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Using guar meal or saponin extracted from guar as safe alternatives to antibiotics in feeding laying hens

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ABSTRACT

The current experiment was carried out to evaluate the ability of guar meal or saponin extracted from it as a safe alternative to antibiotics in laying hens. At 22 weeks old, 168 healthy hens were divided into 7 groups where each group consists of 3 replicates and each replicate held 8 hens. The first group was a control treatment and fed acorn-soya meal diet and the treatments from 2 to 7 fed control diets supplemented with 0.3% guar meal, 0.6% guar meal, 60 ppm saponin, 120 ppm saponin, 60 ppm salinomycin and 120 ppm salinomycin respectively. The parameters of egg production performance, egg quality, each giblets organs and immune organs moreover lipid, protein profile and liver enzymes were measured to determine the experimental aims. The results showed an improvement in most egg production parameters was achieved when saponin extracted from guar or an equivalent amount from guar meal was supplemented to control the diet. Increasing levels of saponin or guar meal had ability to achieve a clear improvement in egg production performance compared with increasing salinomycin levels. The results of egg quality and slaughter parameters did not show a critical difference between levels of saponin or guar meal from one side and levels of salinomycin from the other side. Liver function showed a harmful effect when salinomycin was supplemented with a control diet whereas AST and ALT increased significantly when salinomycin was supplemented to control diets compared with natural ingredients. Responses of production performance and liver enzymes for experimental treatments enhance the idea of using natural components as a safe alternative to antibiotics.

Keywords: *G*uar, saponin, salinomycin, layers performance.

INTRODUCTION

Safe alternatives to antibiotics and anti-coccidiosis in egg production apply to reduce human risk that resulted from consuming eggs containing these residuals. For decreasing this risk in egg production many procedures were applied such as insertion of prebiotics, probiotics and herbs or herbs extracts in layer diets. Guar bean contains saponin that remains in guar meal during gum extraction within germ and hull. Saponin is a hydrophilic glycoside jointed with lipophilic triterpene found in various plant species and it is found in guar meal (Hassan *et al.,* 2013). Guar saponinhad antimicrobial activity against several pathogens in poultry (Hassan, 2008) and had antiprotozoal activity (Hassan, *et al.,* 2008) via connecting with cholesterol exists in cell membrane and causes parasite death (Wang *et al.,* 1998). Hence, saponin possesses protective effectiveness against coccidia in poultry (Alfaro *et al.,* 2007). Used of saponin extracted from some plants was limited in monogastric such as poultry where it depressed egg production (Hassan, 2008). In contrast, saponin extracted from guar improved nutrient absorption via increasing membrane depolarization led to rising intestinal permeability (Oleszek, *et al.,* 1999). According to EFSA, 2009 no data was presented related to transfer of saponin extracted from plants to eggs.

Antibiotics that contain ionophores use commonly as feed additives to prevent coccidia in poultry (Diaz*et al.,* 2018). Salinomycin has an ionophore group that possess anticoccidial and antibacterial activities (Szkudlarek-Mikho*et al.*, 2012) and cause osmotic imbalance for parasite (AL-Oubaidi and AL-Zuhairi, 2017). The toxicity of salinomycin appeared when it was supplemented in diets at levels that ranged from 80- to 160 ppm (Keshavarz and McDougald, 1982). (Abdelrahman *et al.,* 2014) used salinomycin at a level of 66mg/kg as feed additives and for coccidia treatment, so it looks like saponin in this feature. According to EFSA (2017) when salinomycin is supplemented in a diet for 12 weeks before onset of laying at the level of 50 mg/kg its residues are not detected in the first egg. Nevertheless increasing the concentration of salinomycin up to 70 mg/kg in diet causes traces of detection of salinomycin in the first egg.

Coccidia invaded layer chickens and led to a decrease in Glucose, total protein, albumin and globulin moreover, it led to an increase in malondialdehyde, ALTand AST (El-Maksoud *et al.,* 2014). Furthermore, it causes damage to intestinal tissue, bleeding, diarrhoea, reduce egg production and other disease susceptibility increases in laying flocks (McDougald *et al.,* 2008). Coccidiosiswasdetected in subclinical or clinical varieties in non-vaccinated caged layers (Soares *et al.,* 2004) and reduced egg production in caged layers (Kinung'hi *et al.,* 2004). The trial was conducted to study the ability of guar meal and saponin extracted from guar meal to use as safe alternatives to antibiotics and to produce safe eggs free from antibiotics.

MATERIAL AND METHODS

Experimental design:

One hundred and sixty-eight hens were chosen at 22 weeks old when the base flock reached 5% egg production and distributed randomly into 7 treatment groups. The 1st group consumed a control diet that fulfilled needs and strain requirements Table (1). The 2nd and 3rd groups feed control diet supplemented with 60 and120 ppm saponin respectively. The 4th and 5th groups feed control diet supplemented with 60 and 120 ppm salinomycin respectively. The 6th and 7th groups feed control diet supplemented with 0.3% and 0.6% guar respectively. Lighting program of 16 hrs daily continuous light began at 5 am and shot down at 6pmapplied. The experiment was extended for 3 months to detect the effect of experimental treatments on egg production performance, egg quality, body organs (immune and non-immune organs) weight percent, plasma lipid profile, plasma protein profile and liver function.

Table 1. Composition and calculated analysis of experimental diet.

Ingredient	Percentages
Yellow corn	62.15
Soya bean meal 44%	18.45
Corn gluten meal 60%	5.90
Guar meal	0.00
Wheat bran	3.17
Limestone	7.85
Di Calcium Phosphate	1.64
Vitamins and minerals premix*	0.3
DL Methionine	0.02
sodium bicarbonate	0.10
choline chloride	0.10
Total composition	100
crude protein	17.00
Metabolizable energy	2,750
Crude fiber	3.45
Crude fat	2.95
Lysine	0.78
Methionine	0.34
Methionine +cysteine	0.66
Calcium	3.40
Available Phosphorous	0.42
chloride	0.18
Sodium	0.20

*Supplied each kg of diet: Vit.A, 12000 IU; Vit.D3, 2200 IU; Vit.E, 10 mg; Vit K3, 2 mg; Vit.B1, 1 mg; Vit. B2 5 mg; B6 1.5 mg; B12 10 mcg; Nicotinic acid 30 mg; Folic acid 1 mg; Pantothenic acid 10 mg; Biotein 50 mcg; Choline 250 mg; Copper 10 mg; Iron 30 mg; Manganse 60 mg; Zinc 50 mg; Iodine 1 mg; Selenium 0.1 mg; Cobalt 0.1 mg

Measurements:

Eggs were collected daily, counted and weighed per each replicate to the nearest decigram for three months. Egg production percent, average egg weight and egg mass per hen per day were calculated according to Saffarzadeh and Csapó (1999). All hens fed *ad libitum* were diets supplemented at the beginning of each week and fed residuals weighed at the end of each week. Feed intake and feed conversion were calculated. In the last week of the experimental period, ten fresh eggs were picked upper replicate to test egg quality. Selected eggs were weighed and their two diameters (length and width) measured by a vernier caliper to compute shape index. To evaluate egg quality eggs were broken, shells lifted for drying and albumin and yolk heights were measured, while only the width of yolk was measured. Yolk was picked up and weighed to the nearest decigram while egg shells were weighed after three days when it dried and shell thickness was measured using a micrometre thimble. Shape index and yolk index were calculated moreover, albuminweight%, yolk weight% and shell weight% were calculated as a percentage of the entire egg weight. According to (Haught, 1937)Haugh unit is calculated from the flowing equation:

$$\text{Haugh unit} = 100 \log (H - 1.7 W^{0.37} + 7.6)$$

Where H = Albumin height. W = Egg weight.

At the end of the experiment, three hens from each treatment were picked up and slaughtered. The carcass was eviscerated and abdominal fat, giblets, spleen and thymus were weighed and its weights were related to living body weight. Three blood samples from each treatment were collected in test tubes containing EDTA during bleeding. Blood samples were centrifuged (3500rpm) to obtain plasma. The plasma lipid profile was determined according to Z (Ollner and Kirsch, 1962). The plasma protein profile was determined using a method reported by (Gornal *et al.,* 1949). To detect liver function aspartate aminotransferase (AST) and alanine aminotransferase ALT was determined (Reitman and Frankel, 1957).

Statistical analysis:

To detect the effect of experimental treatments the statistical software package of (SPSS, 2007) version 16 was used, where a one-way ANOVA procedure was carried out. To compare means the Post Hoc multiple comparisons of (SPSS, 2007) at F-test (P≤0.05) according to (Duncan, 1955) were used.

RESULTS

Production performance:

Egg production:

All experimental treatments recorded a significant increase in egg production percent compared with control treatment during 1st and 2nd months and for entire period Table (2). Inserting 60ppmsalinomycin in layer diet recorded the highest egg production percent during 3rd and entire period. Nevertheless increasing salinomycin up to 120ppm caused a significant decrease (p<0.01)in egg production percent compared with 60 ppm salinomycin during 1st, 2nd months and entire periods. Introducing 120 ppm salinomycin in layers diet decreased significantly (p <0.01) egg production% compared with introducing 0.3% and 0.6% guar meal for entire period. The highest values of egg mass per hen per day were recorded when 0.3% and 0.6% guar meal were supplemented to control diet. All experimental forms and levels caused a significant increase in egg mass per hen per day compared with control treatment. Increasing either saponin or salinomycin, levels during entire experimental period from 60ppm to 120ppm decreased both egg production percent and egg mass per hen per day. Nevertheless increasing guar meal level from 0.3% to 0.6% increased both egg production percent and egg mass per hen per day.

Table 2. Effect of guar meal, saponin and salinomycin on egg production parameters.

Treatments / Month	Control	Guar 0.3%	Guar 0.6%	Saponin 60 ppm	Saponin 120 ppm	Salino-mycin 60 ppm	Salino-mycin 120 ppm	SE±	P. values
	Egg production percent								
1st month	37.50^{d}	47.78^{a}	43.47^{b}	45.28^{ab}	41.25^{c}	47.08^{a}	41.94^{bc}	1.51	0.026
2nd month	54.86^{d}	63.89^{b}	67.64^{a}	59.31^{c}	63.33^{b}	63.19^{b}	57.64^{cd}	1.32	0.031
3rd month	64.58^{c}	68.19^{b}	69.03^{ab}	69.03^{ab}	67.64^{b}	71.53^{a}	69.17^{ab}	1.23	0.039
Entire period	52.31^{d}	59.95^{ab}	60.05^{a}	57.87^{bc}	57.41^{bc}	60.60^{a}	56.25^{c}	0.95	0.017
	Egg mass per hen per day (gm)								
1st month	15.96^{d}	20.81^{a}	18.43^{bc}	19.16^{ab}	17.28^{c}	18.99^{b}	17.15^{c}	0.64	0.018
2nd month	25.03^{c}	30.80^{a}	31.30^{a}	27.63^{bc}	28.74^{b}	28.23^{b}	26.69^{bc}	0.69	0.024
3rd month	31.78^{c}	34.85^{b}	33.96^{bc}	34.34^{b}	33.11^{bc}	36.12^{a}	35.24^{ab}	0.66	0.027
Entire period	24.02^{c}	28.57^{a}	27.53^{a}	26.74^{ab}	26.11^{b}	27.28^{ab}	26.06^{b}	0.51	0.019
	Average egg weight								
1st month	42.51^{ab}	43.52^{a}	41.91^{b}	42.24^{bc}	41.74^{bc}	40.50^{d}	41.01^{cd}	0.17	0.044
2nd month	45.49^{b}	48.14^{a}	46.25^{ab}	46.52^{b}	45.30^{b}	44.62^{c}	46.29^{ab}	0.23	0.038
3rd month	49.05^{b}	51.11^{a}	49.13^{b}	49.73^{b}	48.81^{c}	49.86^{ab}	50.94^{ab}	0.16	0.042
Entire period	45.68^{b}	47.59^{a}	45.76^{b}	46.16^{ab}	45.28^{b}	44.99^{b}	46.08^{ab}	0.2	0.029

$^{a,b,..}$ Means within the same row with different superscripts are significantly different (P ≤ 0.05).

Feed intake and feed conversion:

Significant differences in feed intake were observed during 1st month, 2ndmonth and entire experimental period. Hens that fed diets containing0.3% and 0.6% guar meal had significantly higher feed intake compared with control and high saponin and salinomycin treatments during 1st month and entire experimental period Table (3). There was no significant effect of experimental treatments on feed conversion during different months and the entire experimental period Table (3).

Table 3. Effect of guar meal, saponin and salinomycin on feed intake and feed conversion.

Treatments / Month	Control	Guar 0.3%	Guar 0.6%	Saponin 60 ppm	Saponin 120 ppm	Salino-mycin 60 ppm	Salino-mycin 120 ppm	SE±	P. values
	Feed intake (gm)								
1st month	72.17^{b}	92.78^{a}	87.33^{a}	76.50^{b}	70.33^{b}	74.78^{b}	71.00^{b}	1.47	0.001
2nd month	88.11^{a}	95.72^{a}	95.83^{a}	87.94^{a}	90.22^{a}	89.00^{a}	78.89^{b}	1.12	0.036
3rd month	98.56	101.17	101	102.61	101.78	101.56	101.5	1.07	NS
Entire period	86.28^{c}	96.56^{a}	94.72^{ab}	89.02^{bc}	87.44^{c}	88.44^{bc}	83.80^{c}	0.86	0.028
	Feed conversion (gm diet/ gm egg)								
1st month	4.53	4.46	4.79	4.00	4.08	3.92	4.13	0.17	NS
2nd month	3.53	3.11	3.06	3.19	3.14	3.16	2.96	0.09	NS
3rd month	3.11	2.90	2.98	2.99	3.08	2.85	2.88	0.05	NS
Entire period	3.61	3.38	3.45	3.33	3.36	3.24	3.23	0.08	NS

$^{a,b,..}$ Means within the same row with different superscripts are significantly differ (P ≤ 0.05). NS: Not significant.

Egg quality:

Both shell weight percent and shell thickness were affected significantly (P ≤ 0.001) by experimental treatments Table (4) Increasing both saponin and salinomycin levels from 60ppm to 120ppm caused a significant increase in shell weight percent and shell thickness when it compared with control treatment.

Table 4. Effect of guar meal, saponin and salinomycin on egg quality.

Treatments / Items	Control	Guar 0.3%	Guar 0.6%	Saponin 60 ppm	Saponin 120 ppm	Salino-mycin 60 ppm	Salino-mycin 120 ppm	SE±	P. values
Shape index	73.91	76.58	76.29	76.72	76.31	76.28	76.28	0.30	NS
Albumin weight%	59.1	58.38	58.95	58.3	57.63	58.27	57.41	0.22	NS
Shell weight%	10.08^{b}	10.57^{ab}	10.40^{ab}	10.57^{ab}	11.13^{a}	10.80^{ab}	11.30^{a}	0.09	0.005
Yolk weight%	30.82	31.05	30.65	31.14	31.24	30.93	31.28	0.18	NS
Yolk index	44.16	45.99	44.99	45.28	45.24	46.65	46.05	0.24	NS
Yolk color	5.64	5.43	5.29	5.62	5.48	5.57	5.24	0.06	NS
Haugh unit	95.51^{c}	96.82^{bc}	95.60^{c}	97.13^{b}	97.31^{b}	101.74^{ab}	103.73^{a}	0.48	0.001
Shell thickness	40.21^{c}	41.90^{b}	42.19^{b}	40.14^{c}	44.71^{a}	40.95^{bc}	45.14^{a}	0.31	0.001

$^{a,b,..}$ Means within the same row with different superscripts are significantly different (P ≤ 0.05). NS: Not significant.

Organs percent:

Except for abdominal fat neither immune organs nor other body organs were affected significantly by experimental treatments Table (5). Increasing saponin levels from 60ppm to 120ppm led to significant decrease (p<0.05) in abdominal fat compared with control treatment Table (5).

Table 5. Effect of guar meal, saponin and salinomycin on carcass, abdominal fat giblets, and immune organs weight%.

Treatments / Items		Control	Guar 0.3%	Guar 0.6%	Saponin 60 ppm	Saponin 120 ppm	Salino-mycin 60 ppm	Salino-mycin 120 ppm	SE±	P. values
Carcass weight%		61.35^{b}	70.64^{a}	69.85^{a}	70.89^{a}	70.13^{a}	68.77^{ab}	68.38^{ab}	0.77	0.001
Abdominal fat weight%		5.99^{a}	3.82^{bc}	2.81^{d}	4.38^{ab}	4.04^{b}	3.08^{c}	4.69^{ab}	0.36	0.027
Giblets weight%	**Liver**	2.35	1.93	2.6	2.38	2.06	1.72	2.08	0.11	NS
	Gizzard	1.25	1.36	1.64	1.28	1.18	1.46	1.44	0.05	NS
	Heart	0.47	0.49	0.49	0.44	0.49	0.49	0.42	0.01	NS
Immune organs weight%	**Spleen**	0.17	0.16	0.13	0.14	0.12	0.14	0.1	0.01	NS
	Thymus	0.07	0.09	0.13	0.1	0.11	0.1	0.1	0.01	NS

$^{a,b,..}$ Means within the same row with different superscripts are significantly differ (P ≤ 0.05).NS: Not significant.

Plasma component:

Plasma protein and lipid profiles did not affect significantly by experimental treatments Table (6). Feeding diets containing saponin, salinomycin and guar meal with different levels recorded numerically lower total lipid and low-density lipoprotein compared with control treatment. The data of plasma protein profile illustrated that saponin, salinomycin and guar meal treats induced a numerical increase in total protein and globulin compared with control treatment but reduced albumin and albumin globulin ratio. On the other hand, increasing saponin, salinomycin and guar meal levels cause a numerical increase in total protein and globulin compared with control treatment.

The data in Table (6) illustrated that experimental treatments affected significantly liver function. Supplemented control diet with either low or high salinomycin levels causes a significant increase in AST and ALT (p<0.05).

Table 6. Effect of guar meal, saponin and salinomycin on lipid profile, protein profile and liver enzymes.

Treatments / Items		Control	Guar 0.3%	Guar 0.6%	Saponin 60 ppm	Saponin 120 ppm	Salino-mycin 60 ppm	Salino-mycin 120 ppm	SE±	P. values
Lipid profile (mg/dL)	**TL**	710.23	630.69	623.58	653.41	605.40	568.19	551.14	76.28	N.S.
	TG	283.34	268.01	238.00	235.34	256.40	288.00	252.67	31.36	N.S.
	HDL	98.84	112.28	105.71	109.38	108.11	87.46	125.71	7.19	N.S.
	LDL	554.73	464.81	470.27	496.97	446.01	423.12	374.89	70.13	N.S.
Protein profile (mg/L)	**TP**	4.86	4.89	4.93	4.93	5.08	4.84	4.95	0.34	N.S.
	Alb	3.58	3.27	3.24	3.23	3.12	3.11	3.15	0.20	N.S.
	Glb	1.28	1.63	1.70	1.70	1.98	1.73	1.80	0.37	N.S.
	A/G	2.80	2.01	1.91	1.90	1.58	1.80	1.75	0.23	N.S.
Liver enzymes	**AST**	42.50^{b}	45.50^{b}	41.50^{b}	41.50^{b}	44.00^{b}	59.50^{a}	59.50^{a}	4.91	0.046
	ALT	9.00^{b}	7.00^{b}	10.50^{b}	7.00^{b}	4.00^{b}	20.00^{a}	25.00^{a}	1.39	0.035

$^{a,b,..}$ Means within the same row with different superscripts are significantly differ (P ≤ 0.05). NS: not significant.

DISCUSSION

The results of product performance with regard to low level of saponin agree with (Hou, *et al.,* 2009) who reported that extracted saponin improved rate of lay, average egg weight, feed intake and feed conversion compared with control diet. Increasing saponin levels from 60 ppm to 120 ppm did not lead to significant improvement in egg production percent as same as increasing guar level from 0.3% to 0.6%. Increasing guar meal level in layer diet up to 10% did not cause harmful effect on egg performance (Youssef and El-Gabry, 2018). The harmless effect of increasing guar meal and saponin extracted from guar bean levels may be due to the levels used in the experiment being so low than the harm level (5gm saponin/kg diet) (Whitehead *et al.,* 1981). The significant increase in egg production percent by increasing guar level compared with saponin may be due to its ability to inhibit coccidia in chickens (Hassan *et al.,* 2008) as same as saponin. Moreover, it contains galactomannan, which, holds useful effects in increasing macrophage activity and in decreasing pathogenic bacteria of gastrointestinal like salmonella (Zhang, 2005). The significant reduction in egg production% by increasing salinomycin levels from 60 ppm to 120 ppm during 1st month, 2nd month and entire period agree with (Hoop, 1998) who reported increasing salinomycin cause a reduction in egg production. The reduction in egg production percent by increasing salinomycin levels may be due to salinomycin, causes poultry disorders (Novilla, 1992) during egg production may be by generating free radical (Kamashi *et al.,* 2004).

Regarding feed intake, the results of guar meal compared with control agree with Youssef and El-Gabry, (2018) and (Rahman, *et al.,* 2011) who reported that guar meal supplementation causes a significant increase in feed intake. Increasing salinomycin levels decreased feed intake compared with control treatment. The result agree with (Brake, *et al.,* 2001) who reported that increasing anticoccidial that contains ionophore such salinomycin decreased feed intake. The decrease in feed intake by increasing saponin levels agree with (Whitehead *et al.,* 1981), this may be due to intestinal motility slowing and digestion process being prolonged by increasing saponin level (Shimoyamada *et al.,* 1998).

The insignificant effect of saponin on feed conversion agree with (Zhou *et al.,* 2014) who found no significant differences of 60, 240 and 480 mg/kg saponin on feed conversion they added that all levels had reduced feed conversion but in insignificant level (P>0.05). The best numerical feed conversion values have been obtained when diets supplemented with different saponin levels compared with other treatments for entire experimental period. Guar meal contains the same levels of saponin in the current experiment, but it recorded lower feed conversion values compared with saponin. The result may be attributed to guar containing a large amount of galactomannan (Lee *et al.,* 2005) that cause an enhancement in intestinal viscosity (Gutierrez *et al.,* 2007). Increasing intestinal viscosity led to an increase in feed intake values (Bedford, 2018).

Increasing shell weight percent and shell thickness agree with (Hou *et al.,* 2009) who reported that 90mg/kg from extracted saponin was able to improve significantly (P ≤ 0.05) eggshell thickness. The result may be due to increasing saponin level improving digestion and absorption of minerals (Alagawany *et al.,* 2016) and being able to keep calcium balance (Qian *et al.,* 2001). Increasing haugh unit for egg produced from hens fed diet supplemented with salinomycin compared with those fed control diet agree with (Domingues, *et al.,* 2014).

The result of abdominal fat and immune organs agrees with Rahman, *et al.* (2011) who found that saponin significantly decreased (p<0.05) body fat by 16% more than that of the control treatment (Rahman, *et al.,* 2011). In the present study supplemented diet with 60 ppm and 120 ppm saponin depressed body fat by 26.9% and 32.6 respectively.
The insignificant effects of saponin, salinomycin and guar meal on plasma protein profile were reported by (Yenge, *et al.,* 2018; Kamashi, *et al.,* 2004; Youssef and El-Gabry, 2018) respectively. Concerning numerical increased in total lipid by salinomycin supplementation, the result is in full agreement with (Angelovičová, *et al.,* 2016). The numerical decreases in total lipid by saponin supplementation and increasing its level agree either with (Afrose *et al.,* 2010). Concerning, response of lipid profile to saponin supplementation the result was supported using gene expression by (Zhou, *et al.,* 2014).

The results of liver functions are in full agreement with (Kamashi *et al.,* 2004; Diaz *et al.,* 2018). This may be due to salinomycin-generated free radicals that cause toxic statues or oxidative damage and cause hepatocellular injury (Kamashi *et al.,* 2004; Diaz *et al.*, 2018) added that salinomycin caused muscle damage and AST was sensitive for this damage. The effect of different levels for both saponin extracted from guar bean and guar meal supplementation on liver enzymes was insignificant. the insignificant effect of extracted saponin on liver enzyme agrees with Zhang *et al.* (2017) who found no differences in AST and ALT extracted saponin supplemented to control diet. In the same manner, guar meal supplementation didn't affect significantly AST and ALT. this result agrees with Youssef and El-Gabry, (2018) who reported that guar meal may not possess an adverse effect on liver function.

CONCLUSION

supplemented control diet with guar bean meal or the equal amount of saponin extracted from it achieved nearly the same improvement of salinomycin compared with a control diet. So these natural components can use safely to replace antibiotics in feeding layers to reduce the risk and harmful effects of antibiotics when humans feed table eggs.

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استخدام كسب الجوار أو الصابونين المستخلص من الجوار كبدائل امنة للمضادات الحيوية في علائق الدجاج البياض

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اجريت هذه التجربة لتقييم القدرة على الاستخدام كسب الجوار أو الصابونين المستخلص منه كبديل آمن للمضادات الحيوية في علائق الدجاج البياض. تم تقسيم 168 دجاج عمر 22 اسبوع وتظهر عليها علامات الصحة الى 7 معاملات تجريبية تحتوي كل واحدة على 3 مكرراتبكل مكرر 8 دجاجات. مثلت المجموعة الاولى معاملة المقارنة وغذية على عليقة مكونة من الذرة وفول الصويا بينما المجموعات من 2 الى7غذية على علائق تحتوي 0.3٪كسب جوار، 0.6٪ كسب جوار، 60 جزء في المليون صابونين، 120 جزء في المليون صابونين، 60 جزء في المليون سالينوميسن، 120 جزء في المليونسالينوميسين على الترتيب. تم تقدير قياسات الاداء الانتاجي للبيض، وجودة البيض، كلا من الاعضاء الماكولة والاعضاء المناعية، ليبيدات وبروتينات البلازما وانزيمات الكبد للتحقق من فرضية التجربة.

اظهرت النتائج تحسن في معظم مقاييس انتاج البيض عندما تم اضافة الصابونين المستخلص من كسب الجوار او نفس الكمية المكافاءة له من كسب الجور الى عليقة المقارنة. وظهر زيادة مستوى الصابونين او كسب الجوار تحسن في الاداء الإنتاجي مقارنة بزيادة مستوى السلينوميسين.

لم تظهر نتائج جودة البيض ومقاييس الذبيحة فروق جوهرية بين مستويات الصابونين والجوار من جهة وبين السلينوميسين من جهة اخرى. بينما اوضحت وظائف الكبد تاثيرات ضارة عندما تم اضافة السلينوميسن لعليقة المقارنة حيث زاد كلاً من انزيمي (AST, ALT) مقارنة باضافة المواد الطبيعية لعليقة المقارنة.

وعليه فان نمط استجابة الأداء الإنتاجي ووظاف الكبد يعزز فكرة استخدام المواد الطبيعية كبدائل امنة للمضادات الطبيعية.

الكلمات المفتاحية : جوار ،صابونين ، ساليتوميسن و اداء الدجاج البياض.