

Pre-absorption effects of potentiated zinc on broilers microbiota

Intestinal microbiota represents a huge metabolic potential and the knowledge about connections between metabolic energy and microbiota composition is growing. Certain micro-elements might influence this microbiota at the condition to be free (not bounded) in the intestinal tract.

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Potentiated zinc source revealed its ability to have a pre-absorption effect on microbiota, prior to be uptaken, as well as an important role on basic body functions due to its bioavailability.

Working on both side of the lamina propria could represent novel strategy for nutritional and cationic trace elements supplementation.

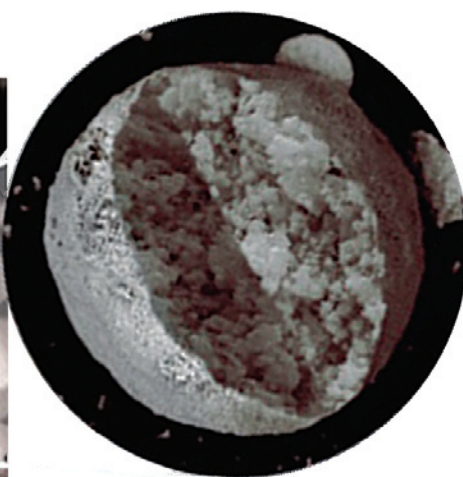
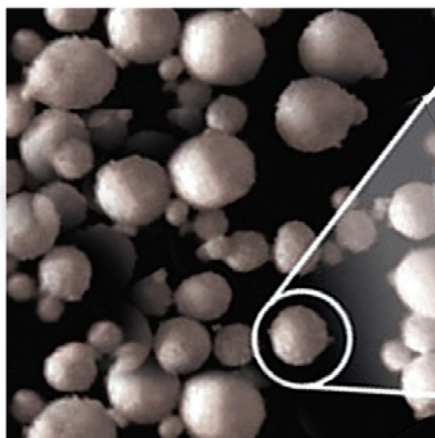
Zinc post-absorption role in metalloenzymes functions

Zinc plays a key role in many enzymatic and metabolic functions in the body as it is primordial for the activity of more than 300 metalloenzymes.

These metalloenzyme are using cationic metals as co-factor, most of the time as element of their structure. Thus, it is easy to understand why supplementing bioavailable zinc is key for:

- The immune system: from the physical barrier of the skin/mucosa to the activation of immune mediators (cytokines, neutrophils or lymphocytes).
- The antioxidant functions: zinc can increase metallothionein – a cysteine-rich protein that neutralises free radicals. This protein is synthesised in tissues in response to dietary zinc and can bind seven atoms of zinc per molecule of protein
- Tissues integrity, cells proliferation and differentiation: zinc is involved in wound healing process, from membrane repairing to coagulation and modulation of inflammation.

These benefits are achieved with any bioavailable zinc source and are post-absorption effects. But can some zinc forms



Porous structure

be also primarily active in the gastro-intestinal tract and before being absorbed by the zinc ZIP transporter?

Potentiated zinc modulates microbiota diversity

From hatch to slaughter, the role of gut health is primordial in broiler performance. Several in-vitro and in-vivo studies have shown that potentiated zinc (HiZox) is more effective to reduce the growth of pathogenic *E. coli* and *C. perfringens*.

This effect is related to its slow dissolution kinetics combined to its high specific surface area, which increases the surface of contact with micro-organisms resulting in a stronger antibacterial effect.

The improved gut health is only one of the potential modes of action by which potentiated Zn improves performance. When assessing α -diversity (Shannon and Simpson index) under challenging conditions of necrotic enteritis, the microbiota profile characterisation by 16s rRNA gene sequence analysis revealed that potentiated zinc increased microbial diversity and resilience in ileum at Genus level.

A significant shift on the reduction of coliforms and an increase in lactic acid bacteria as doses of potentiated Zn increases was observed. Lactic acid producing bacteria are known to have positive effect on gut health.

As shown in past studies, the effects of

potentiated zinc source on microbiota modulation could mainly explain improvements in FCR, resulting in better performance.

Pre-absorption zinc effect and performance

A recent trial published by Dankook University in South Korea also revealed the interest of a highly bioavailable active form of potentiated zinc (HiZox, Animine). In this trial, the impact of several doses of potentiated zinc on performance, gut health, meat quality and gas emissions in broilers was evaluated.

A total of 680 Ross 308 was divided in four treatments with 10 replicates each, trial lasted 35 days. The treatments consisted in a negative control with no zinc supplementation (32ppm of native zinc) and potentiated zinc supplemented at 50, 75 and 100ppm of zinc.

Results showed a significant dose-response in the performance of broilers fed increasing levels of potentiated zinc.

Body weight increased and feed-conversion ratio was significantly improved together with increasing levels of potentiated zinc (Fig. 1).

The linear regression estimated an improvement of 1 point in FCR for every 10ppm of potentiated zinc supplemented, from 50ppm zinc added.

This improvement of performance has

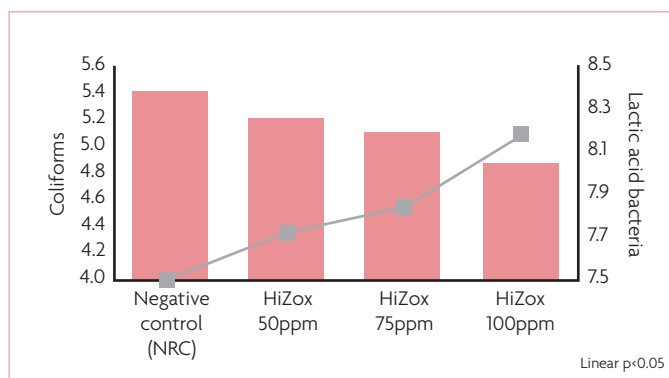


Fig. 1. HiZox effect on ileum bacteria (log 10 CFU/g).

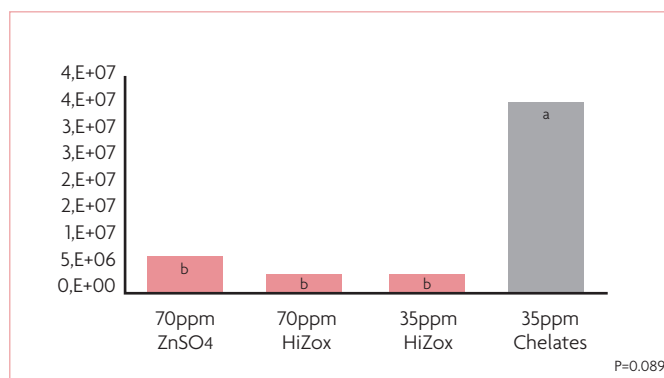


Fig. 2. E. Coli count in cloaca (UFC/ml).

been achieved thanks to better ileal microbiota balance ($p < 0.05$) (Fig. 2).

Beyond bioavailability: what to expect from potentiated zinc?

Starter phases can be really critical in broilers production. When it comes to gut health, many nutritional strategies can be applied.

Nevertheless, some additives already present in the formulation can sometimes bring dual effects.

This is what revealed a large recent trial in France which involved 4,320 Ross broilers

fed for 35 days different zinc sources. One treatment relied on 70ppm zinc from sulfates commodities, two treatments relied on potentiated zinc (HiZox) at two different doses of 70ppm or 35ppm and a last treatment was supplemented with 35ppm of chelates of amino-acids.

Sulfates, chelates of amino-acids and potentiated zinc all perfectly made the job of bioavailability. Nevertheless, only the potentiated zinc source could achieve an additional microbiota control at 18 days, drastically reducing *E. coli* population (bacterial count measured from swab of cloaca content on 28 broilers per treatment). It resulted in higher body weight and improved FCR.

New generation active and potentiated zinc source

When the two last decades of our industry mainly focused on achieving higher trace elements bioavailability, a certain glass ceiling has been achieved limiting the potential of these nutritional additives on the field.

A new generation of active zinc source, which is already largely used in piglets, is now seeing a rise in use in the poultry industry.

This new nutritional strategy is combining dual benefits from a pre-absorption effect on microbiota diversity and a post-absorption effect with bioavailability. ■