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EFFECT OF ADDING *MORINGA OLIEFERA L.* LEAVES POWDER AND ENZYME PREMIX IN DIET ON PRODUCTION PERFORMANCE, EGG QUALITY AND SENSORY TRAITS OF ISA BROWN LAYING HEN

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Abstract

This study aimed to evaluate the effect of adding *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on production performance, egg quality and sensory traits of ISA Brown laying hen. A total 160 ISA Brown laying hen, 29 weeks old of age distributed randomly into 8 treatments with 5 replicates (4 bird in each): T1: control diet without MOLP and EP, T2: control diet + 0.1% EP, T3: control diet + 0.1% MOLP, T4: control diet + 0.15% MOLP, T5: control diet + 0.2% MOLP, T6: control diet + 0.1% MOLP + 0.1% EP, T7: control diet + 0.15% MOLP + 0.1% EP, T8: control diet + 0.2% MOLP + 0.1% EP. Our results indicated to significant differences ($P < 0.05$) in egg production, egg mass(EM), feed conversion ratio (FCR), shape index (ESI), egg specific gravity (ESG), shell thickness (ST), shell weight (SW), shell weight percentage (SWP), yolk color (YC), albumin weight percentage (AWP), albumin diameter (AD), albumin Index (AI), Hough unit (HU)), egg taste after cooking (ET). In the other hand there were no significant differences ($P > 0.05$) in egg weight (EW), feed intake (FI), yolk weight (YW), yolk weight percentage (YWP), yolk diameter (YD), albumin weight (AW), general appearance (GA), odor, flavor and overall acceptability. Our suggestion inclusion (0.1) % of MOLP had positive effects on production performance of ISA Brown laying hen.

***Keyword*:** Moringa leaf, enzyme premix, laying hen, productive performance, egg quality, egg sensory.

Introduction

Now day companies are taking care to supply markets healthier and secure products for human consumption. Recent researches showed the importance of using antibacterial and its role in increase level of nutritional security. One of this important orientations is developing new antibacterial instead of using commercial antibiotics. One of these natural antibacterial is *Moringa oliefera Lam.* which is called a miracle tree for having many medicinal properties, this tree distributes in Asia and Africa in most. Leaves of this plant is empty of heavy toxic metals so that it's safe for using it in poultry diets (Donkor *et al.*, 2013) *Moringa oliefera* is a good natural source of antioxidants such as vitamins, selenium, phenols and flavonoids which makes it high value and healthy food in poultry diets. *Moringa oliefera* leaves contains sterol which is the precursor of estrogen hormone that stimulates gonads which increase the number of follicles around the ovary (Mutiara *et al.*, 2013). The leaves of this plant contains active biological compounds such as (saponin, tannin, phytate, trypsin inhibitors). *Moringa oliefera* absorbs and scavenge the toxic elements so that evaluated its leaves effect in laying hen diet. In the other side one of big issues that facing poultry industry section is the high cost of traditional diet ingredients such as soybean meal and corn that uses mainly in poultry diets, so that finding a way to decrease the cost of diets it's been an emergency thing. One of these ways are exogenous enzymes which proved their efficiency in decreasing the cost of diet. These exogenous enzymes increase the availability of minerals and gross energy that increase the production performance of animal and this was the main reason to attract the cattle and diet producer. Exogenous enzymes digest the structural carbohydrates that endogenous enzymes can't. adding exogenous enzymes in poultry diets destroys cell wall of non-starch polysaccharides which exist in cereals, also these enzymes decrease the viscosity of intestine which effects positively on its work by breaking the bound between nutrients and cell wall that increase the benefit of these nutrients in production performance of animal. So that our study aimed to evaluate the effect of adding *Moringa oliefera* leaves powder and enzyme premix in diet on production performance, egg quality and sensory traits of Isa brown laying hen.

Materials and Methods

This experiment has been done at animal field production of animal department, which is located in Agriculture Collage and Animal Production Science, of Kirkuk university for 60 days from 16/10/2019 to 16/12/2019

Raw materials formulation and their percentage: The raw materials included wheat, soybean meal, yellow corn, di calcium phosphate (DCP), oil, vitamin and mineral complex, salt, L-lysine, DL-methionine, choline chloride, enzyme premix type (Kemzyme plus P) which contains (Xylanase, Phytase, β-glucanase, α-amylase, protease) and *Moringa oliefera* leaves powder which supplied by a farm located at Chemchamal north of Iraq. The layer mash formulated by using the raw materials and *Moringa oliefera* with or without enzyme complex, the formulation contained (0.1, 0.15 and 0.2) % of *Moringa oliefera* leaves powder with or without (0.1) % of enzyme premix.

Experiment birds and their management: A total 160 Isa brown laying hen 29 week old of age allocated randomly into 8 treatments with 5 replicates (4 bird in each) fed layer mash (adlibitum). The birds put in battery cages with (48, 45 and 40) cm length, width and height respectively, the battery cages formed of 4 floors each floor with two cage.

Data collection

Feed intake was determined by weighting the bucket and feed before and after consumption, before the next refilling of the bucket. Egg production recorded daily for each replicate. The egg collected randomly every 15 days (2 egg/ replicate) then weighted by 0.01-g sensitive scale. Yolk

height measured by using china made micrometer and the date collected from highest peak of yolk. Albumin height measured by using china made micrometer and the data collected from three places of thick albumin. Yolk and albumin diameter measured by using china made Vernier caliper. Yolk color measured by using (Rosh color fan) which grade from 1 light yellow to 15 red orange. Eggshells first dried for 24 h at room temperature then weighted by 0.01-g sensitive scale. Shell thicknesses measured by china made Ames micrometer data collected from three places which was tip, side and wide side of eggshell.

Data analysis: All data was entered and stored in Microsoft Excel 2016 then analyzed by Statistical Analyzes System (SAS) program version 6th using Completely randomized design (CRD), and the averages compared by using (Duncan, 1955) test.

Chemical composition of the experimental diets

Chemical composition showed in Table 1, gross energy (GE) content ranged from 2817 to 2819, crude protein (CP) content was 16.36% in all diets, calcium (Ca) was 2.50%, available phosphor (AP) was 0.32%, methionine was (0.40) %, lysine was (0.89) % and choline chloride was (0.05) % in all experiment diets.

Results

Productive performance (0-60) day of experiment

Feed intake (gm diet/bird)

Results presented in Table 2, however there were no visible effects (P>0.05) between all treatments (0-60) day of experiment, feed intake ranged from 109.93 in T8 to 115.81 in T3.

Body weight gain (gm)

There were decreasing in weight in all treatments (Table 2) with no significant effect (P>0.05), this decrease in weight ranged from 0.17 in T5 to 0.42 in T4.

Egg production (H.D) %

There was significant effect between all treatments (Table 2) in total period (0-60) day, the highest egg peak was for T3 which formulated with 0.1% of MOLP and T2 which formulated with 0.1% of EP, the laying percentage ranged from T7: 85.29% to T3: 92.44%.

Egg weight (gm)

There were no significant effects (P>0.05) between treatments in (0-60) day of experiment, however egg weight ranged from T1 which was 67.34 gm to 69.43 gm in T7, the results presented in Table 2.

Egg mass (gm diet/gm egg)

Result showed a significant difference between treatments (Table 2), T3 had highest weight (62.92) gm compared to control diet (T1) which was (58.06) gm. There were no visible effects between other treatments.

Feed conversion ratio (gm diet/ gm egg mass)

There was significant effect (P<0.05) between treatments (Table2), the lowest FCR was in T8 which was 1.76 compared with T1 which was the highest (1.92), however there was no differences (P>0.05) between others.

Egg characteristics (0-60) day of experiment

There was significantly increasing in egg shape index (Table3). T3 and T4 recorded highest egg shape (74.78 and 74.83) respectively compared with T6, T7 and T8 which was (72.34, 73.90 and 72.89) respectively, also There were no visible effects between others. T7 recorded highest weight of egg specific gravity (Table3) which was 1.063 compared with T1 which recorded 1.061 also with no visible effects between other treatments. Although there were no visible effects in yolk weight, diameter, index and weight percentage between all treatments (Table 4). Yolk color affected positively by inclusion MOLP and EP (Table4) where T6 recorded highest score which was (5.92) compared with T4 which recorded the lowest (5.27) score, although there were no visible effects between other treatments. inclusion MOLP and EP in diet of Isa brown layers didn't effect significantly on albumin weight between all treatments (Table5), however weight percentage of albumin affected significantly (Table5) by inclusion 0.1 and 0.15% of MOLP (T3 and T4) recorded highest percent which was (65.82, 65.93) % respectively, compared with T5 that recorded the lowest (64.14) %, while there were no differences between remaining treatments. T3, T5, T6, T7 and T8 recorded highest diameter which was (82.19, 84.57, 86.55, 83.31 and 84.26) mm compared with T1, T2, and T4 which recorded (80.11, 80.20 and 80.19) mm respectively. For the albumin index result showed (Table5) highest average in T1, T2, T3 and T4 which was (9.74, 8.91, 8.56 and 8.94) respectively compared with T5, T6, T7 and T8 which recorded (7.83, 8.26, 7.84 and 8.00) respectively. There were positive effects (P<0.05) in Hough unit where T1, T2, T3 and T4 recorded highest average (85.29, 81.92, 81.77, 80.97) respectively compared with T5, T6, T7 and T8 which was (77.61, 78.63, 76.14, 77.96) respectively, this results presented in Table5. There were significant differences in shell weight (Table3), where T5, T6, T7 and T8 recorded higher weight (7.66, 7.68, 8.00, 7.66) gm respectively compared with T1, T2, T3 and T4 which recorded (7.24, 7.38, 7.46, 7.32) gm respectively. Table3 presented significant effect in shell thickness for T7 which included 0.15 % MOLP and 0.1% EP, T7 recorded highest thick which was (0.41) mm compared with T1 which recorded (0.38) mm, also there were no differences among remaining treatments. There were visible differences (P<0.05) in shell weight percentage (Table3), where T5, T6, T7 and t8 recorded highest percent which was (11.30, 11.27, 11.54 and 11.05) % respectively compared with remaining treatments which recorded (10.75, 10.91, 10.97 and 10.62) % respectively. There was no significant effect in sensory traits among all treatments except in taste where T1 recorded highest score which was (7.21) score compared with T3 which recorded (6.43) score, also there was no visible effects among remaining treatments. This results presented in Table 6.

Table 1: Chemical composition of experimental diets fed Isa brown laying hens

	Groups							
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**
GE (kg calorie/kg diet)	2818	2817	2819	2818	2819	2818	2817	2817
CP %	16.36	16.36	16.36	16.36	16.36	16.36	16.36	16.36
Ca %	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Available P %	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Methionine %	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Lysine %	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Choline chloride %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC + 0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC + 0.2 % MOLP + 0.1 % EP.

Table 2: Effect of supplementing *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on productive performance of Isa brown laying hen (0-60) days. (means ± standard error)

**GROUPS	**FI**	**BWG**	**EP**	**EW**	**EM**	**FCR**
	0-60	**0-60**	**0-60**	**0-60**	**0-60**	**0-60**
T1	111.72±1.68	0.30±0.20	86.14±0.59 d	67.34±1.63	58.06±1.32 b	1.92±0.02 a
T2	114.44±2.09	0.40±0.22	91.52±0.77 ab	67.76±1.88	62.08±2.24 ab	1.82±0.02 cb
T3	115.81±3.25	0.26±0.21	92.44±1.07 a	68.09±1.09	62.92±1.19 a	1.82±0.02 cb
T4	112.67±1.55	0.42±0.18	88.76±0.35 c	68.95±0.95	61.23±0.90 ab	1.83±0.02 cb
T5	115.38±2.16	0.17±0.17	90.78±0.49 abc	67.96±1.72	61.77±1.68 ab	1.83±0.02 cb
T6	114.46±1.69	0.23±0.22	90.11±0.70 abc	68.33±0.90	61.60±0.55 ab	1.83±0.02 cb
T7	110.78±1.80	0.33±0.24	85.29±0.64 d	69.43±1.02	59.17±0.54 ab	1.87±0.03 ab
T8	109.93±2.16	0.24±0.20	89.33±1.13 bc	69.37±0.93	61.96±0.82ab	1.76±0.03 c
*Significant	NS	NS	*	NS	*	*

*different letters in the same column indicates to significance (P<0.05)
**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC + 0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC + 0.2 % MOLP + 0.1 % EP.

Table 3: Effect of supplementing *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on egg shape index (ESP), egg specific gravity (ESG), shell thickness (ST), shell weight (SW) and shell weight percentage (SWP) of Isa brown laying hen (0-60) days. (means ± standard error)

**GROUPS	ESI	ESG	ST	SW	SWP
	0-60	0-60	0-60	0-60	0-60
T1	74.13±0.90 ab	1.061±0.0002 b	0.38±0.006 b	7.24±0.19b	10.75±0.14 bc
T2	74.65±0.51 ab	1.062±0.0001 ab	0.39±0.004 ab	7.38±0.14b	10.91±0.10 abc
T3	74.66±0.77 ab	1.062±0.0003 ab	0.40±0.004 ab	7.46±0.06b	10.97±0.13 abc
T4	74.78±0.90 a	1.062±0.0006 ab	0.38±0.01 ab	7.32±0.26b	10.62±0.35 c
T5	74.83±1.00 a	1.063±0.0004 ab	0.39±0.005 ab	7.66±0.22ab	11.30±0.21 ab
T6	72.340.42 b	1.063±0.0006 ab	0.40±0.008 ab	7.68±0.10ab	11.27±0.16 ab
T7	73.90±0.54 b	1.063±0.0008 a	0.41±0.001 a	8.00±0.08a	11.54±0.18 a
T8	72.89±0.54 b	1.062±0.0007 ab	0.38±0.004 ab	7.66±0.11ab	11.05±0.18 abc
*Significant	*	*	*	*	*

*different letters in the same column indicates to significance (P<0.05)
**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC+0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC+0.2 % MOLP+0.1 % EP.

Table 4: Effect of supplementing *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on yolk diameter (YD), yolk index (YI), yolk weight (YW), yolk weight percentage (YWP) and yolk color score (YC) of Isa brown laying hen (0-60) days. (means ± standard error)

**GROUPS	YD	YI	YW	YWP	YC
	0-60	0-60	0-60	0-60	0-60
T1	40.45±0.39	45.08±0.18	15.91±0.40	23.65±0.42	5.35±0.21ab
T2	40.28±0.30	44.93±0.49	16.14±0.35	23.84±0.26	5.70±0.16ab
T3	39.83±0.41	43.08±0.51	15.78±0.27	23.19±0.21	5.77±0.10ab
T4	40.38±0.51	45.62±0.66	16.13±0.30	23.43±0.36	5.27±0.26b
T5	39.98±0.36	44.07±1.34	16.65±0.23	24.54±0.56	5.82±0.24ab
T6	39.67±0.43	45.64±0.46	16.11±0.29	23.57±0.29	5.92±0.14
T7	39.88±0.48	46.06±0.32	16.27±0.46	23.50±0.67	5.70±0.08ab
T8	39.79±0.17	47.70±1.92	16.12±0.15	23.28±0.40	5.65±0.13ab
*Significant	NS	NS	NS	NS	*

*different letters in the same column indicates to significance (P<0.05)
**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC + 0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC + 0.2 % MOLP + 0.1 % EP.

Table 5: Effect of supplementing *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on albumin diameter (AD), albumin index (AI), albumin weight (AW), albumin weight percentage (AWP) and Hough unit (HU) of Isa brown laying hen (0-60) days (means ± standard error)

**GROUPS	AD	AI	AW	AWP	HU
	0-60	0-60	0-60	0-60	0-60
T1	80.11±1.22 b	9.74±0.58 a	44.18±1.18	65.58±0.34 ab	85.29±1.81 a
T2	80.20±0.65 b	8.91±0.18ab	44.23±1.40	65.24±0.30 ab	81.92±0.52 ab
T3	82.19±1.80 ab	8.56±0.38ab	44.84±0.84	65.82±0.30 a	81.77±0.93 ab
T4	80.19±1.75 b	8.94±0.46ab	45.49±0.83	65.93±0.67 a	1.64±80.97 ab
T5	84.57±1.68 ab	7.83±0.46bc	43.64±1.44	64.14±0.52 b	77.61±2.14 bc
T6	86.55±2.57 a	8.26±0.73bc	44.53±0.71	65.14±0.43 ab	78.63±3.44 c
T7	83.31±2.51 ab	7.84±0.50bc	45.14±1.08	64.94±0.77 ab	76.14±2.21 bc
T8	84.26±0.91 ab	8.00±0.27bc	45.58±0.93	65.65±0.52 ab	77.96±1.32 bc
*Significant	*	*	NS	*	*

*different letters in the same column indicates to significance (P<0.05)
**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC + 0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC + 0.2 % MOLP + 0.1 % EP.

Table 6: Effect of supplementing *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP) in diet on sensory traits of Isa brown laying hen egg (0-60) days. (means ± standard error)

**GROUPS	Appearance	Color	Taste	Odor	Flavor	Overall acceptability
	0-60	0-60	0-60	0-60	0-60	0-60
T1	6.43±0.27	5.62±0.37	7.21± 0.26 a	6.53±0.21	7.12±0.21	7.06±0.23
T2	6.50±0.32	6.12±0.32	7.03±0.14 ab	6.78±0.30	7.03±0.23	7.06±0.23
T3	6.68±0.31	6.53±0.38	6.81±0.25 ab	6.75±0.25	7.00±0.18	7.09±0.22
T4	6.28±0.22	6.25±0.26	6.43± 0.22 b	6.40±0.24	6.53±0.28	6.75±0.20
T5	6.81±0.21	6.68±0.34	7.03±0.17 ab	6.78±0.21	7.09±0.16	7.03±0.17
T6	6.93±0.19	6.34±0.31	6.87±0.12 ab	6.93±0.14	6.81±0.19	7.12±0.18
T7	7.03±0.21	6.37±0.46	6.90±0.21 ab	6.75±0.35	6.96±0.30	7.12±0.29
T8	6.87±0.27	6.46±0.25	6.93±0.19 ab	7.09±0.15	7.06±0.20	7.21±0.22
*Significant	NS	NS	*	NS	NS	NS

*Different letters in the same column indicates to significance (P<0.05)
**T1: control diet (PC) without *Moringa oliefera* leaves powder (MOLP) and enzyme premix (EP); T2: PC + 0.1% EP: T3: PC + 0.1% MOLP: T4: PC + 0.15% MOLP; T5: PC + 0.2% MOLP; T6: PC + 0.1% MOLP+ 0.1% EP; T7: PC + 0.15 % MOLP + 0.1 % EP; T8: PC + 0.2 % MOLP + 0.1 % EP.

Discussion

Incorporation 0.1% of MOLP in diet significantly increased laying rate compared with control diet (T1) this results was in line with (Teteh *et al.*, 2016) who reported supplementing in Isa brown diet with (1 and 2) % of MOLP increase laying rate, while disagreed with (Abou- Elezz *et al.*, 2011) who found no visible effects of inclusion (5, 10, 15) % of MOLP in Rhode Island laying hens. This increasing of laying rate maybe due to that Moringa leaves enhances productive performance of females by increasing of progesterone and estrogen hormone level (Ogunsola *et al.*, 2017), Moringa leaves also effects positively on follicle stimulating hormone (FSH) which increase the number of follicle inside the ovary that increase estradiol level that follicle cells create it (Grover *et al.*, 2005).

Egg mass increases by adding (0.1) % of MOLP and (0.1) % of EP in diet compared with control diet, these results agreed with **)**Ahmad *et al.*, 2018) who reported inclusion (0.5, 1 and 1.5) of MOLP in Hy line laying hens affected significantly on egg mass, also was in line with (Khan *et al.*, 2011) who found adding 2 gm/kg of EP with or without probiotics affected significantly on egg mass, while disagreed with (Abou-Elezz *et al.*, 2011) who found non visible effect by including (5 and 10) % of MOLP in Rhode island laying hen diet, (Lima *et al.*, 2012) who reported no visible effects when including 0.15% of EP in laying hen diet. These positive effects of inclusion MOLP and EP in diet due to the cooperation between MOLP and EP, MOLP is a high value of vitamins such as (C 7 time more than in orange, A 4 time more than in carrot, Ca 4 more time than in milk, K 3 time more in banana, iron 3 times more in than spinach, E 3 times more than in almond), in the other side EP breaks the bounds between these nutrients and anti-nutritional factors which leads to increase the benefit of these nutrients. All these things increase egg weight which increases egg mass.

Supplementing diets with 0.2 % MOLP + 0.1 % EP decrease the feed conversion ratio. These results were in agreement with (Teteh *et al.*, 2016) who reported supplementing in Isa brown diet with (1 and 2) % of MOLP decreases FCR, also with (Khan *et al.*, 2011) who reported decreasing in FCR by including 2 gm/kg diet of EP with or without probiotics in Hy- Line W98 laying hens diet. While disagreed with (Abou-Elezz *et al.*, 2011; Araújo *et al.*, 2015). The decreasing of FCR in diets who included MOLP and EP maybe due to high nutritional value of Moringa leaves and increasing of availability of nutrients which increase the digestibility of these nutrients which decreases the FCR.

Inclusion (0.15 and 0.2) % of MOLP increases ESI. These results agreed with **)**Ahmed *et al.*, 2018) who reported inclusion (0.5, 1 and 1.5) of MOLP in Hy line laying hens affected significantly on ESI, while dis agreed with (Lu *et al.*, 2016) who found no significant effects on ESI by inclusion (5, 10 and 15) % of MOLP in Hy-line grey laying hen diet. Inclusion 0.15 % of MOLP with 0.1 % of Ep effected significantly on ESG, this result was in line with (Lima *et al.*, 2012) who reported visible effects when including 0.15% of EP in laying hen diet. Inclusion diets with (0.1, 0.15 and 0.2) % of MOLP with or without (0.1) % of EP increased yolk color score, these results were in line with (Lu *et al.*, 2016) who found visible effect when including (5, 10 and 15) % of MOLP in Hy-line grey laying hen diet, this increasing is due to the xanthophyll who found in a high level in MOL. Incorruption (0.1, 0.15 and 0.2) % of MOLP with or without (0.1) % of EP increases AWP and AI. (Ahmed *et al.*, 2018) who reported inclusion (0.5, 1 and 1.5) of MOLP in Hy line laying hens decreased significantly in HU compared with control diet. While YWP, YD, YI, and AW remained unchanged. Incorruption (0.1, 0.15 and 0.2) % of MOLP formulated with (0.1) % of EP increase SW positively, these results was on line with (Al-Saffar *et al.*, 2012) who reported inclusion diets with (0.1) % of EP could increase SW, while disagreed with (Teteh *et al.*, 2016; Araújo *et al.*, 2015) who reported respectively on effect of adding Moringa leaves or EP on SW. inclusion MOLP up to (0.2) % with (0.1) % of EP increase ST, these results was in line with (Ahmed *et al.*, 2018; Al-Saffar *et al.*, 2012) who reported respectively inclusion (0.5, 1 and 1.5) of MOLP in Hy, and (0.1) % of EP line laying hens increase ST, while didn't agree with (Swain *et al.*, 2017) who come out inclusion diets with (0.5, 1, 1.5 and 2) kg/ kg diet of MOLP didn't affect ST, also with (Resende *et al.*, 2017) who reported adding 50 gm/ton of EP in Hy-line brown diets has no effect on ST. this increasing in shell weight (SW) and shell thickness (ST) maybe due to the high percentage of Ca in MOLP and the high availability of EP that affect positively on ST which lead to increasing in SW.

Incorruption (0.1, 0.15, 0.2) % of MOLP with or without (0.1) % EP didn't effect positively on sensory traits except taste which decreased significantly compared with control diet.

Conclusion

The result of this study showed inclusion MOLP up to 0.15 % with or without (0.1) % EP could affect positively on egg laying. Inclusion (0.2) % of MOLP with (0.1) % of EP could decrease FCR significantly. Incorruption up to 0.2 % of MOLP with or without (0.1) % of EP could significantly increase EM. Adding MOLP and EP in diet didn't effect significantly on FI.

Supplementing diets with MOLP up to 0.15 % could increase ESI, also inclusion diets with (0.1) % of EP could increase it too. Adding MOLP above to (0.2) % with or without (0.1)% of EP could affect positively on ESG, YC and AWP. Incorruption MOLP with or without EP decreases AI significantly compared with control diet. Inclusion NOLP up to (0.2)% with (0.1)% of EP could increase AD positively. Inclusion MOLP with or without EP decreases HU comparing with control diet. Inclusion (0.1, 0.15 and 0.2) % of MOLP with (0.1)% of EP increase SW significantly. Adding MOLP up to (0.2)% with (0.1)% of EP could increase ST and SWP also adding MOLP with or without EP didn't affect significantly on YW, YWP, YD, YI and AW.

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