Effect of Dietry Sage Plant Leaves Powder and Ascorbic Acid Supplementation on the Performance of Broiler Chickens under Iraq Conditions

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ABSTRACT

A total number of 420 one day-old broiler chicks (Ross 308) were used in this study to evaluate the effect of dietary supplementation of sage plant (*Salvia officinalis*) leaves powder (SP) and ascorbic acid (Vit. C) On growth performance, and metabolic response of broiler chickens. Chicks were randomly divided into seven experimental groups each of 60 chicks. Chicks of the 1st group fed on basal diets (starter and grower) and considered as a control group, chicks of the 2nd, 3rd and 4th groups fed on basal diets supplemented with SP at a levels of 4, 8 and 12 g/kg diet, respectively. While, chicks of the 5th, 6th and 7th group fed on basal diets supplemented with Vit. C at a level of 200, 300 and 400 mg/kg diet, respectively. The obtained results showed that chicks fed diet supplemented with SP at a level of 12 g/kg diet showed higher improvement in body weight, body weight gain , rate of growth, feed consumption and conversion, blood parameters, economical efficiency, carcass yield and decreased mortality rate followed by those fed diet supplemented with Vit. C at a level of 300 mg/kg diet then by those fed diet supplemented with SP at level of 8 g/kg diet. It could be concluded that SP supplementation at a level of 12 and 8 g/kg diet, respectively and vitamin C at a level of 300 mg/kg diet seemed to be adequate to achieve the favorite results and is being recommended from the economical point of view.

Key Words: Broilers – Sage Plant – Ascorbic Acid – Growth Performance, Blood Parameters- Economical Efficiency

Introduction

The poultry industry has become an important economic activity in many countries. Poultry meat and its products have a vast consumer market and are making a significant contribution to the supply of good quality animal protein, vitamins and minerals **(Mothershaw *et al.*, 2009)**.

Herbs species and various plant extracts contain many active components, including essential oils, which boast a wide range of pharmacological activities **(Lewis *et al.*, 2003)**. The essential oil extracted from aromatic plants have been shown anticoccidial **(Jamroz *et al.*, 2003)**, antifungal **(Jantan *et al.*, 2003)**, antibacterial **(Mitsch *et al.*, 2004)**, antioxidant **(Botsoglou *et al.*, 2004)** activities, and stimulate effect on animal digestive systems **(Ciftci *et al.*, 2005)**, to increase production of digestive enzymes and improve utilization of digestive products through enhanced liver functions **(William and Losa, 2001 and Hernandez *et al.*, 2004)**.

Sage plant is one of the important medicinal plants because it contains active compounds, most importantly Thujone compound, which is attributed to the cleanser and anti-infection, and shows the medical impact in the treatment of throat and tonsils inflammation, and has a contraction impact used for light diarrhea treatment and it is also repelling intestinal gases **(Zhang *et al.*, 2005)**. That means sage plant has the advantage of preventing various diseases and give health and wellness for those who taken it **(Lee *et al.*, 2004)**.

Lenuța and Leonte (2011) concluded that sage plant essential oil could be considered as a potential natural growth promoter for poultry, whereas, the addition of sage plant essential oil levels had significant improved economic efficiency of broiler chicken compared to antibiotic and control group.

Many studies were conducted to investigate the effect of Sage plane (leaves or extract) on productive and metabolic performance of chicken, such as **Kishawy *et al.* (2016)** who reported that the pomegranate peel extract and sage plant oil had reduced the damaging of rancid soybean oil feed diets and that may be resulted in the improve of broiler chicken productivity. They also found that supplementation with pomegranate peel extract and sage plant oil had significant improved the final live body weight, weight gain of broiler chicken and blood plasma parameters had affected as well.

Ascorbic acid has been found to be involved in a number of biochemical processes. Function of vitamin C is related to its reversible oxidation and reduction characteristics; however, the exact role of this vitamin in the living system is not completely under stood, since a coenzyme form has not yet been reported.

Several researchers have reported beneficial effects of Vitamin C supplements given either in diets and/in drinking water. Supplements enhanced performance of broiler chickens with experimentally induced hypothyroidism **(Takahashi *et al.*, 1991)**, reduced stress- related response **(Pardue and Thaxton, 1986)** and improved

disease resistance of the birds **(Amakye-Anim *et al.*, 2000)**.

Ascorbic acid as an antioxidant interrupts free radical chain reactions in the body **(Powers and Jackson, 2008)**. Exogenous supplementation of ascorbic acid has shown to be beneficial in reducing the adverse effects of stress **(Konca *et al.*, 2009 and Tawfeek *et al.*, 2014 and Olukomaiya *et al.*, 2015))** and improve the growth performance of broiler chickens **(Sabah Elkheir *et al.*, 2008 and Elagib and Omer, 2012)**. Due to paucity of information on the combined effect of feed restriction and ascorbic acid supplementation on growth performance, rectal temperature and respiratory rate of broiler chickens. The present study aimed to investigate the effect of dietary supplementation of sage plant (*Salvia officinalis*) leaves powder and ascorbic acid on productive and metabolic response of broilers under Iraq environmental conditions..

Materials and Methods

Experimental diets and birds:

A total number of 420 unsexed one-day old broiler chicks (Ross 308) were used in this study. Chicks were randomly divided into seven experimental groups each of 60 chicks. Chicks of the 1st group fed starter and grower basal diets and considered as a control group. The 2nd, 3rd and 4th groups were fed the starter and grower basal diets supplemented with sage plant leaves powder (SP) at a levels of 4, 8 and 12 g/kg diet, respectively. While, chicks of the 5th, 6th and 7th group fed basal diets supplemented with ascorbic acid (Vit. C) at a level of 200, 300 and 400 mg/kg diet, respectively.

Chicks of the experimental groups were kept under similar, standard hygienic and environmental conditions in separate pens with 10 birds/m^2 stocking density until the end of the experiment. Wood shaving was used at 10 cm depth as a litter. Floor brooders with gas heaters were used for brooding chicks. Brooding temperature was maintained at 35°C during for the first 5 days of chick's age then decreased by 2°C weekly until the end of the 4th week (the averages of temperature and relative humidity values outside the farm during the experimental period were 46.6 ±8°C and 39.5 ± 5 % ,respectively) . Feed and water were offered ad-libitum. The lighting program was 24 h light at the first 5 days of age then from 6 to 42 days of age (the end of the experiment) 23 hours light and 1 hour dark was applied. Chicks were fed starter diet at the first three weeks of age then replaced with grower diet up to the end of experiment. The basal diets Table (1) were formulated according to the recommended requirements of **NRC (1994).**

Table 1. The ingredients and nutritional value of the basal starter and grower diets

Ingredients (%)	Starter from 1-21 days	Grower from 22-42 days
Yellow corn	30.00	40.00
Wheat	28.25	24.00
Soybean meal (48% protein)	31.75	24.80
Protein concentrate	5.00	5.00
Sunflower oil	2.90	4.40
Limestone	0.90	0.60
Di-calcium phosphate	0.70	0.90
Salt	0.30	0.10
Mixtures vitamins and minerals*	0.20	0.20
Total	100.00%	100.00%
Calculated chemical analysis (%)**		
Crude protein	23.00	20.00
ME, Kcal/Kg feed	3027.00	3195.3
Lysine	1.20	1.10
Methionine	0.49	0.46
Cysteine	0.36	0.32
Calcium	0.84	0.76
Available phosphorus	0.45	0.49

* Each 3.0kg of the Vit. and Min. contains:
Vit. A, 12000000 IU; Vit. D3, 2000000 IU; Vit. E, 10 g; Vit. K3, 2.0 g; Vit. B1; 1.0 g; Vit. B2, 5 g; Vit. B6;1.5 g; Vit. B12, 10 mg; choline chloride, 250 g; Biotin, 50 mg; folic acid,1 g; nicotinic acid, 30 g; Ca Pantothenate, 10 g; Zn, 50 g; Cu, 10 g; Fe, 30 g; Co,100 mg; Se, 100 mg; I, 1 g; Mn, 60 g and antioxidant, 10 g and complete to 3.0 kg by calcium carbonate.

Growth performance measurements:

Live body weight (LBW) were individually weighed to the nearest (g) at hatch, and at the 6th week of bird's age, then body weight gain (WG) and growth rate(GR) were calculated according to the formula suggested by **Broody (1949)**; WG = W2 – W1 and GR % =[(W2 – W1/ (W2 + W1)/2] ×100.

The feed intake (F.I) was calculated by difference between the weight of offered feed and remainder portion, then divided by the number of birds for each experimental treatments and expressed in gram per chicks during the period from (0-6) weeks of chicks' age. Feed conversion (F.C) was then calculated according to the following formula; F.C =Feed intake (g)/Weight gain (g).

Mortality rate was calculated according to the following formula; Mortality rate (%) = [(Initial total number of birds - number of live birds at the end of the experiment)/ Initial total number of birds] X100.

Economic efficiency:

The Economic traits were calculated according to prices of market at the time of the study. Performance index (PI) was also determined according to **North (1981)**.

Carcass traits and blood plasma parameters:

At the end of the experiment, four birds from each experimental group were randomly chosen for slaughter test. Birds chosen were deprived from feed for 16 hours before slaughtering process, individually weighed to the nearest g and slaughtered for carcass evaluation. After complete bleeding, shank and head were separated, the birds were then eviscerated and abdominal-organs were removed. Dressed and giblets (empty gizzard, heart and liver) were individually weighed. Proportional weights to live body weight of giblets, carcass and total edible meat were then calculated. Blood samples were taken individually from the same slaughtered birds of each group for chemical analysis. Heparinized blood samples were centrifuged at 2500 rpm for 15-min, stored in the deep freezer at approximately -20±l°C. until the time of chemical analysis. Plasma protein fractions (total protein, albumen, globulin and A/G ratio), asparatate aminotransferase (AST), alanine aminotransferase (ALT), creatinine, uric acid, triglycerides, total cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) were calorimetrically determined using commercial kits.

Statistical analysis:

Analysis of variance in one way ANOVA was carried out using SAS procedure guide (SAS, 2004). According to the following linear model:

$X_{ij} = \mu + Ti + e_{ij}$

Whereas:

X_{ij}= the i^{th} treatments

μ= the overall mean

$\mathbf{e_i}$ = the random error assumed to be independently and randomly distributed

Significant differences among groups means were tested using Duncan multiple range test (**Duncan, 1955**)

Results and Discussion

Growth performance:

The obtained results presented in Table (2) showed that highly significant variations ($P<0.01$) in (LBW), (WG) and (GR) of broiler chicks during the period from (0-6 wks) were found due to adding both Sage plant leaves powder (SP) and (Vit.-C) in broiler diets. Chicks fed on diets supplemented with SP levels showed higher averages of LBW, WG and GR than those fed on either diets supplemented with Vit. C or the control group. Concerning to levels of SP and Vit.- C, it is clearly observed that chicks fed diet supplemented with SP at a level of 12 g/kg diet showed the higher averages of LBW, WG and GR at the end of the experiment which mounted by 2300.5, 2258.9g and 192.9%, respectively followed by those fed diet supplemented with SP at a level of 8 g/kg diet (2205.7, 2164.0g and 192.6%, respectively) then by those fed diet supplemented with Vit.- C at a level of 300 mg/kg diet (2045.6g, 2004.4g and 192.1%, respectively). While, birds of control group showed the lowest averages of LBW, WG and GR (1820.0, 1778.2g and 191.0%, respectively). These results may be attributed to the effect of medicinal plants such as SP which have potential immune-modulating effect on the treated chicks that reflect in high growth performance

These results are in agreement with those obtained by **Lenuța and Leonte (2011)** and **Kishawy *et al.* (2016)** they reported that, the addition of sage plant oil (*Salvia officinalis*) or its extract in broiler diets had significant improved the growth performance compared to the control group. **Moreover, Pardue and Thaxton (1986)** stated that, supplementation of ascorbic acid (Vit. C) had beneficial effect on growth and body weight gain when birds were exposed to either environmental or nutritional stresses

Performance index:

Broiler chickens fed diets supplemented with different levels of (SP) and Vit. C showed significantly the higher performance index values compared with control group Table (3). The higher performance index values were recorded by applying SP at a level of 8 g and vit-C at a level of 300 mg/kg diet (171.14 and 172.62%, respectively). This result seemed quit logic since these experimental treatments had significant improvement in body weight and feed conversion of broiler chicken which are involved in calculation of PI.

Feed intake and feed conversion:

Data obtained in Table (3) revealed that, slightly significant variations were found in feed intake (F.I) due to treatments applied. Chicks fed diet supplemented with either Vit.- C at a level of 400 mg/kg diet or SP at a level of 12 g/kg diet consumed more feed at the whole period of the experiment (3166.4 and 3160.9 g/bird, respectively). However, birds fed diets supplemented with Vit.- C at a level of

300 mg/kg diet and SP at a level of 8 g/kg consumed less feed (2825.5 and 2928.7 g/bird, respectively) when compared with other treatments applied and control group. Highly significant variations (P<0.01) were found in the F.C for all experimental groups due to treatments applied. Generally, broiler chicks fed diets supplemented with SP or Vit.-C levels improved significantly average F.C compared with the control group. Chicks fed diets supplemented with 12 g SP/kg diet improved feed conversion (1.43 g feed/g gain), followed by those fed diet supplemented with 8 g SP/kg diet (1.47) then by those fed diet supplemented with Vit.-C at a level of 300 mg/kg diet (1.56 g feed/g gain) compared to the other treatments applied and control group (1.83 g feed/g gain) at the whole period of the experiment.

The improving of the feed utilization and the growth performance due to supplementation of SP and Vit.-C may resulted from the improvement exist in the metabolic system by increase the enzymatic activity. Sage components have many effects as antimicrobial, stimulating animal digestive systems, antioxidants, anticoccidial, increase production of digestive enzymes and improve utilization of digestive products by enhance ring liver function. Some aromatic plants and their essential oils have research on broiler performance the addition to the feed or water improved feed intake, fed conversion ratio, carcass yield action **(Zhang *et al*., 2005).** The result obtained agree with those reported by **Lenuța and Leonte (2011) who** found that the addition of 2% sage oil to the diet was improved feed conversion ratio by approximately 5% compared to the control group. The results of **Kishawy *et al.* (2016)** revealed that improved feed conversion in the supplemental with sage oil compared with control. The results obtain in ascorbic acid agree with those reported by **Bell, (1990); Robertson and Edwards, (1994); Tuleun *et al.* (2011) and Hassan *et al.* (2011)** they stated that, the supplementation of ascorbic acid improved feed conversion.

Mortality rate (%):

Data presented in Table (3) revealed that, significant variation (P<0.05) was found in mortality rate of broiler chickens due to treatments applied. It could be concluded that supplementing diets with SP and Vit.-C significantly decreased mortality rate of broiler, the decreasing in mortality rate increased by increasing levels of both SP and Vit.-C levels during the whole period of the experiment (0-6 wks). Birds fed diets supplemented with SP and ascorbic acid levels showed lower mortality rate compared with control group. The lower mortality rate were observed by chicks which received diet contained 12 g SP/kg diet and those fed diet supplemented with 400 mg ascorbic acid/kg diet which recorded the same value of mortality rate (1.67%), followed by those fed diet supplemented with SP a level of 8 g/kg diet and those fed diet supplemented with Vit.-C at level of 300 mg/kg diet (3.33%). However, the higher mortality rate (6.67%) was recorded by birds of the control group. The decreasing in mortality rate of broiler chickens due to the supplementation of SP and Vit.-C may be attributed to the anti-oxidant and anti-microbial activates of SP contents of essential oil, further to the anti-stress activity of Vit.-C that leads to increasing the immune response and disease resistance of birds. Supplements of vit. C enhanced performance of broiler chickens with experimentally induced hypothyroidism **(Takahashi *et al.*, 1991)**, reduced stress-reduced response **(Pardue and Thaxton, 1986)** and improved disease resistance of the birds **(Amakye-Anim *et al.*, 2000)**.

Relative economical efficiency:

The relative economical efficiency (REE) values of the experimental groups were varied due to applying of the dietary supplementation of SP and Vit. C levels in broiler chicken diets. All levels of feed additives had the superiority of the REE values compared to control group. The higher EE % values were recorded by birds fed diet supplemented with SP at a level of 12 and 8 g/kg diet (163 and 138%, respectively) and those fed diet supplemented with Vit. C at a level of 300 mg/kg diet (139.2%). However, the lower REE value was recorded by birds of the control group. This result may attribute to the significant differences were found in body weight gain and feed conversion for that groups further to the difference in the feeding cost since the selling price of chicken meat is constant.

Table 2. Effect of experimental treatments on life body weight, body weight gain and rate of growth

Independent variables		Body weight (g) at		Body weight gain (g) during	Rate of growth (%) during
Treatments	(Level/kg diet)	Hatch	6 WKS	0-6 WKS	0-6WKS
Control	0	41.8±0.44^{a}	1820.0±15.28^{d}	1778.2±15.01^{d}	191.0±0.08^{d}
SP (g)	4	41.5±0.03^{a}	1951.9±36.67^{bc}	1910.4±36.7^{bc}	191.7±0.16^{c}
	8	41.8±0.73^{a}	2205.7±36.93^{a}	2164.0±37.46^{a}	192.6±0.23^{ab}
	12	41.7±0.33^{a}	2300.5±28.32^{a}	2258.9±28.56^{a}	192.9±0.13^{a}
Vit.c (mg)	200	42.0±0.29^{a}	1853.5±33.50^{cd}	1811.5±33.50^{cd}	191.1±0.17^{d}
	300	41.2±0.17^{a}	2045.6±45.15^{b}	2004.4±45.06^{b}	192.1±0.16^{bc}
	400	42.0±0.50^{a}	1970.5±25.59^{b}	1928.5±25.74^{b}	191.6±0.17^{c}

Mean having similar letters in each column are not significantly different (P>0.05).
SP = sage plant leaves powder.

Table 3. Effect of experimental treatments on performance index, feed consumption, feed conversion and mortality rate.

Independent variables		Performance Index (%) during 0-6 WKS	Feed consumption (g/bird) during 0-6 WKS	Feed conversion (g feed/g gain) during 0-6 WKS	Mortality (%) during 0-6 WKS
Treatments	(Level/kg diet)				
Control	0	133.44 ±6.26^{c}	3050.0±32.35^{ab}	1.83±0.01^{a}	6.67±1.67^{a}
SP (g)	4	151.63±6.26^{bc}	3025.9±141.91^{ab}	1.64±0.05^{c}	5.00±0.00^{ab}
	8	171.14±6.26^{a}	2928.7±49.80^{ab}	1.47±0.02^{d}	3.33±1.67^{ab}
	12	167.43±6.26^{ab}	3160.9±90.95^{a}	1.43±0.02^{d}	1.67±1.67^{b}
Vit.c (mg)	200	137.37±6.26^{c}	3094.1±96.25^{ab}	1.79±0.05^{ab}	5.00±0.00^{ab}
	300	172.62±6.26^{a}	2825.5±116.36^{b}	1.56±0.07^{cd}	3.33±1.67^{ab}
	400	152.02±6.26^{bc}	3166.4±45.77^{a}	1.68±0.04^{bc}	1.67±1.67^{b}

Mean having similar letters in each column are not significantly different (P>0.05)
SP = sage plant leaves powder.

Carcass traits:

Results obtained in Table (5) revealed that significant variations in the absolute and relative weights of carcass, giblets, total edible meat and fabricia gland of broiler chickens due to treatments applied. The highest relative weights of carcass, giblets and total edible meat were observed in birds fed diet supplemented with SP at a level of 12 g /kg diet (79.96, 6.94 and 86.90 %, respectively), followed by those fed diet supplemented with SP at a level of 8 g/kg diet (79.79, 6.83 and 86.62%, respectively), then by those fed diet supplemented with Vit. C at a level of 300 mg/kg diet (79.41, 6.67 and 86.08%) for relative weights of carcass, giblets and total edible meat, respectively. However, the lowest relative weights of carcass, giblets and total edible meat (75.63, 5.66 and 81.29 %, respectively) were showed by chicks of the control group. It could be concluded that the improvement in the relative weights of carcass, giblets, total edible meat and fabricia gland of broilers due to the feeding diets supplemented with SP and Vit. C may be attributed to the beneficial effect of SP and Vit. C in promote growth performance of broilers. The result obtained disagree agree with those reported by **Yurtseven *et al.* (2008)** who found that no significant differences in carcass traits of partridges (*Alectoris chukar*) fed on diets supplemented with sage plant extract with levels of 2.5, 5.0 and 7.5 mL sage extract/kg diet compared to control.

Blood plasma parameters:

The results obtained in Table (6) revealed that highly significant variations ($P<0.001$) were found in plasma total protein, albumin, albumin, globulin and A/G ratio due to treatments applied (table, 6). Broiler chicks fed diet supplemented with SP at a level of 8 and 4 g /kg diet showed the highest averages of plasma total protein (3.79 g/dl) and albumin (2.51 g/dl), respectively compared with other treatments applied and control group. While chicks fed diet supplemented with SP at a level of 12 g/ kg diet and Vit. C at a level of 300 mg/kg diet showed the highest averages of plasma globulin level (1.69 and 1.63 g/dl, respectively). However, birds fed diet supplemented with Vit. C at a level of 400 mg/kg diet and SP at a level of 4g/kg diet showed the highest averages of A/G ratio (2.21 and 2.01, respectively) compared with the different treatments applied and control group. The results obtained agree with those reported by Al-Sherify and Al-Alwany (2016) who reported that supplementation of sage plant leaves power at a level of 1 and 2% to the broiler diet had significant effect on plasma parameters.

Feeding birds on diet supplemented with different levels of SP and ascorbic acid decreased plasma AST and ALT compared with the control group, this lead to conclude that no stressful effect was found on bird's heart and other muscles due to treatments applied with different levels. It is well known that AST may be elevated in diseases affecting other organs rather than liver such as the heart or muscles since AST is elevated after myocardial infarction and during acute pancreatitis, acute hemolytic anemia, severe burns, acute renal disease, musculoskeletal diseases and trauma. Chicks fed diets supplemented with 12 and 8 g SP/kg diet showed the lowest plasma AST vales (19.85 and 19.91 U/L, respectively) and plasma ALT values (19.39 and 19.46 U/L, respectively) followed by birds fed diet supplemented with 300 and 400 mg ascorbic acid/kg diet (20.16 and 20.74 U/L) for plasma AST, respectively and 19.51 and 19.98 U/L for plasma ALT, respectively. However birds of control group showed the highest plasma AST (21.94 U/L) and ALT (20.16 U/L) .

The results obtained are in agreement with **Soltan *et al.* (2008)** and **Majid *et al.* (2015)** who found addition of medical plants such as of anise with levels (0.5 and 0.75 g/kg) reduced serum concentration of AST and ALT concentrations when compared with the control. Also, who stated that supplementation of sage plan (SP) and Marjoram plant medical herbs to broiler chickens diets had significant decrease ($P\leq0.05$) plasma ALT enzyme value compared to control.

The obtained results in Table (7) showed that treatments applied had highly significant effect on plasma creatinine and uric acid levels of broilers at the end of the experiment period. Chicks fed diets supplemented with different levels of SP and ascorbic acid decreased plasma creatinine and uric acid levels compared with control group, this lead to conclude that improvement effect was found on bird's kidney function due to treatments applied with different levels. In addition, chicks fed diet supplemented with 12 and 8 g SP/kg diet showed the lowest averages of plasma creatinine (0.40 and 0.47 mg/dl, respectively) and uric acid vales (4.72 and 5.44 mg/dl, respectively), followed by those fed diet supplemented with 400 and 300 mg/ ascorbic acid/kg diet compared with other treatments applied and control group which showed the highest plasma creatinine and uric acid (0.59 and 8.10 mg/dl, respectively),

It could be concluded from these results that, dietary supplements of SP and ascorbic acid applied had beneficial effect on the renal function in the most levels compared to the control. This result are in disagreement with those reported by **Elshony (2013)** who found that ascorbic acid significant decreased plasma creatinine and uric acid compared to control.

Table 4. Economical efficiency

Independent variables		Economical efficiency								
Treatments	**(Level/kg diet)**	**Average gain(kg)**	**Total revenue gain (U$$)**	**Total feed intake/chick(kg)**	**Total feed costs**	**Other costs**	**Total cost**	**Net revenue chick(U$$)**	**Economical efficiency (EFF)**	**Relative Economical efficiency(REE)**
Control	**0**	**1.78**	**4.55**	**3.05**	**1.95**	**0.59**	**2.54**	**2.01**	**0.79**	**100**
SP (g)	**4**	**1.91**	**4.89**	**3.03**	**1.95**	**0.59**	**2.54**	**2.35**	**0.93**	**117.7**
	8	**2.16**	**5.54**	**2.93**	**2.04**	**0.61**	**2.65**	**2.89**	**1.09**	**138.0**
	12	**2.26**	**5.62**	**3.16**	**2.16**	**0.65**	**2.81**	**2.81**	**1.29**	**163.0**
Vit.c (mg)	**200**	**1.81**	**4.64**	**3.09**	**1.96**	**059**	**2.55**	**2.09**	**0.82**	**103.8**
	300	**2.00**	**5.13**	**2.83**	**1.88**	**0.66**	**2.44**	**2.69**	**1.10**	**139.2**
	400	**1.93**	**4.94**	**3.17**	**1.96**	**0.59**	**2.55**	**2.39**	**0.94**	**119.0**

Net revenue chick (U$$) = Total revenue/kg gain-total feed cost/chick (U$$)
EEF= Net revenue/chick (U$$)/total feed cost/chick (U$$)
Relative economic efficiency% of the control.
SP = sage plant leaves powder.

Table 5. Effect of experimental treatments on carcass traits.

Treatments	Level (/kg diet)	Carcass weight		Giblets weight		Total edible weight	
		(g)	%	(g)	%	(g)	%
Control	0	1666.67±33.33b	75.63±0.92^{b}	124.72±2.28b	5.66±0.09^{d}	1791.39±17.09b	81.29±0.86^{c}
SP (g)	4	1503.43±3.28de	77.72±1.04^{ab}	123.96±0.48b	6.41±0.12c	1627.39±3.28e	84.13±1.14^{abc}
	8	1497.00±26.46e	79.79±1.20^{a}	128.14±1.64b	6.83±0.09^{ab}	1625.14±23.19e	86.62±1.67^{a}
	12	1823.33±14.53a	79.96±0.24^{a}	158.25±1.73a	6.94±0.14^{a}	1981.58±13.57a	86.90±1.29^{a}
Vit. C (mg)	200	1420.00±15.28f	75.80±0.73^{b}	109.96±0.73c	5.87±0.11^{d}	1529.96±25.73f	81.67±0.81^{c}
	300	1563.10±41.63c	79.41±1.66^{a}	131.30±1.09b	6.67±0.10^{ab}	1694.40±42.52d	86.08±0.16^{a}
	400	1580.00±11.25c	77.29±0.39^{ab}	134.51±1.32b	6.58±0.10^{b}	1714.51±10.56c	83.87±0.37^{bc}

Mean having similar letters in each column are not significantly different (P>0.05).
SP = sage plant leaves powder.

Table 6. Effect of experimental treatments on plasma protein fractions, AST and plasma ALT

Independent variables		Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A/G Ratio	AST (U/L)	ALT (U/L)
Treatments	(Level/kg diet)						
Control	**0**	**3.51±0.07^{c}**	**2.16±0.04^{bc}**	**1.35±0.04^{c}**	**1.60±0.01^{c}**	**21.94±0.12a**	**20.16±0.04a**
SP **(g)**	**4**	**3.76±0.05^{ab}**	**2.51±0.01^{a}**	**1.25±0.04^{d}**	**2.01±0.06^{b}**	**21.20±0.45ab**	**19.88±0.15ab**
	8	**3.79±0.03^{a}**	**2.50±0.01^{a}**	**1.29±0.03^{cd}**	**1.94±0.02^{b}**	**19.91±0.15cd**	**19.46±0.20b**
	12	**3.62±0.03^{bc}**	**1.93±0.07^{b}**	**1.69±0.10^{a}**	**1.14±0.03^{c}**	**19.85±0.25d**	**19.39±0.18b**
Vit.c (mg)	**200**	**3.74±0.02^{ab}**	**2.25±0.03^{b}**	**1.49±0.02^{b}**	**1.51±0.03^{c}**	**21.13±0.08ab**	**20.14±0.08a**
	300	**3.74±0.08^{a}**	**2.10±0.04^{cd}**	**1.63±0.05^{a}**	**1.29±0.05^{d}**	**20.16±0.34cd**	**19.51±0.06b**
	400	**3.56±0.06^{c}**	**2.45±0.03^{a}**	**1.11±0.02^{e}**	**2.21±0.06^{a}**	**20.74±0.30bc**	**19.98±0.33ab**

Mean having similar letters in each Column are not significantly different
SP = sage plant leaves powder.

Table 7. Effect of experimental treatments on plasma creatinine, uric acid, triglycerides, cholesterol, HDL and LDL

Independent variables		Creatinine (mg/dl)	Uric acid (mg/dl)	Triglycerides (mg/dl)	Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Treatments	(Level/kg diet)						
Control	**0**	**0.59±0.05^{a}**	**8.10±0.01^{a}**	**95.47±5.71^{a}**	**95.54±0.43^{a}**	**45.46±1.48^{b}**	**30.98±1.11^{a}**
SP **(g)**	**4**	**0.47±0.01^{b}**	**6.57±0.01^{c}**	**90.47±3.30^{a}**	**90.90±1.42^{ab}**	**45.12±0.57^{b}**	**27.69±0.36^{b}**
	8	**0.47±0.02^{bc}**	**5.44±0.02^{d}**	**77.79±1.77^{b}**	**89.31±0.65^{b}**	**47.46±0.88^{a}**	**26.30±0.59^{bc}**
	12	**0.40±0.02^{c}**	**4.72±0.02^{e}**	**74.19±2.49^{b}**	**82.99±0.38^{b}**	**42.86±0.37^{a}**	**25.29±0.28^{c}**
Vit.c (mg)	**200**	**0.52±0.02^{b}**	**7.55±0.05^{b}**	**92.90±5.14^{a}**	**92.52±1.32^{a}**	**46.79±2.20^{b}**	**27.15±0.34^{b}**
	300	**0.49±0.00b^{c}**	**5.64±0.05^{d}**	**89.27±3.25^{a}**	**89.60±2.17^{b}**	**45.19±1.25^{b}**	**26.56±1.57^{b}**
	400	**0.48±0.02b^{b}**	**5.48±0.58^{d}**	**75.62±0.35^{b}**	**85.30±0.51^{c}**	**44.84±0.84^{c}**	**25.33±1.31^{bc}**

Mean having similar letters in each Column are not significantly different
SP = sage plant leaves powder.

Results tabulated in Table (7) showed that plasma triglyceride, cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL) decreased significantly for chickens fed diets supplemented with different levels of sage plant (SP) or Vit. C compared with the control group. Concerning to the dietary levels, it is clearly evidence that plasma triglyceride, cholesterol, HDL and LDL significantly decreasing by increasing the dietary sage plant (SP) and ascorbic acid levels. The lowest levels of plasma triglyceride, cholesterol, HDL and LDL were recorded by chicks fed diet supplemented with 12 g SP/kg diet followed by those fed diet supplemented with 400 mg vit. C compared with different treatments applied and control group. The results obtained are in agreement with those reported by **Takahashi *et al.* (1991)** who found that plasma cholesterol decreased with increased supplemented ascorbic acid, because ascorbic acid supplementation changed lipid metabolism and plasma corticosterone concentration. The reduced plasma content of total cholesterol may reflect the hypocholesterolemic properties attributed to the defatted part of the leaves which are rich in fibrous content and may block intestinal cholesterol absorption (**Lanksy *et al.*, 1993)**.

It could be concluded from the previous results that the addition of SP and Vit. C to broiler diets had significant beneficial effect to decreased blood plasma lipid profiles, this may be attributed to SP fiber and flavonoids contents that is bonds with lipids forming complex-compounds, this disable the lipase enzyme to digestion of this complex- compounds couldn't absorbed from the small intestine **(Nelson and Cox, 2004).**

Conclusion

It could be concluded that, sage plant leaves powder supplementation at a level of 12 and 8 g/kg diet, respectively and Vit. C at a level of 300 mg/kg diet seemed to be adequate to achieve the favorite results and is being recommended from the economical point view.

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