Tikrit Journal for Agricultural Sciences (2019) 19 (3):18-28
https://doi.org/10.25130/tjas.19.3.4

IRAQI Academic Scientific Journals
العراقية المجلات الأكاديمية العلمية

ISSN:1813-1646 (Print); 2664-0597 (Online)
Tikrit Journal for Agricultural Sciences
Journal Homepage: http://tujas.tu.edu.iq

TJAS
Tikrit Journal for Agricultural Sciences

Sheren Dh. Mohammad*; Hurea S. Abdulrazaq; Jinan N. Abulrahman; Sardar Y. Sardary

Animal Resource Dept., Agriculture College, Salahaddin University/Erbil, Iraq.

KEY WORDS:

Flax seed, performance, hematological, RAPD - PCR, quail.

ARTICLE HISTORY:

Received: 22/08/2018

Accepted: 30/04/2019

Available online: 10/10/2019

Effect of Adding Grinded Flax Seed to The Diet on Productive Performance and Some Hematological Traits in Different Lines of Local Quails

ABSTRACT

This study was conducted to investigate the effect of a dietary supplementation with two levels of powdered flax seed and the impact of different quails' lines and the influence of diet × line on the productive performance, and some hematological traits. A total of 162 laying quail in three lines of color as white (W); black (B); and yellowish brown (Y) were randomly distributed into three treatment groups with three replicates/treatment/line T0: control (standard diet); T1 and T2 were standard diet supplemented with 3% and 6% flax seed powder (FSP), respectively. The results upon the overall period of rearing showed that: both FI (g/bird/d) and FCR (g feed: g egg) were the lowest in T1 group than both T2 and T0 groups. HDEP (%) and egg mass (g/ hen/d) of T1 group were significantly higher than other groups. Hematological results explain that T1 group owned significantly higher RBC and HCT (%) than both control and T2 groups. Genetic distance results showed that genetic similarity values range between 0.795 to 0.800. According to the UPGMA dendogram test the white line was the most distant than other two lines genetically. Genetic variation refers to the good genetic resources in the local quail. This study is one of the few studies on determining the effect of interaction between diet and line in the local quail in Kurdistan Region of Iraq, also it represents the first study in Erbil province that depending on the use of RAPD - PCR as a tool to genetic diversity for local quail. Generally, can be concluded and recommended that using 3% flaxseed powder has satisfactorily impacts on performance and health in different local quails' lines.

INTRODUCTION

Recently quail farming diffused popularly for both meat and egg production in Kurdistan Region/ Erbil. Quail eggs are perfect source of healthy savory food in human nutrition, according to the fact that are rich sources of antioxidants, minerals, and vitamins, and give us a huge good quality nutrient (Tunsaringkarn *et al.*, 2013). Flaxseed is a good origin of α-linolenic acid (Bozan and Temelli, 2008), phenolic compounds known as lignans, non-starch polysaccharides, and high quality proteins (Rubilar *et al.*, 2010). Approved that flax seed enhance lactic acid bacteria survival and growth due to its content of prebiotic represented in non-digestible polysaccharides, and soluble fiber known as mucilage (Nezhad *et al.*, 2013). Flax seed is one of the most concentrated sources of PUFA

* *Corresponding author: E-mail*: shireen.dhahir@yahoo.com

available in natural feedstuffs for poultry (Al-Nasser et al., 2011). Despite of the beneficial effect of using flaxseed in layer diets, there has been some concern about toxicity associated with flaxseed.

Some reports showed adding high concentrates of flaxseed negatively affected egg production (Najib and Al-yousef, 2011). Whereas, supplementing an intermittent levels of flaxseed improved egg production in poultry (Scheideler and Froning, 1996 ; Chen et al., 2014). Because of clashing reports on the role of flaxseed in laying diets, the inquiry that should be tended to is whether powdered flaxseed has helpful impact when added to quail diets.

Therefore, this experiment conducted to investigate the effects of a dietary supplementation with two levels of grinded flaxseed and the impact of different local quails' lines and the interacted influence of diet × line on the productive performance and some hematological traits.

MATERIALS AND METHODS

This experiment was performed at Grdarasha Farm, Department of Animal Resources/ College of Agriculture/ University of Salahaddin-Erbil during (7^{th} November till 12^{th} December 2017). Total of 162 laying quails from three different color lines' were: white (W); black (B); and yellowish brown (Y) at 10^{th} week of age were randomly distributed into three treatment groups with three replicates/treatment/line. Each replicate contains six (6) quails, birds' sex ratio were 2 female:1 male. The birds reared in battery cages (50*30*30 cm). The quails fed for 5 weeks (including one week as adaptation period) containing T0: Control (standard diet); T1 and T2 were standard diet supplemented with 3 and 6% flax seed powder (FSP), respectively. All birds received water and diets *ad libitum*. Control diet ingredients composition shown in Table (1).

Table 1: Ingredients and analyzed composition of diet that fed to the laying quails.

Ingredients (%)	Control diet (T0)	Analyzed Feed Composition	
Wheat	175	Crud protein (%)	22.91
Corn	200	Energy metabolism (Kcal)	2930
Wheat flour	250	Lipid (%)	3.32
Soya bean Meal	290	Fiber (%)	3.11
Protein Concentrate (Fish Meal Concentrate)	50	Calcium (%)	1.00
Di-Calcium Phosphate	6	Total phosphorus (%)	0.511
Methionine	0.9	Available phosphorus (%)	0.270
Lysine	0.5	Salt (%)	0.212
Cholin Chloride	0.5	Arginine (%)	1.21
Salt	0.85	Lysine (%)	1.08
Oil (vegetable oil)	13	Methionine + Cystine (%)	0.633
Feed toxic	1	Methionine (%)	0.382
Lime stone	10	Threonine (%)	0.681
Vitamin premix	0.5	Tryptophan (%)	0.234
Antioxidants	0.25	---	---
Feed Sterilizes	1	----	---
Anticoccidia	0.5	----	----
Total	1000	------	----

During the experiment period initial body weight (IBW) (g), final body weight (FBW) (g), weekly and overall feed intake (FI) (g/bird/period), egg weight (g) and produced eggs, were recorded. Hen day egg production (HDEP%), egg mass (g/hen/day), feed conversion ratio (FCR) as (g feed : g egg), were calculated. As well as, at the last week of the experiment blood samples were collected to determine some blood traits and genetic distance using RAPD-PCR marker.

The statistical analysis done according to factorial experiment in Completely Randomized Design (CRD) (3×3) using General Linear Models (GLM) procedure of SAS software program package (SAS, 2012), version 9.1. Duncan's multiple range test was used to identify significant differences between means (Duncan, 1955).

RESULTS AND DISCUSSION

UPGMA dendogram based on Nei's genetic distance grouped investigated quail line genotypes in one clusters, included White (W); Black (B); and Yellowish brown (Y). The dendogram, based on genetic distance constructed to show phylogenetic relationships among the quail lines. It was clear that the white line appeared to be most distant from the other lines whereas the black and yellowish brown lines were closely related together with the highest genetic similarity. The close identity between the black and yellowish brown lines suggests that all the indigenous breeds are more or less comparatively similar and branched from the same line of evolutionary tree Figure (1).

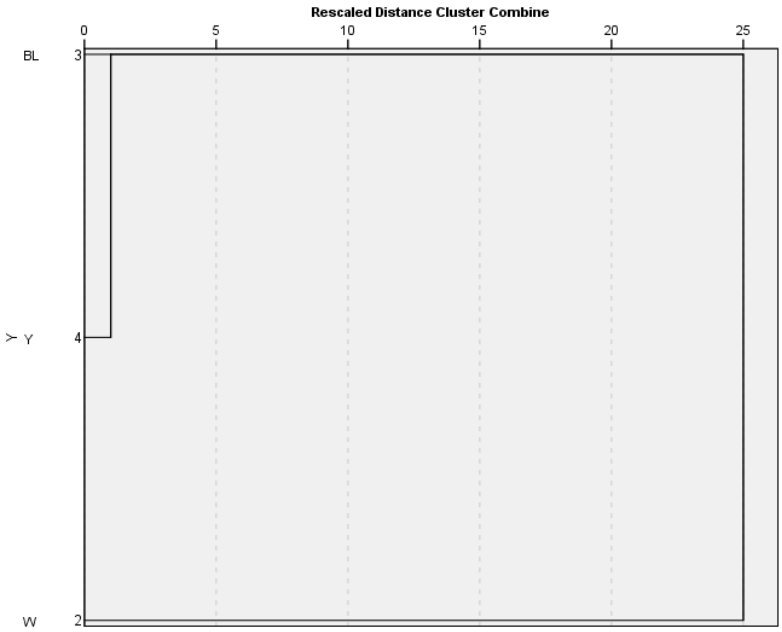

Figure (1): Dendogram of three quail lines based on genetic distances among them.

The data of initial and final body weight (g) are shown in Table (2). The results of final body weight showed that both T1 and T2 groups owned significantly less final body weight than control. While there were not significant differences among quail's lines. However, just T2W group owned significantly less final body weight than each of T0W, T0B, T0Y and T2B groups. The results disagree with the results of Omri et al. (2017) in laying hens. The reduction in final body weight could be related to the presence of Cyanogenic glycosides including linustatin, neolinustatin, and linmarin present in the milled flaxseed due to loss of effective intestinal epithelial cell absorptive function (Kajla et al., 2015).

Feed intake (g/bird/day) and feed conversion ratio (g feed :g egg) in different lines of local quails are presented in Table (3). It can be noted that T1 (3% FSP) consumed less feed and had the lowest FCR than both Control and T2 groups during the overall period of experiment. T1 results agree with Bean and Leeson (2003) and Sceideler and Froning (1996) who reported a decrease in feed intake for groups fed flaxseed as supplement to diet. T2 results agree with Omri et al. (2017); Yassein et al. (2015) and Al-Nasser et al.(2011) as they resulted non-significant (P>0.05) impact in treatments added with linseeds as compared to control in FI and FCR. Whereas Yassein et al. (2015), Novak and Sheideler (2001) and Caston and Leeson (1990) declared an opposite finding that disagree with the results of both T1 and T2 groups in FI. Feed intake reduction in T1 group might have relation to the anti-nutritional factors in flaxseed that has impact on the palatability in poultry (Hayat et al., 2009).

Table2: Effect of adding flax seed powder on initial and final body weight (g) in different lines of local quails (Mean ± SE).

Initial body weight (g)	**Treatments (T)**	**T0=Control**	**T1= +3%FSP**	**T2= + 6% FSP**	**L.S***
		184.39±7.96	189.06±7.66	189.11±8.43	**NS**
	Lines (L)	**W**	**B**	**Y**	**L.S***
		169.78±7.12 b	195.94±7.12 a	196.83±8.06 a	*
	Interaction(T*L)	**T0**	**T1**	**T2**	**L.S***
	W	158.50±11.03 b	175.33±14.88ab	175.50±11.63ab	**NS**
	B	204.83±7.84 a	191.50±13.88ab	191.50±15.48ab	**NS**
	Y	189.83±15.51ab	200.33±10.94ab	200.33±16.96ab	**Ns**
	L.S**	*	**NS**	**NS**	--------
Final body weight (g)	**Treatments (T)**	**T0=Control**	**T1= +3%FSP**	**T2= + 6% FSP**	**L.S.***
		220.28±8.07 a	192.83±8.55 b	188.94±8.69 b	*
	Lines (L)	**W**	**B**	**Y**	**L.S***
		187.44±8.15	206.61±9.88	208.00±8.29	**N.S**
	Interaction(T*L)	**T0**	**T1**	**T2**	**L.S***
	W	207.33±4.84 a	195.00±19.46 ab	160.00±5.80 b	*
	B	217.83±20.71 a	189.83±13.45 ab	212.17±17.25 a	**NS**
	Y	235.67±11.43 a	193.67±13.52ab	194.67±12.56 ab	**NS**
	L.S**	**NS**	**NS**	*	--------

* a, b, c means in rows bearing different superscripts differ significantly at P < 0.05. ** a, b, c means in column bearing different superscripts differ significantly at P < 0.05. L.S= List of Significance.

Table 3: Effect of adding flaxseed powder on feed intake (g/bird/d) and feed conversion ratio (g feed: g egg) in different lines of local quails (Mean ± SE).

Feed Intake (g/bird/d)	**Treatments / Period**	**T0=Control**	**T1= +3%FSP**	**T2= +6%FSP**	**L.S***
	1st Wk	23.289±0.153b	17.245±0.103c	28.085±0.152a	*
	2nd Wk	21.847±0.185 a	19.267±0.092b	19.337±0.086b	*
	3rd Wk	25.674±0.137a	18.339±0.075b	22.959±0.117a	*
	4th Wk	30.544±0.094 a	22.253±0.082c	28.608±0.052b	*
	Overall period	25.464±0.093 a	19.276±0.050c	24.747±0.058b	*
Feed Conversion Ratio (g feed :g egg)	**Treatments / Period**	**T0=Control**	**T1= +3%FSP**	**T2= + 6%FSP**	**L.S***
	1st Wk	2.595±0.201 a	1.426±0.092 c	2.086±0.105b	*
	2nd Wk	1.327±0.078a	1.060±0.063b	1.416±0.064a	*
	3rd Wk	1.424±0.068b	0.831±0.055c	1.614±0.07a	*
	4th Wk	1.135±0.051b	0.814±0.070c	1.498±0.068a	*
	Overall period	1.620±0.096a	1.033±0.047 b	1.653±0.073a	*

*a, b, c means in rows bearing different superscripts differ significantly at P < 0.05. L.S= List of significance.

Result of egg weight (g) shown in Table (4). Generally, there were significant differences in egg weight among treatment, lines and the interacted (T*L) groups as they compared to each other. The data of treatments groups disagree with Yassein *et al*. (2015); Nain *et al*. (2012) and Al-Nasser *et al*. (2011) who resulted that treating laying hens with different levels of flaxseed in their diets had not significant (p>0.05) effects on egg weight. The numerical decrease in egg weight might be linked to the high level of n-3 PUFA in flax seed that results the hypo-triglyceridemic which can reduce the availability of lipids for formation the egg yolk (Gonzalez-Esquerra and Leeson, 2000).

Table (4): Effect of adding flax seed powder on egg weight (g) in different lines of local quails (Mean±SE).

Treatments / Periods		T0=Control	T1= +3%FSP	T2= + 6% FSP	L.S.*
1st Wk		11.244±1.013a	9.375±0.221a	8.719±0.250b	*
2nd Wk		11.403±0.341a	11.175±0.187ab	10.977±0.213b	*
3rd Wk		12.008±0.305a	11.307±0.109b	11.755±0.130a	*
4th Wk		11.743±0.195a	11.967±0.103a	11.949±0.172a	N.S
Overall period		11.599±0.372a	10.956±0.098b	10.850±0.140b	*
Lines / Periods		W	B	Y	L.S.*
1st Wk		9.646±0.379a	10.359±1.144a	9.333±0.211a	N.S
2nd Wk		11.288±0.281a	11.525±0.172a	10.742±0.244b	*
3rd Wk		12.146±0.251a	11.626±0.188b	11.298±0.096c	*
4th Wk		11.771±0.129a	12.175±0.145a	11.713±0.170b	*
Overall Period		11.213±0.222ab	11.421±0.341a	10.771±0.123b	*
Periods / Interaction (T*L)		T0	T1	T2	L.S.*
1st WK	W	10.833±0.440ab	9.600±0.208b	8.504±0.365b	NS
	B	13.500±2.775a	8.892±0.513b	8.685±0.588b	*
	Y	9.400±0.305b	9.633±0.328b	8.966±0.470b	NS
L.S**		NS	NS	NS	----
2nd WK	W	12.016±0.072a	11.550±0.292a	10.300±0.264e	*
	B	12.061±0.171a	11.205±0.120bc	11.309±0.309b	*
	Y	10.133±0.392e	10.77±0.412cd	11.322±0.192b	*
L.S**		*	*	*	----
3rd WK	W	13.036±0.0915a	11.378±0.212de	12.022±0.077b	*
	B	11.833±0.440bcd	11.080±0.042d	11.966±0.033bc	*
	Y	11.154±0.079e	11.463±0.239deb	11.276±0.153e	NS
L.S**		*	*	*	----
4th WK	W	11.928±0.128ab	12.014±0.070ab	11.370±0.237cd	*
	B	12.105±0.440ab	12.187±0.140a	12.23±0.185a	NS
	Y	11.195±0.115d	11.700±0.208bc	12.24±0.123a	*
L.S**		*	*	*	----
Overall period	W	11.953±0.164a	11.135±0.133b	10.549±10.54b	*
	B	12.375±0.773a	10.841±0.190b	11.048±0.27b	*
	Y	10.470±0.190b	10.891±0.192b	10.952±0.20b	NS
L.S**		*	NS	NS	

*a, b means in rows bearing different superscripts differ significantly at P < 0.05. ** a, b, c means in column bearing different superscripts differ significantly at P < 0.05. L.S= List of Significance.

Hen-day egg production (%) results affected by adding FSP in different lines of local quail are presented in Table (5). During the overall period of experiment, the results of hen-day egg production (%) in T1 (3% FSP) was significantly higher than both control (T0) and T2 (6% FSP) groups; also Y line had significantly higher than both W and B lines; as well as for the interacted groups just T1Y possessed higher significantly HDEP % than other interacted groups. T1 and T2 results disagree with Omri *et al.* (2017); Yassein *et al.* (2015); Manohar and Edwin (2016) and Al-Nasser *et al.* (2011) who resulted non-significant egg rate (%) in different levels of flaxseed added to chicken's diet as compared to control. Adding 6% FSP to laying quails diet decreased egg production as compared to both control and 3% FSP diets which related to the presence of anti-nutritional factors in full-fat flax seed might be impair the digestion and absorption of energy yielding nutrients in the hens (Scheideler *et al.* (1995) and Gonzalez- Eesquerra and Leeson (2000).

Table (5): Effect of adding flaxseed powder on hen-day egg production (%) in different lines of local quails (Mean±SE).

Treatments / Periods		T0=Control	T1= +3%FSP	T2= + 6% FSP	L.S.*
1st Wk		31.66±5.89c	48.33±1.66b	55.55±4.89a	*
2nd Wk		53.57±5.32b	60.71±4.20a	45.63±2.12c	*
3rd Wk		54.76±7.74b	67.85±3.02a	44.44±5.71c	*
4th Wk		81.34±8.74a	75.79±7.59b	58.73±5.52c	*
Overall period		55.33±3.17b	63.17±3.84a	51.09±3.18c	*
Lines / Periods		W	B	Y	L.S.*
1st Wk		43.33±8.70b	47.22±2.06a	45.00±4.24ab	*
2nd Wk		61.90±5.98a	48.80±1.19b	49.20±3.70b	*
3rd Wk		62.30±3.99b	33.33±4.78c	71.42±2.66a	*
4th Wk		78.57±5.70b	44.84±1.47c	92.46±3.83a	*
Overall Period		61.52±1.84b	43.55±1.46c	64.52±2.57a	*
Periods / Interaction (T*L)		T0	T1	T2	L.S.*
1st WK	W	13.33±1.68f	43.33±1.60a	73.33±1.66a	*
	B	53.33±1.60b	48.33±1.46c	40.00±0.01d	*
	Y	28.33±1.65e	53.33±1.64b	53.33±1.65b	*
L.S**		*	*	*	------
2nd WK	W	75.79±1.64a	73.80±1.13a	38.09±1.10f	*
	B	48.80±1.10d	45.23±1.15e	52.38±1.08c	*
	Y	38.09±1.14f	63.09±1.17b	46.42±0.01de	*
L.S**		*	*	*	--------
3rd WK	W	70.23±1.19b	70.23±1.19b	46.42±0.08e	*
	B	23.80±1.08f	52.38±1.14a	23.80±1.21f	*
	Y	70.23±1.71b	80.95±1.78a	63.09±1.62c	*
L.S**		*	*	*	------
4th WK	W	98.80±1.19a	77.38±1.14b	59.52±1.47c	*
	B	46.42±0.01d	48.80±1.18d	39.28±0.02e	*
	Y	98.80±1.12a	101.19±0.72a	77.38±0.91b	*
L.S**		*	*	*	------
Overall period	W	64.04±0.66c	66.19±0.66b	54.34±0.52e	*
	B	43.09±0.62g	48.69±0.90f	38.86±0.59h	*
	Y	58.86±66.19d	74.64±0.88a	60.05±1.01d	*
L.S**		*	*	*	------

*a, ….h means in rows bearing different superscripts differ significantly at P < 0.05. ** a, ….h means in column bearing different superscripts differ significantly at P < 0.05.

Table (6) displays the results of egg mass (g/hen/day). T1 (3% FSP) had significantly higher egg mass than both control and T2 (6% FSP) groups. Upon lines both Y and W lines owned significantly higher egg mass. In interacted groups T1Y had significantly higher egg mass as compared to the other interacted groups as overall period of the experiment. Our results of both T1 and T2 as compared to control agree with Omri *et al*.(2017); Yassein *et al*. (2015) and Al-Nasser *et al*.(2011).

Table (6): Effect of adding flaxseed powder on egg mass (g/hen/day) in different lines of local quails (Mean±SE).

Treatments / Periods		T0=Control	T1= +3%FSP	T2= + 6% FSP	L.S.*
1st Wk.		3.74±0.93b	4.53±0.20a	4.83±0.42a	*
2nd Wk.		6.20±0.73b	6.79±0.51a	5.03±0.30c	*
3rd Wk.		6.60±0.96b	7.69±0.52a	5.18±0.62c	*
4th Wk.		9.49±0.97a	9.03±0.86b	7.01±0.68c	*
Overall period		6.51±0.37b	7.01±0.45a	5.51±0.35c	*
Lines / Periods		**W**	**B**	**Y**	**L.S.***
1st Wk.		3.95±0.70b	4.96±0.66a	4.96±0.66b	*
2nd Wk.		7.10±0.80a	5.62±0.17b	5.30±0.44c	*
3rd Wk.		7.57±0.53b	3.82±0.50c	8.07±0.34a	*
4th Wk.		9.28±0.73b	5.45±0.18c	10.79±0.36a	*
Overall Period		6.98±0.35a	4.96±0.21b	7.09±0.31a	*
Periods / Interaction (T*L)		**T0**	**T1**	**T2**	**L.S.***
1st WK	**W**	1.45±0.23f	4.16±0.23cd	6.24±0.33ab	*
	B	7.10±1.21a	4.31±0.37cd	3.47±0.23de	*
	Y	2.66±0.20ef	5.13±0.21cb	4.79±0.36c	*
L.S**		*	NS	*	--------
2nd WK	**W**	8.87±0.18a	8.51±0.14a	3.92±0.17e	*
	B	5.89±0.21c	5.07±0.18d	5.92±0.25c	*
	Y	3.86±0.22e	6.80±0.37b	5.25±0.08d	*
L.S**		*	*	*	-------
3rd WK	**W**	9.15±0.17a	7.99±0.19b	5.58±0.03d	*
	B	2.81±0.16e	5.80±0.15d	2.84±0.13e	*
	Y	7.83±0.18b	9.28±0.32a	7.11±0.16c	*
L.S**		*	*	*	
4th WK	**W**	11.78±0.23a	9.29±0.18c	6.77±0.25d	*
	B	5.62±0.20e	5.94±0.17e	4.80±0.07f	*
	Y	11.06±0.23b	11.84±0.32a	9.47±0.11c	*
L.S**		*	*	*	
Overall period	**W**	7.81±0.14b	7.49±0.15b	5.62±0.18d	*
	B	5.35±0.33d	5.28±0.18d	4.26±0.16e	*
	Y	6.35±0.17c	8.26±0.22a	6.65±0.18f	*
L.S**		*	*	*	

*a, ….e means in rows bearing different superscripts differ significantly at P < 0.05. ** a, ….e means in column bearing different superscripts differ significantly at P < 0.05.

Birds health state can be determined by hematological traits. Blood parameters results' that studied in this experiment as red blood cells account (*10^6/mm³); hematocrit (%) and hemoglobin (g/dl) are displayed in Tables (7, 8 and 9), respectively. As it's clear that blood samples of T1 (3% FSP) had significantly higher of both red blood cells account (*10^6/mm³) and hematocrit (%) as compared to both Control and T2 groups. Whereas other remained groups upon treatments, lines even the interacted groups did not show significant differences as compared to each other and to control neither in red blood cells account nor hematocrit and hemoglobin.

The present results of RBC's count, which is within the physiological rang that could be explained by the normal blood values for a normal growth of birds. The high value of RBC account in T1 group in one hand may be related to the influence of high metabolic energy in laying birds that stimulate bone marrow to produce more red blood cells to provide more oxygen due to erythrocytes number is a signal of the oxygen transfer capacity in the blood thus it can be used as an indicator of health in birds since its contribution in improving the body's defense system against disease (Sergent

et al., 2004), our results in both Table 3 and 5 confirm it. However, the significant low RBCs number in both T0 and T2 groups as compared to T1 might be a sign of anemia, since RBCs production depends on the nutritional status.

Evaluation of hematocrit (HCT %) and hemoglobin (Hgb) are essential for determining the state of health of a bird. The numerical increase in Hbg of T1 group probably is influenced by oxygen levels and erythrocytes so that with the increase in the number of red blood cells will be accompanied by an increase in the amount of Hb (Pantaya and Utami, 2018).

It is clear that the results of hematocrit (%) related directly to the RBCs results because it means the percentage (by volume) of blood that consist of red blood cell after being centrifuged (Fradson et al., 2010). Decrease in hematocrit value can be caused by several factors namely the level of stress by environment influence and nutrition , dehyderation and parasite in blood (Challenge et al., 2001). The improvements for both Hbg and HCT % in T1 group due to feeding 3% FSP may related to the alteration in the fluidity and composition of the plasma cell walls this may attributed to the presence of omega 3 (n-3) polyunsaturated fatty acids which is very useful to be rich in food because it's beneficial effects in reduce risk of cardiovascular disease (Najib and Al-Yousef, 2011).

Table (7): Effect of adding flaxseed powder on red blood cells account (*10^6/mm³) in different lines of local quails (Mean + SE).

Treatments (T)	**T0=Control**	**T1= +3%FSP**	**T2= + 6% FSP**	**L.S.***
	3.575b±0.06	5.850a±1.02	3.945b±0.21	*
Lines (L)	**W**	**B**	**Y**	**L.S***
	3.798±0.21	5.165±0.88	4.407±0.83	**NS**
Interaction (T*L)	**T0**	**T1**	**T2**	**L.S***
W	3.590b±0.08	5.820ab±2.64	3.810b±0.47	NS
B	3.490b±0.09	3.945b±0.72	3.960b±0.00	N.S
Y	3.645b±0.17	7.785a±0.87	4.065b±0.64	*
L.S**	N.S	N.S	N.S	-----

*a, b means in rows bearing different superscripts differ significantly at P < 0.05. ** a, b means in column bearing different superscripts differ significantly at P < 0.05.

Table (8): Effect of adding flaxseed powder on hematocrit (%) in different lines of local quails (Mean±SE).

Treatments (T)	**T0=Control**	**T1= +3%FSP**	**T2= + 6% FSP**	**L.S.***
	27.967b±0.72	45.100a±4.73	31.450b±1.57	*
Lines (L)	**W**	**B**	**Y**	**L.S***
	30.767±2.01	38.317±5.13	35.433±4.68	N.S
Interaction (T*L)	**T1**	**T2**	**T3**	**L.S***
W	28.950b±0.05	33.900b±5.80	29.450b±3.45	NS
B	29.250b±0.15	52.550a±9.15	33.150b±0.45	*
Y	25.700b±0.10	48.850a±4.75	31.750b±4.25	*
L.S**	NS	*	NS	------

*a, b means in rows bearing different superscripts differ significantly at P < 0.05. ** a, b means in column bearing different superscripts differ significantly at P < 0.05.

Table (9): Effect of adding flaxseed powder on hemoglobin (g/dl) in different lines of local quails (Mean±SE).

Treatments (T)	**T0=Control**	**T1= +3%FSP**	**T2= + 6% FSP**	**L.S.***
	16.683±1.08	18.483±0.92	17.083±0.31	N.S
Lines (L)	**W**	**B**	**Y**	**L.S***
	16.700±0.61	18.350±0.91	17.200±0.99	N.S
Interaction (T*L)	**T1**	**T2**	**T3**	**L.S***
W	17.250±0.05	15.300±0.70	17.550±1.45	N.S
B	17.700±0.60	18.050±3.25	19.300±0.30	N.S
Y	16.300±0.20	16.700±1.60	18.600±3.00	N.S
L.S**	N.S	N.S	N.S	N.S

CONCLUSION AND RECOMMENDATIONS

Generally, upon the results, it obvious that T1 (+ 3% FSP) group had positive effects on both production performance and hematological traits. We recommend that using 3% flaxseed powder has satisfactorily impacts on performance and health in different local quails lines. Based on UPGMA dendogram test, white line was the most distant from the other two lines genetically. More experimental investigations should be conducted to determine the optimum and safe using levels of flaxseed powder in quails specially and in other poultry birds generally.

REFERENCES

Al-Nasser, A.Y., Al-Saffar A. E., Abdullah F. K., Al-Bahouh M. E., Ragheb G. and Mashaly M. M. (2011). Effect of adding flaxseed in the diet of laying hens on both production of omega-3 enriched eggs and on production performance. *International Journal of Poultry Science*, 10 (10): 825-831. ISSN 1682-8356.

Bean, L.D. and Leeson S. (2003). Long-term effects of feeding flaxseed on performance and egg fatty acid composition of brown and white hens. *Poult Sci.,* 82: 388-394.

Bozan, B. and Temelli F. (2008). Chemical composition and oxidative stability of flax, safflower and poppy seed and seed oils. *Bioresource Technology*, 99: 6354–6359.

Caston, L. and Leeson S.(1990). Research note: dietary flaxseed and egg composition. *Poult Sci*., 69: 1617-1620.

Challenger, W. O., Williams T. D., Christians J. K. and Vejina F. (2001). Follicular development and plasma yolk precursors dynamics through the laying cycle in the European starling (Sturnusvulgaris). *Physiol. Biochem. Zool.*, 74:356-365. http://dx.doi.org/10.1086/320427.

Chen, W., Jiang Y. Y., Huang Y. Q., Wang Z. X., and Wang J. P. (2014). Effects of dietary flaxseed meal on production performance, egg quality, and hatchability of Huoyan geese and fatty acids profile in egg yolk and thigh meat from their offspring. *Livestock Science,*164(1):102-108.

Duncan, D. B. (1955). Multiple range and multiple F- test. *Biometrics*,11: 1 – 42.

Frandson, R. D., Lee Wilke W. and Fails A. D. (2010). Anatomy and Physiology of Farm Animals. *A John Wiley & Sons, Inc., Publication,* 7th Edition, pp 262.

Gonzalez-Esquerra, R. and Leeson, S. (2000). Effect of feeding hens regular or deodorized menhaden oil on production parameters, yolk fatty acid profile, and sensory quality of eggs. *Poult. Sci.,* 79:1597–1602.

Hayat, Z., Cherian G. , Pasha T. N. , Khattak F. M. , and Jabbar M. A. (2009). Effect of feeding flax and two types of antioxidants on egg production, egg quality, and lipid composition of eggs. *J. Appl. Poult. Res.*, 18 :541–551. doi: 10.3382/japr.2009-00008.

Kajla P., Sharma A. and Sood D. R. (2015). Flaxseed-a potential functional food source. *The Journal of Food Science and Technology*, 52:1857–1871.

Manohar, G. R. and Edwin S.C. (2016). Effect of omega-3 PUFA rich oil sources on egg production performance of japanese quail. *International Journal of Science, Environment, and Technology*, 5(2):794–798.

Nain, S., Renema R.A., Zuidhof M.J. and Korver D.R. (2012). Effect of metabolic efficiency and intestinal morphology on variability in n-3 polyunsaturated fatty acid enrichment of eggs. *Poult. Sci*, 91: 888-898.

Najib, H. and AL- Yousef Y.M. (2011). Performance and essential fatty acids content of dark meat as affected by supplementing the broiler diet with different levels of flaxseed. *Annual Review& Research in Biology*, 1: 22-32.

Nezhad M. H., Duc C., Han N.F. and Hosseinian F. (2013). Flaxseed soluble dietary fiber enhances lactic acid bacterial survival and growth in kefir and possesses high antioxidant capacity. *Journal of Food Research*, 2: 152.

Novak, C. and Sheideler S. E. (2001). Long-term effects of feeding flaxseed-based diets, egg production parameters, components, and eggshell quality in two strains of laying hens. *Poult Sci*, 80: 1480-1489.

Omri, B., Chalghoumi R. and Abdouli H. (2017). Study of the effects of dietary supplementation of linseeds, fenugreek seeds and tomato-pepper mix on laying hen's performances, egg yolk lipids and antioxidants profiles and lipid oxidation status. *Journal of animal sciences and livestock production*, 1:(2)1-9. http://www.imedpub.com/animal-sciences-and-livestock-production/.

Pantaya, D. and Utami M. M. D. (2018). The blood hematological profile on laying hens that treated by different levels of yeast supplementation. *IOP Conf. Ser.: Earth Environ. Sci.*, **207** 012033. **DOI** https://doi.org/10.1088/1755-1315/207/1/012033

Rubilar, M., Gutierrez C., Verdugo M., Shene C. and Sineiro J. (2010). Flaxseed as a source of functional ingredients. *Journal of Soil Science and Plant Nutrition*, 10: 373–377.

SAS, (2012). Statistical analysis system. SAS / STAT User's Guide, Version 9.1. SAS. Inst. Inc., Cary, NC.

Sceideler S.E. and Froning G.W. (1996). The combined influence of dietary flaxseed variety, level, form and storage condition on egg production and composition among vitamin E-supplemented hens. *Poult Sci*., 75: 1221- 1226.

Scheideler, S.E., Jaroni, D. and Froning G. (1995). Strain and dietary oats effect on flax fed hen's egg production and fatty acid profile. *Poult. Sci.*, 74: (suppl. 1).

Sergent, N., Rogers T. and Cunningham M. (2004). Influence of biological and ecological factors on hematological values in wild Little Penguins, Eudyptula minor. *Comp. Bioc. and Phys.* 138: 333-339.

Tunsaringkarn, T., Tungjaroenchai W. and Siriwong W. (2013). Nutrient benefits of quail (*CoturnixCoturnix Japonica*) eggs. *International Journal of Scientific and Research Publications.* 3(5):1-8.

Yassein, S. A., El-Mallah G. M., Sawsan M.A., El-Ghamry A.A., Abdel- Fattah M.M. (2015). Response of laying hens to dietary flaxseed levels on performance, egg quality criteria, fatty acid composition of egg and some blood parameters. *Inter J Res Stu Biosci.* 10: 27-34.

تأثير اضافة مستويات مختلفة من بذور الكتان المطحون في بعض الصفات الانتاجية والدمية لثلاث خطوط من طائر السمان

شيرين ظاهر محمد وحورية صابر عبدالرزاق وجنان نجدت عبدالرحمن وسردار ياسين سرداري

قسم الثروة الحيوانية– كلية الزراعة– جامعة صلاح الدين- أربيل– العراق

المستخلص

أجريت هذه الدراسة لمعرفة تأثير إضافة مستويين من بذور الكتان المطحون وتأثير اختلاف خطوط السمان المحلي بالإضافة الى التداخل بينهما (العليقة × الخطوط) على الاداء الانتاجي وبعض الصفات الدموية. تم توزيع 162 طائر من طيور السمان الى ثلاث خطوط حسب اللون: أبيض (W) ، أسود (B) ، والبني المصفر(Y) عشوائيا على ثلاث معاملات بواقع 3 مكررات/ معاملة/لون خط. غذيت الطيور على ثلاث انواع من العلائق :T0 معاملة السيطرة ؛ اما المعاملتين T1 و T2 فقد اضيف لهما مطحون بذور الكتانً بنسبة 3٪ و 6٪ على التوالى.

طول فترة التجربة أظهرت النتائج بان الاضافة للمعاملة الاولى T1 ادت الى تقليل كل من معدل استهلاك العلف وكفاءة التحويل الغذائي معنويا مقارنة بمعاملة السيطرة والمعاملة الثانية. المعاملة الاولى T1 رفعت معنويا كلا من نسبة انتاج البيض اليومي HDEP% وكتلة البيض، مقارنة بكلتا المعاملتين المقارنة و المعاملة الثانية T2. كانت نتائج صفات الدم المتمثلة بعدد كريات الدم الحمراء RBC و الهيماتوكريت HCT الاعلى معنويا في المعاملة الاولى T1 مقارنة بالمجموعتين الاخريتين. أوضحت نتائج المسافة الوراثية أن قيم التشابه الوراثي تتراوح بين 0.795 إلى 0.800. اعتمادا على UPGMA dendogram تبين بأن الخط الابيض كان الاكثر بعدا من الخطين الاخرين وراثيا. الاختلافات الجينية تشير إلى الموارد الوراثية الجيدة في خطوط السمان المحلي. تعتبر هذه الدراسة واحدة من الدراسات القليلة عن تحديد أثر التفاعل بين النظام الغذائي والخط في السمان المحلي في إقليم كردستان العراق، كما أنها تمثل أول دراسة في محافظة أربيل تعتمد على استخدام RAPD - PCR كأداة إلى التنوع الوراثي للسمان المحلي. بشكل عام، نستنتج ونوصي باستخدام مطحون بذور الكتان بنسبة 3٪ لما له من تأثير مرض وايجابي على الأداء الانتاجي والصحي في مختلف خطوط السمان المحلية.

الكلمات المفتاحية: بذور الكتان، الاداء الانتاجي، الصفات الدمية،RAPD - PCR ، السمان.