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Growth Enhancement Of Broilers Using Varying Levels Of Moringa Oliefera Leaf Meal (Mlm)

MENARDO D. VILLANUEVA
Dean, College of Agriculture and Forestry
Apayao State College
Malama, Conner, Apayao, Philippines
Email: menardovillanueva517@gmail,com

Anik Yuesti
University of Mahasaraswati Denpasar, Bali, Indonesia
anikyuesti@unmas.ac,id

ABSTRACT

The study was conducted to evaluate the effect of different levels of *Moringa oliefera* Leaf Meal (MLM) in broiler diets in term of average daily gain, rate of growth, feed consumption, feed conversion ratio, feed conversion efficiency and return above feed cost. It was conducted at Barangay San Jose Sur, Mallig, Isabela from March 22 to May 2, 2019 where 120 broilers were used in four (4) treatments and replicated thrice following the Complete Randomized Design (CRD). Results of the study showed that the used of Moringa Leaf Meal regardless of the levels had significantly influence on the body weights of the broilers, cumulative gain in weight, and dressing percentage with giblets. Also, broilers fed with different levels of MLM had higher cumulative feed consumption than those broilers not given Moringa Leaf Meal. However, comparable results were observed in terms of pancreas weight, feed conversion ratio and feed conversion efficiency.

Keywords: Feed supplementation, moringa oliefera, broilers, CRD, Isabela, Philippines

1. INTRODUCTION

Poultry farming plays a major role in bridging the protein gap in developing countries where average daily consumption is far below recommended standard. A major constraint in poultry production in the Philippines is the very high cost of conventional feedstuffs especially the primary energy and protein sources. Leaf meals have been incorporated in the diets of poultry as a means of reducing the high cost of conventional protein sources (Nworgu *et al*., 2003). There is evidence in the literature of the beneficial effects of using leaf meal from different sources in poultry production (Iheukwumere *et al*., 2008, Fasuyi *et al*., 2008). D'Mello *et al*., (2008) observed that leaf meals do not only serve as protein source but also provide some necessary vitamins and minerals which cause yellow color of broiler skin and shank.

Moringa is scientifically known as *Moringa oleifera* which is one of the world's most useful plants. Both the leaves and the fruits are very nutritious and possessed many vitamins like Vitamin C and other minerals (Marero, 2008). In the West, one of the best known uses for Moringa is the use of powdered seeds to flocculate contaminants and purify drinking water (Berger *et al*., 1994; Gassenschmidt *et al*., 2005; Olsen 2007), but the seeds are also eaten green, roasted, powdered and steeped for tea or used in curies (Gassenschmidt *et al*., 2005). Although considerable attention has given to the use of leaf meals derived from plants, there is still limited data on the use of moringa leaf meal for broilers. Therefore, the study was conducted using the formulated diets with moringa leaf meal for broilers.

Although considerable attention has been given to the use of leaf meals derived from the plants, there is still limited data on the use of malunggay (Moringa) leaf meal for broiler diets. Therefore the study was conducted using the formulated diets with malunggay leaf meal for broiler.

The study was conducted to evaluate the influence of using different levels of malunggay (Moringa) leaf meal in broiler. Specifically, it was conducted with the following objectives: 1. To determine the growth performance of broilers fed with varying levels of malungay leaf meal; 2. To determine the economy of feeding broilers with malunggay leaf in the formulated diets in terms of return above feed cost.

Moringa oleifera is a multipurpose tree wherein the leaves and green fresh pods are used for vegetable by humans (Makkar *et al*., 1996). It has been praised for its nutritional and medicinal properties, and many claims have been made regarding its benefits (Fayeh, 2005). It is a drought tolerant and thrives well in all kinds of well drained soils and can be propagated by seeds and stem cutting. The moringa plant has a soft, white wood and corky, gummy bark and with a height of nine meters. Moringa is grown in any area as a backyard vegetable and as a border plant. It is rich in carotene and ascorbic acid with amino acids. Aside, from this, it contains vitamins A, B, C and a good source of calcium, iron and phosphorous (Marero, 2008).

All parts of the moringa tree are edible and have long been consumed by humans. The many uses for moringa include: alley cropping (biomass production), animal forage (leaves and treated seed-cake), biogas (from leaves, domestic cleaning agent (crushed leaves0, blue dye (wood), fencing (living trees), fertilizer (seed-cake), foliar nutrient (juice expressed from the leaves, green manure (from leaves), gum (from tree trunks), honey-and sugar cane juice-clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, biopesticide (soil incorporation of leaves to prevent seedling damping off), pulp (wood), rope (bark), tannin for training hides (bark and gum), water purification (powdered seeds). Moringa seed oil (yield 30-40% by weight) also known as Ben oil, is a sweet non-sticking, non-dying oil that resists rancidity (Fuglie, 2001).

2. LITERATURE REVIEW

Phytochemical Constituents Isolated from *Moringa oleifera* Lam.

The phytochemical constituents of *Moringa oleifera* Lam was analyzed by Kamal [5]. The different components are the following:

Parts	Phytochemical Constituents
Root	4-(α-L-rhamnopyranosyloxy)-benzylglucosine and benzylglucosinolate
Stem	4-hydroxymellein, vanillin, β-sitosterone, octacosanic acid and β-sitosterol
Bark	4-(α-L-rhamnopyranosyloxy)-benzylglucosinolate
Whole Gum Exudates	L-arabinose, D-galactose, D-glucuronic acid, L-rhamnose, D-xylose and leucoanthocyanin
Leaves	Glycoside niazirin, niazirinin and three mustard oil glycosides, 4-[4'-O-acetyl-α-L-rhamnosyloxy) benzyl] isothiocyanate, niaziminin A and B
Mature Flowers	D-mannose, D-glucose, protein, ascorbic acid, polysaccharide
Whole Pods	Nitriles, isothiocyanate, thiocarbanates, 0-[2'-hydroxy-3'-(2"-heptenyloxy)]-propylundecanoate, 0-ethy]1-4-[(α-L-rhamnosyloxy)-benzyl] carbamate, methyl-p-hydroxybenzoate, and β-sitosterol
Mature Seeds	Crude protein, crude fat, carbohydrate, methionine, cysteine, 4-(α-L-rhamnosyloxy)-benzylglucosinolate, benzylglucosinolate, moringyne, monopalmitic, and di-oleic triglyceride
Seed Oil	Vitamin A, beta carotene, precursor of Vitamin A

Moringa as Feeds for Animal

Sarwatt *et al*. (2002) on supplementation of horse radish to poor quality hay feed to growing Small East African Goats (SEAG) showed the existence of a negative balance to goats supplemented with 25 and 50% Moringa olifera leaf meal (MLM). Kakengi et al., (2003) stated that Moringa olifera had high pepsin and total soluble protein which makes it more suitable also to monograstic animals.

Moringa oleifera Lamk is a multipurpose tree which could be a substitute for Leucaena leucocephala as it possesses useful characteristics as multipurpose species. Its leaves and green fresh pods are used as vegetables by humans and are rich in carotene and ascorbic acid with a good

profile of amino acids (Makkar *et al*., 1997). It is also used as feed, and its twigs are palatable to ruminants and have palatable crude protein levels (Sarwatt *et al*, 2002; Kimoro, 2002).

Yellow coloration of body parts of broilers observed was mainly attributed to the presence of xanthophylls and carotenoid pigments in MLM (Austic *et al*., 1990). However, the decreasing trend of yellow color intensity on body parts with time probably partly was associated with the gradual losses of xanthophylls and carotenoids in MLM during storage and or partly by the transfer of pigmenting agents for production of egg yolk pigments (North, 1990).

In feed and dry matter intake demonstrate that MLM is palatable and highly preferred by chickens because there was a lower anti-nutritional and toxic materials in MOLM (Makker and Backer, 1997) than in other leaf meals. The increase in feed intake is usually associated with compensatory mechanism to energy demand (Smith 1999). There was a progressive increase of eggs and laying percentages when MOLM used as protein source for laying chickens (North, 1990). With MOLM maintained better Kg feed/Kg eggs up to 10% (Bhatnagar *et al*., 1996). This might be contributed to low available energy and CP when MOLM was high in the diets and with MLM in the layer diet at 20% or more levels more energy is required for better utilization.

Moringa inclusion influenced egg weight as substitution of sunflower. MOLM at 5% levels in diet showed a positive effect on egg weight but the reason of this could not be explained although probably might be associated with higher sulphur containing amino acids reported in Moringa leaves. North (1990) reported a positive influence of sulphur containing amino acids on egg weight. Moringa oleifera have a potential in poultry feeding which may be exhibited through its protein content, relatively low fiber and higher mineral contents. In layers showed that MLM could be used as a source of plant protein since it was highly accepted even at high inclusion levels in the diet. Highest performance in egg production with the utilization 10% inclusion of MOLM.

Ray-yu et al. (2008) stated that moringa diets in poultry significantly enhanced duodenum traits; increased concentrations of total globulin, y-globulin and IgA, lymphocyte ratio, antibody titer to sheep erythrocytes , and delayed type hypersensitivity, reduced E.coli and increased Lactobacillus counts in ileum. Moringa oleifera leaves are potential plant material to enhance immune responses and improve intestinal health of broilers.

The Use of Leaf Meal

Various leaf meals have been used in poultry diets, including those of Leucaena (Udedibie and Igwe, 1989), Amaranthus (Frages *et al*., 1993) Centrosema(Ngodigha and Nworgu, 2004), Cassava (Ogbonna and Oredein, 1998), among others. D'Mello (1997) recommended 5.0 and 10.0% dietary inclusion levels of leaf meals for broiler chicks and laying hens, respectively. Nworgu (2004) recommended 2% Mimosa invisa and Puerairia phaseoloides leaf meals for broiler chickens and 2.5% Centrosema pubescens for broiler starters and finishers. The diet for laying hens and quails, maize grain can be replaced by rice by-products supplemented with 6% of Trichantera gigantean leaf meal, with positive effects on egg quality and no change in egg production.

Ademola and Farinu (2006) recommended dietary inclusion of Tithonia diversifola in combination with either penicillin or streptomycin at 100 ppm in the diet of laying hens while Odunsi (2002) recommended 100 and 150g/kg of *Lablab purpureus* leaf meal for laying hens. The importance of legume leaf meals in poultry has been recognized by frmers because of their relatively high content of protein, some minerals and vitamins (Topps, 1992; Nworgu 2004)). Leaf meal supplements have been included into the diets of poultry as a means of reducing high cost conventional protein sources and to improve profit margin (Topps, 1992; D'Mello 2008; Odunsi et al., 1999; Nworgu and Fapohunda, 2002). Forage meals and yellow maize are the natural sources of carotenoid (D'Mello et al., 2007).

3. METHODOLOGY

Construction, Hygiene and Sanitation of Broiler House

A broiler house was constructed using galvanized iron as roofing, lumber, and screen as flooring and walling. The screen pen was subdivided into 12 experiment units. The experimental house including the feeding and drinking troughs were thoroughly cleaned with soap and water and disinfected with Zonrox diluted with water one week before the arrival of the chicks. Likewise, proper hygiene was observed throughout the study to prevent the occurrences of diseases.

Preparation of Moringa Leaf Meal (MLM)

Moringa leaves were gathered from a standing crop. Bulk amount of moringa leaves was collected to have enough supply for the study. The moringa leaves were dried immediately to avoid rotting of the products. Thereafter, it was ground and stored in a dry place.

Procurement and Brooding Management of Chicks

One hundred twenty (120) day-old Minerva Strain of chicks was used for the study. These were purchased at Belstein Commercial and Poultry Supply, Public Market, Roxas, Isabela. The brooder pen was matted with old newspaper sheets which were changed daily to maintain cleanliness and sanitation for the chicks. Curtain made up of empty sacks were placed to conserve heat inside the brooder. Every experiment unit was provided with electric bulb (60 watts capacity) to meet the required brooding temperature.

Ad libitum feeding was followed during the brooding period, and formulated all mash feeds were spread for three days in their matting materials. Thereafter, the feeds were placed in semi-automatic feeding troughs throughout the duration of the study.

Distribution of Experimental Birds to the Different Treatments

After one day of acclimatization, the experimental birds were randomly distributed to the four treatments following a Complete Randomized Design (CRD). Thirty birds were used for each treatment and were replicated thrice. The Moringa Leaf Meal was mixed accordingly following the designated level per treatment. The experiment was laid out following the Complete Randomized Design.

The treatments used in the study were as follows:

T-1 : Control No MLM
T-2 : 3% MLM
T-3 : 6% MLM
T-4 : 9% MLM

Feed Preparation

The designated rations per treatment were formulated using the chemical composition of the different feed ingredients used in the study as shown in Table 1. The feedstuffs used in the preparation of the experimental diets were as follows: moringa, corn grit, soybean meal, rice bran (D1), fish meal, limestone, salt, and vitamin/premix (Table 2). These were purchased from Centravet, Santiago, Isabela.

Table 1. Chemical Composition of the Different Feed Ingredients Used in the Study.

INGREDIENTS	CP	ME	Ca	P	Lysine	Methionine
Moringa Leaf	16.70	3446	0.20	0.03		
Corn Grits	8.00	3400	0.07	0.25	0.27	0.19
Soybean Meal	43.50	2240	0.45	0.63	2.77	0.63
Fish Meal (60%)	60.00	2800	3.87	2.60	4.08	1.69
Rice Bran (D1)	12.59	2400	0.08	1.60	0.57	0.26

Feeding Management

The experimental birds in the different treatments were fed on ad libitum basis using the designated formulated feeds per treatment. The feeds were placed in their semi-automatic feeding throughs and it was regularly checked to ensure the availability of the feeds for the birds. The formulated feeds were given to the experimental birds for six weeks. Clean and fresh water was made available at all times. The waterer was cleaned and changed daily to avoid the occurrence of microorganisms.

Table 2. The formulated ration used in the study.

Ingredients	Treatment 1	Treatment 2	Treatment 3	Treatment 4

Moringa Leaf Meal	0.00	3.00	6.00	9.00
Corn Grits	52.22	51.70	52.00	52.42
Soybean Meal	23.78	23.30	22.94	22.58
Fish Meal (60%)	6.00	6.00	6.00	6.00
Rice Bran (D1)	15.00	13.00	10.00	7.00
Limestone	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Vitamin Premix	1.50	1.50	1.50	1.50
Parts	**100.00**	**100.00**	**100.00**	**100.00**
CP	20.00	20.00	20.00	20.00
M.E.	2836.15	2863.10	2898.65	2934.00
Ca	0.80	0.80	0.80	0.80
P	0.61	0.64	0.60	0.57
Lysine	1.13	1.10	1.o7	1.05
Methionine	0.39	0.38	0.37	0.36

Statistical Analysis of Data

All the data gathered were tabulated and analysed using the Analysis of Variance following the Complete Randomized Design (CRD). The Least Significant Difference (LSD) was used for the comparison of means for F-values that were significant.

4. RESULTS AND DISCUSSION

Initial and Weekly Body Weight

The recorded body weights of the broilers before the introduction of MLM in their diets and weekly body weights from first to sixth week of fed ration with varying levels of MLM are presented in Table 3. Analysis revealed that the initial body weights of the birds showed no significant differences with each other with means ranging from 41.40 to 47.70. It was observed that there was already an increment of the body weight of the birds after first week of offering MLM on the fed ration, although insignificant result was obtained. Significant differences were found in terms of the body weight of the birds on the second week which treatments 2, 3, and 4 obtained weight with means of 347.43, 358.83 and 377.07 grams respectively. Treatment 1 was the lowest with a mean of 264.43 grams.

Highly significant result was observed on the body weights of the broiler on the third, fourth, fifth and sixth week of feeding the broilers with MLM. The same trend of results was obtained on the sixth week wherein broilers fed with various levels of MLM obtained comparable body weights with means of 1589.33 grams (T_4), 1589.00 grams (T_3), and 1023.00 grams (T_2) which also different significantly over the birds without MLM (T_1) with mean of 966.27 grams.

The birds treated with MLM had consistent comparable result on body weights which were significantly different of those birds without MLM brought about by the components of Moringa which contained total soluble protein that makes it more suitable also to monogastric animals ([6];[7]).

Table 3. Initial and Weekly Body Weights of Broilers Fed Ration with Varying Levels of MLM.

TREATMENT	Initial	WEEKLY BODY WEIGHT (kilogram)					
		1st	2nd	3rd	4th	5th	6th
T_1-Without MLM	47.47	199.4	264.43b	331.00b	462.17.b	674.67.b	966.27b
T_2- 3% MLM	47.70	223.61	347.43a	443.87ab	679.87a	1023.00a	1384.33a
T_3- 6% MLM	47.60	227.83	358.83a	515.67a	809.50a	1181.00a	1589.00a
T_4- 9% MLM	47.40	253.54	377.07a	537.92a	848.74a	1231.67a	1589.33.a
ANOVA RESULT	Ns	ns	**	**	**	**	**
C.V. (%)	0.56	14.74	6.84	9.33	9.2	7.94	6.09
LSD0.01			63.24	117.68	176.77	224.02	230.95

ns – not significant ** - significant at 1% level

Gain in Weight

The first to sixth week gain in weights of the experimental broilers and the cumulative gain in weight as affected by MLM supplementation are shown in Table 4. It was found that the gain in weight of the broilers fed with MLM on the first week of the study revealed insignificant result. It means that the body weight of the birds given with various levels MLM including the control were comparable with each other with means ranging from 131.93 to 206.34 grams. No variation was observed in terms of the gain in weight of the birds on the second week of the experiment with means ranging from 85.03 to 156.89 grams.

On the third week of the study, significant variation existed among the different treatments wherein Treatment 2 (3% MLM), Treatment 3 (6% MLM), and Treatment 4 (9% MLM) obtained comparable gain in weight. Significant result was found on the gain in weights of the birds on the fourth of the study with means of 310.82 grams (T_4), 294.00 grams (T_3), and 236.00 grams (T_2). Treatment 1 obtained the lowest gain in weight with mean of 121.17 grams.

The Same result was observed on the fifth week of the study, in which the MLM influenced the gain in weight of broiler. Comparison of means showed that birds with MLM in fed ration had higher gain in weight with means of 382.93 grams (T_4), 372.17 grams (T_3), 343.13 grams (T_2), than the birds without MLM in the fed ration with a mean of 212.50 grams. No significant result was obtained in terms of the gain in weights on the six week of the study.

On cumulative gain in weight of the birds, highly significant result was obtained. Result showed that various levels of MLM in the fed ration significantly influenced the cumulative gain in weights wherein Treatment-4 had 1508.60 grams, Treatment-3 1543.57 grams, and Treatment-2 1371.03 grams. The lowest was the Treatment-1 with a mean of 782.03 grams.

Rajput *et. al.* [23] stated that broiler production depend on the maximum weight gain within minimum period and which can be fulfilled by proper nutritional and management practices. Thus, for the fast increase of growth performance of the birds various nutrients are to be incorporated in the diet.

Table 4. Gain in Weight of Broilers Fed with Varying Levels of MLM (grams).

TREATMENT	GAIN IN WEIGHT (GRAMS)						CUMULATIVE
	1st	2nd	3rd	4th	5th	6th	
T_1 Without MLM	131.93	85.03	76.57b	121.17b	212.50b	391.6	782.03b
T_2 3% MLM	175.91	156.89	96.44ab	236.00a	343.13a	361.33	1371.03a
T_3 6% MLM	180.25	133	156.83a	294.00a	372.17a	407.33	1543.57a
T_4 9% MLM	206.34	123.54	160.85a	310.82a	382.93a	357.67	1508.60a
ANOVA RESULT	Ns	ns	**	**	**	ns	**
C.V. (%)	18.7	29.18	20.63	13.24	20.73	21.22	13.87
LSD0.01			69.42	87.34	125.19		498.34

ns – not significant ** - significant at 1% level

Percentage Rate of Growth

The percentage rate of growth of the experimental broilers as influenced by the various levels of MLM supplementation is presented in Table 5 and Figure 1. The percentage rate of growth of broilers on the first week of the study did not vary among treatments with means ranging from 115.78 to 138.05 percent. It was observed that the percentage rate of growth of the birds on the second week of the study was comparable among treatments with means ranging from 38.58 to 44.65 percent.

Significant result was observed in terms of the percentage rate of growth of the birds on the third week of the study. Comparison of means showed that Treatment 4 (9% MLM) and Treatment 3 (6% MLM) had the higher percentage rate of growth with means of 35.50 and 35.78 percent. On the other hand, Treatment 2 (3% MLM) and Treatment 1(without MLM) were also comparable with each other with means of 23.89 to 25.16 percent.

The percentage rate of growth of the experimental birds on the fourth week of the study obtained significant result wherein the birds offered with MLM fed regardless of the amount were comparable with each other such that T_4 (9%), T_3 (6%), T_2 (3%) had means of 44.80, 44.28, and 42.03 percent, respectively. The lowest was obtained in

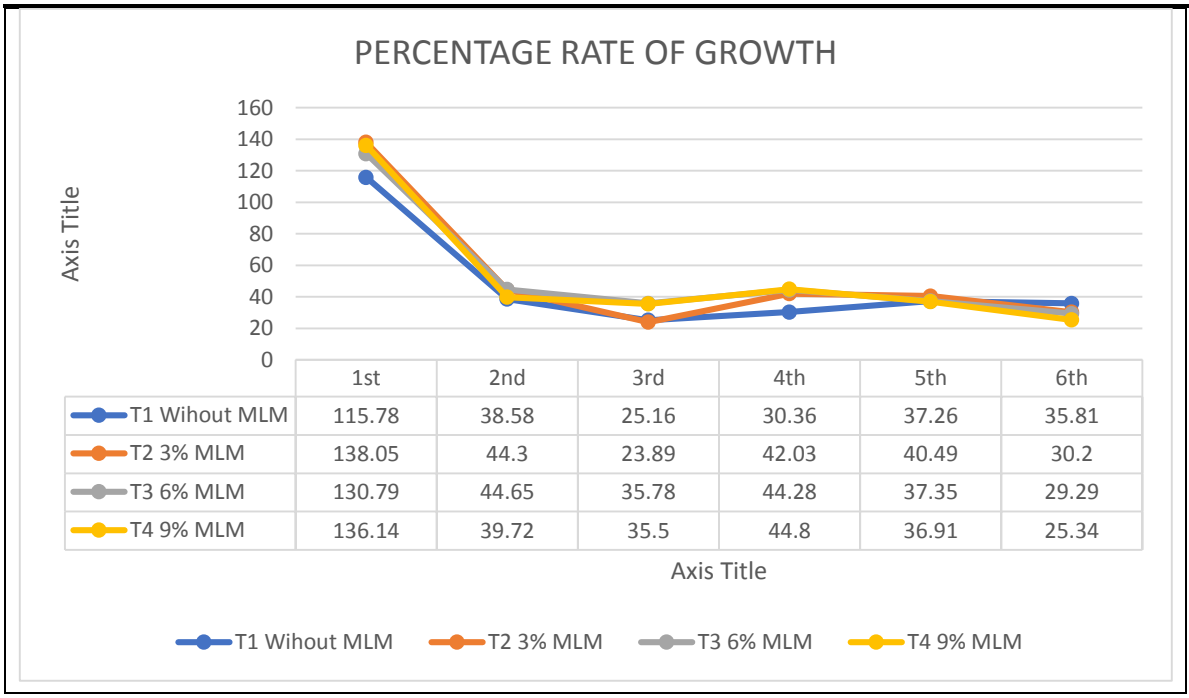
Treatment 1 (without MLM) with a mean of 30.36 percent. The difference in the percentage of growth rate was attributed to the components of moringa [7].

No significant difference was observed in terms of the percentage rate of growth on the fifth week of the study which ranged from 36.91 to 40.49 percent.

Insignificant result was also obtained on the percentage rate of growth of the experimental birds on the sixth week of the study with means ranging from 25.34 to 35.81 percent.

The trend of the graph in figure 1 indicates a normal growth and good performance of the birds wherein there was a decline on the rate of growth along with the growing period (Haye, 2008). Moreover, the result of the study conformed to the statement of Pasternal and Shalev [24] that the broilers having a concave-shaped growth curve grow slowly initially and faster later. The concave-shaped type of growth curve in broiler will result to a better feed efficiency with a leaner bird while increasing body weight.

Table 5 and Figure 1. Weekly Percentage Rate of Growth of Broilers Fed Ration with Varying Levels of Malunggay Leaf Meal.



	1st	2nd	3rd	4th	5th	6th
T1 Wihout MLM	115.78	38.58	25.16	30.36	37.26	35.81
T2 3% MLM	138.05	44.3	23.89	42.03	40.49	30.2
T3 6% MLM	130.79	44.65	35.78	44.28	37.35	29.29
T4 9% MLM	136.14	39.72	35.5	44.8	36.91	25.34

ns – not significant ** - Significant at 1% level

Weekly Feed Consumption and Cumulative Feed Consumption

The weekly feed consumption of the experimental birds fed with various levels of MLM from first to sixth week of the study. On the first week of the study, the feed consumption of the birds varied significantly among treatments. The birds fed with 9% MLM (T_4), 6% MLM (T_3), and 3% MLM (T_2) had the highest feed consumption with means of 339.03, 340.50, and 330 grams, respectively. The birds fed with 0% MLM (T_1) with a mean of 271.00 grams had the lowest feed consumption.

Highly significant result was obtained in terms of feed consumption by the experimental broilers on the second week of the study. The birds fed with various level of MLM were comparable with each other with means of 412.02 grams (T_2), 431.00 grams (T_3), 450.02 grams (T_4). The lowest feed consumed was observed on the birds without MLM in the diet (T_1) with mean of 347.17 grams.

Likewise, The MLM influenced the feed consumption of the birds on the third week of the study. Comparable feed consumption was observed in T2 (3%), T3 (6%), and T4 (9%) with means of 454.26 grams, 450.50 grams, 473.26 gram, respectively. The lowest feed consumption was found in Treatment 1 (without MLM) with a means of 278.83 grams.

It was observed that the feed consumption of the experimental broilers on the fourth week of the feeding period varied significantly among treatments. Highest feed consumed was observed in Treatment 4 (9% MLM) with

a mean of 707.41 grams. It was, however, statistically comparable with Treatment 3 (6% MLM) and Treatment 2 (3% MLM) with means of 580.00 and 548.67 grams, respectively. However, Treatment 2 was comparable with Treatment 1 (without MLM) with a mean of 416.17 grams.

Significant result was observed in terms of the amount of feed consumed by the birds of the fifth week of the study. The birds fed with 9% MLM (T_4), 6% MLM (T_3), and 3% MLM (T_2) had the highest amount of feed consumed with means of 803.13, 730.67, and 678.00 grams, respectively. However, the birds in T_2 (3% MLM) had the same feed consumption with the birds in T_1 (without MLM) with a mean of 527.00 grams. The data indicates that it attributed to the incorporation of moringa in the feed ration of the birds [1].

It was found that MLM supplementation did not affect feed consumption of the birds on the sixth week of rearing period. The broilers from the different treatments consumed same amount of feeds with means ranging from 627.33 to 986.50 grams. The graph indicates that there was an extreme increase on the feed consumption of the broilers on the fourth to sixth week of the study. It indicates that the MLM was palatable and influenced the fast development and performance of the birds.

It was found that the cumulative feed consumption of the broilers varied significantly among treatments. It showed that the birds fed with various level of MLM had higher feed consumption that the birds without MLM. The cumulative feed consumption of the birds in Treatment 2 (3% MLM) had 3158.87 grams, Treatment 3 (6% MLM) 3518.67 grams, and Treatment 4 (9% MLM) 3641.70 grams. Treatment 1 (without MLM) had a cumulative feed consumption of 2452.50 grams. The result of the total feed consumption indicates that it was attributed to the effect of MLM [1] that moringa is rich in carotene and ascorbic acid with a good profile of amino acids, palatable to ruminants and has palatable crude protein levels ([6];[8]).

Table 6. Weekly and Cumulative Feed Consumption of Broilers Fed Ration with Varying Levels of MLM.

TREATMENTS	Feed Consumption						Cumulative
	1st	2nd	3rd	4th	5th	6th	
T_1 Without MLM	271.00_b	347.17_b	278.83_b	416.17_b	527.00_b	627.33	2452.50_b
T2 3% MLM	330.00_a	412.02_a	454.26_a	548.67_{ab}	678.00_{ab}	736.84	3158.87_a
T3 6% MLM	340.50_a	431.00_a	450.50_a	580.00_a	730.67_a	986.50	3518.67_a
T4 9% MLM	339.03_a	450.02_a	473.26_a	707.41_a	803.13_a	852.19	3641.70_a
ANOVA RESULT	**	**	**	**	**	ns	**
C.V. (%)	2.13	5.03	9.63	11.77	10.10	17.05	6.21
LSC0.01	18.68	56.62	181.74	181.74	189.78		544.03

ns – not significant ** - significant at 1% level

Feed Conversion Ratio and Feed Conversion Efficiency

The different treatments did not show any significant differences in terms of Feed Conversion Ratio (FCR) of the broilers fed with the various levels of MLM in their diets with means ranging from 2.36 to 2.59 kilograms. The result of the study was mainly due to better utilization of feed as a result of MLM supplementation [25].

No variations were found on the feed conversion efficiency of the experimental broilers as revealed by the analysis of variance. The data indicate that the broilers in the different treatments had comparable efficiency in converting feeds into a kilogram gain in weight. The FCE of the broilers in the different treatments obtained means ranging from 31.20 to 43.97 percent. Lynch et al. [26] demonstrated that feeding continuously as live weight increases can lead to an increase in efficiency. Animals perform best when diets contain adequate amount of the essential elements.

Table 7. Feed Conversion Ratio and Efficiency (%) of Broilers Fed Ration with Varying Levels of MLM.

TREATMENTS	Feed Conversion Ratio	Feed Conversion Efficiency
T_1 – Without MLM	2.59	31.20
T_2 – 3% MLM	2.53	43.34
T_3 – 6% MLM	2.39	43.97
T_4 – 9% MLM	2.36	42.33
ANOVA RESULT	Ns	Ns
C.V. (%)	15.72	2.37

Liver and Pancreas Weight

Table 8 present the liver and pancreas weights of broilers given with MLM supplementation. Significant result was obtained in terms of the weight of liver of the birds in the different treatments. All the birds fed with various levels of MLM had heavier livers with means of 38.67 grams (T_2) ,42.17 grams(T_3), and 44.0 grams (T_4) than Treatment 1 (without MLM) with a mean of 26.67 grams. In the present study, it was observed that feeding MLM resulted in increased liver weight which contradicts with the findings Carew et al., [27] that MLM had no effect on liver size.

However, Ukachykwu *et al*.,[28] stated that liver size is known to increase in weight in response to several factors, especially to protein and amino acids associated with feed rations. On other hand, the weights of pancreas showed no variations among treatments with means ranging from 3.50 to 3.83 grams. The data indicate that the feed supplements used in the study had no toxic effect.

Table 8. Liver and Pancreas Weight of Broilers Fed Ration with Varying Levels of MLM (grams).

TREATMENT	LIVER WEIGHT (g)	PANCREAS WEIGHT (g)
T_1 – Without MLM	26.67b	3.50
T_2 – 3% MLM	38.67a	3.67
T_3 – 6% MLM	42.17a	3.83
T_4 – 9% MLM	44.00a	3.67
ANOVA RESULT	**	Ns
C.V. (%)	7.73	25.51
LSD0,01	8.03	

Dressing Percentage with and without Giblets

There was a significant result observed in terms of the average dressing percentage with giblets which means that the MLM affected the dressing percentage with giblets of the experimental birds. The dressing percentage of the birds without giblets did not vary significant among treatments which means that the birds fed with various levels of MLM including the birds without MLM had comparable dressing percentage with means from 63.28 to 67.59 percent. The result of the study conformed to the findings of Chen [29] that there were no dietary effect on the dressing percentage without giblets.

Table 9. Dressing Percentage of Broiler Fed Ration with Varying Levels of MLM (%)

TREATMENTS	With Giblets (%)	Without Giblets (%)
T1 – Withour MLM	70.74 ab	66.30
T2 – 3% MLM	66.90 b	63.28
T3- 6% MLM	72.20 b	67.59
T4 – 9% MLM	73.50 a	67.50
ANOVA RESULT	**	Ns
C.V. 9%)	3.84	4.03
LSD (0.01)	4.05	

Return Above Feed Cost (RAFC)

The RAFC from the different treatments are arranged in descending order: Treatment 3- PhP 91.05; Treatment 4- Php 87.47; Treatment 2-Php 77.67 and Treatment 1- Php 48.66.

Table 10. Return above Feed Costs of Broilers fed Ration with Varying Levels of MLM

ITEM	T_1	T_2	T_3	T_4
Average Final Weight of broilers (grams)	966.27	1384.33	1589.00	1589.33
Return per broiler (PhP)[1]	106.29	152.28	174.79	174.83
Total Amount Home mix Feed Consumed with MLM	252.50	3158.87	3518.67	3641.70
Cost of Home mixed feed consumed (PhP)[2]	57.63	74.61	83.74	87.36
Cost of Feed per Kilo (PhP)	23.50	23.69	23.80	23.99
Amount of Feeds Consumed without MLM (g)	2452.50	3064.10	3307.55	3313.95

Amount of MLM Consumed (g)	-	97.77	211.12	327.75
Cost of MLM Consumed (PhP)	-	1.89	4.22	6.56
Return Above Feed Costs	48.66	77.67	91.05	87.47

[1] Computed based on current price of broiler at P110/kg live weight.
[2] Computed based on the current cost of ingredients used in the study that constitute home mixed feeds.

5. CONCLUSION

It was concluded that broilers given different levels of MLM had a better body weight. Likewise, better gain in weights were obtained starting from the third to fourth weeks of the study including the cumulative gain in weight. In terms of growth performance, the inclusion of MLM was revealed in the third and fourth week of the study. Same with the carcass yield, broilers fed with MLM had a better dressing percentage with giblets and heavier liver weight than broilers fed without MLM. In terms of return above feed cost, 6% MLM had produced better return.

6. RECOMMENDATION

Based on the result of the study, the incorporation of 6% MLM as feedstuff is recommended since it obtained the highest return in terms of feed costs. Also, a similar study be conducted during wet season and the experimental feedstuff be used as feed ingredients for layer and other poultry species.

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