L-selenomethionine and 25-OH-vitamin D3 to improve meat quality

Breast muscle myopathies in broilers are a complex problem and so far, there is no one clear solution. However, a recent trial shows some promising results for the use of L-selenomethionine and 25-OH-vitamin D3 as part of the solution towards reducing the severity and incidence of woody breast and white striping and could play a role in a multifaceted approach to tackling myopathy-related problems.

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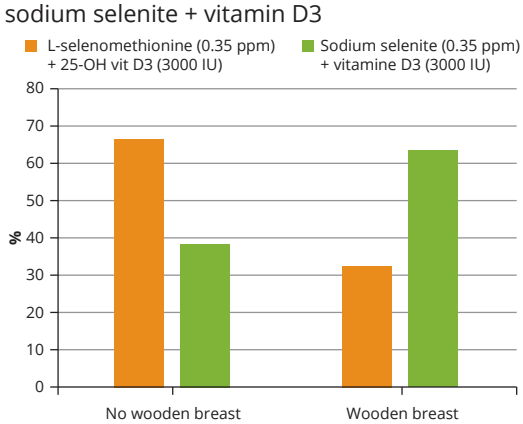
Over the past 50 years genetic selection and refinement in nutrition have facilitated a tremendous increase in the bodyweight gain of broilers. These genetic and nutritional advances have opened the door for the large-scale, high-performing broiler production that we know today and enables us to produce large amounts of broiler meat while minimising the costs. Unfortunately, selection for increased weight gain and breast yield in broilers has increased the incidence of breast muscle myopathies such as Wooden Breast, White Striping and Stringy-Spongy or Spaghetti Breast. Such myopathies cause changes in chicken meat that affect colour and tenderness. Wooden or woody breast (WB) is characterised by pale-coloured, very tough and chewy meat. It is caused by myofiber fibrosis and necrosis. White striping (WS) is recognised by white striations parallel to the muscle fibres. These white striations consist of fatty acid tissue and collagen which accumulates in the muscle tissue when the muscle grows so fast that there is insufficient oxygen supply to the muscle to support this fast growth. This increase in fat content leads to a reduction in meat quality. Although breast muscle myopathies do not cause a food safety issue, the meat from broilers affected with WB/WS negatively affects its sensory qualities and results in large economic losses for broiler producers. Therefore it is important to find strategies that can reduce the incidence of such myopathies and minimise the economic impact. The supplementation of certain feed additives, such as organic selenium and 25-hydroxyvitamin D3, betaine and guanidine acetic acid may contribute to a reduction in the incidence of breast muscle myopathies. Orffa Additives, as an engineer of feed solutions, performed a trial together with the University of Lavras (UFLA) in Brazil, to study the efficacy of different feed additives in reducing the incidence and severity of wooden breast and white striping.

Figure 1 – Incidence of Wooden Breast (WB) for use of L-selenomethionine + 25-OH-vitD3 vs sodium selenite + vitamin D3



Answer to the problem

A trial with 900 day-old Cobb-500 chicks was performed to evaluate the effects of multiple combinations of four feed additives on the incidence and severity of WB and WS: L-selenomethionine (Excential Selenium 4000), 25-OH-vitamin D3 (Excential First25), betaine hydrochloride (Excential Beta-Key) and guanidine acetic acid (GAA). The chicks were divided over 9 treatments, in a factorial scheme (2×2 x 2 + 1) with two L-selenomethionine levels (selenium supplementation at 0.175 and 0.350 ppm) x two 25-OH-vitD3 levels (1,000 and 3,000 IU/kg) x betaine/guanidine acetic acid (1,200/0 and 600/600 ppm), and a control treatment with 0.350 ppm of inorganic selenium (sodium selenite) and 3,000 IU/kg of vitamin D3, without betaine/GAA. After 42 days, the birds were slaughtered and 20 birds per treatment were selected for WB and WS scoring.

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Wooden Breast

For WB, the use of a higher level of L-selenomethionine (0.350 ppm selenium) resulted in a numerical increase in birds with a WB score of 0 (i.e. no wooden breast) and a significant reduction in the percentage of birds with a WB score of 1 ($P<0.05$), compared to when a lower level of L-selenomethionine was supplemented (0.175 ppm selenium).

The results for the use of 25-OH-vitamin D3 showed that the supplementation of a higher dosage of 25-OH-vitamin D3 (3000 IU), compared to a lower dosage (1000 IU), resulted in a significant increase ($P<0.05$) in the percentage of score 0 for WB and a decrease in the percentage for scores 1 and 2. Partial replacement of betaine (1200 ppm) by betaine (600 ppm) and GAA (600 ppm) did not have an effect on the control of WB in this setup. Further investigation of the applied dosages, diet composition and optimised trial protocol for these compounds (betaine and GAA) is recommended.

The comparison between the control group receiving sodium selenite (0.350 ppm selenium) and vitamin D3 (3000 IU) and the treatments receiving L-selenomethionine (0.350 ppm selenium) and 25-OH-vitamin D3, in terms of the incidence of WB is shown in *Figure 1*. The effects on severity are shown in *Figure 2*. The L-selenomethionine + 25-OH-vitamin D3 treatment resulted in a higher percentage of WB score 0 and a lower percentage of WB scores 1 and 2 ($P<0.05$).

Overall, the results indicate that the inclusion of L-selenomethionine at a level of 0.350 ppm can reduce the severity of WB (reduction in WB score 1) and that supplementation of 25-OH-vitamin D3 at 3000 IU can reduce both the incidence and severity of WB (increase WB score 0 and reduction WB scores 1 and 2). The combination of L-selenomethionine and 25-OH-vitamin D3 also reduced both the incidence and severity of WB compared to the control.

White Striping

With regard to WS, a higher inclusion level of L-selenomethionine (0.350 ppm) resulted in a higher zero score (without WS) and a lower percentage of WS score 2 compared to a lower inclusion level of L-selenomethionine (0.175 ppm) ($P<0.05$). No significant effects on WS score were observed for 25-OH-vitamin D3, betaine and GAA. *Figure 2* shows the results for the control group receiving sodium selenite (0.350 ppm selenium) and vitamin D3 (3000 IU) compared to the treatments receiving L-selenomethionine (0.350 ppm selenium) and 25-OH-vitamin D3. The combined use of L-selenomethionine and 25-OH-vitamin D3 significantly reduced the incidence of WS (higher percentage of breast muscles with a WS score of zero and a lower number of breast muscles with WS scores of 1 and 2) compared to the use of sodium selenite and regular vitamin D3 ($P<0.05$). Based on these results, higher levels of L-selenomethionine can reduce the incidence and severity of WS (increase in WS score 0 and reduction in WS score 2). Similar to the results for WB, the combination of L-selenomethionine and 25-OH-vitamin D3 reduced both the incidence and severity of WS.

The supplementation of certain feed additives, such as organic selenium and 25-hydroxyvitamin D3, betaine and guanidine acetic acid, may contribute to a reduction in the incidence of breast muscle myopathies.

Figure 2 – Wooden Breast scores (WB) and White Striping scores (WS) for use of L-selenomethionine + 25-OH-vitD3 vs sodium selenite + vitamin D3, $P<0.05$