

Quality egg production through improved nutrition management

It is widely recognised that eggs are an important foodstuff as they are a source of high quality protein, vitamins and minerals. Additionally, eggs are one of the most widely available and easily affordable animal products.

by **Veerle Hautekiet**,
Global Product Manager Feed Additives,
Huvepharma.
www.huvepharma.com

However, one of the major challenges in their production is the move towards a longer laying period for the hen.

The current production period has been extended to more than 85 weeks of age by selecting on egg persistency, egg shell quality and internal egg quality in hens at older ages.

The aim is to push that number up to an ideal minimum of 100 weeks, under commercial conditions.

Increased calcium requirement

In physiological terms this means the hen is producing 26kg of eggs over those 100 weeks, which is about 14-fold her bodyweight. To achieve this, around 3kg of egg shell is needed, or more than 1kg of calcium – severely challenging the metabolism and homeostasis of the hen.

At the moment, lower shell quality is the main reason to terminate a layer flock, rather than persistency of egg production. Shell



formation especially challenges the calcium metabolism in the hens.

On average, eggshell consists of 96% calcium carbonate and 4% organic matrix: therefore, each egg requires about 2.0-2.5g of calcium for its shell.

To satisfy this need, calcium provision heavily depends on intestinal absorption from the feed, with the skeleton acting as a secondary source of the mineral during the dark hours of the day, when intestinal absorption has ceased. The metabolised form of vitamin D₃ regulates the interaction between the two.

Managing this regulation mechanism is an option to influence calcium uptake, and thus egg shell quality. Vitamin D₃ itself is initially absorbed from the intestine in association with fats, requiring the presence of bile salts for absorption. It is then hydrolysed in the liver, forming 25-OHvitD₃. A second hydrolysis of this metabolite is needed before it can become an active player in calcium regulation.

This step is precisely regulated in the kidneys, thus providing the active metabolite of the vitamin. This active hormonal form, 1,25-OH₂vitD₃, regulates the intestinal absorption of calcium, bone homeostasis, calcium release from bone and the reabsorption of the mineral in the kidneys. However, this cascade heavily depends on the efficiency and health of the liver: without it, 25-OHvitD₃ cannot be produced in sufficient quantities, an example is fatty liver syndrome, frequently seen in aged birds.

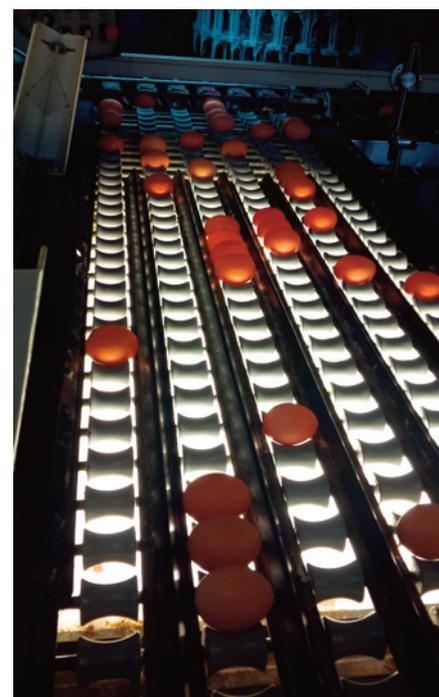
The evident risk is that a vitamin D₃ deficiency develops, additionally derailing

proper calcium regulation even before the first precursor of the final active vitamin D₃ metabolite is formed.

Direct supplementation

Direct supplementation of dietary 25-OHvitD₃ has been proposed as a solution, aiming to improve egg shell quality by positively impacting calcium regulation.

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	Vit D3 5000 IU/kg feed	Vit D3 2500 IU/kg feed + 3.4mg 25-OHvitD3 (provided by Bio D)
Laying rate % (average 50-75 weeks)	80.8 ^a	85 ^a
Incidence of cracked eggs at 75 weeks (%)	8.5 ^a	5.9 ^b
Egg shell strength at 75 weeks (N)	38.9 ^a	41.2 ^b
Tibia breaking strength at 75 weeks (N)	363.3 ^a	397.5 ^b

^{a,b}values with different superscripts differ significantly

Table 1. Summary of Bio D in 75 week old layers.

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To support this, different studies have been conducted to show the benefits of a

new 25-OHvitD₃ form, Bio D, produced by fermentation. The results in 75 week old layers (Lohmann Brown) is one of the studies and summarised in Table 1.

Partly replacing vitamin D₃ by this 25-OHvitD₃ (of fermentation origin) decreased the number of broken eggs as a result of a stronger egg shell.

At the same time, bone strength increased parallel with shell quality, so that the animal's welfare was secured.

These results indicate the value of supplementing this new form of 25-OHvitD₃ directly into the feed, both in terms of positively impacting egg shell quality as well as improving bone mineralisation.

Maintaining the layer hen industry's goal of extending laying cycles with minimal loss of egg quality in mind, it is clear what key role this nutrient should play in the future. ■

References are available from the author on request

