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SUPPLEMENTING FRESH LEMON TO GROWING JAPANESE QUAIL DIET AS A SAFE ALTERNATIVE TO ANTIBIOTIC, SYNTHETIC VITAMINS AND PREBIOTIC UNDER HOT CLIMATE.

Youssef, S.F.[1]; Abdelatif, H. A[1]; Abdel-KafyE.M[1]; Hanan S. Mohamed[1]Heba badr[2];Manal S. Mohamed[1]; and H. A. H. Abd El-Halim[1]

[1]Anim. Prod. Res. Inst., Agric. Res. Center, Dokki, Giza, Egypt.

[2] Bacteri. unit, Ref. Lab. for Vet. Quality Cont. on Poult. Prod. - Anim. Health Res. Inst.Agric. Res. Center, Dokki, Giza, Egypt.

Corresponding author: Youssef, S.F Email: sabbah.farouk@arc.sci.eg

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ABSTRACT: this experiment was carried out to evaluate ability of inserting fresh lemon as a safe natural source in quail diet instead of antibiotic, synthetic vitamins and prebiotic under hot climate condition. A total 280 unsexed one- day- old Japanese quail were divided randomly into 7 groups. Each group consists of 4 replicates hold l0 chicks per each. The 1st treatment fed control basal diet from 1 day to 6wks of age. Treatment groups from 2 to 7 fed control diet supplemented with 0.5gm oxytetracycline (20%) /kg diet, 20 g entire grinded fresh lemon /kg diet, 200mg vitamin C/kg diet, 20mgs vitamin E/kg diet, 1 g pectin /kg diet and 200mg vitamin C + 20mg vitamin E + 1g pectin/kg diet respectively. Growth performance, carcass characteristics, plasma proteins, liver enzymes, total antioxidant capacity and jejunum *lactobacillus* bacteria count were measured. The following results were obtained:

1- Significant improvement in body weight and body weight gain were obtained via supplementing fresh lemon to quail diet compared with control diet but with no difference between other treatments.

2- Plasma globulins and albumin/globulin ratio were significantly improved by fresh lemon supplementation compared with antibiotics.

3- Significant decrease in alanine aminotransferase and total antioxidant capacity significantly increased when fresh lemon supplemented to quail diet compared with other treatments.

4- Jejunum *lactobacillus* bacteria count increased significantly by supplementing basal diet with fresh lemon compared with other treatments.

So, supplementing fresh lemon to growing Japanese quail diet is a good natural source and able to be used as safe alternative to antibiotics, synthetic vitamins and prebiotics.

Key words: growing quail; fresh lemon; antibiotics; synthetic vitamins.

INTRODUCTION

Safe alternative to antibiotics become the major target in poultry industry because the antibiotic resided in poultry tissue and eggs that human consumed. Amount of antibiotics that resided when it used as growth promoters, for treating or preventing bacterial diseases differ depending on type of antibiotics, method of supplementation, level of treatments and withdrawal periods (NRC, 1980). Moreover, most bacterial types able to generate new strains that get resistance against antibiotics in poultry meanwhile, transmitted genetically these resistances to their progeny via plasmid-mediated or mutation (Gould, 2008). Resistances bacteria that generate in poultry potent ability to path through handling or consumption of poultry products to human population (Van den Bogaard and Stobberingh, 2000).

Supplementing vitamin E and C were a suitable management practice for promoting growth performance of Japanese quail (Sigolo, *et. al,* 2019).Vitamin C and E improved Japanese quail performance under heat stress and alleviate heat stress negative effects so it used in management as protective practice (Sahin and Kucuk, 2001) and (Sahin *et al.*,2002).Vitamin E able to scavenge both lipid peroxyl and oxygen radicals (Surai 2007).Cheng, *et al.* (2017) reported that dietary supplemented vitamin E, particularly natural form increased α-tocopherol accumulation in the body and enhance the antioxidant capacity during early age of broilers. Vitamin C supplementation reduced the drop in antioxidant status and performance resulted from heat stress. Such supplementation may offer protection against heat stress–related depression in performance of Japanese quail (Sahin, *et al.*, 2003).

Prebiotics describe as favorite alternatives to antibiotics when it used as growth promoters (Abdel-Khalek *et al.*, 2013). Prebiotics didn't digest by enzymes and improve growth performance through increasing the growth or activity of beneficial bacteria of Japanese quail (Iqbal *et al.*,2015). Pectins, likewise pectic polysaccharides are polysaccharides that consist mainly from galacturonic acid. Some drugs that formulated to treat with Diarrhea contain pectin like Kapect.

Nevertheless, synesthetic vitamins may don't possess the same potential of natural sources where, ascorbic acid in a herbal or synthetic forms alleviate summer stress but lemon juice recorded better results (Kadam*et. al.*, 2009). Şenay *et al.* (2019) reported that fruit peel as natural antioxidant sources can alternate to vitamin E in Japanese quails diets exposed to heat stress. Antioxidant activity of fruit and vegetables may originate from phenolics and flavonoids (Liu, 2003). Lemon juice possesses high antioxidant capacity because it contains vitamin E vitamin C, citrate, and flavonoids (Touhami, 2007). Petrovic *et al.* (2012) found that supplemented lemon balm to broiler diets increased blood vitamin E of broiler compared with control diet. Moreover Elwan *et al.* (2019) reported that flavonoids of citrus limonh as multi biological functions, where it has antiviral, anticarcinogenic, anti-inflammatory, antiproliferative, antiallergic, antimutagenic and antioxidant activities

So the present study aimed to achieve the answer of the question, is fresh lemon able to act as a safe alternative to antibiotics, synthetic vitamins and prebiotic in growing Japanese quail diets during summer season?

MATERIALS AND METHODS

Experimental treatments:

A total number of 280 unsexed one- day-old Japanese quail chicks with average weight 8.9 g were divided randomly into

7 treatment groups. Each group consists of 4 replicates where each replicate contained 10 chicks. The 1st treatment fed control basal diet (Table, 1) that satisfied growing Japanese quail requirements from 1 day up to 6wks of age according to (NRC, 1994). Treatment groups from 2 to 7 fed control basal diet supplemented with 0.5goxytetracycline (20%) (Oxyt)/kg diet, 20 g entire grind fresh lemon /kg diet, 200mg vitamin C/kg diet, 20 mg vitamin E/kg diet, 1g pectin /kg diet and the last group fed control diet supplemented with 200mg vitamin C + 20mg vitamin E + 1g pectin/kg diet respectively.

Housing and management:

Each replicate housed separately in one cage where temperature recorded daily. The rearing period extended from 1 day up to 6 weeks divided into three growing periods where, the 1st period extended from 1 day to 2wks, the 2nd period extended from 3wks to 4wks and 3rd period extended from 5wks to 6 wks. Control basal diet formulated to satisfy quail requirements according to NRC (1994) where it contain 24% protein and 2900 ME. Kcal/Kg and fed from 1day up to 6wks. Freshly diets were prepared weekly to maintain experimental supplementation from degradation and to prevent growth of microbiota especially with increasing moisture of diet supplemented with fresh lemon. Feed and water were available throughout the day. Temperature recorded daily inside the house and average temperature per week was calculated. The average weekly temperatures were 35°C, 34°C,34°C,34°C,35°C and 36°Cfrom the 1stto the 6thwk,respectively. Program of continuous light via led lamps was applied were led light reached equally to all cages.

Measurements and samples:

Quail chicks were weighed individually each two weeks where body weight was recorded and body gain was calculated. So the entire growing period divided into three periods where, the 1st period include 1-2wks, the 2nd period include 3-4 wks and the 3rd period include 5-6wks. Feed intake was measured weekly and collected for two weeks and feed conversion was calculated. At 6 wk of age one male quail was chosen randomly from each replicate and blood samples were collected in test tubes contained EDTA. Blood samples were centrifuged at 3500 rpm for 15 minutes where plasma samples were collected in eppendorf to estimate total protein and albumin (Alb) using colorimetric methods. Globulin (Glb) and Alb/Glb ratio were calculated. Total antioxidant capacity (TAOC) and liver enzyme (AST and ALT) were estimated using colorimetric methods either.

Male quails were weighed before and after slaughtering to determine blood weight. After removing feather manually without heating (to maintain microbiota of gastrointestinal tract) feather weight was calculated. After evisceration, carcass was weighed and carcass weight % was calculated. Moreover liver, gizzard, heart and tests were weighed to calculate organs weight%. Whole intestinal was entirely removed and used to determine intestinal beneficial bacteria.

Lactobacillus count:

Selected small intestine (jejunum) was evacuated and jejunum content of each bird was moved to a sterile glass tube for lactobacillus enumeration. Small sample from intestine digesta (1 g) was diluted at 1:10 with saline solution, then further diluted till 10-5, 10-7, and 10−9, in saline solution, from which 100 µL were plated on agar plates. In order to evaluate *Lactobacillus* species the diluted samples were seeded on MRS agar (LabM) and incubated for 48 h at

37°C anaerobically. Colony forming units were expressed as (CFU per Gram) of small intestine content according to Siadati *et al.,* (2017) and Pokorná *et al.,* (2019).

Statistical analysis:

One way ANOVA model of SPSS, (2007) package program was used to test F values. According to the following equation:

Y ij =μ+ Ti +Eij

Where: Y ij =Observations

μ =The overall mean

Ti =Effect of treatments (i= 1,2,…..7)

Eij =Experimental error

Means compared at (P≤0.05) according to Duncan (1955)

RESULTS AND DISCUSSION

1- Production performance:

a- Body weight and body weight gain:

Data in Table 2 demonstrated that body weight and body weight gain of treated Japanese quail didn't record significant difference between experimental treatments during the 1st period. The results of the 2nd period demonstrated that quail fed diet supplemented with fresh lemon recorded the highest body weight and body weight gain. During the 2nd period the results indicated that higher significant increase in body weight was observed between fresh lemon treat compared with control, VE, VC, and pectin treats. Body weight gain for all treatments recorded sharp decline during the 3rd period. Significant improvement that produced from fresh lemon supplementation during the second period was in a full agreement with Shahid *et al.* (2019) who reported that supplementing lemon to broiler diets increased growth. On the same manner the results agree with Masood, *et al.* (2020) who reported that quail body weight improved by lemon oils administration.

The results of body weight and body weight gain during the 1st and 2nd periods indicated that yield obtained from supplementing fresh lemon to basal diets was on a par with that obtained from supplementing antibiotics or VC+VE+ pectin. This may be due to lemon can be used to improve health and performance (Gadde *et al.,* 2017). The improvement may be due to lemon contains essential oils that enhance health and performance (Kim and Lillehoj, 2019). Moreover, essential oils are phenolic compounds (Bradbury *et al.,* 2018) and Phenolics possesses more antioxidants effectiveness compare dwith VE and VC (Rice-Evans *et al.,* 1997) and increase trypsin and amylase activity (Bradbury *et al.,* 2018). Furthermore, Masood*et al.* (2020) reported that lemon essential oils can be inserting in feeding Japanese quail during growing period as growth promoter to obtain better growth through improving intestinal health

Regardless treatments effect, the entire mean of body gains were 74.91, 101.17 and 47.90 for 1st, 2nd and 3rd periods respectively. Concerning the 3rd period the results illustrated that body weight gain depressed sharply compared with the last two periods for all treatments and this may be due to quail nearly reached mature weight at the end of the second period (4 wk). The results of the 3rd period regardless treatments effect are in a full agreement with Moustafa *et al.* (2015) and Mousa *et al.*(2016) where quails nearly reached mature weight before the 3rd period so feed conversion ratio (g feed/g gain) clearly retarded.

b- Feed intake and feed conversion:

Results of feed intake and feed conversion are shown in (Table, 3). During all experimental periods, feed intake was affected significantly by experimental treatments. The results indicated that fresh lemon and pectin supplementation caused significant reduce in feed intake during the 1st period and during the entire

experimental period compared with Oxyt supplementation. These results were in a full agreement with Saki *et al.* (2010) who reported that pectin supplementation reduced significantly feed intake compared with control diet. Regarding effect of lemon supplementations on feed intake the results may be due to lemon contain pectin that reduced feed intake (Saki *et al.,* 2010). This is may be due to pectin slowed passage of feed in digestive system because pectin increased satiety effect (Paderin *et al.*, 2018).

Feed conversion ratio didn't affect significantly by experimental treatments for the period from 1 day to 4wks and for entire growing period (1day – 6wks). In contrast, feed conversion affected significantly during 1st and 3 periods. During the first period quail fed diet supplemented with Oxyt recorded the worst feed conversion values and this is may be due to during the earlier growing period intestinal length of quail was very small compared with mature quail.

During the 3rd period feed conversion was significantly ($P \leq 0.05$) improved when quail fed diets supplemented with fresh lemon, VE, pectin and VC +VE+ pectin. This is may be due to the ambient temperature during the 3rd periods were 35°C and 36 during 5th and 6th wks respectively and these temperatures were above the optimal quail temperature. So, the roles of antioxidants appear clearly during this period. Vitamin C and E improved Japanese quail performance under heat stress and alleviate heat stress negative effects so it used in management as protective practice (Sahin and Kucuk, 2001) and (Sahin *et al.,* 2002). Moreover, fresh lemon possessed antioxidant ability more than synthetic antioxidants during summer (Kadam *et. al.,* 2009).

2- Carcass characteristics:

Except for liver and tests weight percent, most slaughter parameters didn't influence significantly by experimental treatments (Table, 4). Antibiotics and pectin supplementation caused significant enlargement in liver weight percent but fresh lemon, VC and VE supplementation decreased significantly ($P \leq 0.001$) liver weight percent. The result of Oxyt in agreement with Parsaie *et al.,* (2007) who reported that the antibiotic virginiamycin enlarged liver and they attributed that for antibiotics increased liver load in broiler. Similar results obtained by Denli *et al.,* (2004) who reported that inserting flavomycin in quail diet increased significantly liver weights compared with control diet without antibiotic. Regarding lemon effect, the results may due to lemon peel contain essential oils and these results reinforced by Denli *et al.,*(2004)who reported that essential oils decreased liver weight percent of quail compared with antibiotics.

All antioxidant supplementation either natural (fresh lemon) or synthetic vitamins (VE or VC) caused significant increase in testes weight percent compared with control and antibiotic treatments. The results agree with Triques *et al.,* (2019) who reported that antioxidant supplementation existing significantly greater testes weight and length compared with control.

3-Physiological status

a- Plasma proteins profile:

Total protein, albumin, globulin and Alb/Glb ratio influenced significantly by experimental treatments (Table, 5). Antibiotic supplementation decreased significantly ($P \leq 0.001$)total plasma protein and globulin compared with fresh lemon, VC and VE but increased significantly albumin and Alb/Glb. These results agree with Ologhobo and Adejumo (2015) who reported that Oxyt caused significant increase in albumin concentration compared with other treatments. Moreover the result of Alb/Glb ratio for antibiotic was in a full

agreement with Toghyani *et al.* (2010) who found that antibiotics retarded Alb/Glb ratio compared with natural antioxidant. There were no significant differences in plasma protein fraction among fresh lemon, VE and VC so it can assume that fresh lemon achieved his goal equally with synthetic vitamins.

b- Antioxidant status

Total antioxidant capacity in plasma influenced significantly by experimental treatments (Table, 5) nevertheless, each of Oxyt, pectin, VC and VE treatments didn't differ significantly than control treatment. Gathering of VC, VE and pectin supplementation in one diet caused significant increase ($P \leq 0.05$) in TAOC compared with control diet. This may be due to under heat stress conditions VE and VC possess interaction to reduce harmful effects of heat stress in antioxidant system (Sigolo *et al.*, 2019).

On the other hand supplementing quail basal diet with fresh lemon recorded significantly ($P \leq 0.05$) the highest TAOC values. This may be due to lemon possess antioxidant capacity generate from phenolics and flavonoids (Elwan *et al.*, 2019) and (Liu, 2003) and fresh lemon contains VE and large amount of VC that possess antioxidant ability. Moreover, lemon increased enzymatic antioxidant activities in liver and serum (Elwan *et al.*, 2019).

c- Liver enzymes:

Response of liver enzymes to experimental treatments were dissimilar where, ALT influenced significantly but AST didn't influence (Table, 5). Supplementing basal diet with Oxyt caused significant increase in ALT and the result agrees with Ologhobo and Adejumo (2015) who reported that Oxyt significantly increased ALT. The significant decrease in plasma ALT by lemon supplementation agree with Ali *et al.* (2020)they added that this may be due to lemon possess antioxidant and protective action on and biochemical parameters against oxidative stress. Moreover lemon contains VC phenolics and flavonoids that able to improve antioxidant status and so decreased liver stress.

d- Beneficial bacteria:

Data in Table (5) indicated that intestinal (jejunum) lactobacillus count ($X \times 10^9$) influenced significantly by experimental treatments. Pectin supplementation caused significant increase in total count of lactobacillus bacteria compared with Oxyt and control treatments nevertheless, pectin supplementation reduced significantly lactobacillus bacteria count compared with lemon and VE+ VC + pectin. The results agree with Saki *et al.*,(2010) who reported that pectin supplementation decreased lactic acid bacteria. The results indicated that VC caused significant increase ($P \leq 0.001$) in lactobacillus count and this is agree with Al-Ashoor *et al.*(2020)who reported that VC increased duodenum lactobacilli of Japanese quail.

CONCLUSION

In conclusion, fresh lemon individually able to replace all of antibiotics, synthetic vitamins and prebiotic when it supplemented to growing Japanese diet. This led use to suppose that lemon is inexpensive, obtainable and safe material as a safe alternative to antibiotics, replacement expensive synthetic vitamins and prebiotics.

Table(1): Composition and calculated analysis of control basal diet.

Ingredient	**%**	**Calculated values**	
Yellow corn	53.25	CP%	24
Soybean meal (44%)	33.50	ME. KCal/Kg	2900
Corn gluten meal (62%)	4.55	Ca %	0.83
Sunflower oil	0.90	Avail. P%	0.30
Wheat bran	4.50	Meth. %	0.54
Di-Ca-P	1.44	Lysine%	1.36
Limestone	1.00		
Premix*	0.30		
Na Cl (salt)	0.25		
L-lysine-HCL	0.19		
DL-methionine	0.12		
Total	100		

*Each 3 kg contains: 15000.000 IU Vit.A; 4000.000 IU Vit.D3; 50000 mg Vit.E; 4000 mg Vit.K3; 3000mg Vit.B1; 8000mg Vit.B2; 5000mg Vit.B6; 16000mg pantothenic acid; 20mg Vit.B12;2000mg folic acid; 4000mg niacin; 150mg cobalt; 1000mg iodine; 150mg selenium; 100000mg manganese and 30000mg iron**.**

Table (2): Effect of experimental treatments on body weight and body weight gain.

Treatments	Body weight			Body weight gain				
	2wks	4wks	6wks	1day: 2wks	2wks:4wks	1day:4wks	4wks: 6wks	1day:6wks
Control	83.75 ±1.41	183.28^{b} ±2.33	226.11^{b} ±2.57	74.75 ±1.41	99.53^{b} ±2.22	174.28^{ab} ±2.33	42.74^{c} ±2.73	217.11^{b} ±2.57
Oxytetracycline	83.98 ±1.70	191.53^{a} ±4.51	239.31^{a} ±4.86	74.98 ±1.70	107.55^{a} ±4.34	182.53^{a} ±4.51	47.50^{b} ±4.29	230.31^{a} ±4.86
Fresh lemon	82.73 ±1.81	193.00^{a} ±4.82	239.67^{a} ±4.69	73.73 ±1.81	108.84^{a} ±4.80	184.00^{a} ±4.82	46.44^{b} ±3.52	230.67^{a} ±4.69
Vitamin C	83.80 ±1.47	180.45^{b} ±2.98	235.24^{ab} ±4.95	74.80 ±1.47	96.65^{b} ±2.37	171.45^{ab} ±2.98	54.18^{a} ±3.48	226.24^{ab} ±4.95
Vitamin E	83.73 ±1.45	181.15^{b} ±3.74	230.77^{ab} ±5.09	74.73 ±1.45	92.90^{b} ±5.44	167.63^{b} ±5.82	49.62^{ab} ±3.70	221.77^{ab} ±5.09
Pectin	83.55 ±1.95	182.24^{b} ±3.62	230.86^{ab} ±4.72	74.55 ±1.95	98.08^{b} ±2.72	173.24^{ab} ±3.62	48.06^{ab} ±3.67	221.86^{ab} ±4.72
V C+ V E+ pectin	85.83 ±1.82	190.95^{ab} ±2.96	237.71^{a} ±6.14	76.83 ±1.82	104.62^{ab} ±2.40	181.95^{a} ±2.96	46.76^{b} ±5.08	228.71^{a} ±6.14
P values	N.S.	0.039	0.041	N.S.	0.044	0.039	0.046	0.036

a,b: Means in the same columns with different superscripts are differ significantly at ($P \leq 0.001$).
N.S. not significant.

Table (3): Effect of experimental treatments on feed intake and feed conversion.

Treatments	Feed intake					Feed conversion				
	1day: 2wks	2wks: 4wks	1day: 4wks	4wks: 6wks	1day: 6wks	1day: 2wks	2wks: 4wks	1day: 4wks	4wks: 6wks	1day: 6wks
Control	148.09[b] ±10.55	231.53[ab] ±34.00	379.61[b] ±31.57	365.02[ab] ±13.34	744.63[ab] ±38.07	1.99[ab] ±0.17	2.33 ±0.34	2.18 ±0.18	6.27[a] ±0.56	2.92 ±0.20
Oxytetracycline	176.65[a] ±37.75	236.60[ab] ±29.17	413.25[a] ±42.83	358.82[ab] ±23.37	772.07[a] ±41.53	2.37[a] ±0.53	2.22 ±0.32	2.27 ±0.25	5.21[b] ±0.86	2.88 ±0.24
Fresh lemon	151.34[b] ±37.10	232.58[ab] ±17.78	383.92[b] ±46.76	339.17[b] ±16.23	723.08[b] ±56.37	2.01[ab] ±0.45	2.15 ±0.19	2.09 ±0.27	4.31[c] ±0.59	2.64 ±0.26
Vitamin C	153.76[b] ±10.46	240.03[a] ±34.81	393.79[ab] ±44.17	381.89[a] ±32.73	775.67[a] ±58.90	2.05[ab] ±0.12	2.48 ±0.34	2.29 ±0.24	5.11[b] ±0.78	2.94 ±0.26
Vitamin E	145.18[b] ±18.23	206.48[c] ±11.89	351.66[c] ±26.47	318.31[c] ±37.73	669.97[c] ±61.85	1.94[ab] ±0.24	2.12 ±0.11	2.09 ±0.13	4.12[c] ±0.62	2.50 ±0.22
Pectin	150.69[b] ±10.39	224.67[b] ±24.28	375.36[b] ±19.23	310.49[c] ±30.54	685.84[c] ±49.08	2.04[ab] ±0.22	2.28 ±0.21	2.17 ±0.09	4.35[c] ±0.51	2.59 ±0.16
V C+V E+ pectin	143.61[b] ±7.42	221.01[b] ±30.81	364.61[b] ±31.92	330.82[b] ±25.69	695.43[bc] ±47.73	1.87[b] ±0.11	2.13 ±0.32	2.00 ±0.17	4.98[bc] ±0.94	2.56 ±0.25
P values	0.040	0.044	0.036	0.042	0.041	0.039	N.S.	N.S.	0.047	N.S.

a,b: Means in the same columns with different superscripts are differ significantly at ($P \leq 0.001$).
N.S. not significant.

Table (4): Effect of experimental treatments on slaughter parameters.

Treatments	Carcass%	Blood%	Feather%	Lever %	Gizzard %	Spleen%	Tests%
Control	67.42 ±0.49	5.03 ±1.43	15.45 ±1.44	1.85[b] ±0.15	1.83 ±0.15	0.71 ±0.07	2.55[c] ±0.59
Oxytetracycline	66.12 ±0.37	4.10 ±0.40	18.68 ±1.34	2.57[a] ±1.36	1.98 ±0.11	0.69 ±0.08	2.99[b] ±0.43
Fresh lemon	65.84 ±2.41	4.40 ±0.37	16.23 ±0.38	1.72[c] ±0.20	1.66 ±0.10	0.76 ±0.05	3.39[a] ±0.32
Vitamin C	65.48 ±0.74	4.38 ±0.25	15.70 ±1.20	1.86[b] ±0.23	1.83 ±0.10	0.88 ±0.07	3.23[a] ±0.10
Vitamin E	65.33 ±0.90	4.40 ±0.63	15.28 ±1.28	1.77[c] ±0.25	1.92 ±0.13	0.72 ±0.04	3.14[a] ±0.22
Pectin	65.31 ±1.50	4.00 ±0.18	17.23 ±0.78	2.42[a] ±0.52	1.85 ±0.18	0.99 ±0.22	3.22[a] ±0.52
V C+V E+ pectin	66.96 ±0.83	3.85 ±0.81	16.50 ±0.79	1.79[c] ±0.20	1.94 ±0.10	0.79 ±0.03	3.24[a] ±0.27
P values	N.S.	N.S.	N.S.	0.032	N.S.	N.S.	0.039

a,b: Means in the same columns with different superscripts are differ significantly at ($P \leq 0.001$).
N.S. not significant.

Table (5): Effect of experimental treatments on plasma component and jejunum *Lactobacillus* bacteria count.

Treatments	Total protein mg/L	Albumin (Glb) mg/L	Globulin (Alb) mg/L	Alb/Glb ratio	Total antioxidant capacity (mmol/l)	Alanine amino-transferase ALT (U/L)	Aspartate amino-transferase AST (U/L)	Lactobacillus (N× 10^9)
Control	5.05^{ab}± 0.33	2.00^{b}± 0.15	3.05^{b}± 0.37	0.66^{b}± 0.11	0.51^{c}± 0.04	70.79^{b}± 2.87	6.86± 0.97	2.81^{d}± 12.63
Oxytetracycline	4.90^{b}± 0.74	2.35^{a}± 0.25	2.56^{c}± 0.72	0.92^{a}± 0.36	0.37^{c}± 0.01	116.36^{a}± 33.64	9.19± 2.52	0.415^{f}± 1.35
Fresh lemon	6.40^{a}± 0.54	1.56^{c}± 0.11	4.85^{a}± 0.48	0.32^{c}± 0.03	1.82^{a}± 0.54	11.39^{d}± 0.70	4.51± 0.30	39.75^{a}± 141.56
Vitamin C	6.68^{a}± 0.70	1.67^{c}± 0.18	5.00^{a}± 0.63	0.33^{c}± 0.05	0.42^{c}± 0.04	46.22^{c}± 8.87	9.22± 1.47	25.90^{b}± 90.36
Vitamin E	6.43^{a}± 0.47	1.58^{c}± 0.08	4.85^{a}± 0.46	0.33^{c}± 0.03	0.41^{c}± 0.04	48.08^{c}± 13.30	8.54± 1.53	22.75^{b}± 105.37
Pectin	5.00^{ab}± 0.71	2.04^{b}± 0.20	2.96^{b}± 0.87	0.69^{b}± 0.34	0.39^{c}± 0.01	34.14^{c}± 11.00	8.62± 2.28	14.83^{c}± 55.39
V C+V E+ pectin	4.00^{b}± 0.15	1.56^{c}± 0.13	2.44^{c}± 0.17	0.69^{b}± 0.09	1.58^{b}± 0.40	34.76^{c}± 5.26	4.45± 0.58	13.15^{c}± 86.78
P values	0.045	0.034	0.030	0.043	0.032	0.001	N.S.	0.004

a,b: Means in the same columns with different superscripts are differ significantly at ($P \leq 0.001$).
N.S. not significant.

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growing quail; fresh lemon; antibiotics; synthetic vitamins.

الملخص العربي

إضافة الليمون الطازج إلى علائق السمان الياباني النامي كبديل آمن للمضادات الحيوية، الفيتامينات المخلقة والبريبيوتك في الطقس الحار.

صبّاح فاروق يوسف[١]، هشام احمد عبد اللطيف[١]، السيد محفوظ عبد الكافي[١]، حنان صابر محمد[١]، هبه بدر[٢]، منال سعودي محمد[١] وحسن عبد الكريم حسن عبد الحليم[١]

[١] معهد بحوث الانتاج الحيواني - مركز البحوث الزراعية- الدقي – جيزة.
[٢]وحدة البكتيريولوجي- المعمل المرجعي للرقابة البيطرية على الإنتاج الداجني- معهد بحوث صحة الحيوان -مركز البحوث الزراعية- الدقي – جيزة.

اجريت هذه التجربة بغرض تقييم مقدرة الليمون الطازج كبديل امن للمضادات الحيوية، والفيتامينات المخلقة، البريبيوتك في الجو الحرف. تم تقسيم ٢٨٠ كتكوت سمان ياباني عمر يوم الى ٧ مجموعات تجريبية. وتكونت المجموعة من ٤ مكررات. الاولى تم تغذيتها على عليقة مقارنة من عمر يوم وحتى الاسبوع السادس من العمر. غذيت المعاملات من ٢ الى ٧ على عليقة قاعدية تحتوي على ٠.٥ اوكسيتتراسيكلين (٢٠٪)/كجم علف،٢٠ جم ليمون طازج مطحون/كجم علف، ٢٠٠مجم فيتامين (ج)/كجم علف، ٢٠مجم فيتامين (هـ)/كجم علف،١جم بكتين/كجم علف و ، ٢٠٠مجم فيتامين (ج) + ٢٠مجم فيتامين (هـ) + ١جم بكتين /كجم علف على الترتيب. تم تقدير اداء النمو الإنتاجي، ومقاييس الذبيحة، بروتينات البلازما، انزيمات الكبد، قدرة مضادات الاكسدة الكلية و عدد بكتيريا اللاكتوبسلس. وقد تم الحصول على النتائج التالية.

١-حدث تحسن ملحوظ في وزن الجسم والزيادة في وزن الجسم بإضافة الليمون الطازج لعلائق السمان مقارنة بعليقة المقارنة ولكن بدون فروق معنوية عن باقي المعاملات.

٢-تحسن بروتين الجلوبيولين معنوياً بإضافة الليمون الطازج مقارنة بإضافة المضاد الحيوي.

٣-نقص انزيم الألنين امينوترانسفيريز عند اضافة الليمون الطازج زادة قدرة مضادة الاكسدة الكلية معنويا مقارنة بكل المعاملات التجريبية.

٤-زاد العد الكلي لبكتيريا اللكتوبسلس مقارنة بباقي المعاملات.

لذلك يعتبر اضافة اليمون الطازج لعلائق السمان الياباني النامي مصدرمضاد اكسدة وبريبيوتيك طبيعي جيد وبديل آمن للمضادات الحيوية والفيتامينات المخلقة والبريبيوتيك.