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EVALUATION OF LAYING PERFORMANCE AND EGG STORABILITY OF LAYING HENS FED MORINGA AND FLUTED PUMPKIN LEAF MEAL SUPPLEMENTED DIETS

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ABSTRACT

The study aimed at evaluating the performance and egg storability of laying hens fed moringa and fluted pumpkin leaf meal supplemented diets. The leaves were air dried and meal before inclusion in the experimental diets. Seven experimental diets were formulated with fluted pumpkin leaf meal (FPLM), moringa leaf meal (MOLM) and their mixture in a ratio of 1:1 at the inclusion level of 1% and 2%, respectively and a control. The diets were fed to 34-week old laying hens arranged in a 2x3 factorial arrangement.A total of four eggs were taken from each replicate to measure the storability and egg quality parameters. The results showed that daily feed intake was significantly ($P<0.05$) higher in 2% FPLM based-diet (125.17g). The percentage hen day production (though not significant) was higher in 2% FPLM based-diet and 2% mix based-diet. The feed conversion ratio was better in 2% FPLM (2.94), 1% MOLM (2.97) and the mix based-diets. The percentage weight loss of the egg decreased as the inclusion level of the test supplements increased. Average shell weight was higher in the mix based-diets. The yolk colour was significantly ($P<0.05$) higher in the treatment diets compared to the control.It was concluded that inclusion of FPLM and MOLM significantly improved egg yolk colour. Hen day production and feed consumption were positively influenced by inclusion of fluted pumpkin and moringa leaf meals particularly at 2%.

Keywords: fluted pumpkin, moringa, egg, laying birds, storability

INTRODUCTION

Poultry are easily adaptable to different environmental conditions which lead to the production of poultry meat and eggs worldwide, thus linking the protein gap (Eniola *et al.,* 2012). Eggs are cheap protein source with high biological value that provide the human body with required nutrients. Its nutrient content may be influenced by different attributes such as diet, age, strain as well as environmental factors (Fraeye *et al.,* 2012). Egg contain nutrients such as zinc, selenium, vitamin A and vitamin E which give it antioxidant activity, thus defending people from many degenerative diseases (Natoli *et al.,* 2007). Edible leaves are rich source of nutrients such as minerals, protein and vitamins which can be used to complement other feedstuff (Ifon and Basir, 2003). Some leafy vegetables such as moringa and fluted pumpkin leaf meals can be used as supplements in animal diets. This study was designed to evaluate the effect of supplementing moringa leaf meal and fluted pumpkin leaf meal or their mixture on the performance of laying birds.

MATERIALS AND METHODS

Study location

The feeding trial was carried out at the Poultry Unit of the Teaching and Research Farm of the Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria,which lies on longitude 4º 33E and latitude 7º 28N with an average temperature and rainfall of 26ºC and 1509 mm, respectively.

Processing of test ingredients

Fresh fluted pumpkin leaf (*Telfairia occidentalis)* and Moringa leaf (*Moringa oleifera*) were air dried and milled to form fluted pumpkin leaf meal (FPLM) and moringa leaf meal (MOLM).

Experimental diets

Seven dietary treatments were formulated with treatment 1, a standard diet without test supplements as control, treatment 2 with 1% Fluted pumpkin leaf meal (FPLM), treatment 3 with 2% FPLM, treatment 4 having 1% MOLM, treatment 5 having 2% MOLM, treatment 6 having 1% mixture of FPLM and MOLM and treatment 7 with 2% mixture of FPLM and MOLM, the mixture was in the ratio of 1:1.

Experimental design and management of hens

A total of 105 birds were purchased and divided into seven treatments with 15 birds per treatment and replicated trice with 5 birds each. A total of four eggs were taken from each replicate, the eggs were marked with pencil for identification, and their initial weights at storage were taken. One egg per replicate was used to measure the external and internal quality and deterioration rate as compared to the initial parameters measured for four weeks at 7 days interval. Egg yolk index and egg albumen index were calculated.

Data analysis

The collected data were analyzed using the General Linear Model of Statistical Analysis System (SAS, 2002) software package and means were separated using Duncan's multiple range test (DMRT, 1955).

Table 1: Composition of Experimental Diets

	Control	**FPLM**		**MOLM**		**Mix**	
Ingredients	**0%**	**1%**	**2%**	**1%**	**2%**	**1%**	**2%**
Maize	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Soya Bean Meal	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Wheat Bran	15.0	14.0	13.0	14.0	13.0	14.0	13.0
Test ingredients	0.0	1.0	2.0	1.0	2.0	1.0	2.0
Palm Kernel Meal	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Fish Meal	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Bone Meal	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Oyster Shell	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Premix	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Lysine	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Methionine	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**	**100**
			Calculated Analysis				
M E (kcal/kg)	2676.45	2657.75	2639.05	2657.75	2639.05	2657.75	2639.05
Crude Protein (%)	17.79	17.62	17.45	17.62	17.45	17.62	17.45
Lysine (%)	1.1	1.09	1.08	1.09	1.08	109	1.08

Methionine (%)	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Calcium (%)	3.21	3.21	3.21	3.21	3.21	3.21	3.21
Avail. Phosphorous (%)	0.5	0.51	0.51	0.51	0.51	0.51	0.51

RESULTS AND DISCUSSION

Table 2 shows the performance characteristics of laying hens fed the seven experimental diets. There was significant (P<0.05) difference in daily feed intake with increased consumption as FLPM increase. This suggests that the test supplement may possess some properties that are capable of influencing feed acceptability particularly when used at 2% inclusion level. This was contrary to the report of Eniola *et al*. (2012) who found no significant difference in feed intake when fluted pumpkin stalk was fed to layers.

Hen day production were not significant (P>0.05), but showed similar pattern with trend observed in feed intake. Higher inclusion of test supplement slightly improved (P>0.05) both the final weight and hen day production. This has a lot of implications to farmer because a little upward gain in hen day production may accrue to substantial financial gain at the end of production. Fasuyi and Olorufemi (2008) reported significant difference in hen day production when laying hens were fed fluted pumpkin leaf meal. Feed conversion ratio revealed no significant (P>0.05) difference across the treatments, it appears that fluted pumpkin meal and the mix at 2% would be the preferred choice that support egg production. This was in line with the finding of Eniola *et al.* (2012) who reported no significant (P>0.05) difference in feed conversion ratio when fluted pumpkin stalk was included in layer diet.

The result of egg storability (Table 3) showed that percentage weight loss increased with increasing storage period. There was a significant (P<0.05) weight loss in the control group after four weeks of storage.This was higher than the percentage weight loss in other treatment diets. Onwudike and Sonaiya (1983) reported loss of egg weight with increased storage period.

Lower parameter of the egg albumen index is an indication of egg deterioration compared to an egg with higher egg albumen index value. The egg albumen index was significantly (P≤0.05) low in the control diet. Lu *et al.* (2016) reported a significantly higher albumen height compared to the control group when moringa was included in layer diets. Egg yolk index was only significantly (P≤0.05) different among the experimental diets at the first week of the experiment. The yolk index of diet 3 (2% FPLM) was significantly (P≤0.05) different to that of diets1, 5 and 6 but similar (P>0.05) to diets 2, 4 and 7. Ogunwole *et al.* (2015) reported 11% yolk index after egg storage for four weeks at room temperature.

The yolk weights recorded in this study were increasing with the increased storing period of egg. This may be due to the liquefaction of albumen as the storage period of egg lengthens thus leading to the diffusion of water from the albumen to the yolk. However, there was significant (P<0.05) difference between the dietary treatments only during the first week of storage. This was due to the nutrient composition of MOLM as cited by Witt (2014). The shell weight was only significantly (P<0.05) different at the third week of storage. The shell weight decreased with increasing storage period. This may be due to dehydration of shell constituents, thereby weakening the shell strength, thus becoming fragile as reported by Onwudike and Sonaiya (1983).The authors revealed decreased shell thickness as storage duration lengthen.

The result of egg quality parameters of hen fed the experimental diets is presented in Table 4. The yolk colour was significantly (P≤0.05) higher in the experimental diets compared to the control. This may be due to the carotenoid composition of the test supplements. Significantly higher yolk colour was reported by Lu *et al.* (2016) when MOLM was fed to layers. Other parameters such as egg shape index and yolk index were statistically not significant (P>0.05). However, there were slight increase in almost all the parameters, this suggest that there are some properties in the test supplements such as phytochemicals,

vitamins and minerals compositions that are responsible for the increase. This is contrary to the finding of Tesfaye *et al.* (2014) who reported significantly higher egg quality parameters in moringa diets compared to the control diet.

Table 2: Performance characteristics of birds fed the experimental diets

Treatments								SEM	Supplement*Levels
Parameters	Control	FPLM		MOLM		Mix			
		1%	2%	1%	2%	1%	2%		
DFI(g)/hen	123.97	124.66	125.17	122.03	123.66	120.11	123.18	1.83	0.496
HDP(%)	68.11	69.64	72.02	70.75	70.83	71.34	73.30	7.25	0.959
IBW	1611.17	1609.00	1632.50	1583.67	1614.83	1581.67	1534.67	76.93	0.634
AFBWeight	1697.99	1641.10	1709.13	1643.98	1711.58	1584.73	1619.50	66.61	0.885
FCR(kg feed/kg egg laid)	3.29	3.10	2.94	2.97	3.05	2.99	2.91	0.28	0.768
Feed cost/ kg egg laid (₦)	445.96	486.24	523.76	406.45	421.36	439.08	460.22	62.23	0.001
Feed cost/ kg (₦)	135.55	156.85	178.15	136.85	138.15	146.85	158.15	35.30	0.001
Feed cost/bird (₦)	941.03	1094.96	1248.75	935.19	956.68	987.74	1090.93	81.43	0.001
Egg wt (g)	55.45	57.82	59.80	58.31	57.92	57.03	58.02	2.41	0.700

DFI=Daily Feed Intake, IBW=Initial Body Weight, AFBW=Average Final Body Weight, FCR=Feed Conversion Ratio, SEM=Standard Error of Mean, FPLM=Fluted pumpkin Leaf Meal, MOLM=*Moringa oleifera* Leaf Meal, MIX=Mixture of fluted pumpkin and moringa in ratio of 1:1

Table 3: The effect of experimental diets on the storage quality of egg at room temperature (32°C)

Parameters	Storage period (weeks)	Experimental Diets Control	FPLM		MOLM		MIX		SEM
		0%	1%	2%	1%	2%	1%	2%	
Weight loss%	1	1.72	1.61	1.82	1.65	2.28	2.06	1.73	0.48
	2	3.81	3.76	3.30	3.38	2.85	2.85	3.55	0.75
	3	5.23^{ab}	6.29^{a}	6.11^{a}	5.53^{ab}	6.14^{ab}	4.75^{b}	5.45^{ab}	4.81
	4	7.60^{a}	6.81^{ab}	6.95^{ab}	6.47^{ab}	6.21^{b}	6.62^{ab}	6.34^{b}	0.63
Average Weight loss%		**4.59**	**4.61**	**4.45**	**4.25**	**4.37**	**4.07**	**4.26**	
Albumen index	1	49.91	59.82	62.10	62.40	53.06	62.97	61.81	16.30
	2	38.65^{c}	34.15^{d}	51.11^{a}	33.76^{d}	47.45^{b}	46.88^{b}	48.28^{c}	14.57
	3	25.77^{d}	30.91c	30. 31c	34.15b	33.84b	37.56a	39.99c	11.19
	4	19.91	30.14	30. 00	32.94	32.58	35.72	37.39	10.69
Average Albumen index		**33.56**	**38.75**	**43.38**	**40.81**	**41.73**	**45.78**	**46.86**	
Yolk index	1	28.38^{bc}	31.09^{ab}	33.66^{a}	30.52^{ab}	28.70^{bc}	25.76^{c}	34.20^{a}	2.58
	2	20.14	20.69	23.20	22.16	23.71	24.80	20.50	5.43
	3	17.42	19.74	19.72	18.24	18.28	16.38	17.18	6.88
	4	16.13	18.87	18.81	16.24	16.69	16.98	16.34	4.40
Average Yolk index		**20.51**	**18.80**	**23.84**	**21.79**	**21.84**	**20.98**	**22.05**	
Yolk weight(g)	1	16.11^{b}	15.93^{b}	15.75^{b}	15.34^{b}	19.75^{a}	16.13^{b}	16.36^{b}	1.43
	2	17.01	15.95	16.96	16.85	17.81	18.81	16.49	1.61
	3	17.20	16.86	17.14	18.48	16.91	18.12	16.60	1.04

	4	17.64	16.30	17.81	18.55	16.62	18.10	17.40	1.28
Average Yolk weight(g)		**16.99**	**16.26**	**16.915**	**17.305**	**17.77**	**17.79**	**16.71**	
Shell weight(g)	1	6.13	6.30	6.44	6.09	6.47	6.55	6.93	0.69
	2	6.09	5. 89	5.79	6.11	5.88	6.41	6.81	0.71
	3	5.82^{ab}	5. 70^{a}	5.88^{ab}	5.91^{ab}	5.79^{b}	6.37^{ab}	6.65^{a}	0.65
	4	5.35	5.63	5.80	5.37	5.55	6.25	6.41	0.52
Average Shell weight (g)		**5.84**	**5.88**	**5.97**	**5.87**	**5.92**	**6.39**	**6.70**	

^{abcd}Means in the same row having different superscripts differ significantly at P≤0.05. FPLM=Fluted pumpkin Leaf Meal, MOLM=MoringaLeaf Meal, MIX=Mixture of fluted pumpkin and moringa in a ratio of 1:1

Table 4:Effect of the experimental diets on egg quality parameters

		Treatments						SEM	Supplements *Level
Parameters	Control	FPLM		MOLM		Mix			
		1%	2%	1%	2%	1%	2%		
Egg shape index	76.22	74.90	76.97	76.88	76.13	77.67	76.91	0.84	0.378
Yolk colour	1.00	5.00	4.00	3.00	4.00	3.00	5.00	0.00	<0.01
Shell thickness (mm)	0.34	0.35	0.34	0.34	0.35	0.34	0.34	0.01	0.744
HU	86.48	77.64	80.79	78.94	79.15	76.17	72.68	3.92	0.030
Yolk index	45.24	40.10	43.30	42.87	43.94	43.53	44.12	1.69	0.386
Egg wt (g)	55.45	57.82	59.80	58.31	57.92	57.03	58.02	2.41	0.700

Supplements= Fluted pumpkin, Moringa and Mixture of fluted pumpkin and moringa at 1:1 ratio; Levels= 1% and 2% inclusion of the factors; SEM=Standard Error of mean
HU=Haugh Unit, FPLM=Fluted pumpkin Leaf Meal, MOLM=*Moringa oleifera* Leaf Meal, MIX=Mixture of fluted pumpkin and moringa in a ratio of 1:1

CONCLUSION

It was concluded that FPLM and MOLM significantly improved egg yolk colour at the rate of inclusion used in this study. Hen day production and feed consumption were positively influenced by inclusion of FPLM and MOLM particularly at 2%.

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