The Effect of Using Phyto-Additives in the Nutrition of Broilers (Garlic, Pepper, Turmeric and Coriander) on Nutritional and Bioproductive Indices

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Abstract
The prohibition of using antibiotics in the nutrition of chicken has led to the occurrence of a new category of additives knows as phytoadditives, which have antimicrobial, antioxidant, anti-inflammatory effects, as well as growth stimulation effects. Due to the contradictions in literature, further investigations are needed for the clarification of the different nutritional aspects of phytoadditives. This study was carried out by 60 broilers ROSS 308, in order to assess the effect of feed supplemented with garlic (*Allium sativum*), turmeric powder (*Curcuma longa*), black pepper (*Piper nigrum*) and coriander seeds (*Coriandrum sativum*) on nutritional and bioproductive indices of broilers. The treatments were: a control group received no supplements and four groups that got 1% of garlic (T1), 1% turmeric (T2), 1% pepper (T3) and 1% coriander (T4). The body weight at the end of the growth period was significantly higher ($p<0.05$) in chickens from T1 (garlic) 2833.50±55.449 grams as compared to that of chickens from T0 (control) 2489.00±70.092 grams and insignificantly bigger ($p>0.05$) as compared to T2, T3 and T4. The most efficient feed conversion index was present in T3 (pepper) 1.718±0.114. Supplementing the feed with phytoadditives has led to the improvement of the bioproductive performances.

Keywords: broiler, phytoadditives, growth performance.

1. Introduction

The ban on the use of antibiotics as growth promoters in poultry feed has drawn the attention of researchers to the presence of various natural substances as a new class of feed additives with antimicrobial, anti-fungal, oxidant, and growth-promoting effects. The use of antibiotics in poultry feed not only represents an increase in the cost of production but also leads to an increase in the resistance of microbes and the presence of residues in meat and eggs [1, 2]. Medicinal plants, aromatic plants have not only played a role in human nutrition, they can also be used in animal nutrition, bringing benefits to the health and well-being of animals [3]. Additives obtained from plants and used in animal feed are called "phytogenic feed additives" [4].

The plant contains phytocompounds that have effects on the digestive system, changing the intestinal flora, stimulating the appetite but also improving the palatability of the feed consumed. The bactericidal and bacteriostatic effect of the plants is given by the amount used. Currently,

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plants and their extracts are widely used, especially for the purpose of improving feed conversion and increasing meat quality.

The use of products of plant origin also has a risk, which consists in the fact that the plants can be harvested with diseases and pests that implicitly lead to a decrease in quality and those diseases produce toxic substances that affect the animal. Of course, these problems can be avoided by storing in special conditions, disinfecting with steam or ionizing radiation, which have the effect of reducing the degree of infestation.

Birds do not have a bacterial flora that degrades all nutrients like ruminants, having a sensitivity to infections with pathogenic microorganisms. The reason for the use of phytogenic compounds as feed additives in the reactions of chickens emerges from the antioxidant and antimicrobial actions but also from the efficiency of weight gain.

The positive physiological effects are attributed to the bioactive components that are found in the highest concentration in the respective plant.

Garlic (*Allium sativum*) is traditionally used as a spice, having antimicrobial, hypolipidemic, antithrombotic, antihypertensive, antidiabetic properties [5]. The active components of garlic are ajoene, s-allyl cysteine, diallyl sulfide and, the most active, allicin [6]. Research by Alder and Holub (1997) revealed that allicin can reduce low-density lipoprotein (LDL), triglycerides and cholesterol in serum and tissues [7] but also used in the treatment of cardiovascular diseases [8].

Black pepper (*Piper nigrum*) is one of the most well-known spices and more used in Southeast Asia (mainly Oriental countries) due to the aroma that is given by the volatile oils in the cells of the pericarp [9]. In India, pepper was used to treat malaria and, in China, to treat epilepsy [10].

Turmeric (*Curcuma longa*) is widely cultivated in the tropics, originating from the Asian subcontinent and considered a medicinal plant, extracts obtained from it having antimicrobial [2], immunomodulatory [11], antioxidant activities [12]. Turmeric contains curcumin, fiber, minerals, fat, protein, other murcuminoids, vitamins, carbohydrates, total ash content of 4.7-8.2% [13].

Coriander (*Coriandrum sativum*) is remembered since ancient times. In Greek medicine it was used by Hippocrates (ca. 460–377 BC), the Romans and Greeks used coriander to flavor wine and the Egyptians called the plant "the spice of happiness" [14]. Coriander is a plant from the Middle East and Mediterranean regions with a length between 25–60 cm.

2. Material and Method

The present study was carried out in University of Life Science "King Mihai I" from Timisoara, on 60 broilers ROSS 308, in order to assess the effect of feed supplemented with garlic (*Allium sativum*), turmeric powder (*Curcuma longa*), black pepper (*Piper nigrum*) and coriander seeds (*Coriandrum sativum*) on nutritional and bioproductive indices of broilers. The treatments were: a control group received no supplements and four groups that got 1% of garlic (T1), 1% turmeric (T2), 1% pepper (T3) and 1% coriander (T4). The organization of the experiment is summarized in Table 1.

The breeding period was 42 days and the triphasial growth was practiced: starter 0-10d, grower 11-35d and finisher 36-42d. Ad libitum feeding was used, with combined feed (CF). The CF have had nutritional specifications specific to each growth stage: starter ME 2850 kcal/kg and 21.00% CP; grower ME 3050 kcal/kg and 19% CP; finisher ME 3080 kcal/kg and 17.20% CP.

For the following indicators, group statistical means were the difference between ANOVA test combined with Tukey HSD at the 5% threshold, used SPSS IMB 23

Table 1. Experimental design

Item	T0	T1	T2	T3	T4
1-10 days	**CF starter CP 21% ME 2850 kcal**	CF starter + **1% garlic**	CF starter + **1% turmeric**	CF starter + **1% pepper**	CF starter + **1% coriander**
11 -35 days	**CF grower CP 19% ME 3050 kcal**	CF grower + **1% garlic**	CF grower + **1% turmeric**	CF grower + **1% pepper**	CF grower + **1% coriander**
36-42 days	**CF finisher CP 17.2% ME 3080 kcal**	CF finisher + **1% garlic**	CF finisher + **1% turmeric**	CF finisher + **1% pepper**	CF finisher + **1% coriander**

3. Results and discussions

The body weight at the end of the growing period (Table 2) was significantly higher in broilers from T3 (garlic), 2833.50 ± 55.449 g, compared to that of control broilers (T0), 2489.00 ± 70.092 g, and insignificantly higher if we compare it to T3, T4 and T2. The body weight of T2 (turmeric) broilers was raised 2776.17 ±, placing the batch in second place in the hierarchy. The broilers from variants T3 (pepper) and T4 (coriander) presented, at the end of the growth period, a close body mass value of 2686.50 ± and 2666.67 ±, respectively. The lowest body weight was present in broilers from T0, 2489.00 ± 70.092 g, with insignificant difference compared to broilers from T1 and T2, and insignificant difference compared to broilers from T3 and T4.

Table 2. Evolution of bioproductive indices of broilers (n=12)

Item	T0 $\overline{x} \pm SD$	T1 $\overline{x} \pm SD$	T2 $\overline{x} \pm SD$	T3 $\overline{x} \pm SD$	T4 $\overline{x} \pm SD$	P values (Anova test)
Body weight (g)	2489.00± 270.114 [a]	2833.50± 7.311 [b, c]	2776.17± 6.364 [b, c]	2686.50± 6153.442 [b, c]	2666.66± 188.564 [a, c]	0.010
Total gain (g)	2446.67± 270.589 [a]	2791.50± 7.311 [a]	2733.84± 121.375 [a]	2644.00± 153.683 [a]	2624.83± 188.798 [a]	0.423
INC (g)	4368.00± 579.828 [a]	4797.50± 127.986 [a]	4726.00± 240.416 [a]	4555.00± 691.550 [a]	4535.00± 304.056 [a]	0.871
FCR	1.810± 0.438 [a]	1.719± 0.042 [a]	1.729± 0.011 [a]	1.718± 0.161 [a]	1.748± 0.008 [a]	0.989

SD-standard deviation

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As can be seen from the data presented in Table 2, insignificant differences were reported in terms of the total increase in growth of the broilers (P>0.05). The difference in growth between the lowest value 2446.66± (T0) and the highest value 2791.50 ± (T1), was 344.84 g, statistically insignificant (p>0.05).

It is noted that broilers from the control group (T0) recorded the lowest consumption of combined feed during the course of the experiment (4368.00 ± 579.828g), and the highest NC consumption was reported in broilers from T1 (garlic) 4797, 50±127.986g. The broilers in T2, T3, T4 showed intermediate consumption values between the control group and the group where the broilers consumed a combined feed supplemented with 1% garlic (Table 2).

The reported consumption differences are not statistically significant (p>0.05).

The most effective feed conversion index (Table 2) was present at T3 (pepper), 1.718 ±0.114. Batch T2, in which the combined feed was supplemented with turmeric, recorded an FCR value of 1.728 ±, and in the batch with coriander, the FCR value was 1.748 ±. The control batch had the highest feed conversion index 1.809 ±, with approx. 5.33% higher compared to T1, respectively T3.

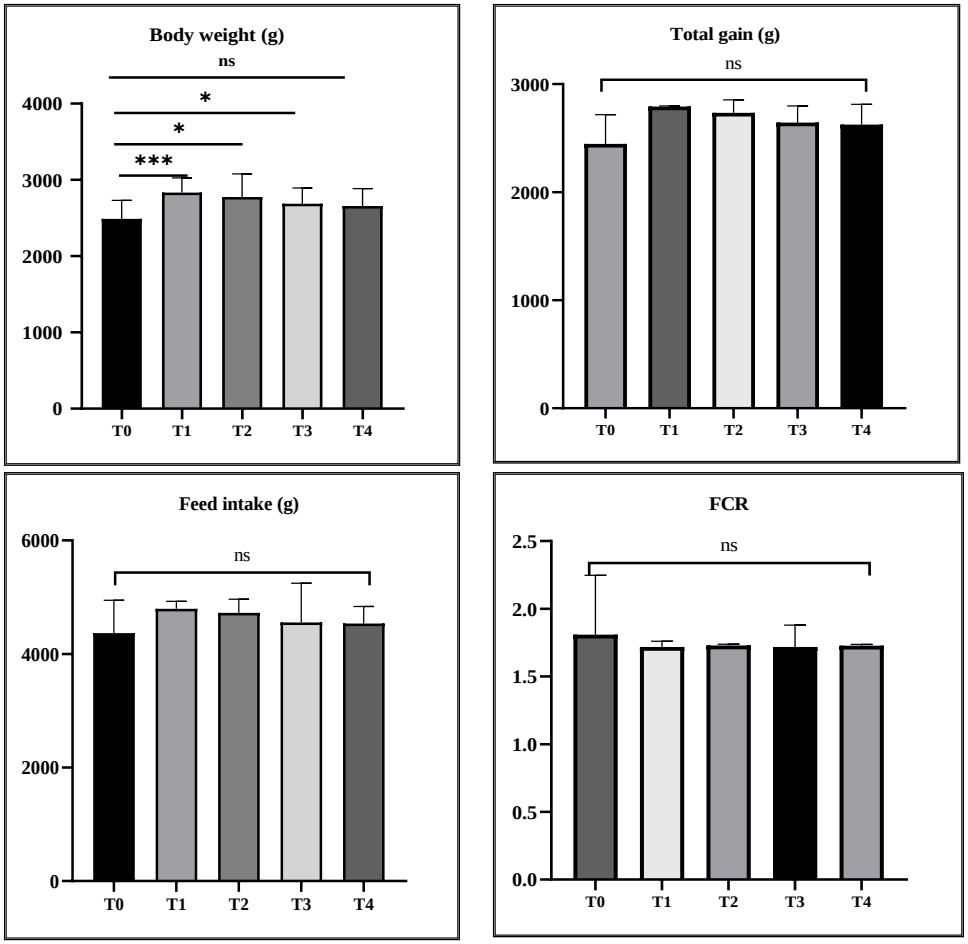

Fig. 1. Graphic representation of the main bioproductive indices

In broiler feed, garlic improved growth and conversion ratio, reduced mortality and increased stomach secretion [15, 16]. The amounts of garlic that are used are 0.5-2% in the feed, which leads to a low production price that represents a fairly important economic factor [3].

In 2013, Elagib et al. [17] showed that the incorporation of garlic as a feed additive at a level of 3% significantly improved the growth and performance of broilers with no side effects detected by the blood profile.

Tazi et al. (2014) [18], following the research carried out, highlighted the fact that the birds fed with the highest level of black pepper (1%) produced the highest net profit compared to other experimental groups in which 0.0% black pepper was administered, 0.5% and 0.75%.

Chaudhary et al. (2018) [19] conducted some research on 144 commercial broilers to see the effects of dietary supplementation with turmeric powder on chicken performance. Chickens were divided into 4 groups of 36 individuals each: T0 (control, feed); T1 (feed + 0.25% turmeric powder); T2 (feed + 0.50% turmeric powder) and T3 (feed + 0.75% turmeric powder). Final body weight was significantly higher ($P \leq 0.05$) at T3 (2134.56 g), followed by T2 (2049.36 g), T1 (1963.97 g) and T0 (1900.28 g).

Research undertaken by Saied and Al-Nasry (2010) [20] revealed that broilers in the supplementary diet fed with 0.3% coriander seeds showed a significant increase in performance parameters compared to groups fed with 0.2 and 0,1%. The results of research undertaken by Rasid et al. (2014) [21] showed that the batch in which 1.5% coriander flour was introduced significantly ($P < 0.05$) affected the live weight of broilers at 28 and 35 days of age. Profit per kg of live broilers increased significantly ($p<0.05$) with increasing levels of dietary coriander flour. These results suggest that

coriander flour could be considered a potential natural growth promoter for poultry and showed the best responses at an inclusion level of 1.5% [21].

Conclusions

In the case of supplementing the feed with garlic and turmeric, the significant evolution of body mass was seen and insignificant in the case of supplementing with pepper and coriander. At the end of the experimental period, the body mass of the chickens that were fed with supplements is higher compared to the chickens in the control group.

The broilers whose feed was supplemented with 1% garlic (T1) had the highest body mass, followed by those fed with supplementation of 1% turmeric (T2), 1% ground black pepper (T3) and 1% coriander (T4).

In the case of the total body growth, the differences between the supplemented groups and the control group were insignificant.

Regarding the feed conversion index (FCR), an insignificant improvement was found in the experimental groups where the feed was supplemented with phytoadditives, compared to the control group.

A significant influence of the carcass yield was in the batches supplemented with pepper, garlic and turmeric and insignificant in the batch with coriander seeds.

Among the phytoadditives studied, the best results were obtained with the use of garlic and turmeric, both from a bioproductive and nutritional point of view.

The supplementation of the combined feed with pepper, garlic, coriander and turmeric led to the improvement of both the bioproductive performance, which entitles us to recommend the use of these phytoadditives (especially garlic and turmeric) in growing broilers.

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