



21 – 22 May 2026

The Inulin Functionality as a Prebiotic Used in Heat Stress Conditions in Broilers' Diet on Growth Performance, Intestinal Microbiota, Blood Parameters and Intestinal Histomorphometry

Cristina Gabriela Tudorică^{1,2}, Laurențiu Tudor², Gabriela Maria Cornescu¹, Ana Cișmileanu¹, Tatiana Dumitra Panaite^{1*}

¹ National Research and Development Institute for Animal Biology and Nutrition – Calea București 1, 075100 Balotești, România

² University of Agricultural Sciences and Veterinary Medicine Bucharest, Faculty of Veterinary Medicine, Splaiul Independenței 105, 050097, București, România

Abstract

A possible alternative source to antibiotics could be the utilization of specific probiotics and prebiotics, such as inulin. There were significant differences in body weight between groups, the CON_{HST} group registered a significant decrease ($p=0,045$) compared to CON_{NTC} group and INL_{HST} group registered a increase compared to CON_{HST}. Also, the weight of the gizzard was significantly ($p=0,001$) reduced in the CON_{HST} group. A significant increase in *Lactobacillus sp.* population ($p=0,038$) and a significant decrease in *Enterobacteriaceae sp.* and *Staphylococcus sp.* ($p=0,004$; $p=0,005$) were observed in INL_{HST} group, compared to CON_{NTC} and CON_{HST}. Concerning the hematological and biochemical profile, a significant increase in heterophils was observed in the CON_{HST} group ($p<0,001$) compared to CON_{NTS} and INL_{HST} groups; serum protein ($p=0,013$) and total protein ($p=0,013$) levels increased CON_{HST} si INL_{HST} compared to CON_{NTC}. The intestinal histomorphometry evaluation of villi width recorded a significant increase ($p=0,003$) in the INL_{HST} group compared to CON_{HST} group. In conclusion, 1% inulin administered in the diet of broilers are significantly increased beneficial bacterial populations in the intestinal microflora, without influencing growth performance, blood parameters and histomorphometry of villi and crypts in the broiler's duodenum.

Introduction

Inulin, as a prebiotic, a fermented ingredient, that allows specific changes in the composition or activity of the gastrointestinal (GIT) microbiota and is not digested by enzymes, being a nutrient for probiotics (beneficial bacterial species) *Lactobacillus* and *Bifidobacterium* (Nabizadeh, 2012). Prebiotics, probiotics, acidifiers, bacteriocins and some phytobiotics are promoters of homeostasis of the GIT ecosystem (Song et al, 2020). This study aimed to determine the effects of inulin supplementation in broiler chickens' diet, on production, hematology and biochemistry parameters, microbial population, and intestinal villi, as a possible alternative source to antibiotics.

Material and method

- ✓ 75-day-old ROSS 308 hybrid, 25 chickens/groups, 3 groups, CON_{NTC} (standard diet under normal temperature); CON_{HST} (standard diet under heat stress conditions 35°C) and INL_{HST} (1% inulin diet supplementation under heat stress conditions 35°C); at the end of the experiment (42 days) the chickens were sacrificed by cervical dislocation, followed by exsanguination and evisceration;
- ✓ **growth performance** - individual body weight, mortality rate, average daily consumption and average daily gain were monitored;
- ✓ **blood parameters** - blood was collected aseptically from the brachial vein;
- ✓ **intestinal microflora** - caecum content samples were collected;
- ✓ **intestinal histomorphometry** - tissue (duodenum, jejunum, ileum and liver) samples was collected;
- ✓ **statistical analysis** - ANOVA, using Minitab for Windows (SAS, version 17, SAS Institute Inc., Cary, NC, USA).

Results and discussions

- ✓ On **growth parameters and carcass and organ development**- inulin 1% inclusion did not influence compared to the CON_{HST} and CON_{NTC} groups;
- ✓ On **blood parameters** - lymphocytes showed a significant decrease ($p<0.0001$) in the CON_{HST} group, compared to CON_{NTC}. heterophils recorded a significant increase ($p<0.0001$) in the CON_{HST} group, compared to the CON_{NTC} and INL_{HST} groups, for serum proteins and total proteins, recorded increases ($p=0.013$) in, CON_{HST} and INL_{HST} groups compared to the CON_{NTC} group. Also, an increased level ($p=0.020$) of total cholesterol was observed in both experimental groups, compared to the CON_{NTC} group;

- ✓ On **intestinal microflora** - Concerning the *Lactobacillus sp.* population the results show a significantly ($p=0.038$) increased in INL_{HST} group compared to CON_{NTC} and CON_{HST} groups, while for *Enterobacteriaceae sp.* and *Staphylococcus sp.* population significantly ($p=0.004$; $p=0.005$, respectively) decreased in CON_{HST} and INL_{HST} groups compared to CON_{NTC} group.

Table 1. Influence of dietary supplementation with inulin on the microbial population in the intestine (average values/group)

Parameter (CFU/g)	Diets			SEM	p-Value
	CON _{NTC}	CON _{HST}	INL _{HST}		
<i>Lactobacillus sp.</i>	7.69 ^b	7.69 ^b	8.95 ^a	0.588	0.038
<i>Enterobacteriaceae sp.</i>	5.47 ^a	4.60 ^a	4.00 ^b	0.229	0.004
<i>Staphylococcus sp.</i>	6.67 ^a	5.00 ^a	3.75 ^b	0.413	0.005

- ✓ On **intestinal morphometry** - experimental groups (CON_{HST} and INL_{HST}), the width of the villi was significantly lower ($p=0.003$) compared to the CON_{NTC} group, probably negatively influenced by the heat stress conditions that limited the intestinal absorption of the nutrients. The similar results were obtained for depth crypts which are significantly decrease ($p<0.0001$) for both experimental groups compared to CON_{NTC} group.

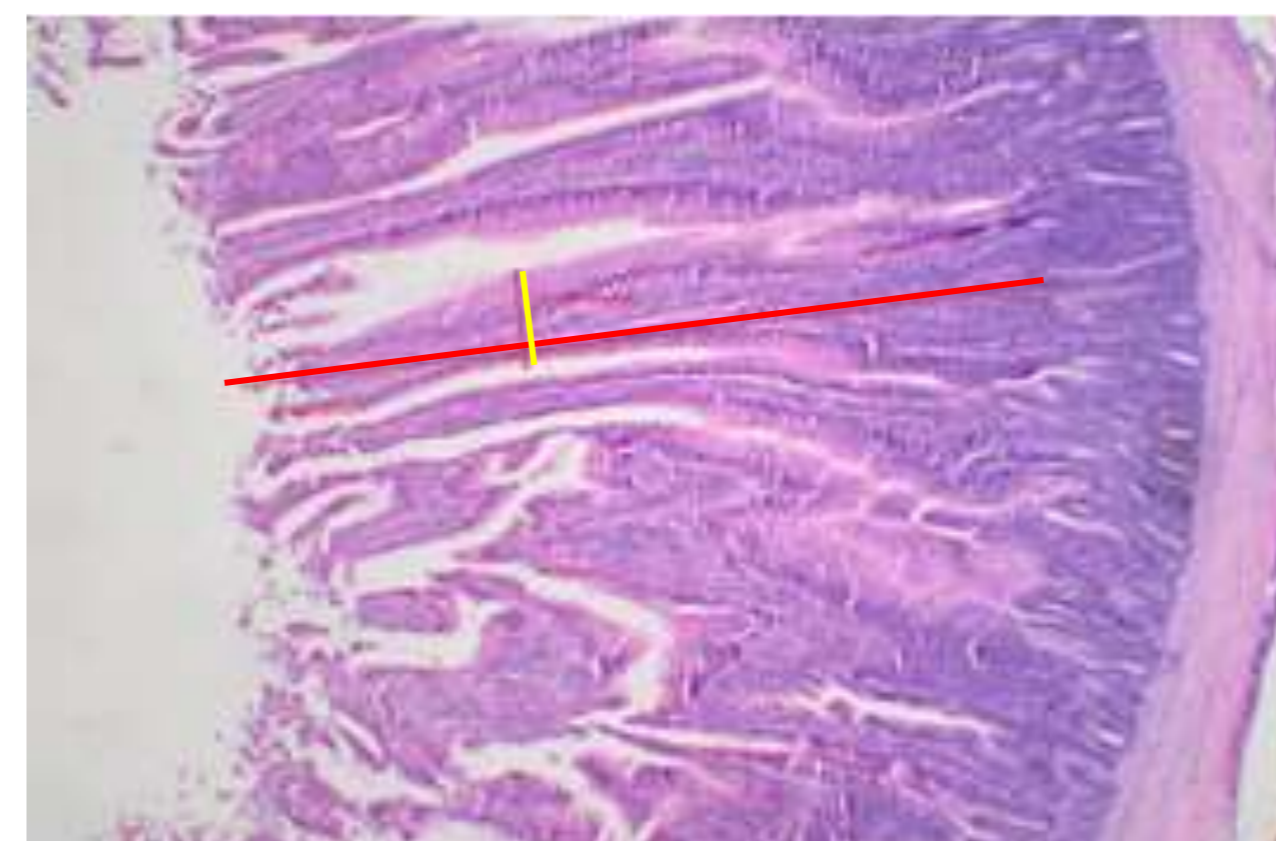


Fig. 1 - CON_{NTC} group - Duodenum - villus (HE stain, ob. 10x)



Fig. 2 - INL_{HST} group - Duodenum - villus (HE stain, ob. 10x)

Conclusions

It can be concluded that 1% inulin administered in the diet of broilers are significantly increased beneficial bacterial populations in the intestinal microflora, without influencing growth performance, blood parameters and histomorphometry of villi and crypts in the broiler's duodenum. The present study will serve as a base for future studies in which the rate of inulin inclusion in broilers' diet can be increased up to 4%.

Acknowledgement:

This study was financed within project MADR PROGRAM-ADER/ 8.1.6./24.07.2023