

4. ENGLISH ABSTRACT

Impact of the selected bioactive substances delivered *in ovo* on gut health and production performance of broiler chickens.

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During the perinatal period, embryos are exposed to various microbes coming from the eggshells and their immediate environments and this could microbial imbalance and affect the gut health and production performance. Thus, the *in ovo* injection of bioactive compounds on day 12 of embryonic development could mitigate these negative factors by colonizing the gut microbiota with beneficial bacteria. Therefore, this PhD dissertation was performed to evaluate the efficiency of *in ovo* stimulation of galactooligosaccharide 3.5mg/egg and *Lactiplantibacillus plantarum* 1×10^6 on gut health, relative bacterial abundance, cecal histomorphology, gene expression of immune-related genes and antioxidant activities, and various plasma metabolites and production performance metrics. The *in vitro* study was performed to assess the kinetic growth of the bioactive compounds and select the ones with the best growth potentials for antioxidant assay. The 2,2-diphenyl-1-picrylhydrazyl in vitro assay was used to screen the bioactive compounds that demonstrated high free radical scavenging activities which is effective for evaluating bioactive substance antioxidant potential that can alleviate oxidative stress in chickens. Upon the *in vitro* study, an *in ovo* stimulation of the selected bioactive compounds (galactooligosaccharide and *Lactiplantibacillus plantarum*) was performed and an animal trial (*in vivo* study) to validate the impact and influence of the treatments on several key parameters related to chicken gut health and performance, chicken gut microbiome by analysis of the relative abundance of bacteria in feces and cecal content. Additionally, gene expression associated with the immune system and antioxidant activities was conducted on a range of tissues (cecal mucosa, spleen, breast muscle and liver), cecal histomorphology, production performance metrics (hatching rate, hatchling quality, body weight, feed efficiency, feed conversion ratio, meat quality and carcass traits). The results demonstrated that the selected probiotics exhibited good growth. Regarding the antioxidant assay, *Lactiplantibacillus plantarum* 1×10^6 exhibited

the highest antioxidant potential (68.89%). Galactooligosaccharide 3.5mg/egg (selected based on previous studies from our groups due to its ability to mitigate heat stress and promote growth performance) and *Lactiplantibacillus plantarum* 1×10^6 /egg led to early gut colonization by commensal bacteria (*Lactobacillus spp.* and *Bifidobacteria spp.*) in chickens thus conferring positive effects on cecal histomorphology, antioxidant activities, upregulation of immune-related genes suggesting a stable and healthy gut. Moreover, performance parameters together with the selected plasma metabolites were not impaired. In a nutshell, the *in ovo* stimulation of galactooligosaccharide 3.5mg/egg and 1×10^6 *Lactiplantibacillus plantarum*/egg can be used in poultry production to improve gut health, performance and overall welfare of broiler chickens.