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Effect of Bay Leaf (*Laurus nobilis* L.) Powder and Oil Additives on Reproductive Performance and Some Hormones Indicators of Quails

ABSTRACT

The present trial was conducted to investigate the effect of using bay leaf powder and its oil on male semen characteristics, female reproductive traits, plasma hormonal alteration and hatchability of local quails.

The results were summarized the uses of different levels of bay leaf (*Laurel nobilis* L.) and its oil as feed additives in quail diets were significantly ($P \leq 0.05$) higher in body weight, testis relative weight, gonadosomatic index, size area of cloaca gland, ejaculate volume, sperm concentration, mass motility, individual motility, live & normal morphology sperm, semen quality factor, seminal plasma testosterone and LH hormones in quail males. Also in females: egg production (H.D %), egg weight, egg mass, eggshell strength, normal eggs for hatching, fertility, hatching of fertile and total eggs, weight of hatched chicks, blood plasma of estrogen, LH and FSH hormones concentrations, also improved in FCR and H/L ratio. While, the results seemed significantly ($P \leq 0.05$) lower in dead sperm. Females in: cracked eggs, total dead embryos. Whereas there were non-significant differences among all treatment in males: mortality, left-right testicular weight ratio, testicular shape index, FSH hormone, also females in: feed Intake.

From the results of bay leaf oil additives had positively effect on body performance, males and females' reproductive parameters, improved blood hormones and hatchability more effective than bay leaf powder.

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INTRODUCTION

In modern countries, about 60-80% of people are more aware of their health that leads them to find natural based products to commute the role of different synthetic products which are available in the markets, so consume traditional medicine for treatment of various diseases. Therefore, herbs, medicinal plants and their oil are getting ahead interest to be good sources to provide better health (Binti Ahmed, 2014). The bay leaf is widely used as a dried herb it gives an aromatic essential oil; it is used as an important spice and flavoring substance in the food synthesis (Conforti *et al.*, 2006). The antioxidants in herbal plant help in the scavenge of free radicals' generation (Elmastaş *et al.*, 2006). The bay leaf (*Laurus nobilis*) have been shown to possess antioxidants (Saalu *et al.*, 2011). Jamroz *et al.* (2005) represented the essential oils that derived from herbs and spices used as functional feed additives, which is beneficial effects on animal nutrition include appetite stimulation as well as improvement of endogenous digestive enzyme secretion and immune stimulator. Moreover, it is widely used in popular medicine to treat alimentary tract problems, excretory problems and stones (Shtayeh *et al.*, 2000). The activity of antifungal laurel oil against the pathogenic fungi, moreover; the antibacterial activity has been assayed using the gram positive bacteria in the various extracts

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(DeCorato *et al.*, 2010), the gram negative bacteria, *Escherichia coli*, *Enterococcus faecalis*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* (Marzouki *et al.*, 2009). [Simic *et al.*, \(2003\)](#) has been investigated the methanolic extracts of bay leaf include polar compounds like phenols and flavones, they show antioxidative activity against lipid peroxidation. The active compound in essential oil of bay leaves are (0.8-3%) 1, 8-cineol (up to 50%) also eugenol, acetyl and methyl eugenol, α - and β -pinene, phellandrene, linalool, geraniol and terpineol ([Zekovic *et al.*, 2009](#)). Karaalp *et al.*, (2011) had been proposed that addition of bay laurel leaves (2 or 4 g/kg feed) had no effect on any performance and egg quality parameters of quails.

Therefore, the aim of this present study is to evaluate the protective effect of bay leaf (*Laurus nobilis* L.) and its oil additives to a conventional diet of laying local quail performances, male semen characteristics and quality, major reproductive hormones alteration in both sex, some egg quality and hatchability characteristics.

MATERIALS AND METHODS

This study was carried out in Grdarasha poultry houses and hatchery of Animal Resources Dept./College of Agriculture/Salahaddin University- Erbil. A total of 225 local quails (150 females +75 males) at age 25th week, the quails were distributed into five treatments, each treatment contains (30 females and 15 males) also each treatment included (3) three replicates local quails were reared in cages of space (65cm ×60cm×50cm) length width and height respectively, for 8 weeks, furthermore 17d hatching period. Quails were randomly distributed in: T0 (standard diet), T1 (1% bay leaf powder), T2 (2% bay leaf powder), T3 (0.1% bay leaf oil) and T4 (0.2% bay leaf oil) as explain in Table 1. Feed and water were supplied *ad libitum*. The birds were maintained under uniform husbandry conditions (17 hrs light/day) the housing temperature (18–25°C).

Table 1. Ingredient and chemical composition of quail layer (production) rations

Ingredients	Percentages (%)					Calculated chemical contents of diet (per kg) ³					
	T0	T1	T2	T3	T4		T0	T1	T2	T3	T4
Corn	48.43	47.43	46.43	48.43	48.43	ME/kcal	2800	2797	2793	2800	2800
Soybean meal	27.6	27.6	27.6	27.6	27.6	CP %	18.52	18.61	18.73	18.50	18.50
Wheat	15	15	15	15	15	CF %	4.30	4.48	4.51	4.30	4.30
Sunflower oil	1	1	1	0.9	0.8	Meth %	0.450	0.455	0.459	0.452	0.452
Bay leaf powder	0	1	2	0	0	Lys %	1.02	1.08	1.103	1.03	1.03
Bay leaf oil	0	0	0	0.1	0.2	Ca %	2.61	2.78	2.93	2.63	2.63
Limestone	6	6	6	6	6	AP %	0.354	0.359	0.364	0.350	0.350
DCP ¹	1.15	1.15	1.15	1.15	1.15	Na %	0.160	0.163	0.170	0.164	0.165
Vitamin premix ²	0.1	0.1	0.1	0.1	0.1						
Mineral premix ³	0.1	0.1	0.1	0.1	0.1						
Methionine	0.17	0.17	0.17	0.17	0.17						
Lysine	0.45	0.45	0.45	0.45	0.45						

CP: Crude protein, CF: Crude fiber, Meth: Methionine, Lys: Lysine, AP: Available Phosphor

Vitamine premix: Provides per kilogram of diet: vitamin A (retinyl acetate), 12,000 IU; vitamin D3 ¹ (cholecalciferol), 60 µg; vitamin E (dl- α -tocopheryl acetate), 32.96 IU; vitamin K3, 3 mg; vitamin B1, 3 mg; vitamin B2, 7 mg; vitamin B6, 4 mg; vitamin B12, 0.02 mg; nicotinic acid, 40 mg; Ca-dpantothenate, 8 mg; folic acid, 1 mg; biotin, 0.045 mg; vitamin C, 50 mg; choline chloride, 125 mg.
² Minerals premix: Provides per kilogram of diet: Mn, 80 mg; Fe, 40 mg; Zn 60 mg; Cu, 5 mg; I 0.4 mg; Co, 0.1 mg; Se 0.15 mg. ³ NRC: Chemical analysis of ingredients depending on NRC (1994).

100 g of dried bay leaves powder analysed in the laboratory (table 2). Bay leaf oil analysed in the laboratory by GC (table 3).

Table 2: Bay leaf (*Laurus nobilis*) powder nutritional value per 100 g dried

Gradients	Nutrient value
Energy	376 kcal
Protein	10.13 %
Total fat	6.41 %
Cholesterol	0 mg
Carbohydrates	54.25
Crud fiber	18.11
Moisture	7.63 %
Ash	3.47
Vitamin A	6053 IU
Ca	815 mg

Table 3 : The GC (Gas Chromatography) analysis for bay leaf (*Laurus nobilis*) oil.

Fatty acids composition			Volatile oils composition	
Numeric name	Compound name	%	Compound name	%
C12:0	Lauric acid	4.34	α -pinene	6.52
C14:0	Myristic acid	0.43	β -pinene	3.95
C16:0	Palmitic acid	29.86	Sabinene	5.63
C18:0	Stearic acid	1.79	Limonene	1.71
C20:0	Arachidic acid	0.18	Cinnamaldehyde	1.58
C16:1	Palmitoleic acid	1.86	cineole1,8	38.87
C18:1 n9	Oleic acid	33.85	p-cymene	1.20
C18:2 n6	Linoleic acid	11.32	terpinene-4-ol	2.63
C18:3 n3	Linolenic acid	13.83	α -terpineol	3.84
	Other compounds	2.54	Eugenol	2.98
	SFA	36.60	α -terpinylacetate	13.95
	UFA	60.86	Other compounds	17.14
	n3/n6	1.222		
	n6/n3	0.818		

SFA: saturated fatty acids, UFA: unsaturated fatty acids.

At week 33rd in males: body weight, mortality percentage and testes relative weight had measured. Feed and water were withdrawal from the males at least 6hr prior to semen collection, in order to minimize contamination of the semen with faces and urine then semen samples were collected according to (Bakst and Cecil, 1997). Semen was collected by stimulation of the male with a teaser female. Semen was collected twice a week from five males (pooling) in each replicate of the treatments, then use of a small glass collector fitted, with rubber tubing and a mouthpiece, into a small calibrated tube enabling measurement of ejaculate volume exact to 10 μ l. The fresh collected semen was evaluated: immediately after collection in each ejaculate such as; semen ejaculates volume, sperm concentration, Live & normal morphology sperm, semen quality factor, dead sperm percentage (Lake and Stewart, 1978), at the end of trial two males from each replicate were scarified for determining gonadosomatic index (GSI), it was calculated as:

$$\text{Gonadosomatic index (GSI)} = [\text{pair testis weight (g)} / \text{Body weight (g)}] \times 100$$

also area of cloaca gland (mm²) measured by Varnier. Testicular shape index:

Testicular shape index = (narrow diameter of cloaca / wide diameter of cloaca) x 100.

Blood plasma sexual hormones (testosterone, LH, FSH) in male and (estrogen LH, FSH) concentrations in female were measured by Radio immunoassay (RIA) using kits purchased from Biochem Immuno Systems. In females egg production (HD%), egg weight, feed intake, FCR, the percentage of normal eggs for hatching and cracked eggs and eggshell strength.

At the beginning of 33rd wk for 7 days a total of 825 fertile eggs, 165 eggs for each treatment incubated and hatched during 17 days. At hatching all live and dead chicks were counted and the percentages of fertility, hatching of fertile and total eggs, dead embryos, disabled chicks and chicks weight.

All data were analyzed by using CRD (Complete Randomize Design) by SAS (statistical Analysis System, 2005), as per variance, significant differences among treatment means were determined by Duncan's multiple range tests at level 0.05 (Duncan, 1955).

RESULTS

Table 4. refer to the effect of different levels of bay leaf powder and its oil had significantly ($P \leq 0.05$) heavier body weight in T4 and T3, also improved gonadosomatic index % in T2, T3 and T4, size area of cloaca gland (mm^2), ejaculate volume (μL), sperm concentration ($10^6/\text{ml}^{-1}$), mass motility %, individual motility %, live & normal morphology sperm (%) and semen quality factor in T4, T3, and T2 respectively compared with control (T0) of local quail males. While, significantly ($P \leq 0.05$) decreases in dead sperm % in the treatments T4, T3 and T2 compared with T1 and T0 (control), Whereas there were insignificant differences among all treatments in mortality percentage, testicular relative weight and testicular shape index.

Table 4. Effect of bay leaf powder and its oil additions on body weight, testis relative weight, and semen quality of local quail males.

Traits	T0	T1	T2	T3	T4	S.E
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00
Body weight (g)	201.4 ^b	209.3 ^{ab}	213 ^{ab}	225.8 ^a	235.6 ^a	35.43
Gonadosomatic Index %	2.59 ^b	2.90 ^b	3.93 ^a	3.83 ^a	3.67 ^a	0.401
Left-right testicular weight ratio	1.333 ^a	1.021 ^a	1.136 ^a	1.082 ^a	1.039 ^a	0.107
Testicular shape Index	0.579 ^a	0.585 ^a	0.586 ^a	0.589 ^a	0.592 ^a	0.092
Size area of cloaca gland (mm^2)	239.5 ^c	291.4 ^b	321.0 ^{ab}	340.2 ^{ab}	383.9 ^a	17.35
Ejaculate volume (μL)	23.1 ^d	25.4 ^d	30.5 ^c	36.7 ^b	41.9 ^a	3.02
sperm concentration ($10^6/\text{ml}^{-1}$)	641.8 ^c	655.4 ^{bc}	685.6 ^b	735.1 ^{ab}	780.7 ^a	38.10
Mass motility %	82.2 ^b	85.5 ^{ab}	89.1 ^a	90.0 ^a	91.3 ^a	5.33
Individual motility %	83.5 ^c	88.1 ^b	90.7 ^{ab}	91.1 ^a	92.5 ^a	4.87
Live & normal morphology sperm%	66.1 ^c	66.4 ^c	70.6 ^b	72.8 ^{ab}	75.8 ^a	3.94
Semen quality factor	9.10 ^d	11.36 ^{cd}	14.85 ^c	19.73 ^b	24.93 ^a	2.79
Dead sperm %	17.95 ^a	15.6 ^{ab}	12.5 ^b	12.8 ^{bc}	10.3 ^c	1.68

T0=Control (free in bay leaf), T1=1% bay leaf powder, T2=2% bay leaf powder, T3=0.1% bay leaf oil, T4=0.2% bay leaf oil, ^{a,b,c,d} different superscripts within rows indicate significant differences at ($P \leq 0.05$), N.S = non significant differences

Table (5) confirmed bay leaf powder and oil addition were significantly ($P \leq 0.05$) higher in testosterone and LH hormones of blood plasma in T4, T3 and T2 in male, also estrogen concentration was significantly ($P \leq 0.05$) higher in all bay leaf and its oil additives in female, so LH and FSH higher in T4, T3 and T2 compared with T1 and T0. While insignificant differences showed among the treatment in the FSH hormone of male blood plasma.

Table 5. Effect of bay leaf powder and its oil additions on blood plasma hormones concentrations of local quail males at age 33 wks.

Sex	Treats	T0	T1	T2	T3	T4	S.E
Male	Testosterone (ng/ml)	2.89 ^c	3.28 ^{bc}	4.00 ^b	4.05 ^b	4.83 ^a	0.209
	LH (ng/ml)	0.632 ^c	0.815 ^{bc}	1.387 ^b	1.228 ^b	1.832 ^a	0.091
	FSH (ng/ml)	0.982 ^a	0.993 ^a	1.147 ^a	1.104 ^a	1.202 ^a	0.088
Female	Estrogen (ng/ml)	0.419 ^c	0.578 ^b	0.768 ^a	0.692 ^{ab}	0.857 ^a	0.057
	LH (ng/ml)	0.586 ^c	0.593 ^c	1.206 ^{ab}	1.064 ^b	1.670 ^a	0.133
	FSH (ng/ml)	0.410 ^c	0.511 ^c	1.192 ^{ab}	0.952 ^b	1.408 ^a	0.095

T0=Control (free in bay leaf), T1=1% bay leaf powder, T2=2% bay leaf powder, T3=0.1% bay leaf oil, T4=0.2% bay leaf oil, LH= Luteinizing hormone, FSH= Follicle stimulating hormone. ^{a,b,c} different superscripts within rows indicate significant differences at ($P \leq 0.05$).

Table (6) shows the additive of bay leaf and its oil had led to significantly ($P \leq 0.05$) increase in egg Production (H.D %), egg weight, eggshell strength, fertility % and the weight of hatched chicks in T4, T3 and T2, the percentages of hatching from fertile and total eggs were higher in T4, T3, T2 and T1 compared with the control T0, normal eggs for hatching % was higher in T4. So FCR (g) feed/ (g) egg improved in T4, T3 and T2. On the other hand feed Intake had no differences among all treatments. Whereas significantly ($P \leq 0.05$) lower in the percentages of cracked eggs in T4, and disabled chicks in (T4 and T2) and total dead embryos in (T4) compared with T0.

Table 6: Effect of bay leaf powder and oil additions on some production and egg quality, and hatchability characteristics of local quail at age 33 wks.

Traits	T0	T1	T2	T3	T4	S.E
Egg Production (H.D %)	79.15 ^c	81.08 ^c	86.19 ^b	86.59 ^b	90.05 ^a	4.25
Egg weight (g)	11.71 ^c	12.04 ^{bc}	12.52 ^b	12.42 ^b	12.96 ^a	1.48
Feed intake (g)	2250.86 ^a	2280.14 ^a	2305.42 ^a	2282.19 ^a	2258.39 ^a	139.6
FCR (g) feed/ (g) egg	2.43 ^a	2.34 ^{ab}	2.15 ^b	2.13 ^b	1.95 ^c	0.23
Normal eggs for hatching ⁰ %	90.5 ^b	92.0 ^{ab}	93.8 ^{ab}	94.1 ^{ab}	96.5 ^a	5.11
Cracked eggs %	5.25 ^a	4.9 ^a	4.1 ^{ab}	3.8 ^{ab}	2.4 ^b	0.23
Eggshell strength (kg/cm ²)	5.40 ^c	5.62 ^{bc}	6.51 ^b	6.30 ^b	7.54 ^a	0.40
Fertility %	85.7 ^c	87.4 ^{bc}	94.2 ^{ab}	92.1 ^b	96.4 ^a	4.89
Hatching of fertile egg %	79.3 ^c	83.2 ^b	86.7 ^{ab}	83.0 ^b	89.4 ^a	3.95
Hatching of total eggs %	68.0 ^d	72.7 ^{cd}	81.7 ^b	76.4 ^c	86.2 ^a	3.10
Total dead embryos %	13.1 ^a	11.8 ^{ab}	11.3 ^{ab}	12.6 ^a	9.6 ^b	1.06
Disabled chicks %	4.60 ^a	2.90 ^{ab}	1.70 ^b	3.10 ^{ab}	1.00 ^b	0.22
Hatched chicks weight g	7.43 ^b	7.67 ^{ab}	8.65 ^a	8.33 ^a	8.90 ^a	0.85

T0=Control (free in bay leaf), T1=1% bay leaf powder, T2=2% bay leaf powder, T3=0.1% bay leaf oil, T4=0.2% bay leaf oil, ^{a,b,c} different superscripts within rows indicate significant differences at ($P \leq 0.05$), N.S= The same superscripts within rows of month indicate non-significant differences at ($P \leq 0.05$).

DISCUSSION

In the male: the evidence may relate to bay leaf (*Laurus nobilis L.*) powder, and its oil is spices used in diet due to their flavoring capacity, aromatic sense, increased appetite and digestion stimulants, stimulants of physiological functions, so increases in body weight and the testes relative weights and testicular shape index in rats (Akunna *et al.*, 2012 and 2013). Besides of the nutrient value of bay leaf and its oil content (Tables 2 & 3). The bay leaf powder and essential oils content rich in special importance products showed in (Tables 2 & 3) due to their generalized beneficial health effects, However, bay leaf (*Laurus nobilis L.*) powder and its oil increase sexual activity through mechanisms of testosterone and LH sexual hormones production increases as shown in Table (5) they

may increase energy supply for reproductive organs. The ability of flavonoids in bay leaf to scavenge hydroxyl radicals hence inhibiting lipid peroxidation (Bahmanzadeh et al., 2008). Although bay leaf has been shown to have antioxidant properties (Gulcin *et al.*, 2002, Lakshmi *et al.*, 2007). All above nutrient due improves in tests statue then significantly manifested in higher sperm concentration and better sperm motility. Also the improvement in semen quality related to the improvement in the body weight and the testis relative weights (Table 4) in the treatments of bay leaf powder and its oil additives especially T4 (0.2% bay leaf oil). Moreover, Al-Daraji, (2002) found significant positive correlation between spermatozoa motility, spermatozoa concentration, and between the percentages of dead and abnormal spermatozoa (Al-Daraji, 2001). Testosterone is secreted by the interstitial cells of leydig in the testis, but only when they are stimulated by LH from the anterior pituitary gland. Furthermore, the quantity of testosterone secreted increases approximately in direct proportion to the amount of LH available (DeKrester, 2004). The nutrient value bay leaf powder and its oil (Table 1 & 2) may enhance testosterone, LH and FSH synthesis that could later have secondary reproductive consequence such as spermatogenesis, because testosterone is clearly essential for the maintenance of established spermatogenesis.

In female: also the nutrient value of bay leaf and its oil (Tables 2 & 3). In addition, herbal essential oils exhibit antibacterial activities in the gut lumen and act as growth promoters in early life, then increased the egg production rate. Also, FSH can stimulate proliferation of granulosa cells (Davis *et al.*, 2001) and is required for the long term culture of granulosa cells (Hattori et al., 1986). Moreover, FSH plays an important role in differentiation of granulosa cells; stimulating progesterone production and expression of steroidogenic acute regulatory protein cleavage in granulosa cells from small yellow follicles (Johnson *et al.*, 2002; Kirby and Vizcarra, 2015), that due increases the number of mature follicles in ovary which increased egg production. Thus the improvement of feed conversion are due to the active materials and the valuable nutrients that found in bay leaf causing greater efficiency utilized of egg production and egg weight. Novero *et. al.* (1991) found the existence of a positive and significant correlation between the concentration of estrogen hormone in blood plasma and egg production rate and egg weight per chicken. Estrogen plays an important role in enhancing sexual libido through its impact on some neurons of hypothalamus (Etches, 2000). A rising shell thickness in treatments of bay leaf powder (T1, T2) and its oil (T3, T4) addition compared with control T0 return to contain the high proportion of calcium (815 mg/100g) content (Table 2) due improve the absorption from the gut and then move to the blood leads to increased concentration of calcium in the blood plasma (Scanes, 2015) and poultry benefited more than the calcium in bay leaf powder and oil compared adding calcium carbonate that help to increase the utilization of calcium in bay leaf treatments then affects the increasing thickness of the shell. Also bay leaf powder additives and natural origin oil that contains (1:8-cineole, α -terpinylacetate, p-cymene and limonene) increased eggshell weight.

Lake (1983) referred that egg production is an indicator of fertility rate in the layer chickens, which is characterized by high production as usually put high percentage of fertile eggs because it has qualified and intact reproductive system able to place high production of eggs and high fertility and then high hatching rate, also the increases of estrogen, LH and FSH hormones in females led to high production of egg, where there is a positive relationship between production, fertility and hatching ratios. Furthermore, the improvement in semen qualities also blood plasma sexual hormones concentration of quail males as indicated in Tables (4 & 5) reflected on the increases of fertility and so on hatchability of hatched eggs. Thus Medicinal plants like *Laurus nobilis* play a significant role as antimicrobial and antibacterial effect (Dadalioglu and Evrendilek, 2004), also the decreases of total embryonic death due increasing in immune response against diseases.

CONCLUSION

The addition of different levels of bay leaf oil then its powder improved body performance semen characteristics, sexual hormones concentration in male of quail. Also they had a beneficial effect on most production performance, egg quality, blood plasma sexual hormones in females, also high percentages of fertility, hatchability and chicks weight at hatching day, while reduced embryo dead.

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تأثير إضافة مسحوق ورق الغار (*Laurus nobilis* L.) وزيته في الأداء التناسلي وبعض مؤشرات الهرمونية لطائر السمان

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المستخلص

أجريت هذه التجربة لدراسة تأثير إضافة مسحوق ورق الغار وزيته في بعض المؤشرات الفسلجية والتناسلية لذكور وإناث طائر السمان.

أن إضافة مستويات مختلفة من ورق الغار وزيته لعلائق السمان أدى الى ارتفاع معنوي ($P \leq 0.05$) في وزن الجسم والوزن النسبي للخصية ودليل الغدد التناسلية gonadosomatic index، مساحة حجم غدة المذرق، حجم القذفة، تركيز الحيوانات المنوية، الحركة الجماعية، الحركة الفردية، مظهر الحيامن الحية والطبيعية، عامل جودة السائل المنوي semen quality factor، هرموني التستوستيرون و LH في ذكور السمان. أيضا في الإناث: ارتفاع معنوي في نسبة إنتاج البيض (HD %)، وزن البيض، كتلة البيض، قوة قشرة البيض، البيض الطبيعي للتقيس، الخصوبة، نسبة الفقس من البيض المخصب والكلي، وزن الأفراخ الفاقسة، تركيز الأستروجين، LH و FSH في بلازما الدم. أيضا تحسنت كفاءة التحويل الغذائي. في حين وجد انخفاض معنوي ($P \leq 0.05$) عند الذكور في النسبة المئوية للحيامن الميتة. وفي الإناث انخفاض معنوي في البيض المكسور والمجموع الكلي للأجنة الميتة. في حين لم توجد اختلافات معنوية بين جميع معاملات التجربة للذكور في نسبة الهلاكات وفي نسبة وزن الخصية، دليل شكل الخصية وهرمون FSH، وفي استهلاك العلف في الإناث. بينت نتائج إضافة زيت ورق الغار كان له تأثير إيجابي على أداء الجسم، الصفات التناسلية للذكور والإناث، وتحسن في هرمونات الدم وقابلية الفقس مقارنة بمسحوق ورق الغار.

الكلمات المفتاحية: ورقة الغار وزيته، الأداء التناسلي، الهرمونات، الفقس، السمان المحلي.