ASSESSMENT OF DIETARY SUPPLEMENTATION OF TURMERIC *(CURCUMA LONGA)* AS A PHYTOBIOTIC ON BROILER PERFORMANCE AND BACTERIAL COUNT

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SUMMARY

A total numbers of 240 unsexed day old Cobb chicks were allocated randomly to four dietary treatments each with three replicates of 20 chicks/replicate, assigning experimental unit to evaluate the impact of different levels of turmeric (Curcuma longa) as a phytobiotic on the performance and bacterial count of broilers. Four experimental diets included (T1) a basal diet without turmeric addition (control), (T2) a basal diet with 0.25% turmeric, (T3) a basal diet with 0.5% turmeric and (T4) basal diet with1% turmeric. The feeding trail was conducted for 42 days. Body weight, weight gain, some carcass characteristics, and bacterial count were recorded. Feed intake and feed conversion ratio were calculated. Results showed that final body weight and weight gain were significantly ($P<0.05$) increased in birds fed diet supplemented with different levels of turmeric powder as compared to the control group. Birds fed diet supplemented with 0.25 or 0.5% turmeric powder recorded significantly ($P<0.05$) improvement in feed conversion ratio, carcass, heart, thymus and spleen percentages as compared to the control group. On the other hand, there were significant ($P<0.05$) decreases in liver, gizzard and total giblets percentages of birds supplemented with dietary turmeric powder at all levels as compared to the control group. No significant ($P>0.05$) differences were detected in feed consumption, dressing and bursa of fabricius percentages between dietary treatments. Total bacterial count was significantly ($P<0.05$) lowest for all supplemented groups as compared to the control. Whereas, coliform group, fecal *E. coli*, *Staphylococcus aureus*, *Salmonella* sp., *Shigella* sp., and *Listeria* sp. count were significantly ($P<0.05$) decreased for all supplemented groups as compared to the control. Total lactic acid bacteria count was significantly ($P<0.05$) increased for all supplemented groups as compared to the control. It could be concluded that, adding turmeric powder supplementation to broiler diet as a growth promoter, at level of 5 g/kg diet recorded superior effects on their productive performance and bacterial count.

Keywords: *Turmeric, broiler, performance, bacterial count.*

INTRODUCTION

For many years, a variety of synthetic feed additives such as drugs and antibiotics were used as growth promoters in livestock and poultry nutrition to improve the efficiency of production, product quality, modify the gut microflora and to control diseases in broiler chickens (Bedford, 2000 and Whitehead, 2002).

Antimicrobial agents usually associated with adverse effects on the host like, development of antibiotic–resistant bacteria (Barton 1998). Due to these concern, in the modern era and over the several last years, much researches around the world had been focused on the development of alternative strategies to maintain poultry health and enhance performance within intensive systems, and numerous substances, commonly known as natural growth promoters (NGPs) have been identified as effective alternatives to antibiotics (Farag and El-Rayes, 2016). Also, many researchers have evaluated an effective antimicrobial compounds from alternative and natural sources like plants and herbs, which

benefits the health of digestive tract (Patterson and Burkholder, 2003; Stephen and Hargreaves, 2007 and Al-Mashhadani, 2015).

Phytobiotics represent a wide range of bioactive compounds that can be extracted from various plant sources. Many medicinal plants can be used as potential phytobiotic compounds to improve productive performance and modify the gut microflora in broiler chickens. (Bedford, 2000 and Wenk, 2003). Bioactive phytobiotic compounds led to beneficial effects in animal nutrition, it may be due to the stimulation of feed consumption, improving the secretion of endogenous digestive enzyme, enhancing of immune response and antimicrobial and antioxidant actions (Toghyani *et al*., 2010, 2011).

Turmeric (*Curcuma longa*) is one of herbaceous plant that belongs to the Zingiberaeceae family. It has a wide range of bioactive compounds that can be extracted from it such: curcumin, dimethoxycurcumin, bisdomethoxycurcumin, (Wuthi-Udomlert *et al*., 2000) and tetrahydrocurcuminoids (Osawa *et al*., 1995). So, it has antimicrobial, antioxidant and other useful properties. Also, it has been used in the old ages as a flavoring agent, a medicinal herb, and a dyeing agent (Iqbal *et al.*, 2003 and Chaturvedi, 2009). Moreover, Curcumin has been studied as an anti-inflammatory (Holt *et al.*, 2005), a chemo preventive agent (Duvoix *et al.*, 2005). It is used in gastrointestinal and respiratory disorders (Anwarul *et al.*, 2006). In addition, Soni *et al.*, (1997) reported the protective effects of turmeric in the prevention of aflatoxin-induced mutagenicity and hepatocarcinogenicity.

Many researchers evaluated the effects of dietary turmeric supplementation on broiler performance. Also, Various studies have shown the antimicrobial effects of extracts of roots of *Curcuma longa* on various microorganisms like *Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecalis, Escherichia coli, Klebsiella pneumonia, Candida albicans, and Candida kruseii* (Rambir *et al*., 2002; Niamsa and Sittiwet, 2009; Kang-Ju Kim *et al*., 2005 and Park *et al.*, 2005); however, the results have not been consistent. The current study was conducted to shed more light on the effect of different levels of turmeric powder as feed additive on productive performance, carcass characteristics and intestinal microflora of broiler chick.

MATERIALS AND METHODS

This experiment was carried out at a private commercial poultry farm under supervision of Animal Production Department, Faculty of Agriculture, Tanta University.

Birds and management:

A total number of 240 unsexed one-day-old Cobb broiler chicks were individually weighed and randomly distributed into four equal groups, each included three replicates of 20 chicks. Four experimental diets included (T1) a basal diet without turmeric addition (control), (T2) a basal diet with turmeric at the level of 0.25%, (T3) a basal diet with turmeric at the level of 0.5%, (T4) a basal diet with turmeric at the level of 1%. The experimental diets were formulated to cover all nutrient requirements of broiler chicks according to (NRC, 1994). The composition and calculated analysis of the basal diet are presented in Table 1. The response of the chicks was assessed in terms of weekly body weight, weight gain, feed intake and feed conversion ratio. At 42 days of age, three birds from each treatment were sacrificed, scalded, de-feathered and carcasses were eviscerated and evaluated.

Bacterial enumeration:

Ten grams of the ileal digesta were weighed in a sterile stomacher bag, and then 90 ml from maximum recovery diluents was added to the sample, the sample was well mixed using stomacher machine. Further serial dilution was done (if needed) by a mean of a 1 ml pipette transferred into two petri dishes, and then the media were poured.

Appropriate dilutions prepared from ileal digesta sample were used for inoculating different nutrient and selective media. The bacteriological examinations of ileal digesta samples included total bacterial counts, *total coliform, fecal coliform, Salmonella spp*., total lactic acid bacteria and *Shigella spp*, total *listeria* sp. and total *staphylococcus* ssp. The identification and enumeration procedures were carried out in the Department of Microbiology, Faculty of Agriculture, Ain Shams University, as described below.

Table (1): Composition and calculated analyses of the experimental diets

Ingredients	Starter	Finisher
Yellow corn	50.48	63.60
Soybean meal (44%)	32.65	26.90
Corn gluten meal (62%)	7.00	1.23
Vegetable Oil	6.00	4.86
Ground limestone	1.45	1.20
DI-Calcium Phosphate	1.69	1.41
NaCl	0.30	0.30
Permix*	0.30	0.30
DL-methionine	0.10	0.10
L-Lysine HCl	0.03	0.10
Total	100	100
Calculated analysis**		
Crud protein, %	23.00	18.03
Metabolizable energy (K cal/kg)	3200	3200
Ether extract (EE %).	2.40	2.66
Crude fiber (CF %)	3.50	3.30
Calcium	1.03	0.86
Available phosphorus, %	0.45	0.39
Lysine, %	1.11	0.90
Methionine	0.50	0.40

** Each 3 kg of premix contained: vit. A 12000 IU, vit. D 2200IU, vit. E 10 mg, vit. K3 2000 mg, vit. B1 1000 mg, vit. B2 5000 mg, vit. B6 1500 mg, vit. B12 10 mg, pantothenic acid 10 mg, niacin 30 mg, folic acid 1000 mg, biotin 50 mg, choline chloride 300 mg, manganese 60 mg, zinc 50 mg, copper 10 mg, Iron 30 mg, Iodine 1000 mg, selenium 100 mg, cobalt 100 mg and CaCo3 to 3 g ** According to NRC. 1994.*

Counts of total bacteria:

Enumeration of total plate count was carried out according to ISO 4833 (2003). Ten-fold serial dilution of the bacterial suspension was made. This was done until 10^{-7} dilution was achieved. Then 0.1 ml was pipetted from the 10^{-7} dilution onto the surface of each of two Petri dishes containing 15 ml of a solidified and sterile plate count agar (PCA), and then spread evenly with a sterile glass spreader. The plates were then incubated for a maximum of 24-72 hrs. at 30°C (including the control plates).

Counts of total lactic acid bacteria:

Total lactic acid bacteria were enumerated on MRS Agar (Difco) by serial dilutions (10^{-5} and 10^{-7}). Plates were incubated in an aerobic condition by using pouring plate technique at 37°C for 24-72 hours.

Counts of total coliforms and faecal coliform:

Total coliforms and fecal coliform were estimated on a MaConkey agar (Eaton *et al*., 1995) using pouring plate technique by serial dilution (10^{-3} and 10^{-4}). Plates were incubated aerobically at 37ºC for total coliforms or 44.5 ºC for fecal coliform for 24-48 hours for coliform and fecal coliform, respectively.

Counts of *Salmonella spp*:

Detection of salmonella was carried out according to modified ISO 6579 (2002). Twenty-five grams of the ileal sample were weighed in a sterile stomacher bag or flask, and then 225 ml of buffer peptone water was added, then 1ml was plated onto XLD plates and incubated at 37 ºC for 24-48 hrs. Typical colonies of Salmonella in XLD were red with black centre. Biochemical reaction (triple sugar iron agar, lysine iron agar, citrate agar and urea agar) was used for confirmation of Salmonella typical colonies.

Data were subjected to the analysis of variance by using the General Linear Models (GLM) Procedure of the Statistical Analysis System (SPSS, version, 18.0; 2010), according to the following model: $Y_{ij} = \mu + T_i + e_{ij}$. Where: Y_{ij} = observation. μ = overall mean. T_i = a fixed effect of treatment. e_{ijk} = experimental error.

Differences among treatment means were detected using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Data presented in Tables (2 and 3) showed the influence of turmeric supplementation at different levels (0, 0.25, 0.5, and 1 %) on productive performance of broiler chicks during all experimental periods. Data revealed that, live body weight values at 21 days of age were not affected (p>0.05) by turmeric supplementation levels. Hence, at 42 days of age, birds fed dietary 0.5% turmeric recorded significantly (P≤0.05) increased in body weight by 7.77% compared to control. During the starter period, weight gain was not influenced (P>0.05) by turmeric supplementation at all levels. Even though, weight gain of broiler chicks fed dietary 0.5% dietary turmeric significantly (P≤0.5) increased by 7.89 and 7.89% as compared to the control group during finisher and the entire experimental period, respectively.

Table (2): Average body weight of broiler chicks as affected by turmeric supplementation levels.

Final BW at 42 day (g)	BW at 21 day (g) (g)	Initial BW	Turmeric levels %
2373.8[b]	796.5	41.7	Control (T1)
2470.3[ab]	828.5	42.1	0.25 % (T2)
2558.2[a]	837.3	42.2	0.50 % (T3)
2431.2[ab]	804.5	41.9	1.00 % (T4)
±51.07	±14.24	±0.6	SEM
*	NS	NS	Significant

a and b: Means of each column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test. SEM indicate standard error of means
*NS indicate not significant. * indicate P<0.05*

Table (3): Average body weight gains (BG), feed consumption (FC), feed conversion ratio (FCR) of broiler chicks as affected by turmeric supplementation levels.

Turmeric levels %	Starter Period From 0 – 21 days of age			Finisher Period From 21– 42 days of age			Total Period From 0 – 42 days of age		
	WG	FC	FCR	WG	FC	FCR	WG	FC	FCR
1.98[a]	4626.5	2332.1[b]	2.28[a]	3602	1577.3[b]	1.36	1024.5	754.8	Control (T1)
1.89[ab]	4591.5	2428.2[ab]	2.16[ab]	3549.5	1641.8[ab]	1.33	1042	786.4	0.25 % (T2)
1.83[b]	4617	2516[a]	2.10[b]	3620.5	1720.9[a]	1.31	1045.5	795.1	0.50 % (T3)
1.90[ab]	4546.5	2389.3[ab]	2.17[ab]	3523.5	1626.7[ab]	1.34	1023	762.6	1.00 % (T4)
±0.07	±26.87	67.4±	±0.13	±34.25	62.7±	±0.02	±5.25	±43.6	SEM
*	NS	*	*	NS	*	NS	NS	NS	Significant

Means of each column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test. SEM indicate standard error of means
** indicate P<0.05*

Adding turmeric to broiler chick diet did not significantly (P>0.05) affect on feed consumption during all experimental periods. Also, feed conversion ratio was not influenced (P>0.05) by turmeric additions during the starter period. On the other hand, FCR of broiler chicks fed 0.5% dietary turmeric significantly (P≤0.5) improved by 9.1 and 7.57% as compared to the control group during finisher and the entire experimental period, respectively. The significant improvement in productive performance of birds fed diet supplemented with 5.0 g/kg turmeric powder may be due to the ideal antioxidant activity which stimulates the synthesis of proteins from the bird's enzyme system. Also, it was stated that, turmeric would be possible to promote digestive enzyme and pancreatic lipase (Platel and Srinivasan, 2000). Additionally, Rajput *et al.,* (2012) cited that the inclusion of pure curcumin at level of 0.2% improved length and weight of the duodenum, jejunum and ceca villus of growing broiler chick. Moreover, turmeric could modify the gut microflora in broiler chickens resulting in balanced gut microbial ecosystem that leads to improvement of feed utilization represented in body weight and weight gain. The previous results are in agreement with findings of (Al-Sultan, 2003 and Durrani *et al*., 2006) who reported that turmeric meal supplementation at the rate of 0.5% improved growth performance of broiler chicken at 42 days of age. In addition, these results are compatible with those reported by Al-

Mashhadani, (2015), who found that final body weight and weight gain increased by increasing supplementation level of turmeric up to 4.0 g/kg.

The impact of turmeric supplementation levels (0, 0.25, 0.5, and 1 %) on some carcass characteristics and lymphoid organs weight of broiler chicks at the end of the experiment (42 days of age) are presented in Tables (4 and 5). Results showed that, the relative weight of gizzard, bursa of Fabricius and dressing percentage were not statistically (P>0.05) influenced by the dietary treatments. However, the inclusion of turmeric powder up to 0.25 % in broiler diet cause a significant (P≤0.5) increasing in relative heart, thymus and spleen weights by 12.77, 28.57 and 42.86% respectively, compared to control group. In the same trend, birds fed diet supplemented with 0.5% turmeric powder significant (P≤0.05) had the highly carcass percentage by 5.75% compared to control. On the other hand, birds fed control diet had the highest relative liver and giblets weight compared to the other groups. These results are compatible with findings of Durrani *et al*., (2006) and Nouzarian *et al*., (2011) they reported that, the inclusion of turmeric powder in broiler diets significantly caused a decrease in relative liver weight and increase in relative heart weight, accompanied by no differences in relative gizzard weight in comparison with control group

Table (4): Effect of turmeric supplementation levels on some carcass traits of broiler chicks.

%Giblets	%Gizzard	%Heart	% Liver	% Dressing	% Carcass	Turmeric levels %
5.22^{a}	2.24^{a}	0.47^{b}	2.51^{a}	77.23	72.01^{b}	Control (T1)
4.73^{b}	1.92^{b}	0.53^{a}	2.28^{ab}	78.12	73.39^{ab}	0.25 % (T2)
4.58^{b}	1.83^{b}	0.50^{ab}	2.24^{ab}	80.72	76.15^{a}	0.50 % (T3)
4.52^{b}	1.89^{b}	0.49^{ab}	2.14^{b}	77.20	72.68^{ab}	1.00 % (T4)
±0.12	±0.09	±0.02	±0.08	±1.19	±1.16	SEM
*	NS	*	*	NS	*	Significant

-Means of each column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test. SEM indicate standard error of means NS indicate not significant.

Table (5): Effect of turmeric supplementation levels on lymphoid organs weight of broiler chicks.

Turmeric levels %	%Thymus	%Bursa	% Spleen
Control (T1)	0.28^{b}	0.06	0.07^{b}
0.25 % (T2)	0.36^{a}	0.07	0.10^{a}
0.50 % (T3)	0.34^{ab}	0.06	0.09^{ab}
1.00 % (T4)	0.30^{ab}	0.06	0.08^{ab}
SEM	±0.02	±0.01	±0.01
Significant	*	NS	*

*Means of each column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test. SEM indicate standard error of means -NS indicate not significant. * indicate P<0.05*

The effect of different inclusion levels of turmeric (*curcuma longa*) on the intestinal microflora of chickens at the end of the experiment (42 days of age) are presented in Table (6) and Fig. (1and 2).

Means of total bacteria and pathogenic bacteria (*total coliform, fecal E. coli, Staphylococcus aureus, Salmonella sp., Shigella sp., and Listeria sp*.) counts were reduced in all supplemented groups (T2–T4) as compared to control group (T1). However, dietary supplementation of turmeric led to an increase in means of total lactic acid bacteria counts in all treatment groups (T2–T4) as compared to control group (T1). Results also showed that the intestinal microflora gradually increased or decreased with increasing turmeric concentration up till 1 %, being (T4) was the best treatment. The high concentration of turmeric (1%) increased the count of total lactic acid bacteria from 7.05 to 9.34 log $cfug^{-1}$ (1.13×10^{8} -2.21×10^{9} $cfug^{-1}$) and decreased each of total count, total coliform bacteria, fecal *E. coli, S. aureus and Listeria sp*. from 12.08:10.09, 7.99:5.51, 6.73:3.26, 6.53:3.30 and 6.94 :2.90 log $cfug^{-1}$.

Table (6): Influence of turmeric supplementation levels on microbiological counts (CFU g^{-1}) of broiler chicks.

Turmeric supplementation levels %				
1.00 % (T4)	0.50 % (T3)	0.25 % (T2)	Control (T1)	Microbial counts (CFU g-1)
$1.24x10^{10}$	$1.38x10^{11}$	$1.83x10^{11}$	$1.20x10^{12}$	Total bacterial count
$2.21x10^{9}$	$1.89x10^{9}$	$1.33x10^{8}$	$1.13x10^{8}$	Total lactic acid bacteria
$0.32x10^{6}$	$0.36x10^{7}$	$0.46x10^{7}$	$0.98x10^{8}$	Coliform group
$0.18x10^{3}$	$0.61x10^{5}$	$0.32x10^{6}$	$0.54x10^{7}$	Fecal *E. coli*
$0.20x10^{3}$	$0.30x10^{5}$	$0.45x10^{5}$	$0.34x10^{7}$	*Staphylococcus aureus*
0.00	$0.68x10^{3}$	$0.56x10^{6}$	$1.05x10^{6}$	*Salmonella* sp.
0.00	$0.43x10^{3}$	$0.78x10^{5}$	$0.94x10^{6}$	*Shigella* sp.
$0.08x10^{3}$	$0.18x10^{4}$	$0.50x10^{6}$	$0.88x10^{7}$	*Listeria* sp.

The regression equation between turmeric concentrations and mean counts of tested bacteria is illustrated by Fig. (1). Results indicated that the regression equation in case of lactic acid bacteria was proportional effect being Y=0.5027X + 7.4428, it might due to the high concentration of turmeric caused in log10. Whereas, the regression was disproportionate effect for another tested bacteria being Y= - 0.608X+12.664 of total bacteria, Y= - 0.754 X+8.565 of total coliform group, Y= -1.415 X + 8.3573 of fecal *E. coli*, Y= -1.8979X + 8.3953 of *Salmonella sp*., Y=-1.9178X + 8.4192 of *Shigella sp.*, Y= - 1.3568X + 8.3424 of *Listeria sp*. and Y= - 0.686X7 + 6.2076 of *Staphylococcus aureus*, respectively, it could be a rebutted to turmeric, with high concentration which decrease the bacterial counts in log10 . In case of *Salmonella spp*. and *Shigella spp.* counts, it was observed that the mean counts was decreased with increasing turmeric concentration which decreased up to 5.75& 4.89 log $cfug^{-1}$ (0.56×10^{5}&0.78×10^{6} $cfug^{-1}$) at 0.25 % of turmeric in T2 group, 3.83 &3.63, (0.68×10^{3} &0.43×10^{4} $cfug^{-1}$) at 0.5% turmeric in T3 group. While at 1% concentration of turmeric, both *Salmonella spp*. and *Shigella spp*. did not affect any growth on agar plates.

Results in Fig (2) showed the percentage inhibition of pathogenic bacteria at leading with turmeric with different concentrations (0.25, 0.5 and 1%). The effect of turmeric concentration were classified into three categories (strong, moderate and weak) according to percent inhibition which ranged from 4-25%, 30-50% and 51-100%,respectively. Results indicated that feeding with turmeric supplementation at 0.25and 0.5% had an effect ranged from low to moderate inhibition of pathogenic bacteria, while the effect of feeding with 1% turmeric was high inhibition of pathogenic bacteria as the percentage ranged from 51- 100%. Both *Salmonella spp.* and *Shigella spp*. were strongly inhibited at 100% with 1% of turmeric concentration as compared to inhibition at 0.25% (weak inhibition ranged from 4.49 to 18.09%) and 0.5% (moderate inhibition ranged from 36.38 – 39.20%), respectively. Also, addition of 1% turmeric as feed supplemented led to inhibit both fecal *E. coli* and *Listeria sp.* with high inhibition (51.56 and 58.20%) and coliform group with moderate inhibition (31.04%), respectively. These results are in agreement with Al-Mashhadani, (2015) who cited that turmeric has been shown to control and restrict the growth and colonization of many species of pathogenic and non-pathogenic bacteria in the chicken's gut resulting in balanced gut microbial ecosystem which improved feed utilization that reflected on body weight and weight gain. And that increase lactobacillus increasing lactobacillus count, accordingly, could be used as growth promoter. Lactobacillus count was significantly ($P<0.05$) highest for all supplemented groups as compared to the control. Also, Gupata *et al* . (2015) reported that, the ability of rhizome of *C. longa* extracts to inhibit the growth of tested pathogen is an indication of its broad spectrum antimicrobial potential that can be used to management of microbial infections.

Conclusion

So, it could be concluded that, dietary supplementation of turmeric (*Curcuma longa*) at 0.5 and 1.0% gave an enhancement of Lactic acid bacteria as well as a reduction of pathogenic bacteria in the intestine and improve productive performance of broiler chicken.

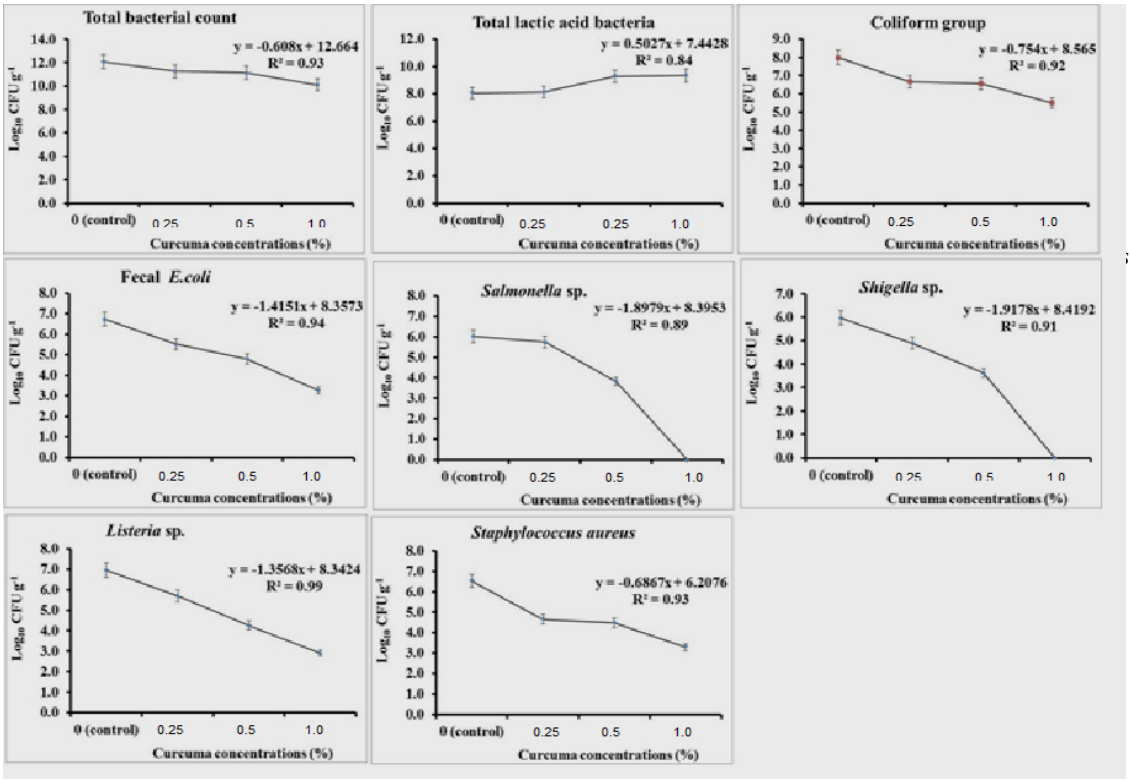

Fig. (1): Regression equation and determination coefficient (R2) between experimental groups and microbial counts in log10 CFU g^{-1}. Data are expressed as error bars with percentage 5% value

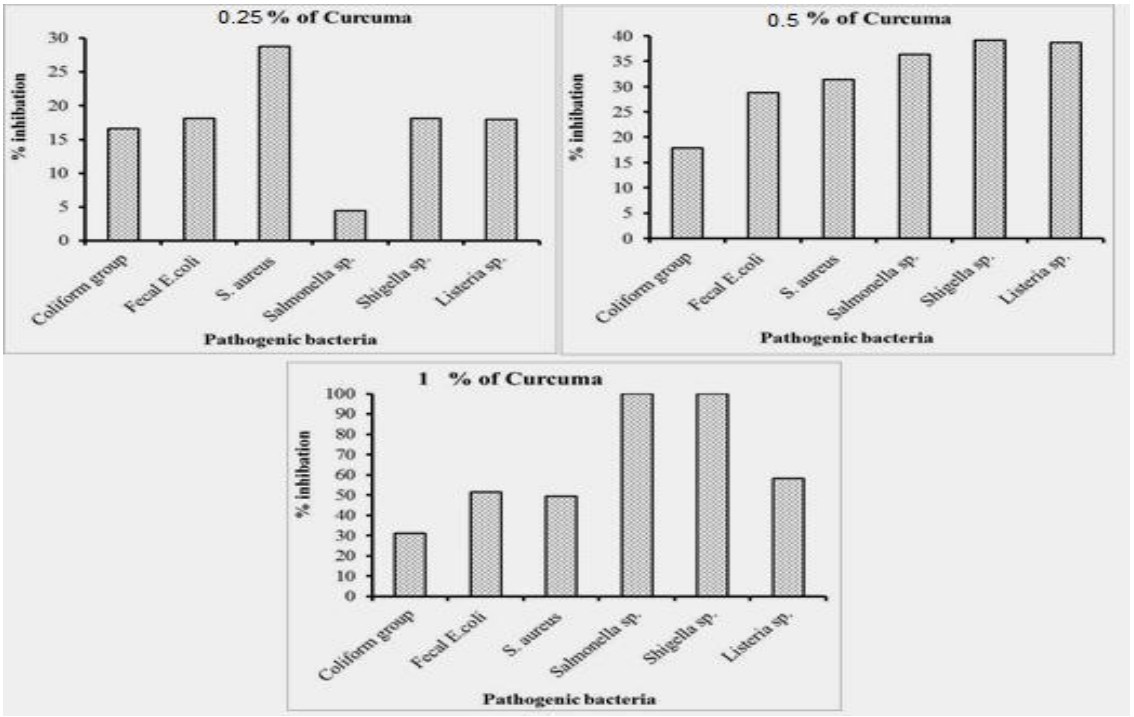

Fig. (2): % inhibition of pathogenic bacteria using three different concentrations of Curcuma longa (0.25, 0.5 and 1%).

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تقييم الإضافة العلفية من الكركم كداعمات نمو نباتيه علي الأداء الانتاجي والعدد الميكروبي لدجاج التسمين

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أجريت هذه الدراسة لتقييم وإلقاء مزيد من الضوء علي تأثير المستويات المختلفة من الكركم علي الأداء الإنتاجي والعدد الميكروبي لدجاج التسمين. أستخدم لهذه الدراسة ٢٤٠ كتكوت عمر يوم واحد غير مجنسه من سلالة الكب ، قسمت عشوائيا إلي ٤ مجموعات تجريبية بكل منها ٣ مكررات بكل مكرر ٢٠ كتكوت. استخدم ٤ علائق تجريبية حسب نسبة إضافة الكركم لكل منها T1 :وهي عليقة المقارنه التي تخلو من اي اضافات من الكركم ، T2مزودة بمعدل ٠.٢٥ ٪ مسحوق الكركم ، T3مزوده بمعدل ٠.٥ ٪ مسحوق الكركم ، T4مزوده بمعدل ١ ٪ مسحوق الكركم ، واستمرت التجربه حتي عمر ٤٢ يوم. وعلي مدار فترة التجربه تم قياس وزن الجسم الحي ، معدل الزياده في وزن الجسم ، معدل استهلاك العلف ، الكفاءة التحويلية ، خصائص الذبيحه ، العدد الميكروبي.

تشير النتائج الي حدوث زيادة معنوية ($P<0.05$)في وزن الجسم الحي ومعدل الزيادة في الوزن لكل المعاملات المضاف اليها مستويات مختلفة من مسحوق الكركم مقارنه بالمجموعة الضابطه ، وفي نفس الاتجاه حدث تحسن معنوي ($P<0.05$) في الكفاءة التحويلية والوزن النسبي لكلا من الذبيحة ، القلب ، الغدة التيموسية ، الطحال وذلك للطيور التي تغذت علي مستويات ٠.٢٥ أو ٠.٥ ٪ من الكركم مقارنه بالمجموعة الضابطة. علي الجانب الآخر حدث انخفاض معنوي ($P<0.05$) في الوزن النسبي لكلا من الكبد ، القانصه والأحشاء المأكوله للطيور المغذاه علي علائق مزوده بمستويات مختلفة من مسحوق الكركم ، بينما لم يكن هناك أي فروق معنويه بين المجموعات التجريبية بالنسبة لمعدل العلف المستهلك والوزن النسبي لغدة البرسا أو نسبة التصافي.

أما بالنسبه للعدد الميكروبي فقد حدث انخفاض معنوي لكل المجموعات المغذاه علي علائق مزوده بالكركم مقارنه بالمجموعة الضابطه ، حيث إنخفض معنويا ($P<0.05$) العدد الميكروبي للبكتريا المعويه الضارة مثل "السالمونيلا ، الشجيلا ، اللستريا ، الإشيرشيا القولونيه ، الاستافيلوكوكس اوريوس" . علي الجانب الأخر حدث زيادة معنويه ($P<0.05$) في العدد الميكروبي لبكتريا حامض اللاكتيك "اللاكتوباسيلس" وذلك في المجموعات المغذاه علي مستويات مختلفة من الكركم مقارنه بالمجموعات الضابطه.

ونخلص من هذه الدراسه بأن إضافة مسحوق الكركم لعلائق دجاج التسمين بمعدل ٥ جم/كجم عليقة تؤدي الي تحسن الأداء الانتاجي والعدد الميكروبي للبكتريا النافعة وتخفض من العدد الميكروبي للبكتريا الضارة بدون حدوث اي آثار سلبية علي الطيور.