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Impact of Certain Feed Additives on Health, Immunological State and Productive Performance of Broiler Chickens

Thesis Presented

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(B.V.Sc.; 2009, Fac.Vet. Med., Zagazig University)

For the degree of

M.V.Sc.

(Nutrition and Clinical Nutrition)

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2019

SUPERVISION SHEET

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ABSTRACT

Two delivery routes of phytobiotic (Digestrom-PEP®) and synbiotic (Poultrystar®) via drinking water or feed were examined to study their effects on broiler chickens health and performance. Five dietary treatments of 3 replicates each were allocated using 750 one-day-old Cobb broiler chicks of both sexes (50 chicks/replicate). The first group consumed water and basal broiler diets without any additive and served as a control group (G-A). Broiler chicks in the second and third groups (G-B and G-C) consumed basal broiler diets without additive and were received drinking water supplemented with Poultry-star® and Digestrom-PEP® respectively. Broiler chicks in the fourth and fifth groups (G-D and G-E) were received drinking water without supplement and reared on the basal diets containing Poultry-star® and Digestrom-PEP® respectively. Poultry-star® and Digestrom-PEP® were used either in drinking water or in the feeds according to the manufacturer recommendations doses. Feed and water were provided *ad-libitum* during 35 days experimental period. Body weights as well as the rest of feed were recorded weekly. Body weight gain and feed conversion were calculated. Blood samples were collected according to a time program to evaluate some health and immunological parameters. At day 16 of age 15 birds from each group (5 birds/replicate) were isolated and challenged orally with 1 ml containing *Clostridium perferingens* (10^7 cfu/ml) daily for 3 consecutive days. Post-challenge, lesion scores, mortalities and intestinal *Clostridium perferingens* levels were assessed. Tissue samples from duodenum, jejunum, ileum, cecum, bursa and thymus were collected for histopathological examination. At the end of the experiment, fifteen birds were randomly selected from each group (5 birds/replicate) to evaluate carcass characteristics. The results reported that the two routes of phytobiotic (Digestrom-PEP®) and synbiotic (Poultrystar®) via drinking water or feed had significant effects ($p<0.05$) on feed intake, weight gain and feed conversion compared with the control group. The best results were reported in G-C and G-B which received phytobiotic and synbiotic in drinking water. The results of immunological parameters measured revealed that phytobiotic and synbiotic treatments could enhance broiler chickens innate immunity as they significantly increased ($p<0.05$) phagocytic activity and humeral immune responses against vaccines used. In addition, phytobiotic and synbiotic treatments maintained oxidant/antioxidant balance. Results of the intestinal histopathology revealed that birds in the second and third groups showed the best results of intestinal integrity and tissue immunity. Mortality was reduced in the supplemented groups in contrast to the control group. On the other hand, carcass weights, dressing percent, carcass cuts and some organs weights were not affected by both supplements used. However, abdominal fat content was reduced significantly ($P<0.05$) in both supplemented groups either via drinking water or as feed supplement. In conclusion, using phytobiotic (Digestrom-PEP®) and synbiotic (Poultrystar®) via drinking water or feed could improve broiler chicken performance, enhance immune status and decrease prevalence of clostridial infection.

Keywords: Broiler Chickens, *Clostridium perferingens*, Poultry-star®, Digestrom-PEP®, Histopathology.

Dedication

To my Father,

To my Mother,

To my Brother,

To my Sister,

To my Friends,

To my Soul.

November 04, 2019

Acknowledgement

In the name of Allah, the most Gracious and the Most Merciful Alhamdulillah, all praises to Allah for his strengths and blessing in completing this thesis.

I would like to express my deep appreciation and sincere gratitude to ***Prof. Dr. Mohamed Ahmed Tony,*** *Professor of Nutrition and Clinical Nutrition, Faculty of Veterinary Medicine, Cairo University for his kind supervision, assistance, wisdom, commitment and help.*

I would also like to extend my thanks to ***Prof. Dr. Khaled Nasr El-Den Fahmy,*** *Professor of Nutrition and Clinical Nutrition, Faculty of Veterinary Medicine, Cairo University for his valuable supervision and continual encouragement, guidance and patience during the research and preparation of this thesis.*

My deepest gratitude to ***Prof. Dr. Hala Farouk El-Miniawy*** *Professor of Pathology, Faculty of Veterinary Medicine, Cairo University for her persistent help, guidance, and support throughout this work and make it possible.*

Special thankful to ***Prof. Dr. Ahmed Samir*** *Professor of Microbiology, Faculty of Veterinary Medicine, Cairo University for his help and cooperation during the challenge test in the present work. Many thanks to* ***Dr. Marwa Khattab*** *Assistant professor of Pathology, Faculty of Veterinary Medicine, Cairo University for her help during pathology investigation.*

Many thanks to ***Dr. Mohamed Mashaly*** *Lecture of Food Hygiene, Faculty of Veterinary Medicine, Cairo University and* ***Dr. Ayman Atef*** *Lecture of Gynecology and Obstetrics, Zagazig University,* ***Dr. Ayah Shawky****, Assistant Professor of Pharmacology, Faculty of Veterinary Medicine, Aswan University for their valuable help to finish this thesis.*

I want to present my appreciation to the all members of the Department of Nutrition and Clinical Nutrition, Faculty of Veterinary Medicine, Cairo University.

I would like to thank my family, without whom I would never have been able to achieve and finish my thesis.

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List of Abbreviations

ALT	Alanine Transaminase
AGPs	Anti-microbial growth promoters
AST	Asparatate Aminotransferase
ADFI	Average Daily Feed Intake
ADG	Average Daily Gain
BP	Blood Pressure
BWG	Body Weight Gain
CAT	Catalyze
Cm	Centimeter
Co	Cobalt
CFU	Colony Forming UNIT
CU	Copper
CP	Crude Protein
ELISA	Enzyme Linked Immunosorbent Assay
EC	European Commision
FCR	Feed Conversion Ratio
FAO	Food and Agriculture Organization
FOS	Fructooligo-Saccharides
GOS	Galactooligo-Saccharides
GIT	Gastro Intestinal Tract
GSH	Glutathione
G	Gram
GALTS	Gut associated lymphoid Tissues
HI	Haemagglutination Inhibition
HDL	High Density Lipoprotein
H	Hour
HMOs	Human Milk Oligosaccharides
HMGCoA	Hydroxy-3-MethylGlutaryl-Coenzyme A
ICITF	Immune Active Long Chain Inulin
IgA	Immunoglobulin A
IB	Infectious Bronchitis
IBD	Infectious Bursa Disease
INF	Interferon
INOS	Interleukin Inducible Nitric Oxide
ISAPP	International Scientific Association For Probiotics
IECs	Intestinal Epithelial Cell
I	Iodine

Fe	Iron
LAB	Lactic Acid Bacteria
LSD	Least significance Difference
LPS	Lipo poly Saccharide
LDL	Low Density Lipoprotien
MDA	Malonialdehyde
MOS	Mannanoligo-Saccharides
MCH	Mean Corpuscular Hemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration
µl	Micro liter
Nm	Nano meter
NE	Necrotic Enteritis
ND	Newcastle Disease
NAD	Nicotinamide Adenine Dinucleotide
NADP	Nicotinamide Adenine Dinucleotide Phosphate
NO	Nitric Oxide
NF-KB	Nuclear Factor KB
NRC	National Research Council
BPS	Phosphate Buffer saline
PFAs	Phytogenic Feed Additives
QPS	Qualified Presumption off Safety
Rpm	Round per minute
SGOT	Serum Glutamic Oxalic Transaminase
SGPT	Serum Glutamic Pyruvic Transaminase
SCFAS	Short Chain Fatty Acids
SD	Standard Deviation
TNF	Tumor Necrosis Factor
U/L	Unites per Liter
VFA	Volatile Fatty Acid
XOS	Xylooligo-Saccharides
Zn	Zinc

INTRODUCTION

Chapter (1)

INTRODUCTION

During the past decades, poultry production has been intensified to meet the world's ever-increasing demand for animal protein. Poultry is considered as an excellent biological machine which convert plant proteins to avian proteins. In recent years, poultry industry has faced many challenges specially after the decision from the Europe Union Commission banning the use of antibiotics as a growth promoters in animal feed as a solution to the problem of antibiotic residues in animal meat which led to release of antibiotic resistance phenomena in human **(E.U. Regulation, 2005).**

Before this decision, there is increased concern over the use of antibiotics as growth promoters in animal feed **(Close, 2000)**. As a result, attention is being focused on setting new regulations for more natural production methods that are friendly to animals, the consumer and the environment **(Wenk, 2006)**, The removal of antibiotics from poultry diets has put a tremendous pressure on the poultry farms, one of the main consequences being a substantial increase in the use of therapeutic antibiotics **(Casewell et al., 2003).**

One way is to use specific feed additives or dietary raw materials to favorably affect animal performance and welfare, particularly through the modulation of the gut microbiota which plays a critical role in maintaining host health **(Tuohy et al., 2005).** Probiotics, phytobiotics and synbiotics could be possible solutions. The main