Plant Archives Vol. 19, Supplement 2, 2019 pp.1841-1848 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

THE INFLUENCE OF *MORINGA OLEIFERA* LEAF MEAL AND THEIR AQUEOUS AND ETHANOLIC LEAF EXTRACTS ON GROWTH PERFORMANCE AND BLOOD PARAMETERS OF BROILER CHICKENS

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Abstract

The purpose of this study to investigate the influence of *Moringa oleifera* leaf meal and their aqueous and ethanolic leaf extracts on growth performance and blood parameters of broiler chickens. Two hundred and ten unsexed day-old Ross-308 broiler chicks were divided to seven experimental diets in a complete randomized design (CRD). Each treatment had three replicates with 10 birds per replicate. Each replicate was fed with an assigned experimental diet for a period of 5 weeks. The treatments were as following :- T1 was the control without addition, T2 adding 2gm *Moringa oleifera* leaf meal (MOLM) \ kg of feed, T3 adding 4 gm (MOLM) \ kg of feed , T4 adding 2 ml Aqueous Leaf Extract (MALE) each 1 liter water , T5 adding 4 ml (MALE) each 1 liter water, T6 adding 2 ml Ethanolic Leaf Extract (MELE) each 1 liter water, T7 adding 4 ml (MELE) each 1 liter water. The results showed that final weight, weight gain, total feed intake, feed conversion ratio and dressing percentage were significantly ($p<0.05$) improvement by inclusion levels of MOLM, MALE and MELE. also there were significantly ($p<0.05$) influence in the values of parameters of blood chemistry of all moringa treatments compare with control . The results indicated that T6 with 2 ml MELE /1 liter water had the highest characteristics of growth performance.

Keywords: *Moringa oleifera*, Aqueous extract, Ethanolic extract, Performance, Broiler.

Introduction

Poultry production remains the most wide spread of all livestock enterprises; it constitutes an important pillar of food security improvement as well as socio-cultural and economic development in most countries (Alders, 2005; Dieye *et al.,* 2010). Broiler production is a source of income, it is a good source of protein and quick returns on investment (Kekocha, 1994). Poultry is popular because when compared with the beef industry for example, it enjoys a relative advantage of easy management, higher turnover, quick returns to capital investment and a wide acceptance of its products for human consumption (Haruna & Hamidu., 2004). Poultry plays very important role for mankind through food supply, income and employment generation, providing raw materials to some industries. Food and Agriculture Organization FAO. (2010) reported that broiler chicken farm business has grown into a complete industry with rapid development due to the increasing and rapid demand for chicken meat especially when meat products from other farm animals have high retail prices. Poultry production provides base for the socioeconomic advancement in the majority of developing countries and this has led to increased demand for poultry products especially broiler meat. This is because consumers perceive that it is a healthy product that contains less fat. The industry in the developing countries is facing some challenges; these challenges include high feed to gain ratio and increase in the cost of feed because of high prices of feed ingredients (Abbas, 2013). Many attempts have been made to faced these challenges and one of them involves the use of antibiotics in feed. The poultry production sectors in developing countries face some problems, such as increased food costs; due to this, alternative sources have been sought in their diet that is available and not expensive. Poultry farming has a high impact in the economic and social spheres; since more than 60% of the animal protein consumed in the world comes from the poultry industry (Sagarpa, 2017). Antibiotics have been utilized as growth promoters and to prevent outbreak of disease (Phillips *et al*., 2004). Furthermore, medication in water using antibiotics helps birds to recover from diseases (Khalafalla *et al.,* 2010) and also antibiotics are administered in poultry drinking water for prevention or control of bacterial contamination and as growth promoters .The benefits of such practice are to maintain good health, suppress mortality of birds and support maximum growth and feed utilization and increased profit (Murwani & Murtini, 2009). However, the benefit of the use of antibiotics as growth promoters has some disadvantages; these include drug toxicity, residual effects and development of bacteria resistance (Ogbe and John, 2012). The use of antibiotics is limited due to their residual effect in poultry products, drug toxicity and development of bacteria resistance (Schwarz *et al.,* 2001). The negative impact on consumers of meat or poultry products due to residual effects has led to the ban on the use of antibiotics as growth promoters since 2006 by the European Union.

Animals scientists and veterinarians are now turning attention to safe and natural alternatives such as plants (phytobiotic) to replace antibiotics. Plants contain phytonutrients and phytochemicals (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides), which are referred to as secondary metabolites. Secondary metabolites are applied in nutrition and as pharmacologically active agents (Soetan & Oyewole, 2009). Plants are also known to have high amounts of essential nutrients, vitamins, minerals, fatty acids and fiber (Gafar & Itodo, 2011). Plant extracts have been used in the diets of poultry as a means of reducing the high cost of conventional protein sources (Nworgu, 2007; Machebe *et al*., 2010) as well as growth promoter (Nidaullah *et al.*, 2010). Moringa products have a wide range of applications in agricultural, industrial and pharmaceutical processes. Plants like *Moringa oleifera* are in high demand for their nutritional and medicinal value. Moringa leaves and seeds are used by humans as a good source of vitamins (B and C) and amino acids. *Moringa oleifera* was also claimed to boost immune systems (Olugbemi *et al*., 2010). It has relatively high crude protein, low anti-nutritional factors and antimicrobial activity (Dahort, 1998). Moringa is a multipurpose tropical tree and it

has been dubbed the "miracle tree" or "tree of life" in popular media (Bosch, 2004; Radovich, 2013; FAO, 2014) mainly because it is used for food and has numerous industrial, medicinal and agricultural uses, including animal feeding. Moringa leaves have been reported to be a rich source of β-carotene, protein, vitamin C, calcium and potassium and act as a good source of natural antioxidant compounds such as flavonoids, phenolics and carotenoids (Anwar & Bhanger, 2003). Its leaves and pods have been reported to be of great nutritional value and yield many vitamins and minerals. The leaves and the young green pods can be eaten like other vegetables are used as feed stuff. Moringa contains high antioxidants and anti-inflammatory compounds (Yang *et al*., 2006). Nutrient composition of *Moringa oleifera* leaves indicates a rich nutrient profile of important minerals, a good source of protein and amino acids, vitamins, ß -carotene and various phenolics with multiple feed additive purposes (Moyo *et al*., 2011). The present study was designed to investigate the influence of *Moringa oleifera* leaf meal and their aqueous and ethanolic leaf extracts on growth performance and blood parameters of broiler chickens.

Materials and Methods

This study was carried out at the farm of the animal production department – collage of agriculture –university of Maysan. Two hundred and ten unsexed day-old Ross-308 broiler chicks were divided to seven experimental diets in a complete randomized design (CRD). Each treatment had three replicates with 10 birds per replicate. Each replicate was fed with an assigned experimental diet for a period of 5 wk**.** The birds were purchased from Al-Barakat hatchery in Amarah city with average initial body weight (40) gm and reared under similar managerial conditions by using floor breeding system .The experimental diets and clean drinking water were supplied to the birds *ad libitum* throughout the study period and also recommended routine medication and vaccination programs were observed. Lighting system was artificial during 24 hour and Ventilation was natural achieved by opening and closing windows and also by using fans to drawing a vicious air. The nutrition was free through experimental period and the Feed intake was recorded daily. Feed conversion ratio was calculated by dividing the feed intake by weight gain. The birds were weighed at the beginning of the study to obtain their initial body weights and thereafter they were individually weighed to the nearest gram at weekly intervals during the experimental period. Mortality was recorded as it occurred and expressed in percentage (%) while the cost benefit of feeding MOLM was also determined by using the cost of the test ingredient (MOLM) and other feed ingredients in the overall cost estimation of the feed. At the end of the feeding trial, three birds from each replicate were randomly selected. They were slaughtered and eviscerated for carcass evaluation. Live weight, dressed weight, and eviscerated weights, primal cut parts and the internal organs weights were taken and expressed as a percentage of the dressed weight.

Nutrition

Through the experimental period using two diets . First starter diet from 1 to 17 day. The metabolic energy was (2936) k cal / kg food and the crude protein percentage (% 22.26), the second was a finisher diet and its given to birds from 18 to end the study at 35 day. It contain (3118)) k cal / kg food as a metabolic energy and (%20.20) the percentage of the crude protein. The feed ingredient purchased from the local market , and broilers feeding on essential diet (table 1) from one day up to age seven days and then were given the experimental diets from the end of the first week (7^{th} day).

Experimental treatments

The study include seven treatments and each treatment had three replicates with 10 birds per replicate as following :- T1 (control without addition), T2 adding 2gm *Moringa oleifera* leaf meal (MOLM) \ kg of feed, T3 adding 4 gm (MOLM) \ kg of feed, T4 adding 2 ml Aqueous Leaf Extract (MALE) each 1 liter water, T5 adding 4 ml (MALE) each 1 liter water, T6 adding 2 ml Ethanolic Leaf Extract (MELE) each 1 liter water, T7 adding 4 ml (MELE) each 1 liter water.

Table 1 : Percentage composition of experimental starter and finisher diets.

Feed ingredient	Starter diet %(1-17)day	Finisher diet % (18-35) day
Maize	54	58
Wheat bran	9	0
Wheat	0	10
Soya bean meal 44%	25	22
Protein concentrate	10	8
Vegetable oil	1	1
Lime stone	0.50	0.50
Salt	0.25	0.25
Premix	0.25	0.25
Total	100	100
Calculating chemical analysis *		
Metabolic energy (k cal/ kg)	2936	3118
Crude protein %	22.26	2002
ME/ CP Ratio	131.90	154.36
Crude Fat **%**	4.90	4.78
Crude Fiber **%**	4.13	3.30
Ca %	1.02	0.88
P **%**	0.50	0.35
Lysine **%**	1.32	1.14
Methionine + Cystine **%**	0.80	0.73

*****According to chemical analysis of (NCR, 1994).

Preparation materials using in experimental treatments

***Moringa oleifera* Leaf Meal**

The green leaves of *Moringa oleifera* (MOL) were purchased from an local orchard in Abu Al-khassib city– Basra governorate at early flowering stage. Branches were cut from the Moringa trees, spread out and dried under the shade for a period of 4 to 5 days. Thereafter, branches were threshed carefully to separate leaves from twigs before milling and also removed by hands. The dried leaves were ground with hammer mill to make a leaf meal. The leaf meals were stored in the nylon bags during entire period of the study. small amount of meal was dried by put it in electric oven for 4 hours at 105ºC in nutrition lab. animal production department - Collage of Agriculture, University of Basra. Then the percentage of humidity, dry matter, ash and another parameters were evaluation according to special methods. The results show in (Table 2).

Table 2 : The composition of *Moringa oleifera* leaf meal

Parameters	Percent on basis dry matter %
Crude protein	26.31
Ether extract	2.44
Total ash	13.07
Crude fiber	16.08
Nitrogen free extract	42.10

Aqueous Leaf Extract

Fresh leaves of the plant were air-dried under normal environmental conditions. The air-dried leaves were ground before extraction and soaked in distilled water for 24 hours using ratio 1:2 (weight/volume). The preparation was then filtered to separate the debris and filtrate using Whatman's filter paper. The filtrate was collected, the solvent was remove using rotary evaporator and the residue obtained after evaporation was weighed. The concentrated stock solution of Moringa leaf extract was prepared by dissolving 500g of the residue in 1 liter of sterile distilled water and stored at 40 ºC. The concentrated extract at calculated doses was administered in fresh drinking water which was served to the birds on a daily basis during the period of study

Ethanolic Leaf Extract

Extraction of the dried leaves was performed by soaking the plant material in ethanolic alcohol (70%) for 24 h in bath water (37°C) then put the mixture in electric stirrer for 1 h then the solution filtration by using Whatman's filter paper and the filtered distribute in tubes of centrifuge for 15 minute. The clear liquid was putting in a small glasses dishes and then set into oven at 37 °C for dried. after drying the extraction scrape off and dissolving in sterile distilled water. The product was keeping in closed flasks and put in ice box for the time of using.

Statistical analysis

All data collected were subjected to one way analysis of variance (ANOVA). based on the completely randomized design (CRD) using statistical package for the social science (SPSS, 2009). They were separated using Duncan's Multiple Range Test at 5% level of probability (P<0.05).

Results and Discussion

Growth performance : The performance characteristics of broiler chickens fed levels of *Moringa oleifera* is shown in Table 3, with significant (p<0.05) difference observed in all of the parameters examined. Final weight and weight gain were significantly (p<0.05) enhanced with birds fed level of MOLM , MALE and MELE having the highest value of 1901.75 and 1861.75 g followed by those fed 2 ml ELE / 1 liter water (T6) while birds fed diet with control had the least value of 1804.25 and 1764.25 g respectively. These results indicate that MOLM improved the growth performance of broilers, which is consistent with (Ayssiwede *et al*., 2011) who reported that leaf meal added to broiler diets significantly increased the average daily weight gain of the broilers. Hence, the improved weight gain of the birds fed MOLM authenticate the nutritional potency of *Moringa oleifera* leaf meal and strengthen the feed protein. Zarkadas *et al*. (1995) reported that proteins of *Moringa oleifera* have very high biological value and all the essential amino acids present in it are in a concentration greater than that of soybean. The reason for the improved weight gain can be attributed to high protein content of moringa leaf meal as claimed by (Kakengi *et al*., 2003; Olugbemi *et al*., 2010; Jayanti *et al*., 2017) concluded that supplementation of MOLM in broiler diets at 2-4 g/kg of feed was improved growth performance. The results also agreement with findings of Okafor *et al*. (2014) who found that broiler chicks fed with diet containing MOLM had high mean final body weight of 2869 gm compared with the group fed on the control diet which had a mean final weight of 2430 gm. The growth performance indices recorded from mean weight gain and protein efficiency ratio proved that *Moringa oleifera* supplemented diet support growth rate of broiler chicks more than the control diet. The obtained data were agreed with those by (David *et al*., 2012) and also with Hassan *et al*. (2016) who found that effect of different levels of MOLM on body weight of broiler chicks were 1307, 1408, 1488 and 1543 gm of treatments levels at (0, 0.1, 0.2 and 0.3)% after 35 days respectively. The presence of the limiting amino acids as well as other essential amino acids in moringa leaves might have contributed to the observed better nutrient intake and growth performance. It might also be to the influence of the other substance such as the vitamins which improved the efficiency of fed utilization of chicks (Melesse *et al.,* 2011). The inclusion of MOLM in the died of broilers significantly (P<0.05) enhance their weight gain at 1% level which was significantly higher than the control. Umar *et al*. (2017) concluded that *Moringa oleifera* leaves extract at 40 ml / liter of water improves growth performance of broiler chickens without adverse effect on the carcass. The decreased of body weight gain observed in birds served moringa leaves extract at 80, 120 and 160 ml / liter of water could be attributed to the presence of anti- nutritional factors in the extract. These findings coincided with a report of Muhammad *et al.* (2011) that the leaves of *Moringa oleifera* contain tannin and saponins which known to reduce feed efficiency and consequently body weight gain. The results of the present findings are not in agreement with Onunkwo and George (2015) who found that there no significant difference in growth performance parameters in broiler chickens when fed graded levels (0, 5, 7.5 and 10%) of MOLM for seven weeks (49 days) and also are not in line with results of study Mona EMY *et al.* (2016). That they aren't found significant difference in the final body weight of different groups fed diets supplemented with various levels of MOLM (0, 2 and 3%). On the other hands the total feed intake (Table 3) were significantly (p<0.05) decreased in birds feed diets included

Moringa oleifera compared with the control that consumed higher feed with 2952.80 gm . while the birds fed with 2 ml MALE / 1 liter water (T4) were the lower feed intake with 2878.50 gm .This finding is similar to those of Ashong & Brown (2011)who reported that the control group had higher feed intake compared to the treatment groups when *Moringa oleifera* were feed to ross-308 type of chicken . The decrease in feed intake in birds on the MOLM, MALE and MELE treatments is also in line with these of Portugliza & Fernandez (2012) who observed that *Moringa oleifera* aqueous extracts in drinking water significantly decreased feed intake of broiler as concentration increased. This could be as a result of improved digestion and metabolism activities of *Moringa oleifera* (Ghazalah and Ali, 2008). The reduce intake could be due to reduce palatability of the diets (Kakengi *et al*., 2003). The reason for the reduce intake of diets include MOLM may be to high crude fiber content which may invariably reduce palatability in all the treatments. While the findings study of Gadziray *et al*. (2012) indicates that there were no significant differences in feed intake of broiler fed with different levels of moringa. and also result of study Nkukwana *et al*. (2014) who found that no significant differences were observed in feed intake between treatments during periods from (0 – 35) day. The results of Feed conversion ratio (FCR) in this study was significantly ($p<0.05$) improvement in birds fed on *Moringa oleifera* diets as compared to control group. The FCR of (T4) which contain 2 ml MALE /1 liter water and (T6) included 2 ml MELE/1liter water was (1.57) while the FCR of control group was (1.68) kg of feed / kg weight gain .The improvement of FCR may be because the birds adequately utilized the nutrients in the diets consumed (Ayo- Ajasa *et al*. (2016). This result agree with the finding of (18) who reported that chicks fed on MOLM based diets performance significantly ($p<0.05$) better than the birds of control in term of higher weight gain and better FCR. Jayanti *et al*. (2017) so found that the FCR was better in all treatments groups were fed at 2 ,4 and 6 gm / kg of feed as compared to control group. while Melesse *et al*. (2011) observed the FCR of chicks fed the moringa leaf meal diets were not different among each other , but were significantly ($p<0.05$) higher than those on the control diet. The result of the findings are not agreement with reports of Divya *et al*. (2014) who reported that no significant differences in FCR among all treatments. Also Paguia *et al*. (2014) reported that the FCR was not relatively better over the control on inclusion of *Moringa oleifera* leaves powder at 20, 30, 40 and 50 gm/kg of feed in broiler diets. The last growth performance parameters in this study is dressing percentage which all treatments of moringa recorded high percentage as compared with control group that recorded less percentage at 72.09% while (T6) was the highest at 76.84%. The result is not in accordance with study of Mona EMY *et al*. (2016) that there were no significant differences in dressing percentage of different experimental groups.

Table 3 : Effect of *Moringa oleifera* leaf meal and their aqueous and ethanolic leaf extracts on growth performance of broiler chickens.

	Treatments						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Final body weight (gm)	1804.25 ± 19.95 d	1843.50 ± 7.26 c	1819.20 ± 9.40 d	1866.10 ± 7.06 b	1856.50 ± 9.69 bc	1901.75 ± 9.86 a	1872.75 ± 8.60 b
Average body weight gain (gm)	1764.25 95.± 19 d	1803.50 26.± 7 c	1779.20 40.± 9 d	1826.10 06.± 7 b	1816.50 69.± 9 bc	1861.75 86.± 9 a	1832.75 60.± 8 b
Total feed intake (gm)	2952.80 67.± 38 a	2885.00 21.± 35 bc	2900.50 66.± 19 bc	2878.50 98.± 15 c	2896.70 46.± 38 bc	2933.50 54.± 15 ab	2905.75 95.± 4 ab
Feed conversion ratio FCR	1.68 ± 0.03 a	1.60 ± 0.01 bc	1.63 ± 0.02 b	1.57 ± 0.01 c	1.60 ± 0.03 bc	1.57 ± 0.02 c	1.59 ± 0.01 c
Dressing percentage (%)	72.09 ± 0.29 c	74.28 ± 0.87 B	73.74 ± 1.72 bc	75.44 ± 1.39 ab	74.59 ± 0.46 b	76.84 ± 0.93 a	74.88 ± 1.03 b

[abcde] Means in the same row with different superscripts were significantly different ($P<0.05$).

T1 (Control without addition), T2 adding 2gm *Moringa oleifera* leaf meal (MOLM)\kg of feed, T3 adding 4 gm (MOLM)\kg of feed, T4 adding 2 ml Aqueous Leaf Extract (MALE) each 1 liter water, T5 adding 4 ml (MALE) each 1 liter water, T6 adding 2 ml Ethanolic Leaf Extract (MELE) each 1 liter water, T7 adding 4 ml (MELE) each 1 liter water.

Haematological parameters:

The result of haematological indices are present in table (4). There were significant higher ($P<0.05$) in values of Red Blood Cell (RBC), Packed Cell Volume (PCV%) and Haemoglobin (Hb) in all treatments fed *Moringa oleifera*. The birds fed T7 diet with 4 ml of MELE/1 liter water was the higher values of RBC (2.45×10^6)/mm^3, PCV (32.12%) and HB(12.55) gm/mm^3 as compared with control group that recorded lower values at (1.94×10^6) /mm^3, (28.96%) and (10.26) gm/mm^3 respectively. While the value of White Blood Cell (WBC) in the control group was the highest with (10.62×10^3) / mm^3. The decrease number of WBC of moringa treatments suggests that the birds were healthy. Red blood cells are responsible for the transportation of oxygen and carbon dioxide in the blood as well as manufacture of Haemoglobin. Hence higher value indicate a greater potential for this function and better state of health (Olugbemi *et al*., 2010). The high Haemoglobin implies high oxygen carrying capacity while below normal indicates low oxygen carrying capacity. Thus animals succumb easily to respiratory stress (Aderemi & Alabi, 2012).White blood cells are involved in protecting the body from infection and consist of

lymphocytes, monocytes, neutrophils and pasophils. They amongst other functions, kill virus - infected cells , enhance the production of antibodies and engulf foreign materials (antigens) that enter the body (Olugbemi *et al*., 2010). Findings from this study were in agreement with the report of Elbashier & Ahmed, (2016) who found increase in RBC, PCV and HB values. The higher values maybe attributed to the influence of *Moringa oleifera* leaf content which is rich in nutrient such as protein and minerals. This results are confirming the findings of Fuglie, (1990) who reported high values in haematological parameters (RBC, PCV and HB) that *Moringa oleifera* has a blood boosting effect because for the high protein content. Onu & Aniebo, (2011) noticed that there were significant (P<0.05) differences among groups in PCV and RBC of the birds. The HB counts showed no significant difference among treatment. The values for WBC were similar between the treatments groups. While Alagbe (2017) observed that no significant influence of the haematological parameters measured (PCV%, HB, WBC and RBC) when fed broilers different levels of *Azolla-Moringa oleifera* mixture throughout the experimental period which lasted for 42 days. Also Liaqat *et al*. (2016) founded that all values of blood parameters were to be within normal range and not affected by *Moringa oleifera* leaf powder supplementation. *Moringa oleifera* meal leaf contains iron (23 mg /100 g) which is necessary f or many function in the body including the formation of haemoglobin and myoglobin. *Moringa oleifera* was also have a natural enzyme which aid digestion of fibrous food in animal (Gaia, 2010).

Table 4 : Effect of *Moringa oleifera* leaf meal and their aqueous and ethanolic leaf extracts on haematological parameters of broiler chickens.

Parameters	Treatments						
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Red blood cell (RBC)	1.94 ± 0.06 c	2.00 ± 0.09 c	2.25 ± 0.04 b	2.05 ± 0.06 c	2.26 ± 0.08 b	2.34 ± 0.12 ab	2.45 ± 0.10 a
White blood cell (WBC)	10.62 ± 0.11 a	6.97 ± 0.14 d	7.96 ± 0.14 c	9.01 ± 0.19 b	7.08 ± 0.11 d	6.43 ± 0.09 e	6.94 ± 0.09 d
Packed cell volume PCV(%)	28.96 ± 0.13 e	30.02 ± 0.24 d	30.80 ± 0.26 C	31.87 ± 0.11 a	29.96 ± 0.16 d	31.44 ± 0.10 b	32.12 ± 0.22 a
Haemoglobin (HB)	10.26 ± 0.09 d	11.20 ± 0.22 c	10.96 ± 0.09 c	10.94 ± 0.23 c	11.97 ± 0.16 b	12.02 ± 0.09 b	12.55 ± 0.10 a

[abcde] Means in the same row with different superscripts were significantly different (P<0.05).
T1 (Control without addition), T2 adding 2gm *Moringa oleifera* leaf meal (MOLM) \ kg of feed, T3 adding 4 gm (MOLM) \ kg of feed , T4 adding 2 ml Aqueous Leaf Extract (MALE) each 1 liter water, T5 adding 4 ml (MALE) each 1 liter water, T6 adding 2 ml Ethanolic Leaf Extract (MELE) each 1 liter water , T7 adding 4 ml (MELE) each 1 liter water.

Serum Biochemical Profile

Results obtained on the serum biochemical profile of the birds are shown in table (5). The values of total protein and albumin in serum were increased in all *Moringa oleifera* treatments. The T7 recorded high concentrate in total protein and albumin with (4.99 and 3.42) gm / 100 ml compared with control group which reached (3.05 and 1.73) gm/100 ml respectively. Higher level of globulin was observed in T4 with 1.95 gm/100 ml. While T1 (control group) recorded lower level with 1.321gm/100 ml which there were no significantly difference obtained with T3 and T5. From table (5) it could be observed that tri glycerides decreased in all moringa treatments compared with control group which recorded high value reached 47.92 mg /100 ml, whereas T4 the lower level with 23.90 mg /100 ml. Also from this study noticed that values of uric acid increased in T7, T3 and T2 which recorded 3.14 , 3.10 and 3.05 mg /100 ml respectively. While the values of T6, T5, T4 and T1 were decreased and which reached 2.73, 2.69, 2.58 and 2.55 mg/100 ml respectively. The data showed increased in values of HDL for all *Moringa oleifera* treatments. T7 which the higher value reached 99.60 mg /100 ml compared with control group was recorded lower value at 78.20 mg/100 ml. While the values of LDL of moringa diets were decreased and the T7 which reached 23.70 mg /100 ml compared with control group was investigated higher value with 34.02 mg /100 ml. The cholesterol value in control group was increased to 118.28 mg/100 ml, whereas moringa treatments which were decreased and the T3 could be recorded the lower value reached 91.15 mg/100 ml. The concentrate of glucose in serum was increased in all *Moringa oleifera* treatments. The T7 was reached 245.21 mg/100 ml while the control group was the lower concentrate reached 184.75 mg /100 ml. The serum biochemical indices that there was significant difference (P<0.05) in the value of total protein, while there was no significant difference in the values of serum albumin and globulin (Onu & Aniebo, 2011). The total serum protein is usually a reflection of the protein quality fed. According to Bush, (1991). The increase in total protein maybe due to dehydration and increase in globulin level, While decrease in total protein always due to low level of albumin. Melesse *et al*. (2013) noticed that inclusion of MOLM in the diets of chicks significantly influenced (P<0.05) of the most the serum biochemical parameters of the chickens. The level of total serum protein and triglycerides increased significantly in the chickens fed MLM containing diets. The increase of total protein in chicks fed the MLM diets may reflect a more intensive metabolism of the protein in the chicken organ as suggested by (Sirvydis *et al*., 2006). The findings which is consistent with the results of (Teye *et al*., 2013). Also Melesse *et al*. (2013) observed that the Serum urea concentration decline with increasing level of MLM. Urea is the form of protein for excretion through urine which is mostly occurred when extra protein is available in the

circulation. However lower urea protein concentration in the serum of birds fed MLM in diets might have occurred with higher protein consumption which may suggest better absorption and efficient utilization of dietary protein. Study of (3) recorded significant difference (P<0.05) between some blood serum parameters (glucose and cholesterol) in treatments fed level of *Moringa oleifera* pods mail (0.5, 1.0 and 1.5) and control. The control group showed highest values of all biochemical indices whereas lowest level of glucose and cholesterol. The reduce values of glucose and cholesterol occurred when the level of MOPM was increased as compared to control. Alnidawi *et al.* (2016) found that the total cholesterol and LDL- cholesterol decreased with increasing level of *Moringa oleifera* poultry diets, While tri glycerides and HDL- cholesterol were increased by increasing level of MOLM.

Table 5 : Effect of *Moringa oleifera* leaf meal and their aqueous and ethanolic leaf extracts on serum biochemistry of broiler chickens.

Parameters	Treatments						
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Total Protein	3.05 ± 0.11 d	4.00 ± 0.15 b	3.95 ± 0.23 b	4.09 ± 0.15 b	3.54 ± 0.08 c	4.11 ± 0.16 b	4.99 ± 0.11 a
Albumin	1.73 ± 0.09 d	2.61 ± 0.05 b	2.58 ± 0.16 b	2.14 ± 0.23 c	2.19 ± 0.04 c	2.65 ± 0.10 b	3.42 ± 0.09 a
Globulin	1.32 ± 0.03 c	1.39 ± 0.11 c	1.37 ± 0.07 c	1.95 ± 0.12 a	1.35 ± 0.05 c	1.46 ± 0.09 bc	1.57 ± 0.03 b
Tri glyceride	47.92 ± 3.43 a	35.60 ± 2.39 ab	32.75 ± 4.46 b	23.90 ± 14.61 b	24.80 ± 4.94 b	28.35 ± 7.52 b	30.45 ± 8.30 b
HDL	78.25 ± 2.96 d	86.10 ± 5.46 c	94.30 ± 3.34 ab	91.50 ± 1.80 bc	94.30 ± 3.34 ab	95.50 ± 4.16 ab	99.60 ± 3.09 a
LDL	39.02 ± 2.21 a	29.95 ± 3.41 b	24.75 ± 0.64 c	30.35 ± 3.30 b	30.25 ± 1.63 b	25.52 ± 1.15 c	23.70 ± 1.36 c
Cholesterol	118.28 ± 1.97 a	100.30 ± 3.07 d	91.15 ± 2.69 e	106.25 ± 2.80 bc	93.50 ± 4.21 e	109.31 ± 2.44 b	103.80 ± 2.17 cd
Glucose	184.75 ± 60.591 d	208.35 ± 3.11 c	212.20 ± 4. 62 c	230.55 ± 3.10 b	245.19 ± 4.63 a	229.26 ± 2.57 b	245.21 ± 1.97 a
Uric acid	2.55 ± 0.06 b	3.05 ± 0.09 a	3.10 ± 0.24 a	2.58 ± 0.16 b	2.69 ± 0.13 b	2.73 ± 0.15 b	3.14 ± 0.08 a

[abcde] Means in the same row with different superscripts were significantly different (P<0.05).

T1 (control without addition), **T2** adding 2gm *Moringa oleifera* leaf meal (MOLM) \ kg of feed, **T3** adding 4 gm (MOLM)\kg of feed, **T4** adding 2 ml Aqueous Leaf Extract (MALE) each 1 liter water, **T5** adding 4 ml (MALE) each 1 liter water, **T6** adding 2 ml Ethanolic Leaf Extract (MELE) each 1 liter water, **T7** adding 4 ml (MELE) each 1 liter water.

Conclusion

From the results obtained in this study, MOLM, MALE and MELE can be used in the diets of broilers at level 2-4 gm MOLM/1 kg of feed and 2- 4 ml MALE and MELE/1 liter of water with positively effecting on growth performance and blood parameters.

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