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Research Article
Leaves of Moringa, Rosemary and Olive as a Phytogenic Feed Additives in Muscovy Duck diets

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Abstract

Background and Objective: Alternative sources of natural ingredients such as herbs or phytogenic plants have beneficial effects which are used as feed supplements or medicines in poultry. The current research objective was to investigate the influence of using phytogenic plants as feed additives on Muscovy ducklings performance. **Materials and Methods:** A total number of 315 of 14 days old Muscovy ducklings were divided randomly into 7 experimental groups, each group was allocated into three replicates. The experimental treatments were arranged in one way classification by using three sources of phytogenic plants being *Moringa oleifera* leaves meal (MLM), *Rosmarinus officinalis* leaves meal (RLM) and *Olea europaea* leaves meal (OLM) with two levels of plant addition (1 or 2%) compared to the commercial diet (control). The experimental diets were formulated to be iso-caloric and iso-nitrogenous. Feed and water were offered *ad libitum* from 14 up to 70 days old. **Results:** Data showed that phytogenic plants did not affect negatively growth performance of ducklings but improved gain compared to the control group. The highest value of live body weights (4185 g) was recorded for diet that supplemented with 1% MLM at 70 days old while, the lowest weight recorded for diet supplemented with 2% OLM being 3507 g compared to the control. A significant decrease in FI (g/bird) was noticed for treatment groups during the interval and the whole experimental periods compared with control group. **Conclusion:** Ducklings fed diet supplemented with phytogenic plants recorded the highest values of feather, carcass, heart, liver and gizzard (%) compared to the control group.

Key words: Moringa, rosemary, olive leaves, ducks, performance and sensory assessment

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Animal scientists and veterinarians are now turning attention towards alternative sources of natural ingredients such as herbs or plants (phytobiotic) to replace antibiotic which used as a growth promoter in chicken diets and has caused some unwanted results[1]. There were some reports on the beneficial effects of herbs which are used as feed supplements or medicines in chickens[2,3]. Certain bioactive chemicals in plants or herbs were reported to be responsible for their therapeutic (medicinal) benefits[4]. Plants generally contain chemical compounds (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides) known as secondary metabolites, which are biologically active[5]. Plants are also known to have high amounts of essential nutrients, vitamins, minerals and fatty acids and fibre[6]. *Moringa oleifera* leave was reported to be a good source of vitamins and amino acids and boost immune systems[7]. *Rosemarinus officinalis* leaves can be used as flavor or perfume , possess carminative properties and has a high degree of inhibition against 25 genera of bacteria and fungi. Rosemary extracts has been shown to improve the shelf life and heat stability of Omega 3-rich oils, which are prone to going rancid. Olive leaves from *Olea europaea* contain many substances, such as oleuropein, which is a bitter monoterpene glycoside and their most active compound, as well as verbascoside, ligstroside, tyrosol or hydroxytyrosol, oleanolic and maslinic acids, luteolin, arginine, olivine, olivine-diglucoside[8]. Most of the phenolic compounds have been shown to possess hypoglycemic and hypocholesteremic activities[9]. Therefore, the benefit of these medicinal plants is of great importance and value and quite in need especially for poultry growers and for those interested in poultry production; so, the purpose of this study was to evaluate the effects of phytogenic plants containing moringa, rosemary and olive leaves meal on nutrient digestibility, growth performance, carcass characteristics and sensory assessment in ducks.

MATERIALS AND METHODS

The present work was carried out at south Sinai Experimental Research Station (Ras sedr city) which belongs to the Desert Research Center, Cairo, Egypt, from 1 October, 2014 and lasted for 56 days later to investigate the influence of using phytogenic plants as feed additives on Muscovy ducklings performance.

Phytogenic plants collection: The phytogenic plants, namely *Moringa oleifera*, Rosmarinus officinalis and *Olea europaea* which were cultivated at Ras Sudr Experimental Station, Southern Sinai Governorate; collected and branches were cut, threshed carefully to separate leaves from twigs then leaves were spread out on a floor and allowed to air-dry for 4 days under shady and aerated conditions. The dried leaves were then removed by hand (manually) and grounded into powder by milling using a locally made Miller machine to obtain a leaf powder and methods of the Association of Official Analytical[10] Chemists were used for determination of chemical composition of leaves powder (Table 1). Quantitative phytochemical analyses of anti-nutrients were determined using the methods of Sofowora[11].

Experimental design: The experiment was designed (Table 2) to study effect of using two levels (1 or 2%) of *Moringa oleifera* leaves meal (MLM), *Rosmarinus officinalis* leaves meal (RLM) and *Olea europaea* leaves meal (OLM) on ducks performance compared with commercial diet (control), the experimental treatments were arranged in one-way classification.

Experimental birds: Three hundred and fifteen Muscovy ducklings of genotype R41 fed on starter diet (2800 ME kcal kg^{-1} and 22% CP) from hatching up to 13 days old, at 14 days old ducklings were divided randomly in to 7 experimental groups (45 birds each), each group was allocated into three replicates (15 birds each). The average of initial body weights of the treatment groups was nearly similar and statically not significant.

Formulation of experimental diets: The experimental diets as shown in Table 3 and 4 were formulated to be iso-caloric

Table 1: Chemical composition of phytogenic plants (DM basis %)

Items	CP (%)	CF (%)	EE (%)	ME (kcal kg^{-1})	Total phenolic (g)
MLM	20	15.55	3.13	2831	6.11
RLM	7.12	25.46	3.40	2971	9.25
OLM	5.99	16.55	6.78	1672	19.7

CP: Crude protein, CF: Crude fibre, EE: Ether extract and ME: Metabolizable energy

Table 2: Experimental design

Treatment No.	Treatment group	Level (%)
1	Control	0
2	Moringa leaves meal	1
3	MLM	2
4	Rosemary leaves meal	1
5	RLM	2
6	Olive leaves meal	1
7	OLM	2

Table 3: Composition of the experimental grower diets (14-35 days)

	Grower diets (14-35 days)						
		MLM (%)		RLM (%)		OLM (%)	
Ingredients (%)	Control	1	2	1	2	1	2
Yellow corn	55.00	55.00	55.00	55.00	55.00	55.00	54.50
Soybean meal (44%)	31.50	31.50	31.60	31.60	31.60	31.50	31.50
Corn gluten meal (60%)	4.60	4.60	4.00	4.60	4.60	4.60	5.00
Wheat bran	3.50	2.50	2.10	2.50	1.70	2.50	1.50
Moringa leaves meal	0.00	1.00	2.00	0.00	0.00	0.00	0.00
Rosemary leaves meal	0.00	0.00	0.00	1.00	2.00	0.00	0.00
Olive leaves meal	0.00	0.00	0.00	0.00	0.00	1.00	2.00
Vegetable oil	1.10	1.10	1.00	1.00	0.80	1.10	1.20
Limestone	1.45	1.45	1.45	1.45	1.45	1.45	1.45
Dicalcium phosphate	2.00	2.00	2.00	2.00	2.00	2.00	2.00
NaCl	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit and Min Premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL- Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15
L-Lysine-HCl	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100	100
Calculated analysis**							
ME (Kcal kg^{-1})	2860	2875	2870	2871	2874	2863	2873
Crude protein (%)	21.95	22.01	21.84	21.92	21.88	21.87	21.99
Crude fiber (%)	3.86	3.91	4.02	4.01	4.18	3.92	3.97
Calcium (%)	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Av. Phosphorus (%)	0.51	0.50	0.50	0.50	0.50	0.50	0.49
Lysine (%)	1.15	1.14	1.14	1.14	1.14	1.14	1.14
Methionine (%)	0.52	0.52	0.51	0.52	0.52	0.52	0.52
Methionine and cystine	0.88	0.88	0.86	0.88	0.88	0.88	0.88

*Each 3 kg vitamins and minerals contain: Vit. A120000 IU, Vit. D_3 22000 IU, Vit. E100 mg, Vit. K_3 20 mg, Vit. B_1 10 mg, Vit. B_2 50 mg, Vit. B_6 15 mg, Vit. B_{12} 100 µg, Pantothenic acid 100 mg, Niacin 300 mg, Folic acid 10 mg, Biotin 500 µg, iron 300 mg, Manganese 600 mg, Choline chloride 500 mg, Iodine 10 mg, Copper 100 mg, Selenium 1 mg and Zinc 500 mg 1, **Source : NRC[16]

Table 4: Composition of the experimental finisher diets (35-70 days)

	Finisher diets (35-70 days)						
		MLM (%)		RLM (%)		OLM (%)	
Ingredients (%)	Control	1%	2%	1%	2%	1%	2%
Yellow corn	61.80	61.80	61.30	61.00	60.50	62.00	61.50
Soybean meal (44%)	20.00	20.00	20.30	20.00	20.50	20.50	21.00
Corn gluten meal (60%)	4.50	4.50	4.00	4.50	4.50	4.50	4.10
Wheat bran	7.80	6.80	6.50	7.60	6.60	6.10	5.50
Moringa leaves meal	0.00	1.00	2.00	0.00	0.00	0.00	0.00
Rosemary leaves meal	0.00	0.00	0.00	1.00	2.00	0.00	0.00
Olive leaves meal	0.00	0.00	0.00	0.00	0.00	1.00	2.00
Vegetable oil	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Limestone	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Dicalcium phosphate	2.05	2.05	2.05	2.05	2.05	2.05	2.05
NaCl	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit and Min premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL-Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15
L-Lysine-HCl	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100	100
Calculated analysis**							
ME (Kcal kg^{-1})	2920	2935	2931	2920	2932	2933	2921
Crude protein (%)	18.03	18.09	18.04	18.00	18.11	18.09	18.00
Crude fiber (%)	3.68	3.72	3.85	3.89	4.06	3.69	3.81
Calcium (%)	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Av. Phosphorus (%)	0.51	0.50	0.50	0.50	0.50	0.50	0.49
Lysine (%)	0.88	0.87	0.87	0.88	0.88	0.88	0.89
Methionine (%)	0.47	0.47	0.46	0.47	0.47	0.47	0.46
Methionine and cystine	0.81	0.81	0.79	0.81	0.81	0.81	0.80

*Each 3 kg vitamins and minerals contain: Vit. A120000IU, Vit. D_3 22000 IU, Vit.E100 mg, Vit. K_3 20 mg, Vit. B_1 10 mg, Vit. B_2 50 mg, Vit. B_6 15 mg, Vit. B_{12} 100 µg, Pantothenic acide 100 mg, Niacin 300 mg, Folic acid 10 mg, Biotin 500 µg, iron 300 mg, Manganese 600 mg, Choline chloride 500 mg, Iodine 10 mg, Copper 100 mg, Selenium 1 mg, and Zinc 500 mg 1, **Source: NRC[16]

and iso-nitrogenous to meet recommendations for Muscovy ducks guide (genotype R41). Feed and water were offered *ad libitum*. Chemical analysis of the experimental diets, meat and feaces were assayed using methods of AOAC[10]; while total phenolic was determined according to Singleton *et al.*[12] Live body weight (LBW) and feed intake (FI) were determined. Body weight gain (BWG) and feed conversion ratio (g feed/g gain) were calculated.

Digestibility trails: At the end of the experimental feeding period, digestion trial was conducted using 21 males of ducks (three from each treatment) to determine the digestion coefficients of the experimental diets. The faecal nitrogen was determined according to Jakobsen *et al.*[13]. The digestion coefficients % of dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated.

Carcass traits: At the end of experimental period three birds from each treatment were selected randomly and held without feed 12 h, without water about 4 h before slaughter tests, after that weighed and slaughtered to complete bleeding and then weighed. Carcass parts were weighed and calculated as a percentage of live body weight and measuring organoleptic properties including meat color, taste, texture, odor and overall acceptability.

Statistical analysis: The data were statistically analyzed according to SAS[14] using one-way classification and differences among treatment means were determined by Duncan's New Multiple Range test[15].

The model used for analysis was:

$$Yijk = U+Ti+eik$$

Where:

Yik = Observation
U = Overall mean
Ti = Experimental treatments (i = 1, 2, 3, ..., 7)
eik = Random error

RESULTS

Live body weight (LBW) and body weight gain (BWG): The data presented in Table 5 showed that differences among treatments of initial means of body weights at 14 days of age of all groups were statistically insignificant and ranged between 115-124 g. It was cleared that three phytogenic plants did not affect negatively growth performance of ducklings, but improved gain compared with control group during interval and whole experimental period.

Feed intake (FI) and feed conversion ratio (FCR): Feed intake decreased ($p<0.05$) and feed conversion ratio were significantly improved by phytogenic additives during the interval and the whole experimental periods compared with control group (Table 6). Ducks fed diet supplemented with 1% MLM recorded the best FCR during the whole experimental periods compared with other experimental groups.

Digestibility coefficients: The results of nutrients digestibility presented in Table 7 indicated that digestibility of DM, EE, CP, CF and NFE for all phytogenic additives groups were improved compared with control group, on the other hand; digestibility of OM was not significantly affected by treatment diets.

Carcass traits: Results concerning carcass characteristics of ducklings as affected by dietary experimental diets were shown in Table 8. The highest ($p<0.05$) values of feather, carcass, heart, liver and gizzard (%) were recorded by ducklings fed diet supplemented with phytogenic plants compared to the control group.

Meat composition: Values of chemical composition of experimental ducklings' meat are illustrated in Table 9. It is worthy to notice that using phytogenic plant sources had insignificant effect on moisture and Protein (%) of meat; while, the highest ($p<0.05$) values of lipid and ash in meat were recorded by ducklings fed diet supplemented with 2% OLM compared with other experimental groups.

Mean panel scores: Results of sensory assessment of ducklings was shown in Table 10. Feeding diets contained

Table 5: Effect of phytogenic feed additives on live body weight and weight gain of ducklings

	Days					
	Live body weight (g)			Weight gain(g)/bird/period		
Treatments	14	35	70	14-35	35-70	14-70
Control	115	1195^{c}	3418^{c}	1080^{b}	2223^{c}	3303^{c}
1% MLM	124	1341^{ab}	4185^{a}	1217^{a}	2844^{a}	4061^{a}
2% MLM	120	1364^{a}	4013^{ab}	1244^{a}	2649^{b}	3893^{ab}
1% RLM	120	1298^{ab}	4021^{ab}	1178^{a}	2723^{ab}	3901^{ab}
2% RLM	118	1267^{bc}	3842^{b}	1149^{ab}	2575^{b}	3724^{b}
1% OLM	121	1339^{ab}	4033^{ab}	1218^{a}	2694^{ab}	3912^{ab}
2% OLM	116	1190^{c}	3508^{c}	1074^{b}	2318^{c}	3392^{c}
±SE	3.68	38.12	76.98	29.21	47.99	108.27

^{a,b,c}Means within the same column showing different letters are significantly different ($p<0.05$)

Table 6: Effect of phytogenic feed additives on average feed intake (FI) g/bird/period and feed conversion ratio of ducklings

	Feed intake			Feed conversion		
Treatments	14-35	35-70	14-70	14-35	35-70	14-70
Control	2746^{a}	7427^{a}	10173^{a}	2.54^{a}	3.34^{a}	3.08^{a}
1% MLM	2487^{b}	6585^{b}	9072^{b}	2.04^{bc}	2.32^{c}	2.23^{c}
2% MLM	2399^{bc}	6419^{b}	8818^{bc}	1.93 ^{c}	2.42^{c}	2.27^{c}
1% RLM	2406^{bc}	6393^{b}	8799^{bc}	2.04^{bc}	2.35^{c}	2.26^{c}
2% RLM	2434^{bc}	6496^{b}	8930^{bc}	2.12^{bc}	2.52^{bc}	2.40^{bc}
1% OLM	2473^{bc}	6368^{b}	8841^{bc}	2.03^{bc}	2.36^{c}	2.26^{c}
2% OLM	2359^{c}	6340^{b}	8699^{c}	2.20^{b}	2.74 ^{b}	2.56^{b}
±SE	28.67	40.48	78.89	0.01	0.07	0.04

^{a,b,c}Means within the same column showing different letters are significantly different ($p<0.05$)

Table 7: Effect of some phytogenic feed additives on digestion coefficients of ducklings at 70 days of age

	Digestibility coefficient					
Treatments	DM	OM	EE	CP	CF	NFE
Control	69.77^{b}	73.49	65.33^{b}	74.44^{b}	36.00^{c}	64.00^{b}
1% MLM	70.06^{ab}	72.78	70.31^{ab}	78.52^{ab}	48.23^{a}	75.07^{a}
2% MLM	70.05^{ab}	73.62	70.56^{ab}	80.13^{a}	43.72^{b}	73.63^{a}
1% RLM	69.89^{ab}	73.26	73.17^{a}	76.21^{ab}	43.79^{b}	75.00^{a}
2% RLM	70.04^{ab}	73.11	70.25^{ab}	77.28^{ab}	46.49^{ab}	74.66^{a}
1% OLM	69.96^{ab}	73.41	75.39^{a}	78.91^{ab}	48.02^{a}	77.92^{a}
2% OLM	70.23^{a}	73.69	70.34^{ab}	76.98^{ab}	43.62^{b}	76.04^{a}
±SE	0.19	0.93	1.15	0.85	0.56	1.23

^{a,b,c}Means within the same column showing different letters are significantly different ($p<0.05$)

Table 8: Effect of phytogenic feed additives on carcass traits of ducklings at 70 days of age

	Carcass traits					
Treatments	Pre-slaughter weight (g)	Feather (%)	Carcass (%)	Heart (%)	Liver (%)	Gizzard (%)
Control	4033	4.75^{c}	66.67^{c}	0.63	1.29^{c}	2.10^{b}
1% MLM	4073	6.17^{a}	72.33^{a}	0.72	1.42^{b}	2.45^{a}
2% MLM	4037	6.27^{a}	71.00^{ab}	0.7	1.61^{a}	2.51^{a}
1% RLM	4058	5.90^{ab}	73.16^{a}	0.74	1.69^{a}	2.63^{a}
2% RLM	4043	6.20^{a}	69.33^{b}	0.69	1.69^{a}	2.66^{a}
1% OLM	4050	5.78^{ab}	69.00^{b}	0.74	1.69^{a}	2.57^{a}
2% OLM	4037	5.43^{b}	69.33^{b}	0.67	1.69^{a}	2.63^{a}
±SE	18.56	0.02	0.67	0.03	0.02	0.07

^{a,b,c}Means within the same column showing different letters are significantly different ($p<0.05$)

Table 9: Effect of phytogenic feed additives on meat composition of ducklings at 70 days of age

	Meat composition			
Treatments	Moisture (%)	Ash (%)	Lipid (%)	Protein (%)
Control	75.66	1.51^{b}	2.91^{ab}	21.83
1% MLM	75.58	1.63^{b}	2.40^{ab}	21.03
2% MLM	76.36	1.89^{b}	1.69^{c}	21.55
1% RLM	75.11	2.62^{a}	2.99^{ab}	21.64
2% RLM	75.24	1.85^{b}	1.92^{c}	21.14
1% OLM	76.00	2.15^{ab}	2.00^{bc}	20.99
2% OLM	76.12	2.72^{a}	3.41^{a}	20.49
±SE	1.22	0.36	0.39	3.75

^{a,b,c}Means within the same column showing different letters are significantly different (p<0.05)

Table 10: Mean panel scores for the descriptive sensory attributes for meat samples of ducklings as affected by phytogenic feed additives

	Mean panel scores				
Treatments	Color	Taste	Texture	Odor	Overall acceptability
Control	8.00^{a}	7.00^{c}	7.00^{b}	7.00^{b}	7.00^{b}
1% MLM	8.00^{a}	6.33^{d}	7.00^{b}	6.33^{b}	6.33^{c}
2% MLM	7.00^{b}	6.00^{d}	7.00^{b}	6.67^{b}	7.00^{b}
1% RLM	8.00^{a}	8.00^{ab}	8.00^{a}	8.33^{a}	8.00^{a}
2% RLM	8.00^{a}	8.00^{ab}	8.33^{a}	8.00^{a}	8.00^{a}
1% OLM	8.00^{a}	8.67^{a}	8.33^{a}	8.00^{a}	8.00^{a}
2% OLM	7.67^{b}	7.67^{b}	7.67^{ab}	7.00^{b}	7.00^{b}
±SE	0.16	0.21	0.11	0.1	0.14

^{a,b,c,d}Means within the same column showing different letters are significantly different (p<0.05)

phytogenic plants resulted in meat with highest score of flavor, juiciness and softness compared to that of the control group. The positive effect on overall acceptability of 1% RLM, 2% RLM and 2% OLM could be attributed to the presence of high concentration of essential oil and probably a great part of its components was metabolized and then precipitated in the duckling's meat.

DISCUSSION

The positive effect on BWG, FCR and overall acceptability of ducklings meat fed on diets supplemented with 1% RLM, 2% RLM and 1% OLM could be attributed to the presence of high concentration of essential oil and probably a great part of its components is metabolized and then precipitated in the duckling's meat and consequence these natural feed additives could be used as growth promoters.

There were many literatures[17] who concluded that addition of blend phytogenic to ducks diets improved BWG. Zeweil *et al.*[18], reported that FCR of broilers was improved when fed phytogenic; improved weight gain of birds fed MLM diets could be attributed to higher protein content of the diets which were efficiently metabolized for growth. Onu *et al.*[19] Yang *et al.*[20] and Ogbe *et al.*[3] found that the presence of essential nutrients and minerals in moringa leaves imply they could be utilized to improve growth performance and health status of poultry. Also Ghazalah and Ali[21] reported that the essential oils of rosemary increase specific enzyme secretion, antibacterial and growth performance. Attia[22] found a significant improvement in BW of broiler by the inclusion of 0.5% RLM. These results were in harmony with Ghazalah and Ali[21], Rostami *et al.*[23] and Elnaggar *et al.*[24] who demonstrated that 0.25 and 0.5% RML diets improved growth performance than 1.0 and 2.0% which negatively affected broiler performance.

The reduction in feed intake by increasing levels of leaves meal in poultry diet could be due to reduced palatability of this diet[25] and observed that unpalatability nature of a feedstuff will consequently prevent chicks from consuming adequate quantity of the feed[22] while, Abhishek *et al.*[26] concluded that increased feed intake with increased level of MLM level in treatment groups might be due to faster passage rate of excreta due to increasing level of fiber content in the diet. However Gadzirayi *et al.*[27] reported that feed intake increased as MLM inclusion increased probably due to increased bulk concentration. Kakengi *et al.*[25] suggested that birds fed MLM based diets adequately utilized the nutrients they consumed. Elnaggar *et al.*[24] fed broilers on diet supplemented with 1.0% rosemary and found improvements in body weight gain and feed conversion.

Wenk[28] reported that the rosemary decrease gastric pH can stimulate favorable micro-organism and the synthesis of catabolic enzymes that help in the digestion and absorption of amino acids, sugars and fatty acids. Improvement in digestion coefficient of nutrients may be due to the fact that MLM is a rich some vitamins which play as a source of some digestive enzyme (i.e., pepsin protease, lipase, amylase and hemicellulase) which improved digestion and consequently weight gain and feed conversion rate[22]. On the other hand; Franciosini *et al.*[29] stated that RLM could improve broilers performance as a result of improving the immune function and balancing gut micro flora that is essential for the digestion process and protection against enter pathogenic organisms. Abhishek *et al.*[26] found that carcass characteristics were significantly affected in diet containing MLM, while; relative weight of liver and spleen was significantly reduced with increased dietary level of MLM in ration as compared to control group. Attia[22] reported that highest values of heart, abdominal fat and spleen weights were recorded by broilers fed 1.0% RLM while 0.75% recorded the highest liver in comparison to control treatment. Duck has higher red muscle fiber in breast compared to chicken is considered as red

meat[30]. Mazanowski *et al.*[31] and Shawkat *et al.*[32] found that fat content in duck breast meat was 1.7%. Erdem *et al.*[33] reported that fat content of breast meat of different genotypes of ducks varied from 1.84-2.34%, while; Ash 1.10% and CP 22.44. Ghazalah and Ali[21] reported that taste, texture, aroma and overall acceptability of the meat was improved by 0.5 and 1.0% dietary addition the negative effect of the higher 2% level of rosemary leaves could be attributed to the presence of high concentration of essential oil and probably a great part of its components are metabolized and then precipitated in the chicken meat. These results are in agreement with those obtained by Jang *et al.*[34]. However, Ologhobo *et al.*[35] reported that inclusion of *Moringa oleifera leaf* meal did not significantly affect aroma, flavor and color for the treatments.

CONCLUSION

In general, based on the results of the present study, it can be concluded that this study will help the researchers to uncover the critical areas of uses natural feed additives as growth promoter that many researchers were not able to explore. Thus a new theory on supplementing ducks diet with 1% RLM, 2% RLM or 1% OLM improved growth performance, digestion coefficient of nutrients and consumer acceptability of Muscovy ducks meat may be arrived at.

SIGNIFICANCE STATEMENT

In this research, feeding diets contained phytogenic plants resulted in meat with highest score of flavor, juiciness and softness compared to that of the control group. This study will help the researchers to uncover the critical areas of uses natural feed additives as growth promoter that many researchers were not able to explore. Thus a new theory on supplementing ducks diet with 1% RLM, 2% RLM or 1% OLM improved growth performance, digestion coefficient of nutrients and consumer acceptability of Muscovy ducks meat may be arrived at.

REFERENCES

1. Foidl, N., H.P.S. Makkar and K. Becker, 2001. The Potential of *Moringa oleifera* for Agricultural and Industrial Uses. In: The Miracle Tree: The Multiple Attributes of *Moringa*, Fuglie, L.J. (Ed.). CTA Publications, Wageningen, The Netherlands, pp: 45-76.
2. Ogbe, A.O., L.O. Mgbojikwe, A.A. Owoade, S.E. Atawodi and P.A. Abdu, 2008. The effect of a wild mushroom (*Ganoderma lucidum*) supplementation of feed on the immune response of pullet chickens to infectious bursal disease vaccine. Elect. J. Environ. Agric. Food Chem., 7: 2844-2855.
3. Ogbe, A.O. and J.P. Affiku, 2012. Effect of polyherbal aqueous extracts (*Moringa oleifera*, Gum arabic and wild *Ganoderma lucidum*) in comparison with antibiotic on growth performance and haematological parameters of broiler chickens. Res. J. Recent Sci., 1: 10-18.
4. Guo, L.D., G.R. Huang, Y. Wang, W.H. He, W.H. Zheng and K.D. Hyde, 2003. Molecular identification of white morphotype strains of endophytic fungi from *Pinus tabulaeformis*. Mycol. Res., 107: 680-688.
5. Soetan, K.O. and O.E. Oyewole, 2009. The need for adequate processing to reduce the antinutritional factors in plants used as human foods and animal feeds: A review. Afr. J. Food Sci., 3: 223-232.
6. Gafar, M.K. and A.U. Itodo, 2011. Proximate and mineral composition of hairy indigo leaves. Electron. J. Environ. Agric. Food Chem., 10: 2007-2018.
7. Olugbemi, T.S., S.K. Mutayoba and F.P. Lekule, 2010. Effect of moringa (*Moringa oleifera)* inclusion in cassava based diets fed to broiler chickens. Int. J. Poult. Sci., 9: 363-367.
8. Cayan, H. and G. Erener, 2015. Effect of olive leaf (*Olea europaea*) powder on laying hens performance, egg quality and egg yolk cholesterol levels. Asian-Aust. J. Anim. Sci., 28: 538-543.
9. Botsoglou, E.N., A.K. Govaris, I.A. Ambrosiadis and D.J. Fletouris, 2013. Olive leaves (*Olea europaea* L.) versus α-tocopheryl acetate as dietary supplements for enhancing the oxidative stability of eggs enriched with very-long-chain n-3 fatty acids. J. Sci. Food Agric., 93: 2053-2060.
10. AOAC., 1990. Association of Official Analytical Chemists. 15th Edn., Official Methods of Analysis, Washington DC., USA.
11. Sofowora, A., 1993. Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd., Ibadan, pp: 191-289.
12. Singleton, V.L., R. Orthofer and R.M. Lamuela-Raventos, 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. Methods Enzymol., 299: 152-178.
13. Jakobsen, P.E., S.G. Kirsten and H. Niclsen, 1960. Digestibility trials with poultry. Fraforogs Laboratoriet, Udgivet of Stants, Kobenhavn, pp: 1-56.
14. SAS., 2002. Statistical Analysis System User's Guide. SAS Institute Inc., Carry, NC., USA.
15. Duncan, D.B., 1955. Multiple range and multiple F tests. Biometrics, 11: 1-42.
16. NRC., 1994. Nutrient Requirements of Poultry. 9th Edn., National Academy Press, Washington, DC., USA., ISBN-13: 9780309048927, Pages: 155.

17. Gheisar, M.M., P. Zhao and I.H. Kim, 2018. Addition of phytogenic blend in different nutrient density diets of meat-type ducks. J. Applied Anim. Res., 46: 854-859.
18. Zeweil, H., M. Ahmed, Y. Eid, W.M. Dosoky and D.A. El-Salam, 2015. Effect of vitamin e and phytogenic feed additives on perfomance, blood constituents and antioxidative properties of broiler chicks. Egypt. Poult. Sci. J., 35: 1077-1093.
19. Onu, P.N. and M.O. Otuma, 2008. Utilization of heat-treated sheep dropping in the diets of broiler finisher chicks. Int. J. Poult. Sci., 7: 169-173.
20. Yang, R.Y., L.C. Chang, J.C. Hsu, B.B.C. Weng, M.C. Palada, M.L. Chadha and V. Levasseur, 2006. Nutritional and functional properties of *Moringa* leaves-from germplasm, to plant, to food, to health. Proceedings of the Workshop on Moringa and other Highly Nutritious Plant Resources: Strategies, Standards and Markets for a Better Impact on Nutrition in Africa, November, 16-18, 2006, Accra, Ghana, pp: 1-9.
21. Ghazalah, A.A. and A.M. Ali, 2008. Rosemary leaves as a dietary supplement for growth in broiler chickens. Int. J. Poult. Sci., 7: 234-239.
22. Attia, F.A., 2018. Effects of dietary rosemary leaves and black seed on broiler performance. Egypt. Poult. Sci. J., 38: 465-481.
23. Rostami, H., A. Seidavi, M. Dadashbeiki, Y. Asadpour and J. Simoes, 2015. Effects of different dietary Rosmarinus officinalis powder and vitamin E levels on the performance and gut gross morphometry of broiler chickens. Rev. Bras. Cienc. Avic., 17: 23-30.
24. Elnaggar, A.S., M.A. Abdel-Latif, M.I. El-Kelawy and H.S. Abd El-Hamid, 2016. Productive, physiological and immunological effect rosemary leaves meal (Rosemarinus officinalis) supplementing to broiler diet. Egypt. Poult. Sci., 36: 859-873.
25. Kakengi, A.M.V., J.T. Kaijage, S.V. Sarwatt, S.K. Mutayoba, M.N. Shem and T. Fujihara, 2007. Effect of *Moringa oleifera* leaf meal as a substitute for sunflower seed meal on performance of laying hens in Tanzania. Livest. Res. Rural Dev., Vol. 19.
26. Kumar, A., K. Kumar, S. Kumar, P.K. Singh, J.K. Paswan and Chandramoni, 2018. Effect of feeding *Moringa oleifera* leaf meal on production efficiency and carcass characteristics of Vanaraja chicken in tropics. Int. J. Micro. Sci., 7: 1213-1220.
27. Gadzirayi, C.T., B. Masamha, J.F. Mupangwa and S. Washaya, 2012. Performance of broiler chickens fed on mature *Moringa oleifera* leaf meal as a protein supplement to soyabean meal. Int. J. Poult. Sci., 11: 5-10.
28. Wenk, C., 2002. Herbs and botanicals as feed additives in monogastric animals. Proceedings of the International Symposium on Recent Advances in Animal Nutrition, September 22, 2002, New Delhi, India, pp: 1421.
29. Franciosini, M.P., P. Casagrande-Proietti, C. Forte, D. Beghelli and G. Acuti *et al*., 2016. Effects of oregano (*Origanum vulgare* L.) and rosemary (*Rosmarinus officinalis* L.) aqueous extracts on broiler performance, immune function and intestinal microbial population. J. Applied Anim. Res., 44: 474-479.
30. Smith, D.P., D.L. Fletcher, R.J. Buhr and R.S. Beyer, 1993. Pekin duckling and broiler chicken pectoralis muscle structure and composition. Poult. Sci., 72: 202-208.
31. Mazanowski, A., T. Kisiel and E. Gornowicz, 2003. Carcass quality, meat traits and chemical composition of meat in ducks of paternal strains A44 and A55. Anim. Sci. Pap. Rep., 21: 251-263.
32. Ali, M.S., G.H. Kang, H.S. Yang, J.Y. Jeong, Y.H. Hwang, G.B. Park and S.T. Joo, 2007. A comparison of meat characteristics between duck and chicken breast. Asian-Aust. J. Anim. Sci., 20: 1002-1006.
33. Erdem, E., E.E. Onbasilar and O.G. Hacan, 2015. Effects of 16L: 8D photoperiod on growth performance, carcass characteristics, meat composition and blood parameters of Pekin ducks. Turk. J. Vet. Anim. Sci., 39: 568-575.
34. Jang, A., X.D. Liu, M.H. Shin, B.D. Lee, S.K. Lee, J.H. Lee and C. Jo, 2008. Antioxidative potential of raw breast meat from broiler chicks fed a dietary medicinal herb extract mix. Poult. Sci., 87: 2382-2389.
35. Ologhobo, A.D., E.I. Akangbe, I.O. Adejumo and O. Adeleye, 2014. Effect of *Moringa oleifera* leaf meal as replacement for oxytetracycline on carcass characteristics of the diets of broiler chickens. Annu. Res. Rev. Biol., 4: 423-431.