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EFFECT OF USING DEHYDRATED *Moringa oleifera* SEED ON GROWTH PERFORMANCE, CARCASS, AND BLOOD PARAMETERS OF BROILER CHICKENS

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ABSTRACT

This study investigates the potential of *Moringa oleifera* seed meal (MOSM) as a feed replacement of soyabean meal for poultry. The investigation was carried out at the Department of Animal and Poultry Production farm at Arish University, North Sinai, Egypt . A total number of 120 7-day-old Ross chicks were selected for the study. The birds were randomly divided into four treatment groups, each with 30 birds and three replicates with 10 chicks each. Four levels of MOSM (0.0, 1, 2 and 3 % were substituted from soyabean) were fed during the experimental period for (7-35days). Growth performance, carcass traits, some blood analyses, and economical efficiency were recorded. The results revealed that, birds fed diet containing MOSM during starter and grower period, respectively recorded significantly ($P \leq 0.05$) the best body weight, body gain, feed conversion ratio, protein utilization ratio and nutrients digestive compared with the control diet. The chicks fed on the diet with 1% MOSM had the highest nitrogen balance. The findings demonstrated that dietary amounts of *Moringa oleifera* seed meal had no impact on the carcass characteristics of growing broilers. According to the effect of MOSM on the blood biochemical parameters of broiler chicks; it appeared that there were no statistically significant difference between the additions of MOSM when compared to the control group ($P \geq 0.05$). Except for, a decrease in total protein, albumin، and glucose when adding the MOSM. Finally, the inclusion of 1% MOSM in broiler diets recorded the higher economical efficiency (expressed as % net revenue/feed cost) compared with control diet.

INTRODUCTION

The search for more affordable, environmentally friendly, and nutrient-dense chicken feed sources has gained momentum in recent years. *Moringa* seeds are one of the sources that have attracted attention as prospective sources. The seeds of the *Moringa oleifera* tree, which is commonly cultivated in tropical and subtropical areas, have been discovered to be particularly nutrient-rich, with potential benefits for poultry. Through a discussion of their nutrient content, impacts on the growth and health of poultry, and potential difficulties, *Moringa* seeds will be investigated for their potential as a feed supplement for chickens.

Moringa seeds are rich in protein, containing about 35-40% protein, as well as essential amino acids, which are important for the growth and development of poultry. The seeds also contain high levels of fat, with a lipid content of up to 40%, which can provide a source of energy for birds (**Makkar and Becker 1996)** Additionally, *Moringa* seeds contain a range of vitamins and minerals, including vitamins A, C, and E, calcium, and potassium (**NRC, 1994)**. These nutrients are important for maintaining the health and well-being of poultry. Studies

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have shown that *Moringa* seeds can be an effective feed supplement for poultry, improving growth rates and overall health. *Moringa* seeds also contain bioactive compounds that have been found to have antimicrobial, antioxidant, and anti-inflammatory properties (**Anjum *et al.* (2017).** These properties may help to improve the immune function and overall health of poultry, reducing the risk of disease and mortality. Thus, the objective of this study was to investigate the effect of using MOSM on growth performance of broiler chicks.

MATERIALS AND METHODS

The study was conducted at the Department of Animal and Poultry Production, Research Farm, Faculty of Environmental Agriculture, Arish University, North Sinai, Egypt. Additionally, a total number of 120 one-day-old Ross chicks with similar weights of around 40 to 50 g. were chosen for the study and acclimatized on the experimental site for seven days. The birds were incubated and fed on a baseline diet for a week to acclimatize. After this week distributed randomly into four treatment groups, each consisting of 30 birds, with three replicates of 10 chicks per replicate. The chicks were subjected to the same management and sanitary conditions throughout the experiment. The diets were designed to cover all of the bird's nutritional needs according **NRC (1994)** during pre-starter (0 to 7 days), starter (7 to 21 days), and grower (21 to 35 days).

The transactions were distributed as follows:

Tr1 (as control, Tr2 control plus 1% MOSM), Tr3 (control plus 2% MOSM), Tr4 (control plus 3% MOSM) were substituted from soyabean meal).

Tables 1 and 2 show the constituent breakdown and chemical analysis of the experimental diets utilized during the starting and growth phases.

Weekly records of the body weight, body weight increase, and feed consumption of various groups of broiler chicks were kept. Feed conversion ratio (FCR) were computed.

At the conclusion of the 35-day study, nine birds from each treatment-three from each replicate were starved of food for eight hours before being weighed and slaughtered in order to assess the characteristics of the carcass, including the head, liver, heart, gizzard, and giblets.

To evaluate the serum levels of different components, including total protein, albumin, globulin, glucose, total lipids, low density lipoprotein (LDL), high density lipoprotein HDL, cholesterol, and liver enzymatic activity aspartate transaminase (AST) and alanine transaminase (ALT), blood samples were taken and subjected to commercial kit analyses. The albumin value was deducted from the total protein value to determine the globulin value. The albumin/globulin ratio (A/G), which was calculated using the albumin and globulin data, was also determined.

The collection period extended to five days in which excreta were quantitavly collected every 24 hours and daily intake was recorded.

The excreta was cleaned from feathers and leed then weighted and dried in an oven at 60^{o}C for 36 hours. Samples were then finally ground and placed in screw - top glasses until analysis.

At the end of (35 days of age), four digestibility trials were performed. In each trial, nine male birds were housed individually caged and fed the experimental diets for three days to allow the birds to become acclimated to the cages .To help the birds become used to their new surroundings, trial diets were provided to them for three days.

Chemical analyses were performed on the examined diets and excreta using **AOAC (2002)** procedures for dry matter,

ash, crude protein, ether extract, crude fiber, and nitrogen- free extract.

For the economic evaluation of the feed, the current market prices of the ingredients and *Moringa oleifera* plant utilized throughout the study period were employed.

E.E= Net revenue / Price of feed to produce one kg LBW.

Statistical Analysis

According to the SAS program's instructions **(SAS, 2004)**, one-way analysis of variance (ANOVA) was used for the study's statistical analysis. Duncan's Multiple Range Test **(Duncan, 1955)** was used to find significant differences across treatment means. P 0.05 was used as the significance level for all statistical tests. This indicates that any findings with a p-value less than 0.05 were considered statistically significant, whilst any results with a p-value equal to or higher than 0.05 were not.

The ANOVA models used were

$$Yij = \mu + Ti + Eij$$

Were:
Yij = the observation of ij.
μ = the overall mean.
Ti = the effect of treatments.
Eij = the experimental randomly error.

RESULTS AND DISCUSSION

Chemical Composition on Dry Matter of *Moringa oleifera* Seed's

The *Moringa* seeds are high in protein, vital amino acids, vitamins, and minerals, according to the study's analysis of their nutritional composition. Therefore, *Moringa* seeds have the potential to be cost-effective for poultry **Leone *et al.* (2016).** Regarding *Moringa oleifera*, the results showed in Table 3 that percentage of protein in seed was 30.9, however, fat was 26.7%, crude NFE was 11.19%. The percentage of crude fiber was 18.2%, regarding ash (6), and Moisture was 7.01.

Performance Growth

Starter period (7-21days)

Regarding the starter period, Table 4 showed the effect of *Moringa oleifera* seed dietary on body weight from 7 to 21 days of age, at first, after 7 days, the outcomes revealed no significant differences among the control and the other treatments. Within 14 and 21 days, the results found a significant decrease between chicks fed diet containing (2% MOSM and 3% MOSM) relative to the control group. Except for 21 days, there was a significant increase chicks fed diet containing 1% MOSM compared with other treatment and control. With regards to weight gain, the outcomes revealed that during the 7–14 day period, the chick birds fed on the control diet and 1% MOSM had statistically significant higher weight gain (145g and 126g, respectively) than the birds fed 2% and 3% MOSM with weight gain (96g and 111g, respectively), and during the 14–21 period, and the entire experiment (days 7–21) were similar to the first period. **Compaoré *et al.* (2011)** these findings are in line with those of **Abbas and Ahmed (2012)**, who added *Moringa oleifera* seed powder to broilers' meals at levels of 0.37, 0.75, or 1.5% and observed that the level of 0.37% increased live body weight relative to control. Additionally**, Elbushra *et al.* (2019)** determined the effect of dietary MOSM on one- day- old Ross broiler chickens at graded levels of 0, 0.5, 1, and 2%/kg and age for 44 days. The effect of varied MOSM levels on weekly weight growth revealed significant differences ($P \leq 0.05$) through treatments during all weeks except the first one. Except for the final week, the control group without *moringa* regularly saw the greatest weight gain values.

Regarding feed intake during 7-14 days of increasing age, the outcome revealed no discernible differences among the control and the other treatments. The feed intake increased during the 14 - 21 days period of

Table 1. Composition and chemical analysis of starter diets (7-21 days)

Ingredients, (%)	T1	T2	T3	T4
Yellow Corn, ground	59.91	60.01	59.51	59.01
Soybean meal (48%cp)	31.9	30.9	29.9	28.9
Corn gluten meal (60%cp)	3.6	3.5	4	4.5
MOSM	0	1	2	3
Limestone	2.1	2.1	2.1	2.1
Di-calcium phosphate(Di-Ca-P)	1.29	1.29	1.29	1.29
Premix*	0.2	0.2	0.2	0.2
Salt	0.3	0.3	0.3	0.3
DL-Methionine	0.1	0.1	0.1	0.1
L-Lysine	0.6	0.6	0.6	0.6
Total	**100**	**100**	**100**	**100**
Calculated analysis				
ME, Kcal/Kg	2919	2960	2972	2982
CP (%)	23.2	23	23.1	23.2
CF (%)	3	3.3	3.3	3.3
EE (%)	2.8	2.8	3.8	3.8
Ca (%)	1	1	1	1
Avail. P (%)	0.4	0.4	0.4	0.4
Lys. (%)	1.1	1.1	1.1	1.1
Meth. (%)	0.6	0.4	0.4	0.4
Determine analysis				
Protein	22.8	22.9	22.9	22.9
Ether extract	3.0	3.6	3.4	3.5
Crude fiber	2.2	2.4	2.5	2.8
Ash	4.6	4.5	5.1	5
Moisture	10.8	9.5	10.3	10.3
OM	95.4	95.4	95.8	95
NEF	56.5	57	55.7	55.5
Metabolizable energy (ME)ENRGY k/100g	344	350	345	345
DM	89.1	90.5	89.6	89.6

*Each 3 kg of vitamin and mineral premix has the following ingredients: 300 g choline chloride; 50 g zinc; 4 g copper; 0.3 g iodine; 30 g iron; 0.1 g selenium; 60 g manganese; 0.1 g cobalt; and carrier CaCO3 to 3000 g.

Table 2. Composition, chemical analysis of grower diets (21-35 days)

Ingredients, (%)	T1	T2	T3	T4
Yellow Corn, ground	70.55	69.93	68.93	68.43
Soybean meal (48%cp)	20	19	18	17
Corn gluten meal (60%cp)	5	5	6	6.5
MOSM	0	1	2	3
Limestone	1.48	2.1	2.1	2.1
Di-calcium phosphate(Di-Ca-P)	2	1.8	1.8	1.8
Premix*	0.3	0.3	0.3	0.3
Salt	0.3	0.5	0.5	0.5
DL-Methionine	0.15	0.15	0.15	0.15
L-Lysine	0.22	0.22	0.22	0.22
Total	**100**	**100**	**100**	**100**
Calculated analysis				
ME, Kcal/Kg	3052	3042	3045	3066
CP%	19.1	19	19.2	19.3
CF%	3.3	3.5	3.5	3.5
EE%	2.9	3.5	3.5	3.5
Ca%	0.9	0.9	0.9	0.9
Avail. P%	0.5	0.4	0.4	0.4
Lys. %	0.8	0.8	0.8	0.8
Meth. %	0.5	0.5	0.5	0.5
Determine analysis				
Protein	18.8	19.6	19.6	19.5
Ether extract	4.3	4.3	4.3	4.2
Crude fiber	2.7	2.5	2.5	2.7
Ash	4.8	4.2	4.6	5.1
Moisture	9.9	10.2	9.7	10
OM	95.2	95.4	95.4	95.1
Metabolizable energy (ME)ENRGY k/100gm	344	347	347	345
DM	90.1	89.7	90.3	90

*Each 3 kg of vitamin and mineral premix has the following ingredients: 300 g choline chloride; 50 g zinc; 4 g copper; 0.3 g iodine; 30 g iron; 0.1 g selenium; 60 g manganese; 0.1 g cobalt; and carrier CaCO3 to 3000 g.

Table 3. Proximate composition of *Moringa oleifera* seed meal (MOSM) (on dry matter basis %)

Item	Moisture	C.P	C.F	E.E	ASH	NEF
MOSM	7.01	30.5	18.2	26.7	6	11.19

the starter period, and the results during the entire experiment (days 7–21) showed a significant increase in all treatments when compared to the control group.

According to the feed conversion ratio of 7-14 days, the result indicated no significant difference among the control and the other treatments. After 14 days of the starter period, the results showed a significant increase in 2% and 3% MOSM contrasted with the control group. In accordance with our investigation, **Granella *et al.* (2021)** discovered that, compared to the control group and other treatments, birds fed MOSM level 0.2% had significantly ($P < 0.05$) higher feed intake values throughout the course of the 7- 42 days period.

According to the feed conversion ratio, from 7-14 days, the results demonstrated no significant distinction between the control group and the various treatments. According to the feed conversion ratio among 14 days of increasing age, the outcome showed no significant difference among the control and the other treatments. After 21 day of the starter period, the results showed a significant worst in treatments (2% MOSM and 3% MOSM) contrasted with the control group.

Additionally, **Paguia *et al.* (2014)** discovered that adding 0.20, 0.30, 0.40, and 0.50% MOSM to broiler diets had no significant ($P<0.05$) impact on FCR values. A study by **Daramola *et al.* (2018)** discovered that *Moringa* seed meal improved live bodyweight gain and feed intake in turkey poults. In conclusion, using *Moringa* seeds as an addition to chicken feed has shown potential in raising LBWG in a variety of poultry species.

NRC (1994) additionally found that *Moringa* seeds contain a range of vitamins and minerals, including vitamins A, C, and E, calcium, and potassium. These nutrients are essential for maintaining the health and wellness of hens. Studies have shown that using *Moringa* seeds in chicken feed can improve the general health of the animals and speed their growth. According to a study by **Daramola *et al.* (2018)**, broiler chickens fed a diet containing *Moringa* seed meal significantly enhanced their body weight development and feed conversion ratios compared to those on a control diet. According to a study by **Anjum *et al.* (2017).** *Moringa* seeds also contain bioactive compounds with antibacterial, antioxidant, and anti-inflammatory properties.

Grower period (21-35 days)

Results on the effect of feeding dietary levels of *Moringa oleifera* seed meal on live body weight of broiler chicks during the grower period (21–35 days). The result, are shown in Table 5 reveals that, at day 28, there was no effect of feeding *Moringa oleifera* seed meal on live body weight ($P\geq0.05$). At day 35, the results found a significant increase in treatments with 1%, 2%, and 3% MOSM relative to the control group. While body weight gain for 21-28 days and 28-35 days, although the results showed numurical increasing in weight gain, there was no effect of feeding *Moringa oleifera* seed meal ($P\geq0.05$) on weight gain. Throughout the entire experiment (days 21–35), the results found a significant increase ($P<0.05$) in body weight gain with treatments 1%, 2%, and 3% MOSM relative to the control group, the results found a significant increase in treatments (1% and 2% MOSM) when compared with the control group. The findings are consistent with those of **Elbushra *et al.* (2019)**, who examined the effects of dietary MOSM on Ross broiler

Table 4. Effect of dietary levels of *Moringa oleifera* seed meal (MOSM) on growth performance of broiler chicks during the starter period (7-21 days)

Item	*Moringa oliefera* seed meal (%)				
	Control	1% MOSM	2% MOSM	3% MOSM	Sign.
Live body weight (g)					
Initial weight at 7 day	176	174	177	182	
Day 14	$321^{a} \pm 5.36$	$300^{ab} \pm 5.77$	$273^{c} \pm 3.71$	$293^{bc} \pm 3.53$	*
Day 21	$620^{b} \pm 16.7$	$674^{a} \pm 11.6$	$525^{c} \pm 3.54$	$562^{c} \pm 14.9$	*
Body weight gain (g)					
Day 7-14	$145^{a} \pm 5.93$	$126^{ab} \pm 5.88$	$96.0^{c} \pm 3.05$	$111^{bc} \pm 0.75$	*
Day 14-21	$300^{ab} \pm 12.1$	$374^{a} \pm 28.9$	$252^{b} \pm 14.6$	$270^{b} \pm 16.7$	*
Day 7-14	$445^{a} \pm 17.3$	$500^{a} \pm 14.4$	$348^{b} \pm 3.91$	$381^{b} \pm 16.0$	*
Feed intake (g)					
Day 7-14	$156^{a} \pm 8.33$	$136^{a} \pm 9.33$	$145^{a} \pm 15.9$	$127^{a} \pm 5.54$	NS
Day14- 21	$334^{b} \pm 14.6$	$478^{a} \pm 25.7$	$413^{a} \pm 3.50$	$464^{a} \pm 37.5$	NS
Day 7-14	$490^{b} \pm 6.3$	$614^{a} \pm 24.31$	$558^{ab} \pm 14.8$	$591^{a} \pm 33.4$	*
Feed conversion ratio (g. feed/g. gain)					
Day 7-14	$1.08^{a} \pm 0.01$	$1.08^{a} \pm 0.03$	$1.52^{a} \pm 0.20$	$1.14^{a} \pm 0.05$	NS
Day14- 21	$1.12^{b} \pm 0.09$	$1.80^{ab} \pm 0.19$	$2.09^{a} \pm 0.26$	$2.16^{a} \pm 0.20$	*
Day 7-21	$1.11^{b} \pm 0.05$	$1.24^{b} \pm 0.03$	$1.61^{a} \pm 0.05$	$1.55^{a} \pm 0.03$	NS

a,b,c Different superscripted means within the same row differ considerably (P<0.05). NS: Not significant (p≥0.05), *: Significant (p<0.05)

Table 5. Effect of dietary levels of *Moringa oleifera* seed meal (MOSM) on growth performance of broiler chicks during the grower period (21-35 days)

Item	*Moringa oliefera* seed meal (%)				
	Control	1% MOSM	2% MOSM	3% MOSM	Sign.
Live body weight (g)					
Initial weight at 21 day	$620^{b} \pm 16.7$	$674^{a} \pm 11.6$	$525^{c} \pm 3.54$	$562^{c} \pm 14.9$	
Day 28	$1101^{a} \pm 12.5$	$1178^{a} \pm 45.2$	$1098^{a} \pm 38.3$	$1092^{a} \pm 25.3$	
Day 35	$2200^{b} \pm 57.7$	$2901^{a} \pm 132$	$2792^{a} \pm 203$	$2378^{ab} \pm 77.9$	
Live body weight gain (g)					
Day 21-28	$481^{a} \pm 5.20$	$503^{a} \pm 44.1$	$573.8^{a} \pm 39.7$	$530^{a} \pm 30.1$	
Day28- 35	$1099^{a} \pm 52.1$	$1723^{a} \pm 175$	$1694^{a} \pm 209$	$1286^{a} \pm 52.9$	
Day 21-35	$1580^{b} \pm 54.3$	$2227^{a} \pm 131$	$2268^{a} \pm 200$	$1816^{ab} \pm 78.1$	
Feed intake (g)					
Day 21-28	$821^{a} \pm 43.5$	$728^{a} \pm 31.5$	$685^{a} \pm 52.7$	$731^{a} \pm 40.8$	
Day 28-35	$1452^{b} \pm 95.5$	$1799^{a} \pm 130$	$1564^{ab} \pm 114$	$1357^{b} \pm 0$	
Day 21-35	$2273^{ab} \pm 90.2$	$2527^{a} \pm 98.7$	$2249^{ab} \pm 122$	$2088^{b} \pm 40.8$	
Feed conversion ratio (g. feed/g. gain)					
Day 21-28	$1.71^{a} \pm 0.10$	$1.46^{ab} \pm 0.06$	$1.19^{b} \pm 0.01$	$1.38^{b} \pm 0.03$	
Day 28-35	$1.32^{a} \pm 0.05$	$1.05^{b} \pm 0.03$	$0.93^{b} \pm 0.04$	$1.06^{b} \pm 0.04$	
Day 21-35	$1.4^{a} \pm 0.04$	$1.1^{b} \pm 0.01$	$1^{c} \pm 0.01$	$1.1^{b} \pm 0.03$	

a,b,c Different superscripted means within the same row differ considerably (P<0.05). NS: Not significant (p≥0.05), *: Significant (p<0.05

chickens for 44 days after they were one day old and at graded levels of 0, 0.5, 1, and 2%/kg. The impact of varied MOSM concentrations on weekly weight growth revealed that, with the exception of the first week, there were significant differences (P0.05) across the treatments. Except for the fourth week, the control group without *Moringa* consistently saw the greatest weight gain values.

According to **Wahab *et al,* (2020)**, the effect of feeding different dietary levels of *Moringa oleifera* seeds powder (MOSP) was evaluated in one-day- old unsexed Cobb 500 chicks for 38 days Results showed that birds fed MOSP at 0.75% with phytase had significantly the highest values of live body weight gain.

Regarding feed intake during 21-35 days period, there were no significant differences among the treatments when compared to the control group, but the results showed increasing in feed intake with increasing age. According to the feed conversion ratio during all the periods, the results showed improving feed conversion ratio with increasing age.

Carcass Characteristics

Based on Table 6, it appeared that the different diets didn't have a significant effect on carcass weight. Looking at the weights of the individual organs, it seemed like the addition of MOSM did not have a significant impact on the weights of the head, gizzard, gut, lungs, and giblets. However, the heart weight appeared to be lower in the groups that received 1% MOSM, with the lowest weight but no statistically significant difference among groups ($P \geq 0.05$). While the dressing percentage appeared to be slightly higher in the 1% MOSM group compared to the other groups with $P \geq 0.05$.

These findings are consistent with those of **Ochi *et al.* (2015**) and **Mousa *et al.* (2016)**, who discovered that ingesting germination of *Moringa* seed meal enhanced gizzard weight. And contrary to what **El-Kashef *et al.* (2017)** said, the birds fed diets containing 0.2 or 0.4% *Moringa oleifera* seeds meal showed substantially (($P \leq 0.05$) higher levels of liver, heart, gizzard, and giblets compared to the control and group given 0.6% *Moringa oleifera* seeds meal.

Digestion Coefficients and Nitrogen Balance

The effect of *Moringa oleifera* seed meal levels on digestion coefficient (%) of crude protein (CP), crude fibre (CF), ether extract (EE), dry matter (DM), nitrogen-free extract (NFE), and nitrogen balance percentage (N.B%) are shown in Table 7.

The results in the Table 7 appeared to show some variations in nutritional parameters among the different diets. For example, the crude fat content (C.F) appears to be lower in the groups that received 1% and 2% MOSM groups having the lowest C.F values. The C.P, EE, D.M, and ether NEF values appear to be relatively consistent across all groups ($P \geq 0.05$). The nitrogen balance percentage (N.B %) was a measure of the balance between nitrogen intake and output.

The results indicated that 1% MOSM had the highest N.B% value of 38.17%, compared to the control group, which had the lowest value of 30.31% with $P<0.05$. This suggests that the addition of the MOSM may have a positive effect on nitrogen balance.

A study **by Nuhu (2010)** found that the digestibility of ether extract or crude fiber was unaffected ($P>0.05$) by diets including *Moringa oleifera* seed meal the findings indicated that *Moringa* seeds could be used as a partial replacement for soybean meal in broiler diets, with a significant improvement in the digestion coefficients for crude protein and NFE.

Table 6. Effect of dietary *Moringa oleifera* seed meal (MOSM) levels on carcass characteristics of growing broiler

Item	*Moringa oliefera* seed meal (%)			
	Control	1% MOSM	2% MOSM	3% MOSM
Carcass weight(g)	$2000^{a} \pm 57.7$	$2000^{a} \pm 57.7$	$2000^{a} \pm 57.7$	$2000^{a} \pm 57.7$
Head (g)	$52.0^{a} \pm 0.58$	$51.67^{a} \pm 0.88$	$51.67^{a} \pm 0.88$	$51.67^{a} \pm 0.88$
Heart (g)	$10.0^{a} \pm 0.58$	$9.0^{a} \pm 0.58$	$9.0^{a} \pm 0.58$	$9.67^{a} \pm 0.33$
Gizzard (g)	$53.33^{a} \pm 1.67$	$53.33^{a} \pm 1.67$	$53.33^{a} \pm 1.67$	$53.33^{a} \pm 1.67$
Gut (g)	$143.0^{a} \pm 0.58$	$143.0^{a} \pm 0.58$	$143.0^{a} \pm 0.58$	$143.0^{a} \pm 0.58$
Liver (g)	$44.67^{a} \pm 2.91$	$44.33^{a} \pm 2.96$	$44.67^{a} \pm 2.91$	$44.33^{a} \pm 2.60$
Lungs (g)	$9.33^{a} \pm 0.33$	$9.67^{a} \pm 0.33$	$9.33^{a} \pm 0.33$	$9.33^{a} \pm 0.33$
Giblets* (g)	$108.0^{a} \pm 3.51$	$106.7^{a} \pm 3.28$	$107.0^{a} \pm 4.00$	$107.3^{a} \pm 3.38$
Dressing (%)	$90.6^{a} \pm 0.26$	$94.4^{a} \pm 0.30$	$90.5^{a} \pm 0.26$	$93.5^{a} \pm 0.15$

a,b,c Different superscripted means within the same row differ considerably ($p<0.05$).*giblets = gizzard+ liver + heart.

Table 7. Effect of dietary *Moringa oleifera* seed meal levels on digestion coefficient (%) of growing broiler

Item	*Moringa oliefera* seed meal (%)			
	Control	1% MOSM	2% MOSM	3% MOSM
C.P	$84.73^{a} \pm 0.37$	$84.07^{a} \pm 0.58$	$84.43^{a} \pm 0.54$	$82.67^{a} \pm 0.88$
C.F	$25.70^{a} \pm 6.64$	$18.80^{a} \pm 6.54$	$19.07^{a} \pm 8.30$	$23.53^{a} \pm 7.55$
E.E	$71.36^{a} \pm 0.60$	$70.31^{a} \pm 4.60$	$67.41^{a} \pm 4.51$	$73.27^{a} \pm 2.90$
D.M	$90.10^{a} \pm 0.10$	$89.77^{a} \pm 0.39$	$90.30^{a} \pm 0.0$	$90.0^{a} \pm 0.0$
NEF	$74.38^{a} \pm 0.11$	$74.76^{a} \pm 0.39$	$74.32^{a} \pm 0.74$	$73.70^{a} \pm 0.56$
N.B%	$30.31^{c} \pm 0.30$	$38.17^{a} \pm 1.54$	$34.19^{b} \pm 0.68$	$32.44^{bc} \pm 1.28$

a,b,c Different superscripted means within the same row differ considerably ($P<0.05$).

In addition, the seeds also contain high levels of fat, with a lipid content up to 40%, which can provide a source of energy for birds (**Makkar and Becker, 1996)**.

Blood Biochemical Parameters

Table 8 shows the effect of dietary levels of *Moringa oleifera* seed Meal (MOSM) on the blood biochemical parameters of broiler chicks. Based on the Table, it appeared that there no statistically significant difference occurred between the control group and the addition of MOSM in the diets ($P \geq 0.05$) regarding globulin, A/G ratio, Total Lipids, LDL, HDL, Total Cholesterol, and AST. The findings of this study concur with those of **Makanjuola *et al.* (2014)**, who discovered that MOSM concentrations of 0.2%, 0.4%, and 0.6 had no effect on serum total protein, albumin, or globulin. The findings revealed the addition of the MOSM had some impact on blood parameters and biochemical measurements. For example, 3% MOSM group had a statistically significant decrease in blood glucose levels when compared to the control group. On the other side, According to **Mousa *et al.* (2016)**, feeding quail birds diets supplemented with 0.2, 0.4, and 0.6% germination-added *Moringa oleif*era seed had no apparent effect on plasma glucose levels.

The total protein and albumin levels in the blood decreased in the groups that received 1% and 2% MOSM having the lowest values. However, **El-Kashef *et al.* (2017) and Mousa *et al.* (2016)** discovered that birds fed diets without any supplementation of *Moringa oleifera* seed meal had slightly higher levels of total protein, albumin, and A/G ratio than birds fed diets with 0.2 or 0.4 percent MOSM treatment. While 3% and 2% MOSM groups both showed statistically significant increases in ALT levels, a marker of liver function ($p<0.05$). On the contrary, **Azza *et al.* (2020)** found that chicken given 0.75% MOSP (with and without protein) had lower blood serum levels of LDL and added up to cholesterol. When compared to controls and other nourishing plans, broilers encouraged MOSM at 0.75% with protein, and those nourished MOSM at 1% without protein had decreased AST levels There were no significant differences in ALT of growing broiler using dietary protein and MOSM levels excluded 1% MOSM was significantly lowest in contrast to the control group.

Economic Efficiency

Based on Table 9 the results show that the highest total revenue, net revenue, and economic efficiency were in 1% MOSM, which had (81.2, 50.9, and 167.6, respectively), followed by 2% MOSM, and compared to the control group. However, the highest relative economic efficiency was 167.6 in 2% MOSM, followed by 3% MOSM. Therefore, using the dietary MOSM increased the net revenue and decreased the feed cost for broilers and the price for growers. While the fixed cost and price were LBW, the results showed no change when adding MOSM. Our study agrees with the study by **El-Kashef *et al.* (2017)** who reported that the best economic efficiency and relative economic efficiency were recorded for birds given 0.4% and 0.2% of *Moringa oleifera* seed Meal, respectively**. Ogundipe *et al.* (2014)** supplement *Moringa* seed for poultry can increase economic efficiency by reducing the cost of feed while improving the growth and health of poultry, by incorporating *Moringa* seeds in poultry feed. The same findings were made by **El-Badawi *et al.* (2014),** who observed that developing rabbits fed diets supplemented with 0.15% dry *Moringa* seed had the highest relative economic efficiency in contrasted with the control group.

Conclusion

In conclusion, adding *Moringa oleifera* seed to poultry feed has the potential to promote economic efficiency in the production of poultry by lowering the cost of feed and enhancing the growth and health of the animal. But more investigation is required to establish the ideal level of *moringa* seeds incorporation in chicken feed and its long-term impact on poultry productivity.

Table 8. Effect of dietary levels of *Moringa oleifera* seed meal (MOSM) levels on the blood biochemical parameters of broiler chicks

Item	*Moringa oliefera* seed meal (%)			
	Control	1% MOSM	2% MOSM	3% MOSM
Total protein g/dl	$3.32^{a} \pm 0.24$	$2.74^{b} \pm 0.05$	$2.75^{b} \pm 0.07$	$2.60^{b} \pm 0.14$
Albumin (g/ dl)	$1.74^{a} \pm 0.01$	$1.37^{b} \pm 0.17$	$1.60^{ab} \pm 0.02$	$1.52^{ab} \pm 0.04$
Globulin (g/dl)	$1.59^{a} \pm 0.24$	$1.38^{a} \pm 0.12$	$1.15^{a} \pm 0.05$	$1.08^{a} \pm 0.09$
A/G ratio	$0.91^{a} \pm 0.14$	$1.06^{a} \pm 0.19$	$0.72^{a} \pm 0.02$	$0.71^{a} \pm 0.04$
Total Lipids (mg/dl)	$358^{a} \pm 6.75$	$369^{a} \pm 6.76$	$358^{a} \pm 6.75$	$361^{a} \pm 9.30$
Glucose (mg/dl)	$207^{a} \pm 3.0$	$202^{a} \pm 6.0$	$191^{a} \pm 11.3$	$130^{b} \pm 11.7$
LDL (mg/dl)	$103^{a} \pm 0.0$	$90.4^{a} \pm 11.2$	$95.5^{a} \pm 3.30$	$91.5^{a} \pm 4.24$
HDL (mg/dl)	$86.8^{a} \pm 2.74$	$86.8^{a} \pm 2.74$	$91.1^{a} \pm 2.36$	$85.3^{a} \pm 1.67$
Total cholesterol (mg/dl)	$190^{a} \pm 2.74$	$177^{a} \pm 8.92$	$187^{a} \pm 1.57$	$177^{a} \pm 5.32$
ALT (U/l)	$16.3^{b} \pm 0.33$	$14.7^{c} \pm 0.67$	$18.7^{a} \pm 0.33$	$19.0^{a} \pm 0.0$
AST (U/l)	$132^{a} \pm 1.79$	$128^{a} \pm 6.11$	$134^{a} \pm 2.09$	$136^{a} \pm 13.6$

a,b,c Different superscripted means within the same row differ considerably ($P<0.05$).

Table 9. Effect of dietary *Moringa oleifera* seed meal (MOSM) levels on the economic efficiency of growing broiler

Item	*Moringa oleifera* seed meal, (%)			
	Control	1% MOSM	2% MOSM	3% MOSM
Fixed cost (L.E.)	15	15	15	15
Price of kg starter	7.1	7.8	8.9	10.1
Price of kg grower	13.8	7.5	8.7	9.9
Total feed cost	23	16	18	20
Total cost	35.9	30.3	32.7	35
LBW kg.	2.2	2.9	2.79	2.38
Price LBW	28	28	28	28
Total revenue (L.E.)	61.6	81.2	78.18	66.58
Net revenue (L. E.)	25.7	50.9	45.4	31.6
Economic efficiency	71.4	167.6	138.9	90.2
Relative economic efficiency %	100	101	167.6	138.9

Fixed cost: Bird price and rearing cost, Total revenue: Assuming that the selling price of one kg live body weight is 28 LE, Net revenue: Total revenue – total cost, Economic efficiency (E.EF): Net revenue per unit total cost, Relative economic efficiency (R.E.F): Relative economic efficiency of the control =100

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تأثير استخدام بذور المورينجا أوليفيرا المجففة على النمو وخصائص الذبيحة، ومؤشرات الدم في دجاج اللحم

اية جمال عابد، محمود أحمد عبد الغفار، كامل سيد أحمد، أحمد محمد علي

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أجريت هذه الدراسة لمعرفة امكانية استخدام بذور المورينجا عن طريق احلالها بدلاً من فول الصويا في تغذية كتاكيت التسمين، وتمت الدراسة في قسم الإنتاج الحيواني والداجني بجامعة العريش بشمال سيناء. مصر. أجريت الدراسة باستخدام 120 كتكوت تسمين (روس) غير مجنس عمر 7 ايام تم التوزيع عشوائيا على المعاملات الغذائية وتمت التغذية على علائق تحتوي على اربعة مستويات من بذور المورينجا صفر و1و2و3% تم تقسيمها إلى 4 مجموعات كل مجموعة 30 كتكوتًا وكل مجموعة تتكون من 3 مكررات كل مكررة 10 كتاكيت خلال فترة التجربة 7-35 يوم. وتم تقدير كل من وزن الجسم الحي ومقدار الزيادة المطلقة في وزن الجسم ومعدل استهلاك الغذاء ومعدل التحويل الغذائي ومعدل الاستفادة من البروتين.وفى نهاية التجربة اختيرت عشوائيا تسعة طيور من كل مجموعة وذبحت من اجل قياس صفات وقياس بعض التغييرات البيوكيمائية للدم وفي نهاية التجربة تم عمل دراسة اقتصادية لتقييم العلائق المختلفة. اظهرت النتائج تفوق واضح للطيور المغذاة على العلائق المضاف اليها بذور المورينجا في وزن الجسم والزيادة في وزن الجسم ومعدل استهلاك الغذاء ومعامل النمو وكذلك معدلات أفضل فى معامل تحويل الغذاء والاستفادة من البروتين ومعاملات هضم المواد الغذائية واوضحت الدراسة ان الطيور المغذاة على 1% بذور المورينجا حققت اعلى نسبة اتزان نيتروجيني. لم يكن هناك تأثير على خصائص الذبيحة مقارنة بالمجموعة الكنترول ولا يوجد فروق معنوية في خصائص الدم على الطيور المغذاة على بذور المورينجا مع التأثير الايجابي على الكفاءة الاقتصادية للطيور مقارنة بالكنترول وسجلت الدراسة أفضل كفاءة اقتصادية 167.6 في المعاملة المضاف لها 1% من بذور المورينجا أوليفيرا.

الكلمات الاسترشادية : الكتاكيت ، بذور المورينجا أوليفيرا ، الأداء الإنتاجي.

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