calves are out at pasture but reduce significantly once daylight hours lessen and cattle are housed, particularly under a low concentrate supplementation system such as is practised in Ireland. This also has important implications for the season-related changes in disease susceptibility.

How much vitamin D?

Whereas vitamin D concentrations in US dairy cattle range between 50 and 80ng/ml, with significant changes due to geography and sun exposure, our research has shown that more than 87% of cows on one Irish farm were below this optimal threshold in the immediate post-partum period. This is likely to have important consequences for the physiology of the transition cow – from a reproductive, metabolic and immune function perspective.

Our work shows that vitamin D activates the innate immune defences in cattle, which includes host defence peptides – a natural suite of proteins that target both bacteria and viruses. We know that there is potential there to supplement animals via the diet; however, strict guidelines are in place under EU

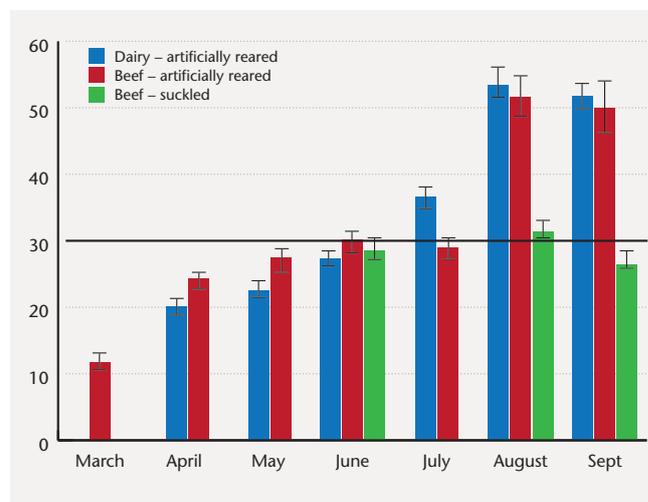


FIGURE 1: Measurement of circulating levels of 25(OH) vitamin D in serum from spring-born beef and dairy calves under standard management systems in Teagasc. The horizontal black line shows the levels of vitamin D recommended by research in the USA for optimal immune function.

regulations for both milk powder and concentrates. This research, led by Teagasc, will help to establish if these levels are sufficient to meet the demands of cattle under Irish conditions or if new guidelines are required. The current focus of this work, in collaboration with other research institutes, is the investigation of how this level of vitamin D affects disease susceptibility, and whether supplementation can alter disease outcomes. Given the pressure that the agricultural sector is currently under to find alternatives to antibiotics, identifying mechanisms like vitamin D to support natural immune defences has enormous potential to reduce the disease burden across livestock species.

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