زانکۆی سەلاحەدین - هەولێر
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Phytogenics in Broiler Nutrition

Research Project

Submitted to the department of (Animal Resources) in partial fulfillment of the requirements for the degree of BSc. in (College of Agricultural Engineering Sciences)

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2023-2024

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ACKNOWLEDGMENTS

All praise and thanks to Allah that help and gives me this ability to write this research paper, after that I would like to express my deep gratitude and sincere thanks to MR. Sami mahdi , my supervisor , for his constant guidance and advice during the preparation of this research paper , and for the correction he has so kindly suggested after his reading of the paper. To all colleagues and friends.

INTRODUCTION

Usage of antibiotics concerning animal nutrition and as antimicrobial growth promoters is undoubtedly beneficial for the improvement of zootechnical performance parameters and prevention of disease. Nevertheless, because of the biosecurity threats for human and animal health which come from escalating resistance of pathogens to antibiotics and the accumulation of antibiotic residues in animal products and the environment (Stanaćev et al., 2011), there is a global need to remove antimicrobial growth promoters from animal diets. As a result, the demand for alternative products to antibiotics that can be used as prophylactic and growth promoting agents is very high. The intensive broiler production sector of the poultry industry is keen to optimise performance and minimise economic losses as a result of antimicrobial growth promoter removal, as well as ensuring the safety of broiler meat via the control or elimination of foodborne pathogens (Nikola P. et al., 2013)

The ban of using antibiotics as growth promoters have spurred research into using plant-derived compounds named phytogenic feed additives (PFAs). The use of PFAs from herbs or spices as antibiotic alternatives are generally recognized as safe .The botanical constituents used in broiler diets as a single compound or multiple cocktails exhibit growth-promoting, immune-regulatory, antimicrobial, stimulating nutrient digestibility and antioxidant properties . Dietary protein is a major contributing factor in driving feed cost. Reducing the crude protein level in the broiler diet has recently attracted much attention since it could reduce the feed cost and nitrogen excretion . The previous study demonstrated the inclusion of PFA stimulated the nutrient digestibility and small intestine villus height of broilers fed a corn soybean diet however, it remains unknown for the effects of PFA in a low protein diet, and there might be an interaction between PFA and crude protein level . In broilers, PFA in a diet with reduced metabolizable energy and crude protein reduced plasma cholesterol and improved plasma and meat total antioxidant capacity, gut microbiota (Jinquan W. et al. 2021).

Phytogenic as an Alternative to Antimicrobials in Poultry Feeding

In recent years, PFAs have attracted an increasing attention as natural alternative to antibiotic growth promoters (AGPs) in poultry production which can be included in feeds as dried, solid, and ground form, or as extracts (crude, concentrated and purified). A wide variety of herbs and spices (thyme, oregano, cinnamon, rosemary, garlic, ginger, green tea, black cumin, among others) as well as EOs (from thymol, carvacrol, cinnamaldehyde, garlic, anise, rosemary, clove, ginger) have been used in poultry, individually or mixed, for their potential application as AGP alternatives (Gadde U. et . 2017). Although the repertoire mechanisms of action of PFAs is not fully elucidated in poultry, one of their primary mode of action is related to their antimicrobial effects which allow controlling potential pathogens (Mohammadi M. and I.H. Kim 2018).

Effects of PFA on Growth Performance

Several studies have been carried out using herbs, spices, and EOs and showed inconsistent results on chicken performance. Although some studies showed that PFAs have positive effects on body weight gain and FCR in chickens , others reported either an improved chicken body weight gain without affecting FCR (Zhang et al, 2009) or an enhanced feed conversion rate associated to a lack of effects on body weight or feed intake. This inconsistency may be explained by several factors such as the botanical source, the concentration and the duration of supply of the active compounds, the feed composition, and the experimental conditions, animal age and health status (Van der Aar et al. 2017).

Effects of PFA Supplementation on Digestibility

Evaluating digestibility is important as it directly contributes to the animal feed efficiency. However, improving the digestibility is crucial not only for better feed efficiency but also to reduce the amount of undigested feed in the gut, which may favour the occurrence of intestinal imbalances. These imbalances may lead to inflammatory processes, which results in poorer performance. in broiler chickens supplemented with an EO blend (Reyer et al. 2017) or a PFA of Aerva lanata, Piper betle, Cynodon dactylon, and Piper nigrum leaded to significantly increased protein and fat digestibility (Oso et al.,

2019). Authors attributed the digestion-stimulating properties of the PFA basically to piperine, which has been previously reported to stimulate digestion and increase absorption of selenium, vitamin B complex, carotene, and other nutrients. Possible mechanisms behind improved nutrient digestibility by PFAs supplementation could be attributed to the ability of these feed additives to stimulate appetite, saliva ecretion, intestinal mucus production, bile acid secretion, and activity of digestive enzymes su ch as trypsin and amylase (Nedra A.
et ai., 2021)

Effects of PFA Supplementation on Meat Quality

Benefits of dietary PFA supplementation on the quality and shelf-life of meat products are still ambiguous. Authors reported increased antioxidant levels. And reduction of lipid peroxidation by Nigella sativa seeds, turmeric, curcuminoids as well as herbal components containing curcumin, carvacrol, thymol and cinnamaldehyde (Nedra A. et ai., 2021).

Manipulating lipid peroxidation has been shown to be, in part, achieved through modulating the profile of meat fatty acids by PFAs supplementation. Total saturated fatty acid (SFA) levels were reduced and monounsaturated/polyunsaturated fatty acid (MUFA/PUFA) levels were increased by PFAs supplementation. Particularly, SFA such as lauric, stearic, myristic and palmitic acid are undesirable due to their hypercholesterolemic properties in the form of LDL (Ahmed et al., 2015).

Effect of PFA on broiler performance

In a study conducted by (Murugesan et all., 2015). An experiment was conducted with the objective to evaluate the effects of PFA (phytogenic feed additives) as an alternative to AGP (antibiotic growth promoters) on nutrient digestibility, and growth performance in broiler chickens.

Body Weight Gain

According to the study no significant differences in BWG were noted during the 1–7 days pre-starter phase. There was an effect of dietary treatment on BWG during the starter phase (8–21 days) grower phase (22– 39 days) and during the overall period (1–39 days). During the starter phase, birds-fed AGP had significantly increased BWG compared to control fed birds ($P \leq 0.05$), while the BWG for PFA-fed birds was not significantly different from either control or AGP groups. During the grower phase, birds-fed PFA had significantly increased BWG in comparison to both control ($P \leq 0.05$) and AGP groups ($P \leq 0.05$), which did not differ from each other. Supplementation of either AGP ($P \leq 0.05$) or PFA ($P \leq 0.05$) to the basal diet significantly increased BWG for the overall experimental period (**Table 1**).

Feed Intake

In (Table 1) as shown no significant differences in FI were noted among the groups throughout the experimental period, except during the starter phase (8–21 days) when the FI of PFA-fed birds was significantly lower in comparison to both AGP ($P \leq 0.05$) and control -fed birds ($P \leq 0.05$)

Feed Conversion Ratio

No significant differences in FCR were present during the 1–7 days pre-starter phase. There was a significant effect ($P \leq 0.05$) of PFD on FCR during the 8–21 days starter phase, 22–39 days grower phase and for the overall period (1– 39 days). Supplementation of PFA lowered the FCR in comparison to control-fed birds during all time periods ($P \leq 0.05$). (Table 1)

TABLE-1- : Performance of broilers supplemented with either an antibiotic or a phytogenic feed additive during 1–39 days of age.

	Dietary treatments		
	Control	APG	PFA
Pre-starter period (1-7 days			
Body weight gain (g)	140.5	144.3	142.3
Feed intake (g)	185.4	185.9	185.5
Feed conversion	1.323	1.292	1.305
Starter period (8-21 days)			
Body weight gain (g)	8.23.4^{b}	860.3^{a}	835.1$_{ab}$
Feed intake (g)	1004.5^{a}	1007.8^{a}	975.3^{b}
Feed conversion	1.221^{a}	1.173$_{ab}$	1.169^{b}
Grower period (22-39 days)			
Body weight gain (g)	1073.5^{b}	1109.2^{b}	1183.1^{a}
Feed intake (g)	2599.6	2606.5	2590.6
Feed conversion	2.431^{a}	2.355^{a}	2.195^{b}
Overall period (1-39 days)			
Body weight gain (g)	1896.9^{b}	1969.5^{a}	2018.2^{a}
Feed intake (g)	3789.5	3800.2	3751.5
Feed conversion	2.002^{a}	1.931$_{ab}$	1.860^{b}

- The same rows with different superscripts are significantly different ($P \leq 0.05$)
- (Murugesan et all., 2015).

Nutrient Digestibility

There was a significant effect of dietary treatment on apparent total tract digestibility of DM. CP and EE (Table 2). The apparent total tract DM digestibility for the PFA-fed group was increased in comparison to the control group, while the AGP group was not different from either the control or PFA groups. Supplementation of either AGP or PFA to the basal diet significantly increased the apparent total tract digestibility of CP and EE when compared to the control group ($P \leq 0.05$).

TABLE-2-: Nutrient digestibility of broilers supplemented with either an antibiotic or a phytogenic feed additive during 1–39 days of age.

Dietary treatments			
Nutrient digestibility (g/g intake)	**Control**	**AGP**	**PFA**
Dry matter	0.674^{b}	0.711^{ab}	0.744^{a}
Crude protein	0.761^{b}	0.784^{a}	0.794^{a}
Ether extract	0.736^{b}	0.781^{a}	0.782^{a}

- The same rows with different superscripts are significantly different ($P \leq 0.05$)
- (Murugesan et all., 2015).

Conclusion

It could be concluded that; phytogenic feed additives mixtures are more efficient than antibiotic growth promoter on improving broiler performance. If PFDs mixtures were used correctly along with nutritional, managerial and biosecurity measures, they can be a powerful tool in maintaining the health of the gastrointestinal tract of poultry, thus improving their performances and successfully used as growth promoters.

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