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IMPROVING UTILIZATION OF ACACIA LEAVES MEAL AND ITS EFFECTS ON BROILERS PERFORMANCE.

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ABSTRACT: Two hundred and forty day old Cobb broiler chicks were distributed into eight groups; the experimental treatments were arranged in a factorial design (2x4) by using two levels of tartaric acid (0 and 0.30 %) and four levels of *Acacia saligna* leaves meal (ALM) L1, L2, L3 and L4 to be 0, 3, 6 and 9%, respectively. Results showed that supplemented broiler diets with 0.30%of tartaric acid improved digestion coefficients of CP, CF, NFE , DCP, live body weight , body gain ,feed conversion ,increased edible giblets%, digestive tract weight (%) and digestive tract length (cm) compared with the control. Increasing the level of ALM in the diet from 0 to 9% decreased the digestibility of nutrients , live body weight ,body gain and digestive tract weight (%) but , increased feed intake , edible giblets% and digestive tract length (cm) and gave inferior feed conversion. The interaction between organic acid addition and ALM level had a significant effect on improving the digestion coefficients of CP, CF, NFE , DCP, live body weight and body gain. A significant decrease in values of feed intake, feed conversion, edible giblets% and digestive tract length (cm) was seen in this respect. Also, a significant decrease in digestive tract weight (%) was detected among the fourth experimental groups fed ALM with 0.30% tartaric acid compared with the other un-treated groups. Supplemented broiler diets with 6% of ALM with 0.30%of tartaric acid improved economic efficiency % of feed and relative economic efficiency of feed as compared with the control group. It may be concluded that using 6% of Acacia leaves meal and adding 0.30% tartaric acid in the diet reflect desirable results on broilers performance.

Keywords: Acacia leaves meal – tartaric acid and broilers performance.

INTRODUCTION

The most important constraints that hinder the productivity of livestock in Egypt are the low quality of food and inadequate feeds. Arid and semi-arid areas had many prominent sources of forage like trees and shrubs which have leaves with nutritional protein sources that need more researcher efforts to get the right information about utilization of this forages' leaves which are in great interest due to the high nutritional value and low cost were in a limits in their uses likes chemical composition, anti-nutritional factors content, viability and palatability (Anon., 2009).

Acacia saligna (also called *Acacia cyanophylla)* is from *Leguminosae* family, it is a big perennial shrub which can tolerate all desert environmental conditions and gives a successful growth under saline conditions of soils and irrigated water recover. (Orwa *et al*., 2009). It may survive and grow on sites receiving as little as 200mm of rain annually or even less (El Lakany, 1987). Recently, organic acids and their mixtures showed inhibiting activity on the growth and development of pathogens in poultry feed and gastrointestinal tract (Wald, 2004 and Jovank *et al*., 2008). Tartaric acid is a carboxylic acid bearing a hydroxyl group (usually on the alpha carbon), such organic acid can cause a weakness of antimicrobial activity like salmonella (Luckstadt, 2005). Decreasing colonization of pathogen and production of toxic metabolites, improved digestibility of protein, calcium, phosphorus, magnesium, and zinc, and serve as substrates in the intermediary metabolism Ca , P, Mg and Zn have been obtained by acidification of feeds by using weak organic acids (Veeramani *et al*.,2003).

The study was conducted to investigate how can tartaric acid as an organic acid can improve utilization of acacia leaves meal and its effect on broilers performance.

MATERIALS AND METHODS

Site and the aim of study:

An experiment was conducted at South Sinai Experimental Research Station (Ras-Suder City) which belongs to the Desert Research Center. The main objective was to improve utilization of *Acacia saligna* leaves meal (ALM) as un-traditional feedstuff in broiler chicks' diets under south Sinai conditions by supplementing diets with the organic acid (tartaric acid) and their effects on broiler performance, nutrients digestibility, organs morphology and productive efficiency.

Experimental procedure:

Two hundred and forty day old Cobb broiler chicks were individually weighed and randomly distributed into 8 treatment groups, each in three replicates (10 birds /replicate). The experimental treatments were arranged in a factorial design (2x4) by using two levels of tartaric acid (0 and 0.30 %) and four levels of *Acacia saligna* leaves meal (ALM) L1, L2 , L3 and L4 to be 0,3, 6 and 9%, respectively.

Feed and water were offered *ad libitum*, basal diets were formulated (Tables 2 and 3) to be iso-caloric and iso-nitrogenous to meet the nutrients requirements of Cobb 500 broiler performance guide supplement (2012) and NRC (1994) at starter (1-21d) and finisher (21-42 d) periods. Chemical analysis of the experimental diets and feaces were assayed using methods of A.O.A.C. (1990).

Growth performance:

Live body weight (LBW) and feed intake (FI) were recorded while, body weight gain (BWG) and feed conversion ratio (g feed/g gain) were calculated.

Digestibility trail:

At the end of the experimental feeding period, digestion trial was conducted using 32 cockerels adult (four for each treatment) to determine the digestion coefficients of the experimental diets. Birds were individually housed in metabolic cages. In that, the trials extended for 9 days; 5 days as a preliminary period followed by 4 days as collection period. During the main period, excreta were collected daily and weighed, dried at 60 C^{o}, bulked, finally ground and stored for chemical analysis.

Carcass traits:

3 birds / treatment were randomly taken and slaughtered to obtain carcass characteristics.

Economic efficiency:

The Economic efficiency (EE) was calculated according to the equation EE=((A-B)/B) x100, where A the selling cost of the obtained gain and B is the cost of this gain.

Statistical analysis:

The data obtained were statistically analyzed according to (SAS, 2002) using factorial two-way classification and differences among treatment means were determined by Duncan's New Multiple Range test (Duncan, 1955).

The model used for analysis was: Yijk = U + Ei+ Tj + TEij + eijk

Where: Yijk = Observation, U = The overall mean, Ei = organic acid levels (i=1 and 2), Tj = Acacia leaves meal levels (j=1, 2, 3 and 4), ETij = The interaction between organic acid levels and Acacia leaves meal levels (ij =1, 2, …..8) and eijk = Random experimental error.

RESULTS

Chemical composition of ALM

The chemical composition and fiber fractions of ALM were 90.80, 92.35, 16.52, 17.00, 4.45, 45.18, 7.65, 54.38, 43.84 and 32.10% for DM, OM, CP, CF, EE, ash, NFE, NDF and ADF These values are nearly similar to those reported by Abd El-Galil and khider (2000) while ,the values recorded for ash, EE and CF were less than those obtained by El-Eraky and Mohamed (1996). In this connection, Abd El-Mawla(2008) showed that chemical composition of ALM were 16.63, 17.81, 5.16, 8.67, 51.73, 44.79 and 23.83%for CP, CF, EE, ash, NFE, NDF and ADF ,respectively. The variation of the chemical composition of ALM may be due to the differences between cultivars, climatic and soil conditions in different geographical locations, drying methods under shade or the sun. So, it is clear that ALM contains a mediate percentage of CP and NFE content, indicating that it has potential values as a source of protein for livestock as previously reported by Gupta *et al*. (1978). The Gross energy (GE) of ALM was 5.42 MJ/kg (1290 kcal/kg) .Our results disagreed with those obtained by Ibrahim (1998) who found that ME of ALM by broiler chickens were 2290 kcal/kg.

Digestibility coefficients

It is worthy to note that the experimental diets were adjusted to be nearly of isonitrogenous and isoenergetic values; accordingly any differences in the digestibility values could be due to the quality of the tested material (ALM) which incorporated to the control diet. Tartaric acid is monocarboxylic acid and its inclusion poultry diet was considered due to its ability to inactive salmonella by decreasing pH in the gastrointestinal tract (GIT) as the same time it was to promote favorable environment in the GIT for growth of the micro flora resistant to pH<7 (such as Lactobacillus) and this reflect an ideal flora which resulted in improving digestion , absorption, growth and efficiency (Boroojeni *et al*.,2014).

As can be seen in Table 4 supplemented broiler diets with 0.30%of tartaric acid improved (P<0.05) digestion coefficients of CP, CF, NFE and DCP compared with the control. The digestibility of each component decreased with increase in the level of ALM in the diet from 0 to 9% ALM. It may be due to the presence of tannins and phenolic amines in ALM which are the most reason for digestion coefficients depression by forming insoluble components with proteins and carbohydrates (Reddy ,1999). Moreover, Streeter *et al.* (1993) showed that reducing digestibility of protein, carbohydrates and the inhibition of digestive enzymes by altering permeability of the gut wall were due to the presence of tannins; and added that CP and CF digestibility were the most affected ones. Similarly, Abd El-Mowla (2008) showed that using 16.50% ALM resulted in non-significant effect on CP, but it increased digestibility coefficient of EE, and added that; the most important aspect to tannins nutritional and toxicological effects were the ability to form strong complexes with proteins . The interaction between organic acid addition and ALM level had a significant effect on improving the digestion coefficients of CP, CF, NFE and DCP especially for group fed diets contained 6 and 9% levels of ALM and supplemented with 0.30% tartaric acid as compared with the un-supplemented groups. Positive effects was reported by; Luckstadt *et al*.,(2004) and Alcicek *et al*.,(2004) who concluded that lowering pH caused by the organic acid can protect the animal from infiction espcially at their younger ages . However , the composition and buffering capacity of the diet were the two reasons which affect the effectiveness of organic acids in broiler diets .

In this repect,Brenes *et al.*(2003) concluded that to provide a favorable environement in the digestive tract of broilers and the effective digestion of dietary nutrients we must mix organic acid to the diet because the poultry digestive tract acidity is not desirable for complete hydrolyze. More recent research has indicated that organic acid (citric acid) added to chickens fed corn-soybean meal diets containing un-supplemented P is very efficient in improving phosphorus utilization (Boling *et al*.,2000) and other nutrients (Brenes *et al*.,2003; Snow *et al*.,2004 and Rafacz-Livingston *et al*.,2005).

Live body weight and body gain:

Obtained data in Table 5 showed that supplemented broiler diets with 0.30%of tartaric acid improved (P<0.05) live body weight and body gain at whale experimental period compared with the control group. It has been shown that adding organic acids to broiler rations increases body weight gain and improves feed efficiency (Abdel-Fattah *et al*., 2008). However; live body weight and body gain were decreased (P<0.05) by gradual increases in the ALM in the diet from 0 to 9%. On the other hand; Ncube *et al.*, (2018) demonstrated that broilers on the control and 5%ALM diet gained more and were heavier, with better feed conversion than those on the 10% diet (*P* <0.05) and added that higher feed intake during the growing and finisher phases of feeding translated to superior live weight and weight gain on the control and 5% ALM diets.

Regarding to the interaction between organic acid addition and ALM level ; a significant increase in both live body weight and body gain were obtained in the treatment groups fed 0.30% tartaric acid compared with the other un treated groups. These findings are in agreement with that reported by Abd El-Mowla (2008) who proved that the best body gain of rabbits was recorded by group fed 16.50% ALM supplemented with 0.025 % acetic acid.

Feed intake and conversion

Irrespective of dietary ALM, data in Table 6 reflected that supplemented broiler diets with 0.30%of tartaric acid increased ($P<0.05$) Feed intake and improved feed conversion at whale experimental periods compared to the control group. Different result was found by Aksu *et al*., (2007) who reported that organic acid addition had no effect on feed intake and feed conversion.

However, feed intake and feed conversion were gradually increased ($P<0.05$) by increasing the level of ALM in the diet from 0 to 9%. On the other hand, Ncube *et al.*(2018) fed broilers on 0, 5 and 10% of ALM and found that feed intake of birds was not affected.

Regarding to the interaction effect between organic acid addition and ALM level there were a significant decrease feed intake and improved feed conversion in the fourth experimental groups fed ALM containing diets supplemented with 0.30% tartaric acid as compared with the other un-treated groups. High positive correlations between feed intake and growth rate were reported by Ferket and Gernat (2006). The higher weights during the growing and finishing phases for birds on the 5% and control diets could also be attributed to better feed conversion associated with the two diets, compared with the 10% leaf meal-based diet, possibly because of its higher crude fibre content and tanniferous ingredients confer a bitter taste to the feed (Frutos *et al.*, 2004; Onyimonyi *et al*., 2009; Medugu *et al*., 2010; Onunkwo & George, 2015), but given the inability of broilers to detect taste, and the fibrous nature of the leaf meal, it is likely that feed intake was highly controlled by the gastrointestinal capacity of the broilers (McDonald *et al*., 2010).

Carcass traits

Irrespective of inclusion levels of ALM, data presented in Table 7 shows that supplemented broiler diets with 0.30%of tartaric acid increased ($P<0.05$) edible giblets%, digestive tract weight (%) and digestive tract length (cm) in comparable with the control. Aksu *et al*. (2007) Showed that carcass, breast, liver and internal edible organs were improved when broilers diet supplemented with organic acid.

Increasing the level of ALM in the diet from 0 up to 6% caused a significant increase in edible giblets% with significant decrease in digestive tract weight (%)whereas , the digestive tract length (cm) was increased. Ncube *et al*., (2018) found that no effect on dressing percentage was detected where, 10% inclusion significantly reduced carcass weight. Also, Inclusion of ALM had no influence on the proportional yield of abdominal fat, wings, back, chest portions, entire drumstick and meat to bone ratio in thighs and drumsticks, breast meat to bone ratio decreased with increasing levels of ALM.Regarding to the interaction between organic acid addition and ALM level there were a significant increase edible giblets% and digestive tract length (cm) but significant decrease digestive tract weight (%) in the fourth experimental groups fed ALM with 0.30% tartaric acid as compared with the other un treated groups.

Economical evaluation

Data presented in Table 8 showed that supplemented broiler diets with 6% Acacia leaves meal with or without adding 0.30%of tartaric acid improved economic efficiency % of feed and relative economic efficiency of feed compared to the control group. Islam *et al*., (2008) showed that adding 0.5% of citric acid in diet or 0.5% of acetic acid in water increased feed cost in comparison with control group.The highest net profit was obtained by adding 0.5% citric acid and the lowest t was obtained in 0.5% acetic acid treatment as compare to control group. The low price of the ALM reflected the price of experimental diets, net return and the EEF values.

It may be concluded that 6% of Acacia leaves meal and supplementation of 0.30% tartaric acid in the diet showed positive effect on broilers performance with no detrimental effect on carcass characteristics.

Table(1): Chemical composition of Acacia leaves meal (%DM basis).

Components	**Composition**
Dry matter	90.80%
Organic matter	92.35%
Crude protein	16.52%
Crude fiber	17.00%
Ether extract	4.45%
Ash	7.65%
NFE	54.38%
NDF	43.84
ADF	32.10
GE(MJ/kg))	5.42
Total tannins mg/g DM.	11.14

Table (2): Composition of the experimental starter diets (1-21 days)

Ingredients (%)	Levels of ALM			
	L1	**L2**	**L3**	**L4**
Yellow corn	54.30	51.00	49.50	47.50
Soybean meal (44%)	34.00	33.00	31.50	30.00
Corn gluten meal (60%)	3.00	3.30	3.80	4.50
Acacia leaves meal	0.00	3.00	6.00	9.00
Vegetable oil	3.86	4.86	4.36	4.16
Limestone	1.40	1.40	1.40	1.40
Dicalcium phosphate	2.14	2.14	2.14	2.14
NaCl	0.35	0.35	0.35	0.35
Vit& Min Premix*	0.30	0.30	0.30	0.30
DL- Methionine	0.24	0.24	0.24	0.24
L-Lysine-HCl	0.18	0.18	0.18	0.18
Choline chloride	0.10	0.10	0.10	0.10
Anti Coccidiosis drug.	0.05	0.05	0.05	0.05
Sodium bicarbonate	0.08	0.08	0.08	0.08
Total	100	100	100	100
Calculated analysis**				
ME, K cal/kg	3000	3000	3004	3000
Crude protein (%)	21.55	21.59	21.50	21.57
Crude fiber (%)	2.56	2.99	3.40	3.80
Calcium (%)	1.11	1.11	1.11	1.11
Av. Phosphorus (%)	0.50	0.52	0.53	0.55
Lysine (%)	1.08	1.07	1.04	1.02
Methionine%	0.35	0.35	0.36	0.36
Methionine & Cystine	0.70	0.71	0.71	0.72
Price /Ton (LE)	4704	4606	4503	4416
Determined analysis% (% DM basis)				
CP	21.50	21.50	21.50	21.48
CF	2.41	2.80	3.30	3.70
EE	2.74	2.70	2.90	3.06
Ash	2.35	2.55	2.70	2.94
NFE	71.00	70.45	69.60	68.82

* Each3 kg Vitamins and minerals contain: Vit. A120000IU, Vit. D_3 22000 IU, Vit.E100 mg, Vit.K_3 20mg,Vit. B_1 10 mg, Vit. B_2 50mg, Vit.B_6 15 mg, Vit.B_{12} 100 µg, Pantothenic acide 100mg,Niacin 300mg,Folicacid10mg,Biotin500µg, iron300mg,Manganese 600 mg, Choline chloride 500 mg,Iodine10 mg,Copper 100 mg, Seleneium 1 mg, and Zinc 500 mg
1.**According to, NRC (1994). L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.

Table (3): Composition of the experimental finisher diets (22-42 days).

Ingredients (%)	Levels of ALM			
	L1	**L2**	**L3**	**L4**
Yellow corn	62.20	60.80	58.00	55.40
Soybean meal (44%)	24.00	21.00	20.40	19.20
Corn gluten meal (60%)	4.60	6.20	6.20	6.70
Acacia leaves meal	0.00	3.00	6.00	9.00
Vegetable oil	4.36	4.16	4.56	4.86
Limestone	1.40	1.40	1.40	1.40
Dicalcium phosphate	2.14	2.14	2.14	2.14
NaCl	0.35	0.35	0.35	0.35
Vit& Min Premix*	0.30	0.30	0.30	0.30
DL- Methionine	0.24	0.24	0.24	0.24
L-Lysine-HCl	0.18	0.18	0.18	0.18
Choline chloride	0.10	0.10	0.10	0.10
Anti Coccidiosis drug.	0.05	0.05	0.05	0.05
Sodium bicarbonate	0.08	0.08	0.08	0.08
Total	100	100	100	100
Calculated analysis**				
ME, K cal/kg	3182	3179	3176	3177
Crude protein (%)	18.79	18.81	18.79	18.83
Crude fiber (%)	2.36	2.75	3.17	3.58
Calcium (%)	1.08	1.08	1.08	1.08
Av. Phosphorus (%)	0.48	0.49	0.51	0.52
Lysine (%)	0.84	0.79	0.79	0.77
Methionine%	0.33	0.34	0.34	0.34
Methionine & Cystine	0.64	0.66	0.66	0.66
Price /Ton (LE)	4512	4477	4350	4254
Determined analysis% (% DM basis)				
CP	18.65	18.80	18.75	18.70
CF	2.36	2.75	3.17	3.58
EE	3.44	3.45	3.76	3.46
Ash	2.33	2.56	3.00	3.20
NFE	73.22	72.44	71.32	71.06

* Each3 kg Vitamins and minerals contain: Vit. A120000IU, Vit. D_3 22000 IU, Vit.E100 mg, Vit.K_3 20mg,Vit. B_1 10 mg, Vit. B_2 50mg, Vit.B_6 15 mg, Vit.B_{12} 100 µg, Pantothenic acide 100mg,Niacin 300mg,Folicacid10mg,Biotin500µg, iron300mg,Manganese 600 mg, Choline chloride 500 mg,Iodine10 mg,Copper 100 mg, Seleneium 1 mg, and Zinc 500 mg 1.**According to, NRC (1994).L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.

Table (4): Effect of Acacia leaves meal, Organic acid and their interactions on digestibility coefficient of broiler chicks.

Items	Parameters				
	CP	**CF**	**EE**	**NFE**	**DCP**
Organic acid (tartaric acid)					
T1 (0.0%)	80.50 [b]	24.75 [b]	81.00	84.50[b]	12.03[b]
T2 (0.3%)	81.70 [a]	25.90 [a]	81.05	85.22[a]	12.69[a]
± Se	1.10	0.20	0.75	1.12	0.37
ALM%					
L1	80.50 [a]	24.75 [a]	80.16	84.50[a]	12.39[a]
L2	80.00 [a]	24.35 [a]	80.00	84.32[b]	12.15[a]
L3	79.00 [a]	23.38 [b]	80.50	82.40[b]	12.00[a]
L4	76.02[b]	21.95 [c]	80.35	80.90[c]	11.54[b]
± Se	0.35	1.20	1.10	1.10	0.25
Interaction (acid × ALM)					
T1×L1	80.50 [a]	24.75 [b]	80.58	84.50 [a]	12.21 [a]
T1×L2	80.25 [a]	24.55 [b]	80.50	84.41 [a]	12.09 [a]
T1×L3	79.75 [b]	24.07 [c]	80.75	83.45 [b]	12.02 [a]
T1×L4	78.26 [c]	23.35 [d]	80.68	82.70 [d]	11.79 [b]
T2×L1	81.10 [a]	25.33 [a]	80.61	84.86 [a]	12.54 [a]
T2×L2	80.85 [a]	25.13 [a]	80.50	84.77 [a]	12.42 [a]
T2×L3	80.35 [a]	24.64 [b]	80.78	83.81 [b]	12.35 [a]
T2×L4	78.86 [b]	23.93 [c]	80.70	83.06 [c]	12.12 [a]
± Se	0.24	1.15	1.00	1.10	0.20

a, b ....Means in the same column in each classification bearing different letters differ significantly ($P \leq 0.05$). T1=0% Tartaric acid, T2=0.30% Tartaric acid, L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.

Table (5): Effect of Acacia leaves meal, Organic acid and their interactions on live body weight and weight gain of broiler chicks.

Items	Live body weight (g)			Weight gain(g)		
	1 day	21 days	42 days	1-21 days	22-42days	1-42 days
Organic acid (tartaric acid)						
T1 (0.0%)	40.00	949.00	1868.00^{b}	909.00	919.00^{b}	1828.00^{b}
T2 (0.3%)	40.00	974.00	2016.00^{a}	934.00	1042.00^{a}	1976.00^{a}
± Se	0.01	16.34	37.86	16.33	33.92	37.86
ALM%						
L1	40.00	949.00^{a}	1868.00^{a}	909.00^{a}	919.00^{a}	1828.00^{a}
L2	40.00	887.20^{b}	1822.00^{a}	847.20^{b}	934.80^{a}	1782.00^{b}
L3	40.00	738.50^{c}	1668.00^{b}	698.50^{c}	929.50^{a}	1628.00^{c}
L4	40.00	675.80^{d}	1573.00^{c}	635.80^{d}	897.20^{b}	1533.00^{d}
± Se	0.03	19.00	30.00	13.00	20.00	37.00
Interaction (acid × ALM)						
T1×L1	40.00	949.00^{a}	1868.00^{b}	909.00^{a}	919.00^{c}	1828.00^{b}
T1×L2	40.00	918.10^{a}	1845.00^{b}	878.10^{b}	926.90^{c}	1805.00^{b}
T1×L3	40.00	843.60^{b}	1768.00^{d}	803.60^{c}	924.25^{c}	1728.00^{c}
T1×L4	40.00	812.40^{c}	1720.50^{d}	772.40^{d}	908.10^{c}	1680.50^{d}
T2×L1	40.00	961.50^{a}	1942.00^{a}	921.50^{a}	980.50^{a}	1902.00^{a}
T2×L2	40.00	930.60^{a}	1919.00^{a}	890.60^{a}	988.40^{a}	1879.00^{a}
T2×L3	40.00	856.25^{b}	1842.00^{b}	816.25^{c}	985.75^{a}	1802.00^{b}
T2×L4	40.00	824.90^{b}	1794.50^{c}	784.90^{c}	969.60^{b}	1754.50^{c}
± Se	0.29	12.00	40.00	20.00	37.00	42.00

a, b....Means in the same column in each classification bearing different letters differ significantly ($P \leq 0.05$). T1=0% Tartaric acid, T2=0.30% Tartaric acid, L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.

Table (6): Effect of Acacia leaves meal, Organic acid and their interactions on feed intake and feed conversion of broiler chicks.

Items	Feed intake(g)			Feed conversion (g feed/g gain)		
	1-21 days	22-42days	1-42 days	1-21 days	22-42days	1-42 days
Organic acid (tartaric acid)						
T1 (0.0%)	1523.35	2577.50 [b]	4100.85[b]	1.68	2.80 [a]	2.24 [a]
T2 (0.3%)	1532.00	2956.40 [a]	4126.40[a]	1.64	2.55 [b]	2.09 [b]
± Se	19.41	57.00	65.00	0.01	0.02	0.01
ALM%						
L1	1510.00	2286.30 [b]	3796.30 [b]	1.66 [c]	2.49 [b]	2.08 [c]
L2	1515.00	2308.80 [b]	3823.80 [b]	1.79 [b]	2.47 [b]	2.15 [c]
L3	1533.35	2970.20 [a]	4503.55 [a]	2.20 [a]	3.20 [a]	2.77 [b]
L4	1545.00	3126.50 [a]	4671.50 [a]	2.43 [a]	3.48 [a]	3.05 [a]
± Se	23.35	16.95	40.30	0.01	0.01	0.03
Interaction (acid × ALM)						
T1×L1	1516.68	2431.90 [d]	3948.58 [c]	1.67	2.65	2.16
T1×L2	1519.18	2443.15 [d]	3962.33 [c]	1.73	2.64	2.20
T1×L3	1528.35	2773.85 [a]	4302.20 [a]	1.90	3.00	2.49
T1×L4	1534.18	2852.00 [a]	4386.18 [a]	1.99	3.14	2.61
T2×L1	1521.00	2544.15 [c]	3961.35 [b]	1.65	2.59	2.08
T2×L2	1523.50	2549.78 [c]	3975.10 [b]	1.71	2.58	2.12
T2×L3	1532.68	2715.13 [b]	4314.98 [a]	1.88	2.75	2.39
T2×L4	1538.50	2754.20 [a]	4398.95 [a]	1.96	2.84	2.51
± Se	10.29	15.00	40.00	0.02	0.01	0.01

a, b ....Means in the same column in each classification bearing different letters differ significantly ($P \leq 0.05$). T1=0% Tartaric acid, T2=0.30% Tartaric acid, L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.

Table (7): Effect of Acacia leaves meal, Organic acid and their interactions on some carcass traits of broiler chicks at 42 days of age.

Items	Parameters				
	Pre-slaughter (g)	Carcass %	Edible giblets* %	Digestive tract Weight (%)	Digestive tract length (cm)
Organic acid (tartaric acid)					
T1 (0.0%)	2020.00	75.62	4.16[b]	8.58[a]	166.00[b]
T2 (0.3%)	2010.00	75.100	5.39[a]	5.96[b]	195.00[a]
± Se	50.00	0.20	0.40	0.72	5.16
ALM%					
L1	2020.00	75.62	4.16 [b]	8.58[a]	166.00 [b]
L2	2010.00	76.54	5.64 [a]	8.30[a]	170.00 [b]
L3	2050.00	81.42	5.96 [a]	7.69[ab]	182.00 [ab]
L4	2030.00	75.76	4.18 [b]	5.19[b]	202.00 [a]
	70.00	1.19	0.32	0.65	6.14
Interaction (acid × ALM)					
T1×L1	2020.00	75.62	4.16 [c]	8.58[a]	166.00 [b]
T1×L2	2015.00	76.08	4.90 [b]	8.44[a]	168.00 [b]
T1×L3	2020.00	78.52	5.06 [b]	8.14[a]	174.00 [b]
T1×L4	2035.00	75.69	4.17 [c]	6.89[b]	184.00 [a]
T2×L1	2015.00	75.36	4.78 [b]	7.27[b]	180.50 [a]
T2×L2	2010.00	75.82	5.52 [a]	7.13[b]	182.50 [a]
T2×L3	2030.00	78.26	5.68 [a]	6.83[b]	188.50 [a]
T2×L4	2020.00	75.43	4.78 [b]	5.58[c]	198.50 [a]
± Se	55.00	0.11	0.21	0.50	3.00

a, b ....Means in the same column in each classification bearing different letters differ significantly ($P \leq 0.05$). T1=0% Tartaric acid, T2=0.30% Tartaric acid, L1=control, L2=3%ALM, L3=6% ALM and L4=9%ALM.*Edible giblets = liver, heart and gizzard weights.

Table (8): Economical efficiency of Broilers as affected by the experimental treatments

Items	L1		L2		L3		L4	
	T1	T2	T1	T2	T1	T2	T1	T2
Feed intake kg.	3.95	3.96	4.30	4.39	3.96	3.98	4.31	4.40
Cost of Kg feed (LE)	4.61	4.66	4.54	4.54	4.43	4.43	4.34	4.33
Total cost of intakes	18.21	18.45	19.52	19.93	17.54	17.63	18.71	19.05
Body weight gain kg.	1.83	1.81	1.73	1.68	1.90	1.88	1.80	1.75
Market price of one Kg meat (LE.)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Selling price (LE)	54.90	54.30	51.90	50.40	57.00	56.40	54.00	52.50
Net return (LE).*	36.69	35.85	32.38	30.47	39.46	38.77	35.29	33.45
Economic efficiency % (Ee) of feed **	2.01	1.94	1.66	1.53	2.25	2.20	1.89	1.76
Relative economic efficiency of feed***	100	96.5	82.6	76.12	111.94	109.45	94.03	87.56

*Net return = Selling price (LE) - Total cost of intakes

**Economic efficiency %= Net return/ Total cost of intakes

***Relative economical efficiency% of the control, assuming that relative EE of the control = 100.

REFERENCES

Abd EL-Fattah S. A., M. H. EI-Sanhoury, , N. M. EI-Mednay, , and F. Abdul-Azeem 2008. Thyroid activity of broiler chicks fed supplemental organic acids. Inter. J. Poul. Sci. 7: 215–222

Abd El-Galil , K. and R.E.,khider 2000. utilization of acacia saligna in feeding growing rabbits under the desert and newly reclaimed areas. Egypt.Poult.Sci.20 (3):497-515.

Abd El-Mowla, L.F. 2008. productive performance, carcass traits and some physiological changes in rabbits fed on acacia desert plants .Master, Thesis,Fac.Agric. Alex. Univ .

Abd El-Samee A.M., K.M. El-Gendy and H., Ibrahim 1994. rabbit growth and reproduction performance as influenced by feeding desert forage (*Acacia saligna* and *Atriplex numularia*) at north Sinai. Egypt. J. Rabbit Sci.,4: 25-36.

Aksu T., C. Ates, Z. Erdogan and E. Baytok 2007. The response of broilers to dietary organic acid mixture. Indian Vet. J., 84:385-387.

Alcicek A., M. Bozkurt and M. Cabuk 2004. The effect of a mixture of herbal essential oils, an organic acid or a probiotic on broiler performance. S. Afr. J. Anim. Sci., 34: 217-222.

Anon S. 2009. Introduction of salt-tolerant forage production systems to salt-affected lands in Sinai Peninsula in Egypt: a pilot demonstration project. Final Report, DRC, Egypt—ICBA, UAE.

A.O.A.C.1990. Association of Official Analytical Chemists. Official methods of analysis. 15th. Ed., Washington, USA.

Boling F., J. Snow, C. Parsons and D. Baker 2001. The effect of citric acid on the calcium and phosphorus requirements of chicks fed corn-soybean meal diet. Poult. Sci., 80:783-788.

Boroojeni F, Vahjen W, Mader A, Knorr F, Ruhnke I, Röhe I, Hafeez A, Villodre C, Männer K and Zentek J 2014. The effects of different thermal treatments and organic acid levels in feed on microbial composition and activity in gastrointestinal tract of broilers. Poultry Science 93: 1440–1452.

Brenes A., A.Viveros, I.Arija, C. Centeno,M. Pizarro and C.Braro 2003. The effect of citric acid and microbial phytase on mineral utilization in broiler chicks. Anim. Feed Sci. Technol., 110: 201-219.

Cobb Broiler Performance and Nutrition Supplement. 2012. Cobb-Vantress Inc., Siloam Springs, AR.

Duncan, D.B. 1955. Multiple ranges and multiple F- test. Biometrics, 11: 1-42.

El-Eraky W.A. and W.M. Mohamed 1996. Growth performance, carcass traits and some related physiological changes of growing rabbits fed on acacia and water hyacinth. Egypt. J. Rabbit Sci., 6:87-98.

El-lakany M.H. 1987. Use of Austrlian Acacias in Norht Africa. In 'Australian Acacias in Developing Countries'. Gympie, Qld., Australia. (Ed. JW Turnbull) ,ACIAR Proceedings 16, pp. 117.

Ferket P.R. and A.G. Gernat 2006. Factors that affect feed intake of meat birds: A review. Int. J. Poult. Sci. 5, 905-911.

Frutos P., Hervas G., F.J. Giraldoz and A.R. Mantecon 2004. Review: Tannins and ruminant nutrition. Spanish J. Agri. Res. 2(2), 191-202.

Gupta,P.C., N. Sagar and K. Pradhan 1978. Guar as a feed and fodder crop. Forage Res., 4A:109-122.

Ibrahim X. 1998. nutritional studies on non-conventional feeds in poultry nutrition in Sinai. Ph D. Thesis, Fac. Agric. Cairo Univ.

Islam M.Z., Z.H. Khandaker, S.D. Chowdhury and K.M. Islam 2008. Effect of citric acid and acetic acid on the performance of broilers. J. Bangladesh Agric. Univ. 6(2): 315–320.

Jovank, L; S. Markov; D. Olivera and S. Sredanovic 2008. " Slavica1Herbs and organic acids as an alternative for antibiotic growth- Promoters". Archiva Zootechnica 11(2): 5-11.

Luckstadt C. 2005. "Synergistic acidifiers to fight Salmonella", Feed Mix, 139(1): 28-30.

Luckstadt C., N. Senkoylu, H. Akyurek and A. Agma 2004. Acidifier –a modern alternative for antibiotic free feeding in livestock production with special focus on broiler production. Vet Zootechny , 27:91-93.

Mc-Donald P., Edwards, R. A. Greenhalgh, J. F. Morgan, C. A., Sinclair, L. A. and R. G. Wilkinson 2010. Animal Nutrition. 7th edition. Prentice Hall, UK.

Medugu C.I., I. D.Kwari, J.Igwebuike, I.Nkama, I.D. Mohammed and B. Hamaker 2010. Carcass and blood components of broiler chickens fed sorghum or millet as replacement for maize in the semi-arid zone of Nigeria. Agric. J. North America, 1(3), 326-329.

N.R.C. (National Research Council) 1994. Nutrient requirements of poultry. 9th rev.ed. National Academy Press, Washington, DC.

Ncube S., T. Halimani, E. Chikosi and P. Saidi 2018. Effect of *Acacia angustissima* leaf meal on performance, yield of carcass components and meat quality of broilers. S. Afr. J. Anim. Sci. 48 (2):271-283.

Onunkwo, D. N and O. S. George 2015. Effects of *Moringa oleifera* leaf meal on the growth performance and carcass characteristics of broiler birds. J. Agric. Vet. Sci. 8(3), 63-66.

Onyimonyi A.E., O. Adeyemi and G.C. Okeke 2009. Performance and economic characteristics of Broilers fed varying dietary levels of Neem leaf meal (Azadirachta indica). Inter. J. Poul. Sci. 8 (3): 256-259.

Orwa C., A. Mutua, R. Kindt, R. Jamnadass and S. Anthony 2009. Agroforestree database:a tree reference and selection guide version 4.0 (http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp)**.**

Rafacz-Livingston K. A., C. Martinez-Amezcua, C. M. Parsons, D. H. Baker and J. Snow2005. Citric acid improves phytate phosphorus utilization in crossbred and commercial broiler chicks. Poul. Sci. 84(9): 1370–1375.

Reddy C.V. 1999. Improving the nutritional quality of feed. Poult.Inter.J.44:36-44.

Scott T. A. 2005. Variation in feed intake of broiler chickens. Recent Advances in Animal Nutrition in Australia. 15,237-242.

Snow J., D. Baker and C. Parsons 2004. Phytase, citric acid and 1 a-hydroxycholecalciferol improve phytate phosphorus utilization in chicks fed a corn-soybean meal diet. Poult. Sci., 83:1187-1192.

S.A.S. 2002. Statistical Analysis System, User’s Guide, Statistics, SAS Institute Carry, North Carolina.

Streeter M.N., C.M. Hill and C.A. Hibberd 1993. effect of bird resistant and non-bird resistant sorghum gain on amino acid digestion by beef heifers. J. Anim. Sci.71: 1648-1656.

Veeramani P.; S. Selvan and K. Viswanathan 2003. Effect of acidic and alkaline drinking water on body weight gain and feed efficiency in commercial broiler. Int. J. Poult. Sci. 38: 42-44.

Wald C. 2004."Phytobiotics in animal nutrition", Feed magazine, 5: 136-140.

الملخص العربى

تحسين الاستفادة من مسحوق اوراق الاكاسيا وتاثير ذلك على اداء بداري التسمين .

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تهدف الدراسة الحالية الي تحسين الاستفادة من مسحوق اوراق الاكاسيا باضافة احد الاحماض العضوية (التارتاريك) للعليقة وتاثير ذلك على اداء بدارى التسمين ، صفات الذبائح و الكفاءة الاقتصادية،حيث استخدم عدد 240 كتكوت تسمين Cobb قسمت الي 8 مجاميع تجريبية تضمنت اربعة مستويات من اضافة مسحوق اوراق الاكاسيا وهي3,0, 9,6 % ،مع مستويين من الحامض العضوي 0% أو 0,3%.أظهرت النتائج أن:

-تدعيم علائق بدارى التسمين بالحامض العضوي (0,3% من التارتاريك) ادت لتحسن معاملات هضم البروتين, الالياف الخام, المستخلص الخالى من الازوت , الوزن الحي , معدل الزيادة في الوزن, معدل التحويل الغذائي , زيادة نسبة وزن الاحشاء الماكولة,زيادة نسبة وزن القناة الهضمية وزيادة طول القناة الهضمية (سم) مقارنة بالكنترول.

-ادت زيادة مستوى اضافة مسحوق اوراق الاكاسيا من 0 الى 9% لعلائق بدارى التسمين الى خفض معاملات الهضم , الوزن الحى و معدل الزيادة في الوزن ونسبة وزن القناة الهضمية وأعطى أقل كفاءة تحويلية للغذاء ، مع زيادة الماكول من الغذاء, زيادة نسبة وزن الاحشاء الماكولة, وزيادة طول القناة الهضمية (سم) .

-ادى التداخل بين مستوى اضافة الحامض العضوي ومستوي اضافة مسحوق اوراق الاكاسيا الى تحسن معنوي في معاملات هضم البروتين, الالياف الخام, المستخلص الخالى من الازوت , الوزن الحي , معدل الزيادة في الوزن, معدل التحويل الغذائي– انخفاض معنوي في كمية الغذاء الماكول –تحسن معدل تحويل الغذاء- زيادة نسبة وزن الاحشاء الماكولة, وزيادة طول القناة الهضمية (سم)-انخفاض نسبة وزن القناة الهضمية وذلك للعلائق الاربعة المغذاه على مسحوق الاوراق المدعم بحامض التارتاريك مقارنة بالاربعة مجاميع الاخرى .

-أدى استخدام مستوى 6% من مسحوق اوراق الاكاسيا مع او بدون الحامض العضوي (0,3% من التارتاريك) إلى تحسن الكفاءة الاقتصادية والكفاءة الاقتصادية النسبية للغذاء مقارنة بالكنترول .

-وبصفة عامة: انه يمكن استخدام مستوى 6% من مسحوق اوراق الاكاسيا كمصدر علف غير تقليدي في علائق بدارى التسمين بتدعيمها بنسبة 3 ,0% من الحامض العضوي التارتاريك لما له من اثار ايجابية على النمو بدون اي اثار سلبية على صفات الذبائح.