SUPPLEMENTATION OF *MORINGA OLEIFERA* LEAF MEAL AS PROTEIN SOURCE ON HAEMATOLOGICAL RESPONSES AND GROWTH PERFORMANCE IN BROILER

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Abstracts

The study was conducted to evaluate the effects of supplementation of different dietary levels of *Moringa oleifera* leaf meal (MOLM) on growth performance and blood parameter of broilers in six weeks period. A total of 160 male broilers (Cobb- 500) were randomly divided into five treatment groups in a completely randomized design. Each treatment contained four replicates with eight chickens in each. The dietary treatments were T1 (control group without MOLM), T2 (diet containing 3% MOLM), T3 (diet containing 4 % MOLM), T4 (diet containing 5 % MOLM) and T5 (diet containing 6% MOLM). They were formulated to meet nutrient requirement of the National Research Council (1994).The average daily feed intake of broiler chicks fed with T1diet was significantly ($P<0.05$) lower than those of chicks fed with T2, T3, T4 and T5 diets while those of chicks fed with T3,T4 and T5 diets were not different from each other in feed intake. The average daily weight gain of chicks fed T2,T3, T4 and T5 diets were significantly higher ($P<0.05$) than that of chicks fed control diet. The birds fed the diet T3, T4 and T5 did not significantly differ ($p > 0.05$) from each other. Feed conversion ratios were not affected by all dietary treatments. Hundred percent liability was observed that in all treatment groups. There were no significant ($p>0.05$) differences among the treatments for total RBC count, PCV, Hb, MCV, and MCH except from total plasma protein. Therefore, the birds fed T1 was significantly lower than birds fed T2, T3, T4 and T5 diets in plasma protein. According to the findings, *Moringa oleifera* leaf meal up to 6 % dietary level of broiler diet did not give any adverse effects on their performance and blood parameters of broiler chickens indicating that *Moringa oleifera* leaf meal has nutritional potency in broiler diets.

Key words: Broiler chicks, *Moringa oleifera,* Red blood cells, Packed cell volume, Haemoglobin, Mean Corpuscular Volume and Mean Corpuscular Haemoglobin

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1. Introduction

Poultry production sectors in developing countries are facing some problems, one of which is an increase in the cost of feed due to high prices of protein and energy sources. Therefore, researchers had looked for cheap, available and alternative sources of protein and energy. *Moringa oleifera* leaves used as livestock feed for beef and milking cows, swine and poultry (Fuglie, 1999). Kakenji *et al*. (2003) observed that *Moringa oleifera* leaf meal contains 86% DM, 29.7% CP, 22.5% CF, 4.38% EE, 27.9% calcium, 0.26% phosphorus and negligible amount of tannin(1.23 g/kg).Olugbemi *et al.* (2010) evaluated that the suitability of diet including *Moringa oleifera* leaf meal (MOLM) as a feed ingredient (0, 5 and 10%) in cassava (CC)-based broiler diets. The Safa (2012) showed that heaviest body weight gain at 5% MOLM when different dietary levels of MOLM (0, 3, 5 and 7%) were incorporated in Ross broiler diet. Du *et al*. (2007) observed no significant depression in growth performance of 3 weeks old broilers (Arbor Acres) that were fed on diets substituted with 0.5, 1.0, 2.0 and 3.0% levels of

Moringa leaf meal. Banjo (2012) observed that there was highest body weight gain at 2% MOLM among varying dietary levels of 0, 1, 2 and 3 % MOLM in Anak two week old broilers. Ebenebe (2012) observed that the final weight of the birds fed diet supplemented with 10% MOLM were significantly higher than that of the diets supplemented with 15% and 0% MOLM. The birds fed the diet supplemented with 10% MOLM had the highest PCV, while the birds fed the diet without MOLM had the least PCV value. The highest RBC and Hb values were found in the diet supplemented with 10% MOLM those of the least value at the diet supplemented with 15% MOLM.

The blood parameters are important in assessing the quality and suitability of feed ingredients in farm animals (Maxwell et al. 1990). Haematological characteristics of livestock have been observed as factors determining the response of livestock to the diet they are fed (Khan *et al*., 2005). The examination of blood gives the opportunity to investigate the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutrition and pathological status of an organism (Aderemi, 2004; Doyle, 2006). According to Afolabi *et al*., 2010), changes in haematological parameters are often used to determine various status of the body and to determine stresses due to environmental, nutritional and/or pathological factors.

Although researchers had been done various inclusion of MOLM in broiler on growth performance and haematological parameter, it is still remained to evaluate the growth performance and haematological responses of broiler by inclusion of the different dietary level of Moringa leaf meal (0, 3, 4, 5 and 6%) to get accurate efficient level. Therefore, this experiment was carried out to assess the effect of different dietary level of *Moringa oleifera* leaf meal on haematological responses and growth performances on broiler.

2. Materials and Methods

2.1 Study area

This study was conducted at the poultry farm of Department of Animal Science, Yezin Agricultural University, Nay Pyi Taw from June 26th, 2015 to August 7th, 2015.

2.2 Experimental design and dietary treatment

Samples of the various ingredients including Moringa leaves were subjected to proximate analyses before being used in the formulation of experimental diets. A total of 160 chicks were weighed and randomly assigned to five treatment groups with four replicates into 20 pens in the slatted floor system. There were 8 chicks in each replicate in a completely randomized design (CRD).

The *Moringa oleifera* leaves used in this experiment were collected from the region of Yezin area, ZayarThiri Township, Nay Pyi Taw. They were air-dried in the shade until they were crispy to touch, while retaining their greenish coloration. These dried *Moringa* leaves were then processed into meal using a machine with grinder mesh of 2 mm in diameter for grower diet and 1mm in diameter for starter diet.

Five isocaloric and isonitrogenous starter and finisher diets were formulated to meet nutrient requirements of National Research council (NRC, 1994). They were: diet T1 (control diet with 0% of *Moringa oleifera* leaf meal) and the other diets (T2, T3, T4 and T5) were supplemented with *Moringa oleifera* leaf meal at dietary level of 3%, 4%, 5% and 6% respectively. For the first three week, the chicks fed on starter diets and afterward, they fed on grower diets. The birds had continuous access to water and the experimental diets were fed *ad libitum.*

2.3 Bird housing and management

A total of 160 day old male Cobb broiler chicks purchased from Myanmar C.P Livestock Production Company Limited were used in six weeks study. They were randomly allocated to four replicates (cage) per treatment with eight chickens in each replicates. Chicks were housed in pen and brooded according to the recommended brooding management. Brooding temperature was set at 32 ± 1°C. On day 7, all chicks were vaccinated with live vaccine against Newcastle disease (Live ND + IB) via intraocular route and boostered on day 21 in the same route of administration. Infectious bursal disease (IBD) vaccine was administered to all chicks on day 14.

2.4Sample collection and measurements

Live weight and feed consumption of birds were recorded on a replicate basis every 7 days. Mortality was recorded for the correction of feed conversion ratio. At the end of third week and sixth week of this experiment, blood samples were collected from two birds per replicate of each treatment via jugular vein puncture. About 5 ml of blood was collected in bottles containing Ethylene Diamine Tetra Acetic Acid (EDTA).The blood samples were analyzed by *Neubauer* type of haemocytometer (Arther H. Thomas Co., Philadellphia, U.S.A) for red blood cells (RBC), by *wintrobe* Haematocrit tube (West Germany) for packed cell volume (PCV), by using HelligeHaemometer (Hellige Inc., Garden City, USA) for haemoglobin concentration and by the colourimeter for total plasma protein. The chemical composition of experimental diets of starter and grower diets are shown in table (1) and (2).

2.5 Chemical analysis

Feed samples were analyzed for dry matter (DM), organic matter (OM), crude protein (CP) and ether extract (EE) by the method described by AOAC (1990) and analyzed for neutral detergent fibre (NDF) and acid detergent fibre (ADF) by Goering and Van Soest (1970) and tannin by spectrometric method. Samples were analyzed for nitrogen by using Kjeldahl method (Foss 2020 digester and Foss 2100 Kjeltec distillation unit).All of the chemical analyses were carried out at the Department of Physiology and Biochemistry, University of Veterinary Science, Yezin, Nay Pyi Taw.

2.6 Statistical analysis

The datas were subjected to the analysis of variance (ANOVA) using SAS (version 9.0) software (SAS, 2002) and the significance of differences between treatments means were compared by Duncan's Multiple Ranged Test (DMRT).

3. Results and discussions

The effect of diet containing different levels of MOLM on performance of broiler chickens is shown in table (3). The average daily feed intake of birds fed T1 diet showed the lowest value in comparison with those fed MOLM supplemented diets (T2, T3, T4 and T5). However, T3, T4 and T5 diets were not significantly different ($p > 0.05$) from each other in feed intake. The average daily weight gains of birds fed T2, T3, T4 and T5 diets were significantly higher than those fed T1 diet. The birds fed the diet T3, T4 and T5 did not significantly differ ($p > 0.05$) from each other. Feed conversion ratios were not affected by all dietary treatments. Onu and Aniebo (2011) reported that the average daily feed intake and weight gain were significantly increased by supplementation of MOLM (2.5, 5.0%) and were significantly lower by supplementation of 7.5% MOLM. They explained that the reduced feed intake in birds fed

7.5% MOLM supplemented diet in comparison with 2.5% and 5.0% supplemented diet could be due to reduced palatability and higher crude fibre contents of this diet. In this study, the fibre contents of the dietary treatments were relatively similar and could not enough to retard the feed utilization. The increase in feed intake by MOLM supplementation current study was in agreement with the report of Bolu *et al*. (2013). In their report, the feed intake was increased when the levels of MOLM were increased in broiler diets. However, the final body weight was not significantly affected by MOLM supplementation which was not supported to the current result. The Atuahene *et al*. (2010) was observed that there was no significantly dietary effect of MOLM on feed intake of broilers. There was a marked at the diet with 7% MOLM could be due to reduced palatability of the diet (Kakengi*et al*., 2003).

The effect of diet containing different levels of MOLM on the haematological values at of broiler chickens is shown in table (4). Red Blood Cells (RBC), Packed Cell Volume (PCV), Hemoglobin (Hb), MCV and MCH showed no significant differences ($p>0.05$) among treatments and these value were within the normal range whereas the total plasma protein was significantly ($p<0.05$) higher in MOLM supplemented diet.

The value of various haematological parameters by MOLM supplementation in current study was in agreement with the report of Bolu *et al*. (2013).In their report, there was no significant differences ($p>0.05$) among the treatments with respect to these blood parameters. Onu and Aniebo (2011) reported inclusion of varying dietary levels of MOLM (0, 2.5, 5 and 7.5%) in Anak breed of broiler. In their report, the values for Red Blood Cells and Packed Cell Volume were higher at 7.5% compared with 2.5% and 5%.The Hb, MCV and MCH showed no significant difference ($p>0.05$) among treatments. There was a significant difference ($p<0.05$) in the values of total plasma protein among treatments.

The haematological responses to dietary treatment of current study were contradicted with those observed by Aderionola *et al*. (2013). They observed that the values for PCV was significantly ($p<0.05$) higher at the diet 0% MOLM which declined as the MOLM inclusion level increased in the diet and RBC and Hb values started to decline from the diet supplemented with 1.0% MOLM when MOLM used as a feed supplement at five varying dietary inclusion level of (0, 0.5, 1.0, 1.5 and 2%) in broiler diets. The major function of RBC is to transport haemoglobin, which in turn carries oxygen from the lungs to the tissues. Reduced RBC is an indication that oxygen carrying capacity of the animals' body would be reduced.PCV is an index of toxicity level of the blood or suggest the presence of a toxic factor which has adverse effect on blood formation or caused reduction in the percentage of red blood cells(Oyawoye and Ogunkunle, 1998). In the current study, the haematological parameters resulted within normal value indicating that no toxic factors in MOLM supplemented diet. The increased total plasma protein was observed in MOLM supplemented diet. The higher total plasma protein is due to a reflection of the protein quality of the diet fed to the animal (Eggum, 1970).

4. Conclusions

Supplementation of MOLM in diets increased the growth performances of broiler chicken in comparison with diet without MOLM. No significant differences were observed among 4%, 5% and 6% MOLM supplemented diet. There were no adverse effects on blood parameters of broiler chicken by supplementation MOLM. It could be concluded that up to 6% MOLM supplemented diet have nutritional adequacy and potency in broiler with no detrimental effects.

Table 1. Chemical composition (%) of experimental diets (Starter diets)

Description	DM [1)]	Ash	CP	ADF	NDF	EE
(Analyzed values)						
T_1	89.23	8.62	21.70	13.43	23.92	2.56
T_2	89.98	9.06	21.71	15.18	25.96	2.65
T_3	89.71	8.77	21.47	15.11	25.92	2.68
T_4	88.58	8.89	21.64	15.76	26.88	2.73
T_5	88.74	8.84	21.94	16.60	27.84	2.74
(Calculated values)						
T_1	87.33	6.33	21.98	9.07	23.49	2.78
T_2	87.90	6.17	21.93	9.24	24.05	2.87
T_3	87.88	6.23	21.92	9.26	24.14	2.89
T_4	87.85	6.35	21.97	9.28	24.22	2.92
T_5	88.01	6.52	21.87	9.31	24.32	2.93

[1)] All values except DM are on DM basis.
DM = dry matter; CP = crude protein; ADF = acid detergent fibre; NDF = neutral detergent fibre; EE = ether extract

Table 2. Chemical composition (%) of experimental diets (Grower diets)

Description	DM [1)]	Ash	CP	ADF	NDF	EE
(Analyzed values)						
T_1	88.08	8.57	20.30	14.80	24.07	2.71
T_2	89.24	8.75	20.18	14.99	24.15	2.75
T_3	88.97	8.90	20.68	15.93	26.04	2.80
T_4	88.57	8.60	20.55	16.27	26.09	2.84
T_5	88.79	8.96	20.81	16.89	26.53	2.89
(Calculated values)						
T_1	87.79	6.12	19.35	9.07	23.37	2.66
T_2	87.71	6.03	19.08	9.16	23.71	2.73
T_3	87.69	5.92	19.06	9.20	23.86	2.76
T_4	87.67	5.61	18.87	9.25	24.05	2.78
T_5	87.64	5.57	18.84	9.28	24.17	2.81

[1)] All values except DM are on DM basis.
DM = dry matter; CP = crude protein; ADF = acid detergent fibre; NDF = neutral detergent fibre; EE = ether extract

Table 3.Growth performances of broiler chicks fed diets containing different levels of *Moringa oleifera* leaf meal

Parameters	T_1	T_2	T_3	T_4	T_5	SEM	P(value)
Initial weight(g/b)	42.72	43.22	44.19	43.28	43.84	0.23	0.2998
Final weight(g/b)	1640.53^{b}	1720.66^{ab}	1800.59^{a}	1830.63^{a}	1846.85^{a}	25.55	0.0346
Daily weight gain (g/b)	38.04^{b}	39.94^{ab}	41.82^{a}	42.56^{a}	42.93^{a}	0.97	0.4213
Daily feed intake (g/b)	79.64^{c}	84.94^{b}	89.89^{a}	90.27^{a}	91.46^{a}	48.08	<0.0001
FCR	2.04	2.07	2.10	2.08	2.08	0.02	0.9491
Liability	100	100	100	100	100	-	-

[a,b,c,d;] Mean value with different superscripts with the same row are significantly different (P<0.05) (ANOVA).
g/ b = gram per bird;

Table 4. Effect of diet containing different levels of MOLM on haematological values of broiler chickens

Parameters	T_1	T_2	T_3	T_4	T_5	SEM	P(value)
RBC count (mm^3)	2.64	2.16	2.43	2.58	2.53	0.07	NS
Hb (g %)	8.08	7.88	8.15	8.25	8.15	0.06	NS
PCV (%)	23.25	20.50	21.00	21.50	21.50	0.46	NS
MCV (μ^3)	88.52	95.26	89.16	83.78	86.66	3.29	NS
MCH (pg)	30.46	39.17	33.89	32.16	30.73	1.31	NS
Plasma Protein (g %)	3.13^b	3.75^a	3.75^a	3.38^{ab}	3.38^{ab}	0.12	0.0185

a,b,ab; Mean value with different superscripts with the same row are significantly different ($p<0.05$) (ANOVA)

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