INFLUENCE OF INDIVIDUAL AND SYNERGISTIC ADDITION OF *MORINGA OLEIFERA* SEEDS AND LEAVES POWDER TO BROILER DIETS ON GROWTH PERFORMANCE

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ABSTRACT

This study was conducted at the poultry farm\Abu Ghraib, College of Agricultural Engineering Sciences, University of Baghdad, for the period from 12-10-2022 to 22-11-2022 lasted for 42 days to study the effect of individual and synergistic addition of *Moringa oleifera* seeds and leaves powder to broiler diets on growth performance. 210 one day old unsexed broiler chicks (Ross-308), randomly distributed in to seven treatments with three replicates per treatment and 10 chicks per replicate as follows: T1 (control treatment) without additive, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5 leaves powder, T7: 1% seeds powder + 1% leaves powder. The results indicated a significant superiority (P≤0.05) for the T4 treatment in the average live body weight and weight gain compared to control treatment T1 at the first week, as well as the T1 and T4 outperformed the T3 in the same trait at the fourth week, and the T4 recorded a significant superiority in the amount of feed consumed compared to control treatment T1 and T3 at the first week. Also, the T1 and T2, followed by T4, outperformed the rest of the other treatments in the average of feed consumption at the sixth week, while no significant differences appeared between all the treatments in the feed conversion throughout the experiment period. Based on the results of this study, it is concluded that the addition of Moringa seed and leaf powder did not have a significant effect on cumulative growth performance, and it is considered safe at the levels used.

Keywords: seeds powder, leaves powder, broiler, feed consumption.

تأثير الاضافة المفردة والتآزرية لمسحوق بذور وأوراق المورينجا (*Moringa Oliveira*) في الاداء الانتاجي لفروج اللحم

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المستخلص

نفذت هذه الدراسة في حقل الطيور الداجنة في أبو غريب – كلية علوم الهندسة الزراعية – جامعة بغداد ، للفترة من 12-10-2022 الى 22-11-2022 ولمدة 42 يوماً لدراسة تأثير الاضافة المفردة و التآزرية لمسحوق بذور وأوراق المورينجا *Moringa oleifera* الى علائق فروج اللحم في الاداء الانتاجي ، أستعمل 210 فرخ (Ross-308) غير مجنسة بعمر يوم واحد ، وزعت عشوائياً على سبعة معاملات بثلاثة مكررات / معاملة (10 طير/ مكرر)، وكانت المعاملات كالاتي: T1 معاملة السيطرة) عليقة أساسية بدون أضافة المورينجا، T2: 1% مسحوق البذور، T3: 2% مسحوق البذور، T4: 1% مسحوق الأوراق، T5: 2% مسحوق الأوراق، T6: 0.5%مسحوق البذور + 0.5 مسحوق الأوراق، T7: 1% مسحوق البذور + 1% مسحوق الأوراق. وأشارت النتائج الى تفوق معنوي (P≤0.05) للمعاملة T4 في معدل وزن الجسم الحي والزيادة الوزنية على معاملة السيطرةT1 عند الاسبوع الاول، و تفوقت المعاملتين T1و T4 على المعاملة T3 عند الاسبوع الرابع ، كما تفوقت T4 معنوياً في كمية العلف المستهلك على T1و T3 عند الاسبوع الاول ، وتفوقت T1 و T2 ثم تلتها T4 على بقية المعاملات في معدل أستهلاك العلف عند الاسبوع السادس ، ولم تظهر فروقات معنوية بين جميع المعاملات في معامل التحويل الغذائي طيلة فترة التجربة. استناداً إلى نتائج هذه الدراسة، يُستنتج أن إضافة مسحوق بذور وأوراق المورينجا لم تُحدث تأثيراً معنوياً على الأداء الإنتاجي التراكمي، كما انها آمنة عند المستويات المستخدمة.

الكلمات المفتاحية: مسحوق البذور، مسحوق الاوراق، فروج اللحم، أستهلاك العلف.

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INTRODUCTION

The recent studies concerned poultry nutrition revealed that introducing the medicinal herbs in poultry diets as feed additives to their contents of some affective natural substances, resulted to some significant effects on many undesirable microorganisms and improved birds performance as be considered as an natural antioxidant which enhance birds immunity such as artichoke leaves (6) Nigella sativa seed (32) *Lawsonia inermis* Leaf (4) turmeric root (29) Annatto seed powder (7) cinnamon bark (31) Rosmarinus Officinalis and Thymus Vulgaris(22). *moringa oleifera* is one of these important medicinal herbs as a natural antioxidant, antimicrobial and anti-inflammatory in addition to its ability to activate digestive enzymes in the stomach (21,23). Studies have indicated that Moringa leaves and seeds have been successfully used in poultry feeding to replace soybean meal (17), and that their use as a source of protein is receiving attention due to their abundance and low cost (34,1). Where showed (27,28) that Moringa leaves are rich in protein, in which amino acids are similar to those found in soybeans, as well as essential vitamins and minerals such as calcium, magnesium, potassium, sodium, iron, copper, manganese, zinc, ascorbic acid, beta-carotene, alpha-tocopherol(8), but they contain a high percentage of fiber (15,38). Moringa seeds are characterized by containing effective plant compounds such as alkaloids, glycosides, flavonoids, reducing sugars, steroids, saponins and tannins (2,35) in addition to their high content of minerals and vitamins (13,18). (9,39) Studies pointed out that the seeds are rich sources of antioxidants, and Moringa seeds oil is a rich source of unsaturated fatty acids such as oleic acid, which constitutes the largest proportion of them and saturated fatty acids such as palmitic, stearic and benic (10). Flavonoids and alkaloids are the main components in seeds that are responsible for resisting oxidative stress (3,37). The aim of the present study is to find out the effect of individually and synergistic addition of *Moringa oleifera* seeds and leaves powder to broiler diets on growth performance.

MATERIALS AND METHODS

Diets and management: A total of 210 one day old unsex chicks with an average primary body weight of (41) g/chick, randomly distributed in to seven experimental treatments of three replicates per treatment and 10 chicks per replicate. The treatments were as follows: T1 (control treatment) basic diet without additive, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5 leaves powder, T7: 1% seeds powder + 1% leaves powder. Chicks were fed on the starter diet from 1-10 days of age (Table1), on the growth diet from 11-22 days of age (Table 2) and on the Finisher diet from 23-42 days of age (Table 3). growth traits were studied, including average live body weight, weight gain, feed consumption and feed conversion ratio.

Chemical tests of moringa seeds and leaves: The samples were taken to the laboratories of the Department of Environment and Water / Ministry of Science and Technology to analyze the components of the material as shown in Table (4). Quantitative detection of active substances and some amino acids, fatty acids and vitamins was carried out at the Department of Environment and Water, Ministry of Science and Technology Tables (5, 6).

Statistical analysis: The experiment data were analyzed according to the complete randomized design to study the effect of different levels on the studied traits, and the significant differences between the averages were compared using the Duncan polynomial test (12) and used statistical analysis system (33).

Table 1. Ingredients and chemical analysis of the starter diet provided from 1-10 days of age

Ingredients%	T1	T2	T3	T4	T5	T6	T7
Wheat	28.2	27.9	28.6	28.4	30	30	29.3
Yellow corn	30	30.3	30.1	29.5	28	28.3	29.1
Soybean Meal 48% Protein	31.7	31	30	31	30.2	30.9	30.2
Protein concentrate (1)	5	5	5	5	5	5	5
Sunflower oil	2.7	2.4	1.9	2.7	2.4	2.4	2
Moringa seeds powder	0	1	2	0	0	0.5	1
Moringa leaves powder	0	0	0	1	2	0.5	1
Limestone	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Vitamin and mineral premix (2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Dicalcium phosphate	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Total	100	100	100	100	100	100	100
Chemical Analysis Calculated by NRC (1994) (3)							
Crude Protein%	23	23.04	23.01	23	23.02	23.05	23.07
Metabolic Energy (kcal/kg)	3007	3017	3016	3019	3013	3006	3005
Lysine%	1.23	1.20	1.18	1.20	1.19	1.20	1.19
Methionine + Cysteine%	0.86	0.85	0.84	0.85	0.85	0.85	0.85
Calcium%	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Phosphorus %	0.46	0.45	0.45	0.45	0.45	0.45	0.45

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

(1)The protein concentrate (WAFI) type brocon – 5 special w, produced in Holland, each kg contains: 40% crude protein, 5% crude fat , 2.81% crude fiber, 3.14% Ca, 2.50% sodium, 3.88% chloride, 3.85% Lysine, 3.70% Methionine, 4.012% Methionine+ Cysteine, 2117 Kcal/Kg feed metabolism energy, also includingvitamin A 200000IU, vitamin D3 80000IU, vitamin E 600Mg, vitamin K3 50 mg, vitamin B1 60 mg, vitamin B2 140 mg,vitamin B6 80 mg, vitamin B12 700 mg, folic acid 20 mg, Niacin 800 mg, Butane 2 mg, iron1000 mg, copper 200 mg,manganese1600mg.

(2) The vitamin and mineral mixture of colavita, each kg contains: contains: 5000 IU Vitamin A, 600 IU D3,2 mg E, 2mg K3,2 mg B1, 2mg B2,2 mg B6, 5mg B12, 10 mg C, 15mg Niacin, 500 mg folic acid, 4.8 mg calcium, 3.18 mgp, 10 mg copper, 80 mgmanganese,80mg zinc,50mgiron,0.2 mgselenium,0.1mg cobalt,0.5mgIodine,100mg antioxidants.

(3) According to the chemical analysis of the mixture according to NRC (1994).

Table 2. Ingredients and chemical analysis of growth diet provided from 11-22 days of age

Ingredients%	T1	T2	T3	T4	T5	T6	T7
Wheat	22.6	27.1	29.3	26	28.8	25.5	28.4
Yellow corn	38	34.1	32.3	34.9	32	35.4	32.8
Soybean Meal 48% Protein	28.5	27.3	26.3	27.5	26.6	27.5	26.5
Protein concentrate (1)	5	5	5	5	5	5	5
Sunflower oil	3.6	3.2	2.8	3.4	3.3	3.3	3
Moringa seeds powder	0	1	2	0	0	0.5	1
Moringa leaves powder	0	0	0	1	2	0.5	1
Limestone	1.2	1.2	1.2	1.1	1.2	1.2	1.2
Vitamin and mineral premix (2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dicalcium phosphate	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Total	100	100	100	100	100	100	100
Chemical Analysis Calculated by NRC (1994) (3)							
Crude Protein%	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Metabolic Energy (kcal/kg)	3103	3101	3102	3103	3103	3102	3100
Lysine%	1.14	1.11	1.1	1.11	1.1	1.11	1.1
Methionine + Cysteine%	0.82	0.82	0.81	0.81	0.81	0.81	0.81
Calcium%	0.88	0.88	0.88	0.85	0.88	0.88	0.88
Phosphorus %	0.44	0.44	0.44	0.44	0.44	0.44	0.44

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

(1)The protein concentrate (WAFI) type brocon – 5 special w, produced in Holland, each kg contains: 40% crude protein, 5% crude fat , 2.81% crude fiber, 3.14% Ca, 2.50% sodium, 3.88% chloride, 3.85% Lysine, 3.70% Methionine, 4.012% Methionine+ Cysteine, 2117 Kcal/Kg feed metabolism energy, also includingvitamin A 200000IU, vitamin D3 80000IU, vitamin E 600Mg, vitamin K3 50 mg, vitamin B1 60 mg, vitamin B2 140 mg,vitamin B6 80 mg, vitamin B12 700 mg, folic acid 20 mg, Niacin 800 mg, Butane 2 mg, iron1000 mg, copper 200 mg,manganese1600mg.

(2) The vitamin and mineral mixture of colavita, each kg contains: contains: 5000 IU Vitamin A, 600 IU D3,2 mg E, 2mg K3,2 mg B1, 2mg B2,2 mg B6, 5mg B12, 10 mg C, 15mg Niacin, 500 mg folic acid, 4.8 mg calcium, 3.18 mgp, 10 mg copper, 80 mgmanganese,80mg zinc,50mgiron,0.2 mgselenium,0.1mg cobalt,0.5mgIodine,100mg antioxidants.

(3) According to the chemical analysis of the mixture according to NRC (1994).

Table 3. Ingredients and chemical analysis of the Finisher diet provided from 23-42 days of age

Ingredients%	T1	T2	T3	T4	T5	T6	T7
Wheat	23	22.5	22.5	20.7	20.5	24.2	24.1
Yellow corn	40.8	41.6	42	43	43.1	39.8	40.1
Soybean Meal 48% Protein	24.8	24	23.1	24.2	23.5	23.9	23.1
Protein concentrate (1)	5	5	5	5	5	5	5
Sunflower oil	4.5	4	3.5	4.2	4	4.2	3.8
Moringa seeds powder	0	1	2	0	0	0.5	1
Moringa leaves powder	0	0	0	1	2	0.5	1
Limestone	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Vitamin and mineral premix (2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dicalcium phosphate	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total	100	100	100	100	100	100	100
Chemical Analysis Calculated by NRC (1994) (3)							
Crude Protein%	20.01	20.02	20	20	20	20	20
Metabolic Energy (kcal/kg)	3200	3200	3200	3201	3203	3202	3200
Lysine%	1.05	1.03	1.00	1.03	1.01	1.02	1.00
Methionine + Cysteine%	0.78	0.77	0.76	0.77	0.76	0.77	0.76
Calcium%	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Phosphorus%	0.42	0.42	0.41	0.42	0.41	0.42	0.41

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

(1)The protein concentrate (WAFI) type brocon – 5 special w, produced in Holland, each kg contains: 40% crude protein, 5% crude fat , 2.81% crude fiber, 3.14% Ca, 2.50% sodium, 3.88% chloride, 3.85% Lysine, 3.70% Methionine, 4.012% Methionine+ Cysteine, 2117 Kcal/Kg feed metabolism energy, also includingvitamin A 200000IU, vitamin D3 80000IU, vitamin E 600Mg, vitamin K3 50 mg, vitamin B1 60 mg, vitamin B2 140 mg,vitamin B6 80 mg, vitamin B12 700 mg, folic acid 20 mg, Niacin 800 mg, Butane 2 mg, iron1000 mg, copper 200 mg,manganese1600mg.

(2) The vitamin and mineral mixture of colavita, each kg contains: contains: 5000 IU Vitamin A, 600 IU D3,2 mg E, 2mg K3,2 mg B1, 2mg B2,2 mg B6, 5mg B12, 10 mg C, 15mg Niacin, 500 mg folic acid, 4.8 mg calcium, 3.18 mgp, 10 mg copper, 80 mgmanganese,80mg zinc,50mgiron,0.2 mgselenium,0.1mg cobalt,0.5mgIodine,100mg antioxidants.

(3) According to the chemical analysis of the mixture according to NRC (1994).

Table 4. Chemical analysis of Moringa seeds and leaves

Ingredients %	Leaves	Seeds
Dry matter	96.56	96.78
Moisture	3.44	3.22
Crude Protein	35.06	38.15
Fats	8.74	30.37
Crude Fiber	3.05	2.88
Ash	6.24	4.15
Carbohydrates	43.47	21.23
Calcium	0.065	0.015
Phosphorus	0.24	0.04
Metabolic Energy (kcal/kg)	4033	5330

Table 5. Estimation of the total content of active groups in Moringa seeds and leaves

Active groups	Concentration	
	Leaves	Seeds
Total flavonoids (mg / gm)	41.25	44.15
Total phenol (mg / gm)	75.49	85.59
Total alkaloid %	12.56	9.44
Total Tannin %	3.25	5.11
Total Saponin %	2.19	1.88
Active compounds	Concentration (ppm)	
Gallic acid	41.05	54.89
Ferulic acid	16.89	31.25
Chlorogenic acid	20.45	35.69
Caffeic acid	15.59	22.58
Qurcetine	20.89	37.49

Table 6. Fatty and amino acids and vitamins in Moringa seeds and leaves

Fatty acids	Concentration%	
	Leaves	Seeds
Oleic	8.11	18.55
Palmatic	10.15	5.14
Stearic	1.46	2.46
Lenolinic	0.46	0.66
Linolic	14.55	22.58
Amino acids	Concentration (ppm)	
Lysine	6.25	22.5
Methionine	12.05	41.25
Vetamins	Concentration (mg /100 gm)	
Vit C	35.25	41.25
Vit E	12.58	22.05
Vit A	8.25	12.30

RESULTS AND DISCUSSION

Table (7) shows the effect of adding Moringa seeds and leaves powder individually and synergistically to broiler diets on the average live body weight, as these results indicate that some significant differences (P≤0.05) between the treatments of the experiment at the first and fourth weeks. The average living body weight of the fourth treatment birds (1% Moringa leaves powder) was significantly superior to the control treatment T1 and the addition treatments T2, T6, T7 (1% Moringa seeds powder, 0.5% seeds powder + 0.5% leaves powder, 1% seeds powder + 1% leaves powder) respectively, while T3 and T5 (2% seeds powder, 2% Moringa leaves powder) respectively did not differ significantly, which did not differ significantly with the treatments mentioned above. T4 in addition to the control treatment significantly (P≤0.05) at the fourth week outperformed T3 only, which included 2% of Moringa seeds powder and did not differ significantly with the rest of the addition treatments. In the second, third, fifth and sixth weeks, no significant differences were recorded between all the experiment treatments. It is noted from Table (8) the presence of statistically significant differences in the average of weight gain at the first week, where the birds of treatment T4 recorded a significant superiority (P≤0.05) on the treatment of control and the treatments of addition T2, T6 and T7, which did not differ significantly with the treatments of addition T3 and T5, and did not record the treatments T1, T2, T3, T6 and T7 significant differences among themselves in this productive characteristic at the same week. It is also noted that a significant superiority (P≤0.05) for the group of birds of the control treatment and treatment T4 at the fourth week on the group of birds of treatment T3 did not differ significantly with the treatments T2, T5, T6 and T7, and no significant differences were recorded between the treatments T2, T3, T5, T6 and T7 in the same week. While the significant differences between all the treatments of the experiment disappeared at the weeks of the second experiment, third, fifth, sixth and when calculating the cumulative weight gains.

Table 7. Effect of individually and synergistic addition of Moringa seeds and leaves powder for diet on Average live body weight (g/bird) of broiler (Mean ± Standard error)

Average live body weight (g/bird) weekly						
Treatments	**1**	**2**	**3**	**4**	**5**	**6**
T1	**116.66 ± 0.72^{b}**	**319.17 ± 9.13**	**704.17 ± 18.67**	**1165.17 ± 11.89^{a}**	**1736.33 ± 48.63**	**2445.00 ± 61.36**
T2	**116.83 ± 0.83^{b}**	**308.67 ± 5.58**	**687.50 ± 3.51**	**1128.00 ± 8.23^{ab}**	**1731.17 ± 12.39**	**2452.00 ± 7.76**
T3	**120.00 ± 2.88^{ab}**	**303.67 ± 18.09**	**677.33 ± 16.11**	**1086.83 ± 28.06^{b}**	**1626.67 ± 51.66**	**2352.00 ± 59.01**
T4	**122.66 ± 1.20^{a}**	**315.83 ± 9.67**	**705.83 ± 14.18**	**1158.33 ± 28.19^{a}**	**1750.83 ± 40.49**	**2414.67 ± 58.77**
T5	**122.00 ± 0.50^{a}**	**315.67 ± 5.13**	**694.67 ± 3.16**	**1143.67 ± 14.62^{ab}**	**1741.83 ± 35.89**	**2515.33 ± 20.98**
T6	**116.83 ± 1.92^{b}**	**307.33 ± 12.69**	**691.83 ± 12.84**	**1128.50 ± 10.25^{ab}**	**1747.67 ± 29**	**2444.33 ± 43.80**
T7	**116.50 ± 2.46^{b}**	**305.17 ± 18.24**	**678.33 ± 26.13**	**1124.50 ± 39.52^{ab}**	**1692.33 ± 47.97**	**2382.00 ± 79.21**
Sign. level	*****	**N.S**	**N.S**	*****	**N.S**	**N.S**

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

Different lowercase letters indicate significant differences between the treatments.

*** Significant differences at the probability level of 0.05.**

N.S: Non-significant.

Table 8. Effect of individual and synergistic addition of Moringa seeds and leaves powder for diets on Average weight gain (g/bird) of broiler (Mean ± Standard error)

Average weight gain (g/bird) weekly							
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**Cumulative weight gain (0-6) week**
T1	**75.66 ± 0.72^{b}**	**202.50 ± 9.71**	**385.00 ± 16.37**	**461.00 ± 9.29^{a}**	**571.17 ± 38.62**	**708.67 ± 21.89**	**2404.00 ± 61.36**
T2	**75.83 ± 0.83^{b}**	**191.83 ± 5.23**	**378.83 ± 2.12**	**440.50 ± 5.61^{ab}**	**603.17 ± 8.21**	**721.00 ± 14.93**	**2411.17 ± 7.53**
T3	**79.00 ± 2.88^{ab}**	**183.67 ± 20.97**	**373.67 ± 9.31**	**409.50 ± 12.45^{b}**	**539.83 ± 73.90**	**725.50 ± 95.68**	**2311.17 ± 58.92**
T4	**81.66 ± 1.20^{a}**	**193.17 ± 10.21**	**390.00 ± 11.98**	**452.50 ± 14.63^{a}**	**592.50 ± 17.76**	**663.83 ± 34.43**	**2373.67 ± 58.77**
T5	**81.00 ± 0.50^{a}**	**193.67 ± 4.63**	**379.00 ± 2.46**	**449.00 ± 12.93^{ab}**	**598.17 ± 21.36**	**774.00 ± 24**	**2474.83 ± 20.98**
T6	**75.83 ± 1.92^{b}**	**190.50 ± 12.29**	**384.50 ± 4.53**	**436.67 ± 16.26^{ab}**	**619.17 ± 35.78**	**696.67 ± 61.21**	**2403.33 ± 43.80**
T7	**75.50 ± 2.46^{b}**	**188.67 ± 20.42**	**373.17 ± 10.24**	**446.17 ± 13.41^{ab}**	**567.83 ± 8.45**	**689.67 ± 32.49**	**2341.00 ± 79.21**
Sign. level	*****	**N.S**	**N.S**	*****	**N.S**	**N.S**	**N.S**

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

Different lowercase letters indicate significant differences between the treatments.

*** Significant differences at the probability level of 0.05.**

N.S: Non-significant.

While the results of Table (9) indicate that there were no significant differences between all the experimental treatments in the average of feed consumption for the period of 2-5 weeks of the experiment, as well as in the average cumulative feed consumption for the period of 0-6 weeks except for the first week as the treatment of adding Moringa leaves powder by 1% recorded the highest average of feed consumption at a significant level ($P\leq0.05$) compared to the control treatment and the treatment of adding Moringa seeds powder by 2% (T3), while it did not differ significantly with the rest of the addition treatments (T2, T5, T6, T7). At the sixth week, a significant superiority ($P\leq0.05$) was observed in the amount of feed consumed for the control treatment and T2, followed by T4, which did not differ significantly with T3, T6 and T7. The results of the statistical analysis of Table (10), which included the effect of adding Moringa seeds and leaves powder individually and synergistically to broiler diets throughout the experiment period (0-42) days in the feed conversion showed that no significant differences appeared between all treatments.It is noted from the review of the results of the growth performance that there was an improvement in the average of live body weight and weight gain in favor of Moringa leaves powder treatments in the first and fuorth weeks compared to the seeds powder treatments of the same plant. This improvement may be attributed to the group of important nutrients and active compounds contained in the leaves of the Moringa plant used in our current study (Table 4, 5, 6) as it has a high content of protein with high biological value due to the presence of the two essential amino acids methionine, which has an active role in synthesisi various body tissues, which leads to increasing body weight and improving growth (20) and lysine, which is important in the growth of skeletal muscles (19). As well as its content of essential unsaturated fatty acids such as linoleic and linolenic acids (16), which work to increase digestion and absorption of nutrients, as these acids improve the secretions of the gastrointestinal tract and reduce the number of pathogenic bacteria and prevent their adherence to the intestinal wall, which enhances the bird's immunity and thus improves growth performance (36,10). Through the chemical analysis of Moringa leaves and seeds (Table 5) that were added to the broiler diets used in this study, we note that there is a combination of important vitamins such as vitamin C and E and vitamin A. Where vitamins C and E are natural antioxidants that protect the body from the occurrence of oxidative stress resulting from the speed of metabolism and rapid growth, which is offset by weak immunity and then the body's inability to resist diseases(26), and effective aggregates (Table 6) such as flavonoids, phenols, alkaloids, tannins and saponins contribute to improving the growth performance of birds, (40) explained the role of polyphenols as antioxidants in removing free radicals and protecting the body from the damage they cause to the body's cells. (11) also indicated the importance of chlorogenic acid as an important antioxidant in the lining layer of the intestine from damage and thus enhance the health and performance of the small intestine, which increases the process of absorption of nutrients, which in turn is reflected in the growth performance and then on the qualities of the carcass.

Table 9. Effect of individual and synergistic addition of Moringa seeds and Leaves powder for diets on the Average of feed consumption (g/bird) for broiler (Mean ± standard error)

Average feed consumption (g/bird) weekly							
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**Cumulative feed consumption (0-6) week**
T1	**96.50 ± 3.27^{bc}**	**268.50 ± 10.75**	**552.33 ± 42.58**	**709.00 ± 19.18**	**944.83 ± 12.60**	**1097.50 ± 38.67^{a}**	**3668.67 ± 67.99**
T2	**104.50 ± 3.17^{abc}**	**262.00 ± 9.25**	**519.00 ± 12.77**	**695.00 ± 8.15**	**940.67 ± 11.74**	**1086.83 ± 33.60^{a}**	**3608.00 ± 47.23**
T3	**96.16 ± 2.45^{c}**	**264.50 ± 9.12**	**548.50 ± 20.20**	**705.17 ± 16.94**	**884.17 ± 36.92**	**893.17 ± 26.64^{bc}**	**3391.67 ± 31.67**
T4	**111.33 ± 3.17^{a}**	**283.83 ± 4.17**	**561.33 ± 5.34**	**703.50 ± 15.89**	**949.33 ± 20.38**	**1046.17 ± 50.26^{ab}**	**3655.50 ± 74.74**
T5	**106.50 ± 2.59^{ab}**	**269.00 ± 10.11**	**572.33 ± 20.34**	**711.17 ± 8.62**	**942.17 ± 18.71**	**859.00 ± 25.13^{c}**	**3460.17 ± 24.82**
T6	**102.33 ± 4.04^{abc}**	**270.90 ± 7.23**	**545.77 ± 16.28**	**685.00 ± 4.64**	**921.67 ± 11.41**	**896.83 ± 46.79^{bc}**	**3422.50 ± 32.57**
T7	**102.83 ± 2.04^{abc}**	**261.00 ± 17.40**	**536.33 ± 36.18**	**697.83 ± 31.62**	**956.67 ± 51.73**	**992.33 ± 45.64^{abc}**	**3547.00 ± 87.50**
Sign. level	*****	**N.S**	**N.S**	**N.S**	**N.S**	*****	**N.S**

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

Different lowercase letters indicate significant differences between the treatments.

*** Significant differences at the probability level of 0.05.**

N.S: Non-significant.

Table 10. Effect of individual and Synergistic addition of Moringa seeds and leaves powder for diets on the feed conversion ratio for Broiler (Mean ± standard error).

Feed conversion ratio (g feed / g weight gain) weekly							
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**Cumulative feed Conversion (0-6) week**
T1	**1.27 ± 0.05**	**1.32 ± 0.01**	**1.44 ± 0.16**	**1.54 ± 0.06**	**1.67 ± 0.14**	**1.54 ± 0.04**	**1.52 ± 0.05**
T2	**1.37 ± 0.04**	**1.36 ± 0.01**	**1.36 ± 0.02**	**1.57 ± 0.03**	**1.56 ± 0.03**	**1.50 ± 0.04**	**1.49 ± 0.12**
T3	**1.21 ± 0.05**	**1.47 ± 0.13**	**1.46 ± 0.05**	**1.72 ± 0.08**	**1.70 ± 0.27**	**1.28 ± 0.20**	**1.46 ± 0.04**
T4	**1.35 ± 0.04**	**1.47 ± 0.07**	**1.44 ± 0.03**	**1.55 ± 0.03**	**1.60 ± 0.01**	**1.58 ± 0.12**	**1.53 ± 0.03**
T5	**1.31 ± 0.03**	**1.39 ± 0.06**	**1.51 ± 0.05**	**1.58 ± 0.06**	**1.57 ± 0.05**	**1.11 ± 0.04**	**1.39 ± 0.14**
T6	**1.34 ± 0.06**	**1.42 ± 0.05**	**1.41 ± 0.03**	**1.57 ± 0.05**	**1.49 ± 0.09**	**1.32 ± 0.18**	**1.41 ± 0.03**
T7	**1.37 ± 0.03**	**1.39 ± 0.05**	**1.43 ± 0.08**	**1.56 ± 0.02**	**1.68 ± 0.06**	**1.45 ± 0.20**	**1.51 ± 0.04**
Sign. Level	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

T1: control treatment, T2: 1% seeds powder, T3: 2% seeds powder, T4: 1% leaves powder, T5: 2% leaves powder, T6: 0.5% seeds powder + 0.5% leaves powder, T7: 1% seeds powder + 1% leaves powder.

N.S: Non-significant.

Also, with observed (24) of the absence of significant differences between the treatment of control and the treatments of adding Moringa leaves powder in all productive qualities. Although Moringa seeds contain the important nutrients and antioxidants,we did not notice a significant superiority of the seeds powder addition treatments in the productive qualities compared to the control treatment and addition treatments. The reason may be attributed to the content of the seeds at a high level of caffeic acid, which is characterized by its bitter taste, which may reduce the palatability of the feed material and thus affect the amount of feed consumed, which is reflected in the feed conversion as the level of seeds in the diet (T3). This is consistent with (5) when adding Moringa seeds at different levels to broiler diets, he noticed a decrease in the average of feed consumption and feed conversion, and this was explained by the poor acceptance of diets based on moringa seeds powder with an increase in its levels in the diet by birds due to its unpalatable taste. Also, noted (14) a significant decrease in the weight gain of birds that fed on diet that included 2% of Moringa seeds and attributed this to the possibility of the presence of phytate, which is an anti-nutritional agent has been reinforced by what he indicated (25) that the kernel of *Moringa oleifera* seeds contain high levels of phytate compared to the rest of the other parts of the plant.

CONCLUSION

Based on the results of this study, it is concluded that the addition of Moringa seed and leaf powder did not have a significant effect on cumulative growth performance, and it is considered safe at the levels used.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DECLARATION OF FUND

The authors declare that they have not received a fund.

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