

Research Article

**Effect of Moringa, Thyme, Sumac Powders and Their Mixture on Growth Performance in Broiler Chicken<sup>‡</sup>**

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**Abstract**

This study was conducted to figure out the effect of 1% inclusion of three herbal (Moringa leaves powder, Sumac fruit powder, Thyme powders and their mixture) in the diet on broiler chick's growth performance. A total of 181 a day-old male broiler chicks (Ross 308) were randomly distributed into five dietary treatments with 3 replicates (12 birds/rep). The groups were Control (no addition, T1), 1% Moringa (*Moringa oleifera*) leaves powder (MLP, T2), 1% Sumac (*Rhus coriaria* L.) fruit powder (SFP, T3), 1% Thyme (*Thymus vulgaris* L.) leaves powder (TLP, T4), 1% Mixture of Moringa, Sumac and Thyme leaves powder (MST, T5). The birds were offered non-pelleted diets *ad libitum* from beginning to end of the trail. Live body weight, body weight gain, accumulative feed intake and feed conversion ratio were recorded weekly. Moringa leaves powder (MLP), Sumac fruit powder (SFP), the mixture of Moringa, Sumac and Thyme (MST) had significant ( $p<0.05$ ) effects on growth performance. Dietary supplementation of the herbs had positive effect on live body weight (LBW) and feed conversion ratio. The highest LBW was observed in MLP and MST groups. In terms of LBW, however, there was no significant ( $p<0.05$ ) differences for the birds fed with supplemented Thyme leaves powder (TLP) relative to the control group during all total periods (0-42 d). Positive effects was observed on accumulative FCR comparing to the control group and the best significant FCR was obtained by using Moringa additive. However, there were no significant effects ( $P<0.05$ ) of treatments on accumulative feed intake except the feed supplementation with Thyme only when comparing to control group and other treatments. As a result, Moringa leaves powder, Sumac fruit powder, Thyme leaves powder, and Mixture of Moringa, Sumac & Thyme leaves powder could be used as growth promoter instead of antibiotics by 1% of supplementation in the diet of broiler with no negative effects.

**Key words:** Broiler, moringa, sumac, thyme, feed performance.

**Moringa, Kekik, Sumak Tozları ve Karışımının Etlik Piliçlerin Besi Performansı Üzerine Etkisi**

**Özet**

Bu çalışma, üç tıbbi aromatik bitkinin (moringa yaprak tozu, sumak meyve tozu ve kekik yaprak tozu) ve bunların karışımları %1 oranında rasyona ilavesinin etlik piliçlerin besi performansına etkisini araştırmak amacıyla yürütülmüştür. Toplam yüz seksen adet bir günlük erkek broyler civcivleri (Ross 308), 3 tekerürlü beş gruba şansa bağlı olarak dağıtılmıştır. Gruplar; Control (T1), %1 Moringa (*Moringa oleifera*) tozu (T2), %1 Sumak (*Rhus coriaria* L.) meyve tozu (T3), %1 Kekik (*Thymus vulgaris* L.) tozu (T4) ve %1 Moringa, Sumak ve Kekik Karışımı tozu (T5) olarak belirlenmiştir. Deneme boyunca hayvanlara rasyon toz formunda adlibitum olarak verilmiştir. Canlı ağırlık, canlı ağırlık artışı, yem tüketimi ve yemden yararlanma haftalık olarak kaydedilmiştir. Moringa tohumları (T2), Sumak meyve tozu (T3) ve Moringa, Sumak ve Kekik karışımı (T4) broiler civcivlerdeki canlı ağırlık ve yem dönüşüm oranı üzerinde önemli ( $P < 0.05$ ) ve pozitif etkilere sahip olmuştur. Ayrıca, deneme süresinde kontrol grubuna kıyasla, muamele gruplarında yemden yararlanma oranı daha iyi olduğu tespit edilmiştir. Moringa ilavesinin yem tüketimi üzerine önemli bir etkisi ( $P > 0.05$ ) görülmemiştir. Kontrol grubuna ve diğer muamele gruplarına kıyasla k-Kekik yaprak tozunun yem tüketimine etkili olduğu görülmüştür. Sonuç olarak, ticari broyler

rasyonunda antibiyotik yerine büyüme faktörü olarak tek başına *Moringa oleifera* veya bitki karışımının (Moringa, Sumak ve Kekik) kullanılmasının büyüme ve gelişme özellikleri üzerine herhangi bir olumsuz etkisi olmadan rasyona katılabileceği anlaşılmıştır.

**Anahtar kelimeler:** Broiler, moringa, sumak, kekik, besi performansı.

## Introduction

Chicken production considers one of the most commonly animal production species in developed countries. World Health Organization (WHO) recommended animal protein intake of 60gm per day is hardly met. It has been reported that, the cost of feed represents up to 60-80% of the total cost of broiler chicks production (Teguia and Beynen, 2005), accounts of feed cost for up to 80% of the total cost of production and is a very important component to finding out the extent of poultry survival and then profitability. Unremitting use of antibiotics in poultry may result in remainder effects in poultry products which may make the bacterial resistance against treatments in human body. Because of these disadvantage effects to human health, European Union since 2006 use of antibiotics in poultry was completely banned (Catala-Gregori et al., 2008). At present prevalent infectious diseases is the major trouble to the whole world which causes the financial failure to the poultry farmers. Also other factors like vaccination failure, infection by immune-oppressive diseases, and using antibiotics with the poor experience can cause deficiency in animal immunity. various alternatives to these antibiotic growth promoter replacements have been proposed to used such as organic acids and medicinal plants as natural feed additives are now recently used in poultry nutrition to improve the performance of the immune response of birds (Lee et al., 2003).

The medical plants have been the motif of stupendous scientific investigation. Due to present a number of pharmacologically effective materials, become to have a field for growth increment of livestock, they are supposed to promote activate digestive enzymes, stimulate immune and feed intake (Lee et al., 2003; Inci et al. 2015a; 2015b; Inci et al., 2016; Aydın and Alçiçek, 2017). There is a needed to innovation more efficient alternatives or blending of various alternatives to maintaining health and amendment the performance of poultry and other livestock (Fritz et al., 1993; Sogut et al., 2012; Aydın and Alçiçek, 2018). Some authors reported a significant positive effects on broiler performance (Ertas et al., 2005). Another group of authors reported no effect on gain, feed conversion or feed intake (Cross D.E et al., 2007).

Thyme (*Thymus vulgaris*) contain the main phenolic components Thymol (5-methyl-1-2-isopropyl phenol) and carvacrol (5-isopropyl-2-

methyl phenol). *Thymus vulgaris* species has special functions such as antimicrobial, antioxidant, expectorant, antispasmodic and antiseptic (Abu-Darwish et al., 2009). Performance promoting influences of extract, essential oil, powder or principal components of thyme have been demonstrated in poultry (Lee et al., 2003). There was an influence of dietary supplemental plant extracts on digestive system development, intestinal microflora of broiler chicks carcass characteristics, performance and some blood parameters (Tekeli et al., 2006).

Sumac (*Rhus coriaria* L.) used as a spice and with the long history of use by indigenous people as medicinal plant, and other applications. The fruits of sumac contain hydrolysable tannins, flavonols, phenolic acids, anthocyanins and organic acids such as malice, citric and tartaric acids (Özcan and Haciseferogullari, 2004).

*Moringa oleifera* tree, from the roots to the leaves has beneficial properties. Various parts of which are used as fodder, spices, herbal medicine, food, natural coagulants, fertilizer, nectar for bees and fuel. Moringa contains very high anti-inflammatory and antioxidants compounds (Yang et al., 2006). The leaves, flowers and pods are used as better sources of vitamins A, B and C, folic acid, ascorbic acid, nicotinic acid, riboflavin, pyridoxine, beta-carotene, iron, calcium, and alpha-tocopherol. The pods are considered as an interest source of the essential amino acids. A compound, pterygospermin found in the flowers and roots of the Moringa has strong fungicidal and antibiotic effects (Das et al., 1957). The leaves of *Moringa oleifera* have increase immunity in broilers. Thus, leaf meal from both *Moringa oleifera* and *Moringa stenopetala* might be good feed additives in livestock production, (Du et al., 2007).

The effect of 1% inclusion of three herbal (Moringa leaves powder, Sumac fruit powder, Thyme powders and their mixture) in the diet on broiler chick's growth performance was the subject of this study.

## Material and Methods

According to the ingredient composition, based broiler starter, grower and finisher were formulated by Local feed manufacturers company in Bingol city in Turkey. *Moringa oleifera* leaf

powder (MLP) was acquired from online market of Herbal natural international company in the United States, and original of plant from India. Sumac fruit powder (SFP) from our orchard in Dohok-Akre city in Iraq and Thyme leaf powder (TLP) was acquire from Mardin city in Turkey. All herbal plants were purchased as dried grinded and fine powders, and they were analyzed in University central laboratory, University of Bingol, by instrument called Gas Chromatography/Mass Spectrometry (GC-MS), to determine active compounds in all of Moringa, Sumac and Thyme.

A total of 181 a day-old male broiler chicks (Ross 308) strain, were purchased from a commercial hatchery in Turkey. And they were weighed and assigned into five dietary treatments in a complete randomized design. On arrival, they were randomly distributed into five dietary treatments, and each treatment was divided into three replicates with 12 chicks per replicate. Moringa, Sumac and thyme as powders were added to the diet at 7<sup>th</sup> day of age. The birds offered non-pelleted diets *ad libitum*, starter, grower and finisher diets were offered from 7 to 21 days, from 22 to 35 days and from 36-42 days, respectively, and clean water be provided throughout the period of the experiment. Experimental diets were starter, grower, and finisher, with all of them in non-pelleted form. A starter diet was offered to birds during the period of 7-21 days and included %23 crude protein (CP) and 3150 kcal/kg ME; a grower diet was offered from 22-35 days and included % 21 CP and 3200 kcal/kg ME; and a finisher diet was offered from 36-42 days and included % 19 CP and 3200 kcal/kg ME. Before to beginning of addition of herbs plants (up to 7 days of age), all chicks were fed on a starter diet. This study was initiated at 7 days of age. Five dietary treatments namely Control (No addition, T1), 1% Moringa (*Moringa oleifera*) leaves powder (MLP, T2), 1% Sumac (*Rhus coriaria* L.) fruit powder (SFP, T3), 1% Thyme (*Thymus vulgaris* L.) leaves powder (TLP, T4), 1% Mixture (Moringa, Sumac & Thyme) leaves powder (MST, T5).

The birds were kept in a deep litter housing system at concrete floor. Wood shavings or sawdust were used as litter at a 5 cm in depth. Before use the house, cages, drinkers, and feeders and all equipment, they were cleaned and disinfected with suitable disinfectants before to the commencement of the experiment. Heating was provided by electrical heaters, where the initial ambient temperature was set at 33 °C and was gradually decreased by 2.5 °C approximately per week to final temperature of 23-22 °C at 21 day of age then continued till the end of experiment. Chicks were leg-tagged and body weight and feed intake were

taken at the beginning of the experiment and subsequently on a weekly. Weight gain, feed conversion ratio and feed efficiency ratios were calculated.

Grow performance characteristics include; weekly and final live body weight, body weight gain, feed intake level, feed conversion ratio.

### Statistical analysis

All data were subjected to statistical analysis as per standard methods. Statistical analysis SAS (2005) was used to analyze the data to account the effects of treatments. The Duncan's multiple range tests was used to test the significance between means.

## Results and Discussion

### Live body weight

In the present study, the effects of herbal feed additives on live body weight of broiler chicks during 7-42 days of age period were presented in Table 2. The diets with herbal feed additives improved the live body weight generally. At the end of experiment (42 d), the highest (2479.7 live body weight (LBW) were observed in T2 group which was significantly ( $p<0.05$ ) different than control. Besides, treatment groups (T2, T3 and T5) had higher LBW than control. Additives of 1% thyme leaves powder did not alter the LBW significantly ( $P>0.05$ ) even though lower than control. The results indicated that live body weight with herbal feed additive for birds fed on T2 and T5 which containing *Moringa* leaves powder were significantly ( $p<0.05$ ) higher as compared to the control group.

The improving live body weight of chick fed with *Moringa* leaves powder could be attributed to high digestibility of *Moringa* leaves (Becker, 1995) which may enhance absorption of nutrients. This effect of *Moringa* leaves powder leads to higher LBW. These results were in agreement with the finding of Banjo (2012) who observed that the inclusion of *Moringa oleifera* leaf meal (MOLM) with 1%, 2% and 3% levels in diet of broilers significantly ( $P<0.05$ ) improved LBW gain at 1% level, which was higher than the control significantly. In this accept, David et al. (2012) who used seven experimental diets consist of control, negative control, 0.0125% flavomycin (positive control), 0.05% *Moringa* leaf powder, 0.1% *Moringa* leaf powder, 0.035% Zigbir (commercial herbal product), 0.05% *Moringa* fruit powder (MFP) and 0.1% *Moringa* fruit powder (MFP). The study exposed that all selected additive dietary supplements significantly ( $P<0.05$ ) enhance the growth performance of birds compared to the

negative control. Moreover, the body weight gain of birds were increased with the increasing levels of both *Moringa* leaf and fruit powder during the finisher and total periods. Also, Teteh et al. (2013) observed that all chick LBW and daily body weight gain increased significantly ( $P<0.05$ ) compared to the control group when used 1% and 2% *Moringa oleifera* leaf meal (MOLM). On the other hand, Nkukwana et al., (2014) applied MOLM low (ML; 1, 3 and 5g); (MOLM) medium (MM; 3, 9 and 15 g); (MOLM) high (MH; 5, 15 and 25 g)/ kg of feed, and a negative control. Chicks fed MH had the highest LBW. Along the same line, Karthivashan

et al. (2015) showed that fed on 0.5%, 1.0% and 1.5% of MOLM extracts significantly ( $P<0.05$ ) enhanced weight gain compared to control group, while there were no significant differences in weight gain for the dietary treatments with MOLM. On the contrary, Makanjuola et al., (2014) pointed that adding 0.2, 0.4 and 0.6% of MOLM to the feed, lasted 28 days, had no adverse influence on final weight and BWG in broiler chicken. Also Pagua et al., (2014) observed that using 0.20, 0.30, 0.40 and 0.50% of MOLM in the diet of broiler chicks did not ( $P<0.05$ ) significantly affect the broilers BW and BWG.

**Table 1.** Composition and ingredients of broiler diets.

Ingredient (g)	Starter	Grower	Finisher
Maize, yellow	355.5	330.4	256.8
Soybean meal (480 g CP kg*)	275.3	204.5	171.5
Sunflower meal (350 g CP kg*)	110.0	150.0	111.5
Wheat	99.0	130.0	330.0
Wheat bran	-	38.0	-
Meat-bone meal	64.4	56.0	49.2
Vegetable oil	73.7	85.0	73.6
Limestone	13.6	-	-
Premix1	3.5	3.5	3.1
Sodium chloride	3.0	2.5	2.5
L-lysine	0.4	-	0.1
DL-methionine	1.6	0.1	1.7
Chemical composition (g kg* as fed)			
ME (Mcal/kg of diet)	3.15	3.20	3.20
Crude protein	230.0	212.0	189.8
Calcium	15.0	9.0	8.0
Available phosphorus	5.0	4.7	3.9
Lysine	12.0	10.0	8.5
Methionine	5.6	4.0	5.2
Methionine + cysteine	9.3	7.6	8.4
Sodium chloride	3.4	2.9	2.9

CP: Crude protein; ME: Metabolizable energy. \*Provides per kilogram of diet: Mn, 80 mg; Zn, 60 mg; Fe, 60 mg; Cu, 5 mg; Co, 0.2 mg; I, 1 mg; Se, 0.15 mg; choline chloride, 200 mg; vitamin A, 12,000 IU; vitamin D3, 2,400 IU; vitamin E, 50 mg; vitamin K3, 4 mg; vitamin B1, 3 mg; vitamin B2, 6 mg; niacin, 25 mg; calcium-D-pantothenate, 10 mg; vitamin B6, 5 mg; vitamin B12, 0.03 mg; D-biotin, 0.05 mg; and folic acid, 1 mg.

**Table 2.** The effect of medical plants powders on live body weight (g) of broilers at different period.

	Body weight (g) at different time (day)					
	7	14	21	28	35	42
T1	180.1±4.7 <sup>a</sup>	376.6±10.5 <sup>a</sup>	750.6±27.3 <sup>b</sup>	1168±35.1 <sup>b</sup>	1660.5±59.8 <sup>a</sup>	2275±58.5 <sup>ab</sup>
T2	182.6±4.7 <sup>ab</sup>	449.5±10.5 <sup>c</sup>	894.4±27.3 <sup>c</sup>	1371.5±35.1 <sup>c</sup>	1875.2±59.8 <sup>b</sup>	2479.7±53.2 <sup>c</sup>
T3	193.4±4.7 <sup>b</sup>	431.5±10.5 <sup>bc</sup>	841±27.3 <sup>c</sup>	1211.5±35.1 <sup>b</sup>	1811±59.8 <sup>ab</sup>	2387.3±55.2 <sup>bc</sup>
T4	187.5±4.7 <sup>ab</sup>	404±10.5 <sup>ab</sup>	649±27.3 <sup>a</sup>	911.3±35.1 <sup>a</sup>	1665.7±59.8 <sup>a</sup>	2194.5±59.8 <sup>a</sup>
T5	184.1±4.7 <sup>ab</sup>	447.6±10.5 <sup>c</sup>	887.5±27.3 <sup>c</sup>	1392.4±35.1 <sup>c</sup>	1960.3±59.8 <sup>b</sup>	2436.7±52.3 <sup>c</sup>

T1= Control (No addition). T2= Moringa leaves powder 1%. T3= Sumac fruit powder 1%. T4= Thyme leaves powder 1%. T5= Mixture Moringa, Sumac & Thyme 1%. a, b, c= Means between treatments having different letters in same column are significant ( $p<0.05$ ).

The higher weight in the chicks fed MLP diets in T2 may be partly due to a good protein quality,

perhaps arising from a higher methionine and lysine provide (Booth and Wickens, 1988). Vitamin A is

necessary for growth. MLP was reported to have a high Vitamin A (Booth and Wicken, 1988; Grubben and Denton, 2004; Fuglie, 2005). The control treatment might have provided insufficient Vitamin A, therefore resulting in poor growth since Vitamin A to promoting growth. Pond et al. (1995) stated that Vitamin A insufficiency in the diets makes the rabbits to exhibit poor growth. Our collections established that addition of sumac fruit powder (SFP) at level of 1% for broiler led to significant ( $p < 0.05$ ) differences on the live body compared to the control group. Mansoob (2012), showed that using different levels sumac had significant effects on weigh enhancement, average of weight and feed conversion ratio of broiler chicks ( $P < 0.05$ ). The enhancement of body weight gain and feed conversion ratio may be because of the active materials (cinnamaldehyde and ugenol) present in sumac, inducing higher efficiency in the utilization of nutrition, resulting in improved growth (Lee et al., 2003). The present of Phenolic compounds in sumac inhibit lipid peroxidation, scavenge the hydroxyl radical and superoxide anion (Jung, 1998, Khalaf et al., 2008) and increase the activities of detoxifying enzymes like glutathione-S-transferase (Mazloom, 2011). D-limonene (1-methyl-4-(1-methylethenyl)-cyclohexane) is a monocyclic monoterpen constituent of sumac that has hypocholesterolemic influences (Kurucu et al., 1993). Ahmadian-Attari et al. (2007) observed that use of sumac extract can enhance growth and have good effect on broilers. Rayne and Mazza (2007) showed that sumac extracts had antimicrobial, antioxidant and hypoglycemic activities and has led to better performance growth for broilers. Some herbal plants or specific combinations of herbs in preparations may act as antioxidants by exerting superoxide scavenging activity or by raising superoxide dismutase activity in various tissue sites (Weiner, 1994). Antimicrobial substances existing in sumac can decrease the harmful bacteria in the gastrointestinal tract and increase the levels of absorbed amino acids. Sumac contains polyphenolic components which may be causing the hypocholesterolemic action (Mansoob 2011).

Although it was awaited that supplementing the plant extracts (Lee et al., 2003; Demir et al., 2008) or additive herbs (Bampidis et al., 2005; Cross et al., 2003; 2007) could induce the growth performance of broilers. Plant extracts, essential oil and the main components of the essential oil afforded contradicting results (Alcicek et al., 2003, Acamovic and Broker, 2005; Griggs and Jacob, 2005; Bampidis et al., 2005). In present study of thyme (1% TLP), there was no significant effect ( $p < 0.05$ ) in terms of LBW comparing to control, these results

were in agreement with some studies (Demir et al., 2008; Cross et al., 2003, 2007; Hernandez et al., 2004; Bampidis et al., 2005). Also Najafi and Torki (2010) reported that the low dosage (5g/Kg) of Thyme have significant effect on broiler chick LBW and their FCR, while the high dosage (10g/Kg) did not show this effect. The improvement of performance observed in broilers fed the mixture of dried thyme leaves powder with other herbs could be due to the enhancement of nutrient digestibility established in this study with the development of digestive organs. Reduce in crypt depth in the ileum of birds given dietary natural growth promoters, and conserved the energy by the decrease turnover rate of the epithelial cells made be utilized for lean tissue mass synthesis (Lilja, 1983).

#### **Feed intake (FI)**

The effect of 1% dietary supplementation of T2, T3, T4 and T5 on daily accumulative feed intake showed in Table 3. Broilers fed with T2, T3 and T5 were not affected significantly ( $P > 0.05$ ) compared to the control in terms of FI. On the other hand, FI was significantly affected ( $P < 0.05$ ) by Thyme leaves powder (T4) compared to the control and to all other treatments. The lowest FI was observed in T4.

As a discussion about feed intake, Banjo (2012) reported no significant differences in feed intake in broilers fed with levels of *Moringa* (1, 2 and 3%). Result of this study agreement in results of Soad (2010), who state that there was no significant differences ( $P > 0.05$ ) in feed intake between the groups fed with 0, 2, 4 and 6% of *Moringa oleifera* Leaf. This note was supported by the findings of Ravindran et al. (1983), in where feed intake and feed/gain raised as cassava leaf meal or dehydrated alfalfa meal leaf meals raised. On the other hand, Madubuike and Ekenyem (2006) reported enhanced feed intake for broilers fed diets with 5 and 10% levels of *Moringa*, however, FI was depressed at 15%. This conforms to the observations established by Ash et al. (1992) that including of MOL meals in broiler diets about 5 to 10% results in depressed performance.

#### **Feed conversion ratio (FCR)**

The effect of 1% feeding dietary supplementation of T2, T4 and T5 on daily accumulative FCR of broilers was showed in Table 4. It was noted that average accumulative FCR was not affected by T2, T3 and T5 compared to the control at 0-14days and 0-21days of age. But it was significant ( $p < 0.05$ ) in T4 comparing to the control and other treatments during all period of experiment.

**Table 3.** Effect of the medicine plants powders on daily accumulative feed intake (g) of broilers.

Treatments	Time period (d)				
	0-14d	0-21d	0-28d	0-35d	0-42d
T1	439.13 <sup>ab</sup>	978.43 <sup>b</sup>	1762.28 <sup>b</sup>	2915.30 <sup>b</sup>	4116.39 <sup>b</sup>
T2	485.98 <sup>bc</sup>	1041.49 <sup>b</sup>	1820.30 <sup>b</sup>	2873.94 <sup>b</sup>	3883.05 <sup>b</sup>
T3	545.02 <sup>c</sup>	1092.16 <sup>b</sup>	1789.77 <sup>b</sup>	2863.21 <sup>b</sup>	4050.19 <sup>b</sup>
T4	385.48 <sup>a</sup>	724.75 <sup>a</sup>	1309.57 <sup>a</sup>	2934.65 <sup>a</sup>	3283.87 <sup>a</sup>
T5	523.95 <sup>b</sup>	1078.78 <sup>b</sup>	1804.81 <sup>b</sup>	2254.29 <sup>b</sup>	3978.70 <sup>b</sup>
SEM	±28.22	±35.14	±47.8	±69.4	±94.16

T1= Control (No addition). T2= Moringa leaves powder 1%. T3= Sumac fruit powder 1%. T4= Thyme leaves powder 1%. T5= Mixture (Moringa, Sumac & Thyme) 1%. Figure mean ± standard deviation of chicks of treatment. a, b, c= Means between treatments having different letters are significantly ( $p<0.05$ ).

At the interval of T2 (1%MLP) and T5 (1%MST) at 0-28 days, 0-35 days and 0-42 days of age, the FCR was recorded a significantly ( $p<0.05$ ) different compared to the control, and the best significant FCR (1.29) was obtained in group T5 at 0-28 days as comparing to control and other treatments. Mansoob (2011) demonstrated that using different levels sumac had significant ( $P<0.05$ ) effects on FCR of broilers, and this because of the active materials (cinnamaldehyde and ugenol) found in sumac, causing high efficiency in the utilization of feed, resulting the growth improvement. Lower FCR was observed in birds fed diets containing 5, 10 and 15% of MOL

(Iheukwumere *et al.*, 2008) consistent with present findings. There was also differences of treatments on the cost of feed per kg. The cost of feed reduced as more moringa oleifera replaced groundnut cake in the diets. The results are in agreement with the findings of studies (Al-Jugifi, 2009; Al-Mashhadani *et al.*, 2011; Foroughi, *et al.*, 2011) that using diet additive of thyme in broilers had a significant effect on the FCR compared to the control. Aromatic oil from thyme (*Thymus vulgaris*) was evaluated for antibacterial, antifungal and antiviral activity as inhibitors of microbial growth (Dorman and Deans, 2000). This phenomenon perhaps leads to increase the availability of fatty acids and hence, performance improvement.

**Table 4.** Effect of the medicine plants powders of daily accumulative feed conversion of broilers.

Treatments	Time Period (d)				
	0-14d	0-21d	0-28d	0-35d	0-42d
T1	1.18 <sup>b</sup>	1.34 <sup>a</sup>	1.52 <sup>b</sup>	1.78 <sup>b</sup>	1.87 <sup>c</sup>
T2	1.08 <sup>ab</sup>	1.16 <sup>a</sup>	1.32 <sup>a</sup>	1.53 <sup>a</sup>	1.63 <sup>b</sup>
T3	1.26 <sup>b</sup>	1.29 <sup>a</sup>	1.47 <sup>b</sup>	1.58 <sup>ab</sup>	1.62 <sup>b</sup>
T4	0.95 <sup>a</sup>	1.12 <sup>a</sup>	1.43 <sup>b</sup>	1.38 <sup>a</sup>	1.57 <sup>a</sup>
T5	1.17 <sup>b</sup>	1.21 <sup>a</sup>	1.29 <sup>a</sup>	1.49 <sup>a</sup>	1.63 <sup>b</sup>
SEM	±0.06	±0.07	±0.03	±0.07	±0.04

T1= Control (No addition). T2= Moringa leaves powder 1%. T3= Sumac fruit powder 1%. T4= Thyme leaves powder 1%. T5= Mixture (Moringa, Sumac & Thyme) 1%. Figure mean ± standard deviation of chicks of treatment. a, b, c= Means between treatments having different letters are significantly ( $p<0.05$ ). N.S= The same superscripts within row of week indicate non-significant differences at ( $p<0.05$ ).

### Conclusion

Results showed that there was a significant differences ( $p<0.05$ ) among the experimental groups. Medical plants powders in the diet of broilers, (MLP, SFP, and MST) had significant ( $p<0.05$ ) effects on broilers performance. They were recorded positive effect on LBW gain and FCR in broiler chicks, and with the highest body weight in (MLP) and (MST). However, dietary treatments of herbal plants powders in this study had no significant ( $p<0.05$ ) differences for birds fed on Thyme leaves powder (TLP) relative to the control group during all total periods (0-42) day of age. There were positive effects on accumulative FCR

comparing to the control group during the experiment and the best significant FCR was obtained in the group fed by Moringa additive. However, FI was not affected by treatment except the feed supplementation with Thyme only when comparing to control group and other treatments.

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