

## Effects of Phytogetic Feed Additives as an Alternative to Antibiotic on Broiler Performance and Carcass Characteristics

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ARTICLE INFO	ABSTRACT
<p><i>Research Article</i></p> <p>Received : 27/11/2019 Accepted : 11/12/2019</p> <p><b>Keywords:</b> Phytogetic feed additives Avilamycin feed additives Feed additives Broiler performance Carcass characteristic.</p>	<p>This study conducted to determine the effect of phytogetic feed additives as natural feed supplements with comparing avilamycin feed additive broiler performance and various carcass characteristics. For this aim possible effects of the phytogetic feed additives and avilamycin feed additives as a feed additive on live body weight (LBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), carcass weight (CW), abdominal fat (AF) and liver weight (LW) characterization of broiler chickens. A total of 252 broilers chick (ROSS 308) were selected and divided into 7 treatments and 3 replicates based on completely randomized design (CRD). 3-day-old chicks are reared for 42 days. The limited amount of feed was provided whilst water was supplied ad-libitum. Each treatment contained three replicates of 12 birds. Each group of birds was supplied with 0, 10%, 0.15% and 0.20% of either phytogetic feed additives or avilamycin as feed additives as feed additive and control group was supplied with neither phytogetic feed additives nor avilamycin in their ratio. Data of LBW, BWG, FCR, and FI were statistically analyzed using one-way analysis of variance and means compared using multiple range test in Statistical Analysis System Programs. Means LBW, BWG, FI, FCR, CW, AF and LW against T6 phytogetic feed additives (PFA) were significantly higher for broilers in other groups. However, they were non-significant effect on the carcass weight, carcass yield, and abdominal fat. Results of the present study suggested that feeding phytogetic feed additives tends to improve the growth performance of the broilers and FCR.</p>

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## Antibiyotiğe Alternatif Olarak Fitojenik Yem Katkı Maddelerinin Broiler Performansı ve Karkas Özelliklerine Etkisi

MAKALE BİLGİSİ	ÖZ
<p><i>Araştırma Makalesi</i></p> <p>Geliş : 27/11/2019 Kabul : 11/12/2019</p> <p><b>Anahtar Kelimeler:</b> Fitojenik yem katkıları Avilamisin yem katkıları Yem katkı maddeleri Piliç performansı Karkas özellikleri</p>	<p>Bu çalışma, fitojenik yem katkı maddelerinin doğal yem takviyesi olarak avilamisin yem katkı maddesine alternatif olarak, piliçlerin performans ve çeşitli karkas özelliklerine etkisini belirlemek amacıyla yapılmıştır. Bu amaçla fitojenik yem katkı maddelerinin ve avilamisin yem katkı maddelerinin, canlı vücut ağırlığı (CA), vücut ağırlığı artışı (CAA), yem alımı (YT), yem dönüşüm oranı (YDO), karkas ağırlığı (KAG), broiler tavuklarının karın yağları (KY) ve karaciğer ağırlıkları (KA) değerleri kayıt edilmiştir. Toplam 252 piliç piliç (ROSS 308) seçilmiş ve tamamen rasgele dağılım temel alınarak 7 muamele ve 3 tekrerrür olacak şekilde gruplandırılmıştır. Denemede 3 günlük civcivler, 42 gün boyunca su ve karma olarak yedirilmiştir. Her tekrerrür gurubunda 12 adet civciv bulunacak şekilde alt gruplar oluşturulmuştur. Her bir gruba, yem katkı maddesi olarak; %0,10, %0,15 ve %0,20 ya fitojenik yem katkı maddeleri ve avilamisin verilmekle birlikte control grubunda ne fitojenik yem katkı maddeleri ne de avilamisin verilmemiştir. CA, CAA, YDO ve YT verileri, Varyans Analizi kullanılarak istatistiksel olarak analiz edildi ve İstatistiksel Analiz Sistem Programlarında çoklu aralık testi kullanılarak karşılaştırıldı. T6 fitojenik yem katkı maddelerine (PFA) karşı CA, CAA, YT, YDO, KAG, KY, KA ve diğer gruplardaki piliçler için anlamlı olarak daha yüksek olmuştur. Bununla birlikte, karkas ağırlığı, karkas verimi ve karın yağları üzerinde istatistiksel olarak önemli bir etki bulunmamıştır. Bu çalışmanın sonunda fitojenik yem katkı maddelerinin performans değerlerini iyileştirme eğiliminde olduğu gözlemlenmiştir.</p>

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## Introduction

Feed additives are ingredients added to animal rations, feed or water to improve feed quality, promote growth, breakdown anti-nutritive factors, absorb toxins, improve nutrient lacks, effect animal production, performance or welfare, act coccidiostatic or histomonostatic and to decrease energy-wasteful processes containing the production of methane in the rumen (Regulation EC 1831/2003). During the years, medical herbs, and phytogetic compounds have fascinated a lot of consideration for their important role as alternatives to antibiotic growth promoters (AGPs) in animals. AGPs have been an essential part of the poultry for more than fifty years (Alloi et al., 2014). However, AGPs alternatives have been searched since antibiotics sustained use has caused the progress of resistant strains within groups of main pathogenic or principled bacteria and the break of the symbiosis between animals and necessary flora. Similarly, in poultry phytogetic compounds were discovered to decrease bacterial colony amounts, lesser gut fermentation, decrease the action of the gut associated lymphatic structure and endorse intestinal mucus (Windisch et al., 2008). These compounds have displayed some important special effects (antimicrobial, antioxidant and regulator of the gut flora) in poultry feeding. This indicates that medical plants can be considered as feed additive (Cabuk et al., 2006).

According to European Commission (2003), PFA are considered as sensory and flavoring feed additive, which involve mainly of medical plant extracts (essential oils, oleoresins, and flavonoids) and their energetic values (Mountzouris et al., 2011). Thyme adding to basal rations at the level of 0.1-0.5% have given an improvement in feed conversion ratio in layer hens (Banerjee et al., 2013; Alkalabi and Al-Kassie, 2013). Phytogetic growth promoter can be used as a potent replacer of antibiotic growth promoter if used at an optimum level. For examples, peppermint and basil leaves contains numerous plant derived chemical compounds that health benefiting essential oils such as eugenol, citronellol, linalool, citral, limonene, and terpineol (Gürbüz and Salih, 2017; Brenes and Roura, 2010); Khodambashi et al. 2012). Medical plants as sumac and ginger had some beneficial effects on productive performance of Hubbard broiler diets (Abdelaziz, 2015; Gürbüz and Salih, 2017). Lippens et al. (2005) stated that the efficiency of a mixture of cinnamon, oregano, thyme, cayenne pepper, citrus extracts and of another mixture of plant extracts and organic acids in comparison with the avilamycin in broiler rations. The added with medical plant group of animals reached a greater body weight than the other groups. Feed conversion ratio in animals of the medical plant group (0.4% lesser than the avilamycin group and 2.9% lower than the organic acids group. Mountzouris et al. (2011) explained that the result of three addition levels of (PFA) comprising a mixture of (OE) from oregano, anise and citrus on broiler performance, nutrient digestibility. Commonly, in situation with the total diet, this work approves the significance of evaluating phytogetic feed addition levels for improving significance in broilers. Ganguly, (2013) reported that phytogetic feed additives are generally well-defined as plant-derivative compounds combined into rations to

advance the productivity of livestock through amelioration of feed properties, promotion of the individual production performance, and improving the quality of food derived from those animals. Puvača, (2013) determined that phytogetic additives in animal nutrition have attracted attention for their potential role as alternatives to antibiotic growth promoters. However amount of research data support a potential role of phytogetic additives as natural, non-antibiotic growth promoters in broiler nutrition. The mechanisms behind growth promotion are far from being elucidated, as data on phytogetic additive effects on nutrient digestibility, gut function, and the immune system are still scarce. Phytogetic intake may certainly depress pathogen growth in the gut. There is an insufficient amount of studies describing the effects of phytogetic additive dietary intake on carcass meat safety, whereas the beneficial effect of phytogetic on carcass meat quality is very well documented. The objective of this study was to evaluate the efficacy different levels of PFA as an alternative to AGP in broiler production by determining their effects on growth performance and carcass characteristic.

## Material and Methods

This experiment was carried out in a field for poultry farm. The experiment was affiliated to the Kahramanmaraş Sutcu Imam University (Agriculture Faculty, Animal Science Department). An experiment of 42 days duration was conducted using a total of 252-day-old Ross 308 broiler chicks, which were randomly assigned to one of three dietary groups at the start of experiment. The 7 groups consisted of 3 replicate pens of 12 chicks, each resulting in 36 birds per group. The feeds to be used in the experiment were produced in a feed factory in Kahramanmaraş-TURKEY. The chicks for the first three days were feed on standard diet after that were feed on two 3-42 day-old and ingredients of these rations were shown in Tables 1. A phytogetic feed additive (PFA) contains a blend of essential oils from oregano, anise and citrus on broiler growth performance and Treatment (AFA) were used as a positive control due to the well-known function of avilamycin feed additives as growth promoter in poultry.

A total of 252 one-day-old chicks were fed using starter diet. after that broiler chicks were randomly distributed into seven treatments (252 chicks) each treatment in the same weight non-significant between groups. Each treatment divided into three replications each replication contains (12 chicks). BWG( Body weight gain) and LBW( live body weight): At Three day old and at the end of each week, digital scales weighted birds for live body weight and body weight gain was calculated by using this equation: Live weight gain (g) = LBW at the end of the week- LBW at the beginning of the week. FI (Feed Intake) and FCR (Feed conversion ratio): Feed intake in each pen or replicate was recorded and measured weekly and feed conversion ratio was calculated Feed conversion ratio= FI during a period/body weight gain during the same period. In the last week, for determination of carcass yield, carcass weight, abdominal and liver eight that chickens were recorded corpse weight were butchered by cutting the

throat and jugular vein utilizing a sharp blade close to the principal vertebra. From each imitate 3 chicken (every treatment 12 chicken) were picked for gutting to compute the body weight without head, feet, digestive system, feet and the palatable giblets. Two chicken' creatures were haphazardly chosen from each enclosure and independently weighed. The winged creatures were butchered and gutted by hand (Gurbuz and Ismail, 2006).

The cadavers were additionally handled by evacuation of the stomach fat and by part into remains at the last day. The data were subjected to analysis of variance procedures appropriate for a completely randomized design using the General Linear Model procedures of SAS (2000). Means were compared using Tukey test. Statements of statistical significance are based on  $P < 0.05$ .

Table 1. Ingredients and chemical composition of the experimental diets

Ingredient	T1	T2	T3	T4	T5	T6	T7
Maize	562.3	571.3	575.8	580.3	571.3	575.8	580.3
Soyabean meal (48% CP)	161.5	161.5	161.5	161.5	161.5	161.5	161.5
Full fat soyabean meal	124.5	124.5	124.5	124.5	124.5	124.5	124.5
Maize gluten	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Sunflower meal (39% CP)	51.6	51.6	51.6	51.6	51.6	51.6	51.6
Vegetable oil (Soyabean oil)	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Dicalcium phosphate	12.7	12.7	12.7	12.7	12.7	12.7	12.7
Ground limestone	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Salt	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Vitamin premix*	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Mineral premix**	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DL-methionine	1.7	1.7	1.7	1.7	1.7	1.7	1.7
L-lysine	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Phytogenic FA	0.0	0.0	0.0	0.0	1.0	1.5	2.0
Avilamycin FA	0.0	1.0	1.5	2.0	0.0	0.0	0.0
Total	1000	1000	1000	1000	1000	1000	1000
Chemical composition (Calculated) (g/kg)							
Dry matter	906.3	906.3	906.3	906.3	906.3	906.3	906.3
Crude protein (CP)	208.6	208.04	208.02	208.0	208.04	208.02	208.0
Ether extract	62.3	62.3	62.3	62.3	62.3	62.3	62.3
Crude fiber	39.1	39.1	39.1	39.1	39.139.1	39.1	39.1
Crude ash	55.4	55.4	55.4	55.4	55.4	55.4	55.4
Starch	358.3	358.3	358.3	358.3	358.3	358.3	358.3
Sugar	46.1	46.1	46.1	46.1	46.1	46.1	46.1
Total calcium	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Total phosphorus	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Lysine	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Met. + Cys	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Available phosphorus	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Metabolizable energy (MJ/kg)	12.66	12.77	12.89	12.92	12.77	12.89	12.92

T1= Cont.(0.0%), T2= AFA (0.1%), T3= AFA 0.15%), T4= AFA (0.2%), T5= PFA (0.1%), T6= PFA (0.15%) and T7= PFA (0.2%), \* Vitamin premix (/kg diet): vitamin D3: 1500 IU; Vitamin A : 12000 IU; vitamin E : 30 mg; vitamin K3 : 5 mg; vitamin B1 : 3 mg; vitamin B2 : 6 mg; vitamin B6 : 5 mg; vitamin B12 : 0.03 mg; nicotine amid : 40 mg; D-biotin : 0.075 mg; choline chloride : 375 mg; Calcium-D pantothenate :10 mg; folic acid : 0.75 mg; antioxidant : 10 mg., \*\* Mineral premix (mg/kg diet): Fe: 80 mg; Mn: 80 mg ; Cu: 8 mg; Zn: 60 mg; Co: 0.2 mg; I: 0.5 mg ; Se: 0.15 mg

## Results and Discussion

The different level of PFA and AFA had significant ( $P \leq 0.05$ ) effect in LBW, BWG, FI and FCR. At the totally broiler on T1 and T2 and T5 achieved highly significant ( $P \leq 0.05$ ) increase on LBW as compared with other treatments. But, there were non-significant differences between T1 and T2 and T5, T3 and T4 and T6 and T7, T2 and T3 and T5 and T6 and T7 at the totally of LBW. At the treatments T1 and T5 showed significant ( $p \leq 0.05$ ) increases in LBW as compared with other treatments. However there was non-significant effect if compare between T1 and T2 and T5, T3 and T4 and T6 and T7, T2 and T3 and T5 and T6 and T7, but T4 which give lowest LBW at the totally broiler performance. At the totally broiler on T1 and T2 achieved highly significant ( $P \leq 0.05$ ) increase on FI as compared with other treatments. There

were non-significant differences between T1 and T2 and T3 and T5 and T6 and T7, T2 and T3 and T4 and T5 and T6 and T7 at the totally of FI. At the treatments T1 and T2 showed significant ( $P \leq 0.05$ ) increases in FI as compared with other treatments, but there was non-significant effect if compare between T1 and T2 and T3 and T5 and T6 and T7, T2 and T3 and T4 and T5 and T6 and T7, but T4 which give lowest FI at the totally broiler performance. At the totally broiler on T6 and T7 achieved highly significant ( $P \leq 0.05$ ) increase on FCR as compared with other treatments. There was non-significant difference in experiment. Table 2 refers to different level of PFA and AFA had there were non-significant effect in carcass weight and abdominal fat and carcass yield at the final day of age. There were non-significant differences between T1

and T2 and T3 and T5, T4 and T6 and T7, T2 and T3 and T5 of liver weight. At the treatments T5 showed significant ( $P<0.05$ ) increases in liver weight as compared with other treatments, but there was non-significant effect if compare

between T1 and T5 and T7, T2 and T3 and T4, T1 and T5 and T6 and T7, but T2 which give lowest liver weight of age.

Table 2. Effect of different levels of PFA and AFA on broiler performance and carcass characteristic

Grp	LBW (g)	BWG (g)	FI (g)	FCR
	X±SE	X±SE	X±SE	X±SE
T1	2722.39±16.276 <sup>c</sup>	2544.89±14.825 <sup>c</sup>	4312.00±2.081 <sup>ab</sup>	1.69±0.014 <sup>a</sup>
T2	2809.92±32.768 <sup>b</sup>	2636.18±33.575 <sup>b</sup>	4284.67±35.843 <sup>b</sup>	1.63±0.030 <sup>b</sup>
T3	2773.62±9.152 <sup>bc</sup>	2597.42±7.868 <sup>bc</sup>	4344.67±4.630 <sup>a</sup>	1.67±0.005 <sup>ab</sup>
T4	2743.47±23.083 <sup>c</sup>	2566.87±22.950 <sup>c</sup>	4329.33±3.666 <sup>ab</sup>	1.68±0.017 <sup>a</sup>
T5	2873.83±4.842 <sup>a</sup>	2645.09±16.823 <sup>ab</sup>	4381.00±2.081 <sup>a</sup>	1.66±0.010 <sup>ab</sup>
T6	2890.11±2.327 <sup>a</sup>	2660.84±2.819 <sup>a</sup>	4327.00±1.000 <sup>ab</sup>	1.63±0.000 <sup>b</sup>
T7	2873.04±4.063 <sup>a</sup>	2640.67±4.942 <sup>ab</sup>	4370.00±2.645 <sup>a</sup>	1.65±0.006 <sup>ab</sup>
P	0.030	0.034	0.032	0.048
Grp	Carcass weight (g)	Carcass yield (%)	Abdominal Fat(g)	Liver weight(g)
	X±SE	X±SE	X±SE	X±SE
T1	1898.13±2.030	70.92±0.292 <sup>ab</sup>	25.50±0.134	49.62±0.396
T2	1892.61±5.396	71.080±.554 <sup>ab</sup>	24.99±0.128	50.28±0.265
T3	1912.86±10.170	71.4±50.961 <sup>ab</sup>	25.56±0.231	50.62±0.220
T4	1911.08±20.858	70.11±0.049 <sup>b</sup>	25.13±0.148	49.94±0.511
T5	1928.38±20.090	71.07±0.293 <sup>ab</sup>	26.94±0.328	53.44±2.421
T6	1959.38±41.625	72.43±0.759 <sup>a</sup>	27.79±0.338	54.58±2.595
T7	1936.20±18.107	70.57±0.367 <sup>b</sup>	26.46±0.445	54.40±2.279
P	0.065	0.048	0.076	0.290

T1= Cont.(0.0%), T2= AFA (0.1%), T3= AFA 0.15%), T4= AFA (0.2%), T5= PFA (0.1%), T6= PFA (0.15%) and T7= PFA (0.2%), a,b,c,d Means within columns with different superscripts differ significantly at ( $P<0.05$ )

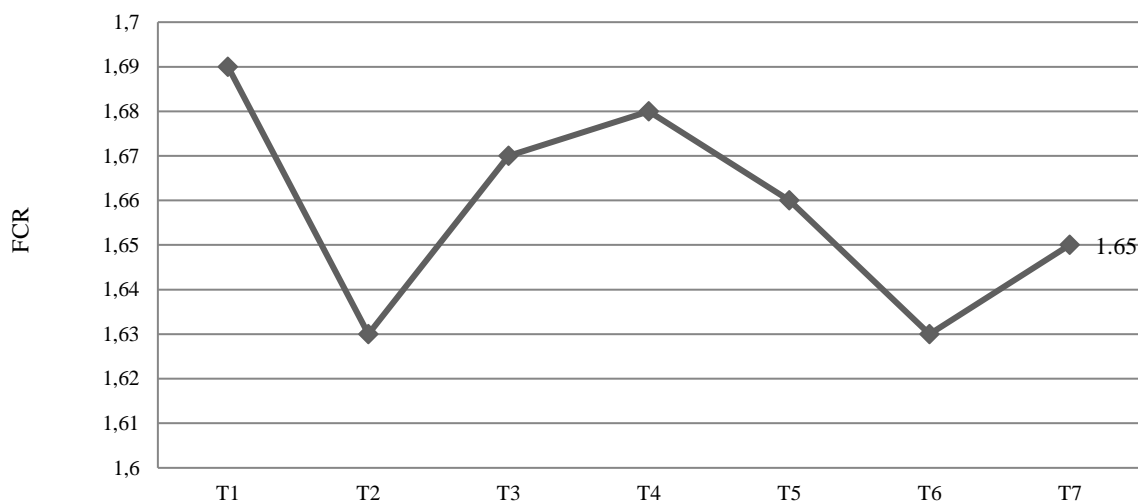


Figure 1. Results of Feed Conversion Ratio in different levels of PFA and AFA on Broiler Nutrition  
T1= Cont.(0.0%), T2= AFA (0.1%), T3= AFA 0.15%), T4= AFA (0.2%), T5= PFA (0.1%), T6= PFA (0.15%) and T7= PFA (0.2%)

The results of the present experiment were also in the mark of, who established unimportant result of supplementation of peppermint on broiler body weight, but with developing performance compared to the control group. Similar outcomes were stated by (Demir et al., 2008) about the influence of spearmint on broiler body weight. Gurbuz and Ismail (2013) displayed the effect of spearmint on FCR which was found to be unimportant in the first five weeks of age, but it is meaningfully affected by supplementation of spearmint in the sixth week. These results were in arrangement with the results of (Lee and Ahn (1998); Lee et al. (1998) defined an growth in relative liver weight for birds assumed thymol, but this was realized

only at the age of 21 d and not at 40 days that managed growths of body weight. The leaves of peppermint similarly hold many significant B-complex vitamins like folates, riboflavin and pyridoxine and the herbs are an tremendous source of Vitamin-K. A important role in maintaining epithelial lining membrane of the organs and systems then increase their helpfulness (Hencken, 1992), thus improving the feed intake (Figure 1), FCR, body weight and body weight gain, also medical herb because of their high fiber content which led to decrease the speed passageway of food into the gastro-intestinal tract and thereby rise the rate of digestion and absorption of feed (Naji and Kabro, 1999).

Generally, an improvement in feed conservation ratio in broilers when feeding phytochemicals has been demonstrated in the popular of the studies lately reported by Brenes and Roura (2010), who concluded that in most experiments the progress in FCR derives as a result of a reduced FI at a generally affected BWG. In this study, the improved feed conservation ratio in overall experiment was accompanied both statistically different of FI and BWG with PFA supplemented level (Table 2 and Figure 1). PFA supplement in treatments T5, T6 and T7 at 0.10 %, 0.15 % and 0.20 % ration, respectively, resulted in a significantly ( $P < 0.05$ ) improved feed conservation ratio a least ratio compared to the un-supplemented control treatment (T1). In addition, the improvements were of similar degree to the ones determined for treatment (T2, T3 and T4) containing avilamycin, known as a acknowledged feed additive in broiler rations.

The supplementation of maize–soybean meal or wheat–barley–soybean meal broiler rations with 100 mg/kg of an extract blend containing carvacrol, cinnamaldehyde and capsicum oleoresin considerably developed FCR by 4.2% in the maize ration and 2% in the wheat and barley ration. Developments both in BWG and in FCR have been reported in the literature as for example, when oregano EO was incorporated at 300 mg/kg of a wheat–soybean meal basal ration fed to chicks diseased with *Eimeria tenella*, compared to the infected non-supplemented controls. Also, anise oil supplementation of broiler basal rations at 400 mg/kg, resulted in a significant development in BWG and FCR during the trial compared to the control managements. Usually, in studies where a useful phytochemical effect on broiler growth performance was displayed, an age reliant on effect could be distinguished in some cases. However, other experiments have not confirmed important effects of phytochemicals on overall broiler performance. For example, no beneficial effects for growth performance were seen when oregano EO was added at 50 and 100 mg/kg of a wheat–soybean meal basal diet (Botsoglou et al., 2002) or when thymol, cinnamaldehyde and a commercial phytochemical feed additive were involved at 100 mg/kg of a maize–soybean meal basal diet (Lee et al., 2003) or when wheat–maize–soybean meal basal diets were added with two commercial three part mix phytochemicals at 200 mg/kg and 5000 mg/kg stages (Hernandez et al., 2004). For example, depending on the training and the phytochemical additive differences in performance parameters have been reported after the first week of age, then 14 d of age the period 14–21 d and 28–35 d (Hernandez et al., 2004), among the age of 21–41 d and the period 3–42 d in this study. It is understood from this above results that the age of the animal, the content of additives and the amount of these additives have an important place in the use of these additives.

## Conclusions

These results show that PFAs can develop nutrient digestibility and helpfully modulate the intestinal microbial ecosystems. PFA are capable of helping intestinal health and gut performance. It can be determined that phytochemical feed additive can be used as natural nonantibiotic growth promoters, which is established from medical herbs, spices, essential oils and oleoresins. Phytochemical feed additives have antioxidative,

antimicrobial, growth promoting and immune system special effects in broiler feeding. In this study; phytochemical addition at 0.10 % for this purpose in ration resulted in an improved overall feed conservation ratio that was comparable to that of avilamycin used as a feed additive.

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