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Effects of Fermented Madre De Agua Leaf Meal (*Trichanthera gigantea*) on Growth Performance of Heritage Free-Range Chicken (*Gallus domesticus Linn.*)

By

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Abstract

The study was conducted to evaluate the performance of six (6) week-old heritage chicken (Black Australorp) fed with Madre de agua leaf meals of the compound diets. A single-factor experiment was used for 75-head starter chicks with three (3) dietary treatments and five (5) replications. The feeding trial was run for 84 days through feed mixtures containing 16.105% and 3,105; Crude Protein and ME, Kcal/kg, respectively. *Trichanthera*gigantea leaf meal was produced through 3-day sun drying and 10 min of oven-drying until the 10-14% moisture content was achieved. The dried leaves were hammer-milled through a 2-mm sieve. The experimental feeds were subjected to laboratory analysis. The results of the study observed a marked improvement in the growth performance of the experimental birds as measured by the parameters used. Significant differences among treatment means were observed from the average gain weight, average feed consumption (3,698g – 4,538g), and final weight gain (774.82–977.39 g). The feed conversion ratio (4.65 – 4.77), and feed cost per kg of meat produced (PhP126.60 – 37.72) were not significantly affected by the experimental diets (*P*>0.05). The improved growth performance of the experimental chicken indicated that the madre de agualeaf meals-treated dietcan be a viable feed option for free-range chicken. It is recommended to further explore the viability of the said experimental feed mixture to other chicken breeds and poultry species using various feed formulations with madre de agua leaf meals as protein feed ingredients.

Keywords

Feed formulation, heritage chicken, feeding trial, practical diets, poultry productivity.

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I. INTRODUCTION

The Philippine native chickens are generally raised in free range.They are being fed consisting of corn/cracked corn, rice bran, home mixed ration,filled/unfilled palay, and rice/milled rice and are generally broadcasted on the ground. To have a consistent andtablemarketable weight, most growers relied on costly commercial feeds for feeding tocomplement the forage and free-range activities of the birds (Mananghaya 2017).Considering the high cost of important feed ingredients (e.g., soybean meal) for poultry production, the utilization of locally produced plant-based protein sources as a practical feed ration is becoming more popular (Paguia et al. 2022; Tecson andCatubis, 2022).

Madre de Agua is a tropical leguminous tree native to Central and South America. While it has been traditionally used for its medicinal properties, recent studies have revealed its potential as a valuable source of poultry feed. The leaves and pods of madre de agua are rich in protein, essential amino acids, and minerals, making it an excellent supplement for poultry diets. Additionally, its high fiber content aids in digestion and promotes gut health in chickens (Abuanet al., 2022).

The inclusion of madre de agua in poultry feeds has shown promising results; the inclusion of fermented leaf meal improved body weight gain and feed conversion ratio, growth performance,egg production, and overall bird health (Morboset al., 2016;Libatique 2020). Furthermore, fermented madre de agua leaf meals (FMDALM) in poultry diets have gained attention due to their potential to enhance the growth performance and efficiency of free-range chickens.

Berdos et al. (2019) and Pernites(2023)revealed that the inclusion of fermented madre de agua leaf meal in the diet significantly improved the body weight gain and feed intake with comparable egg laying percentage of the laying ducks. Thus, incorporating fermented madre de agua leaf meals in poultry diets can be a beneficial strategy to enhance the productivity and profitability of free-range chicken production systems, hence, this study.

II. MATERIALS AND METHODS

A. Experimental Animal and Treatment Diets

A total of 75 heads of Black Australorp (35-day-old) starter chicks were used in the feeding experiment. Physical attributes of the experimental birds were examined prior to research proper. The birds were relatively free from disease and external parasites. The 35-d old chickens were raised and acclimatized at the Poultry Experimental Facility of Bataan Peninsula State University (BPSU), Philippines.

Experimental diets were produced using local-based feed ingredients including rice bran, molasses, vegetable oil, oyster shells, salt, fish meal, soybean meal, and yellow corn. The formulated diets were prepared following the details listed in Table I. Locally produced madre de agua were also used in the study. The fermented madre de agualeaf meal was produced by fermenting the fresh leaves through aerobic conditions using Effective microorganism-activated solutions, and molasses for seven days. The fermented leaf meals were air-dried and oven-dried until 14% moisture content was observed. The nutrient contents of the experimental feeds including calcium, phosphorus, NFE, metabolizable energy, and amino acids (lysine, methionine + cysteine, and methionine) were taken through laboratoryanalysis. The common feedstuffs in the locality such as rice bran D1, molasses, vegetable oil, oyster shells, salt, fish meal, soybean meal, yellow corn, and duckweed meal were used. The formulated feeds containing 16.0% crude protein and about 2,800 ME/kcal/kg were achieved and standardized among treatment groups. No additives and supplements were added to the feed

formulation. The experimental feeds were fed in pelletized form. Proximate composition and nutrient composition of formulated feeds are shown in Table I.

TABLE I. FEED INGREDIENTS, INCLUSION LEVELS, AND CALCULATED ANALYSIS FOR THE TREATED DIETS

Feed Ingredients	**Control**	**5%FMDALM**	**15% FMDALM**
Yellow Corn	60	59	51
Fish Meal, 60%	8.0	10	8.0
Molasses	3.0	3.0	3.0
Rice Bran D1	13.5	11.5	11
Soybean meal (Full Fat)	11	7.0	6.5
FMDALM	0	5.0	15.0
Coconut oil	3.0	3.0	4.0
Salt	0.25	0.25	0.25
Probiotic	0.25	0.25	0.25
Limestone	1.0	1.0	1.0
Total	100	100	100
Calculated Analysis			
ME (KCal/kg)	3,151	3,036	2,770
CP, %	16.105	16.165	16.00
Crude Fat,%	7.74	7.73	8.44
Crude, Fiber, %	3.46	3.8	4.7
Ash	4.0	5.0	6.7
Calcium	0.72	0.72	1.53
Available Phosphorus	0.24	0.24	0.24
Lysine	0.69	0.69	0.69
Methionine	0.29	0.29	0.29
Methionine + cysteine	0.56	0.60	0.52

Chemical and nutritional composition of the fermented Madre de Agua leaf meal samples was determined according to standard AOAC methods.

B. Experimental Design and Feeding Trial.

The study was conducted for a duration of 84 days, under a single-factor experiment. It consisted of 75 heads of 35-day-old starter chicks, distributed into three dietary treatments with five replications each. The treatments were as follows: T1 = Control, 0% FMDALM; T2 = 5% FMDALM, and T3 = 15% FMDALM.

The study was conducted from January 2023 until April 2023 at the full litter-floor type Experimental Poultry House of BPSU Abucay Campus, Bataan, Philippines. The chickens were fed twice a day with a pre-weighed ration throughout the experiment. Data recording was done at weekly intervals.

C. Production Parameters

The mean weight (g) of experimental chickens was determined using a digital balance (0.01 g), whereas daily gain in weight (%), average gain in weight (g), final mean weight (g), average daily gain (g), average consumption (g), feed conversion ratio (FCR) = (feed consumed/gain in weight), and mortality were determined and recorded every month. Moreover, income over feed and chick cost,cost per kg of bird produced, and hematological profile of the experimental birds were determined

D. Blood Collection and Hematological Measurements

At 80 days of age, two birds were used from each replicate for blood extraction. Blood was collected from the wing vein into anticoagulant EDTA-treated tubes for determination of hematological parameters. The hematological parameters were analyzed using Automatic Fully Digital Hematological Analyzer, BC 3000 Plus, ShenzhenbMinday, Bio-Medical Electronics Co. LTD(Mansour et al. 2011).

E. Statistical Analyses

Growth performance, FCR, and hematological variables of treatments (mean ± SD) were compared using analysis of variance ($P< 0.05$). All data were normally distributed as indicated by the Shapiro-Wilk test ($P< 0.05$). Tukey's post-hoc test was then employed to determine the significant variation between treatment means ($P< 0.05$). Parameters were expressed as means ± standard deviation. Statistical analyses were performed using a statistical package software, Statistical Tool for Agriculture Research.

III. RESULTS AND DISCUSSIONS

The growth performance of the experimental birds containing FMDALM in the dietsis presented in Table 2. The mean daily gain in weight of experimental chickens wassignificantly different among treatments, with T1 having the highest observation (11.63 ± 1.18 g) for such growth parameter (F = 14.92; $P< 0.01$) (Figure 1). While mean feed consumption was statistically different among treatments ($P> 0.05$), the FCR levels and cost to produce a kilogram of chicken meat did not significantly vary among the experimental chicken groups. The control group achieved the highest final weight and was significantly heavier than T2 and T3 ($P< 0.01$).In the hematological analysis, the difference in mean levels of every blood component was found to be not significant among treatments ($P> 0.05$)(Table 3).

TABLE 2.GROWTH PERFORMANCE (MEAN ± SD) OF *Gallus domesticus* (BLACK AUSTRALORP) FED DIETS WITH VARYING INCLUSIONS OF FERMENTED MADRE DE AGUA LEAF MEAL.

Performance Parameters	**T1 (Control)**	**T2 FMDALM meal 5%**	**T3 FMDALM meal 15%**	***F* value**
Feed Consumption (g)	4,538.57 ± 464.97[a]	3,885.72 ± 357.18[ab]	3,698.11 ± 365.93[b]	6.12*
Feed Conversion Ratio	4.65 ± 0.31[a]	4.92 ± 0.48[a]	4.78 ± 0.47[a]	0.49[NS]
Cost per kg of meat produced (Php)	139.50 ± 9.28[a]	137.72 ± 13.49[a]	126.61 ± 12.51[a]	1.72[NS]
Final Weight Gain (g)	977.39 ± 99.24[a]	790.89 ± 30.95[b]	774.82 ± 44.59[b]	14.86**

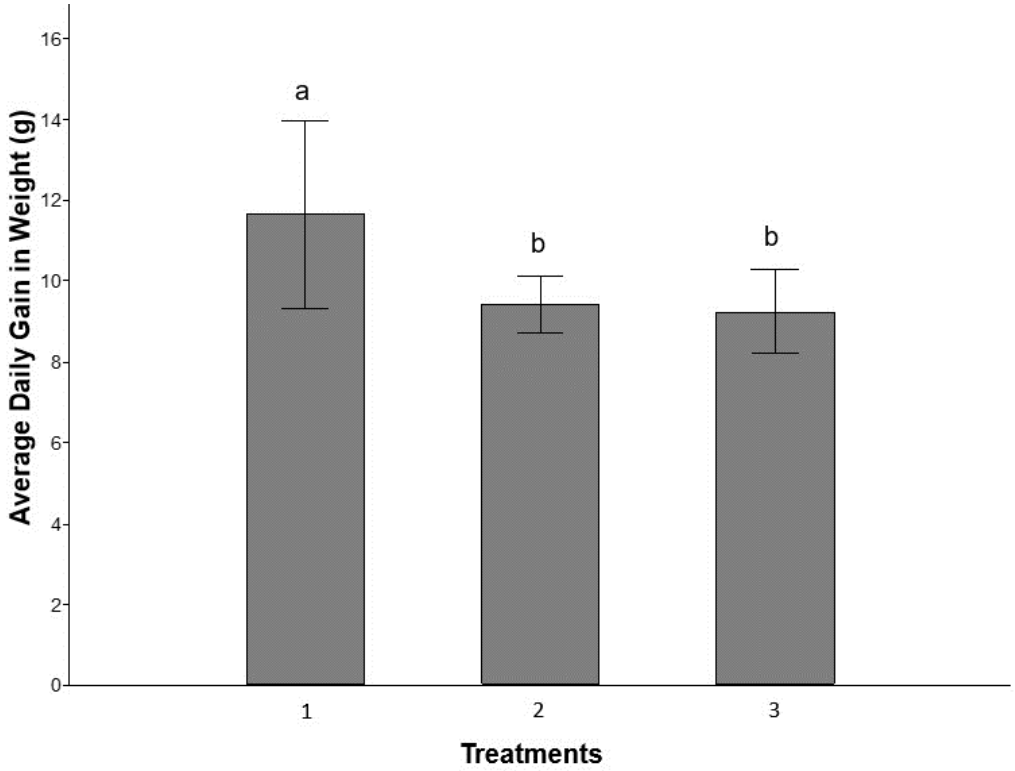

Figure 1. Comparison of average mean daily gain in weight of the experimental birds (35 to 84 days of age) fed diets containing varying levels of fermented Madre de Agualeaf meal.

The observed variation can be attributed to a wide array of essential amino acids, proteins, and minerals in Madre de Agua leaves and pods, providing a good supplementation to poultry diets (Libatique 2021). However, the inclusion of 5.0% and 15% FMDALM in the feed formulation having 16% CPdid not remarkably improve the growth parameters. The results contradicted the findings of Berdoset al. (2019) which utilized *Trichanthera gigantean* fresh leaves as practical diets for the Philippine mallard duck. Thepresent FMDALM-based diet is palatableconsidering thatthe fermentation process enhances the nutrient availability and digestibility of the leaf meal. The practical diets, however, were not adequate enough to supply the nutrients needed for a comparable weight gain, FCR, and final weight (Morbos et al. 2016). Nevertheless, the cost of production is

comparatively lower for the diets containing FMDALM. The results implied that adding 5% and 15% FMDALM in the compound feed remained a good alternative source of nourishment for free-range chickens. These results provide evidence of the viability of FMDALM on the growth performance of free-range chickens.

TABLE 3.HEMATOLOGICAL PARAMETERS (MEAN ± SD) OF FREE-RANGE CHICKEN, *Gallus domesticus* (BLACK AUSTROLORP) FED DIETS WITH VARYING INCLUSIONS OF FERMENTED MADRE DE AGUA LEAF MEAL

Hematological Parameters	**T1 (Control)**	**T2 FMDALM meal 5%**	**T3 FMDALM meal 15%**	***F* value**
Erythrocyte, 10^{12}/L	2.04 ± 0.18	1.97 ± 0.20	1.95 ± 0.15	0.39 ^{NS}
Leucocytes, 10^{9}/L	51.10 ± 7.92	48.38 ± 5.80	53.12 ± 7.49	0.56^{NS}
Lymphocyte, %	84.26 ± 3.19	86.22 ± 4.08	84.64 ± 3.49	0.41^{NS}
MID, %	7.52 ± 1.19	6.58 ± 1.20	7.74 ± 1.20	1.37^{NS}
Granulocyte, %	8.22 ± 2.08	7.20 ± 2.92	7.62 ± 2.32	0.22^{NS}
Hemoglobin, g/L	102.20 ± 12.29	98.20 ± 16.78	87.21 ± 11.08	1.62^{NS}
Hematocrit, %	30.60 ± 3.86	29.78 ± 4.78	26.32 ± 3.75	1.49^{NS}
Mean Corpuscular Volume, fL	104.34 ± 2.88	102.64 ±3.63	101.4 ± 3.82	0.91^{NS}
Mean Corpuscular Hemoglobin, pg per cell	50.08 ± 4.24	49.54 ± 4.47	44.76 ± 4.99	2.04^{NS}
Mean Corpuscular Hemoglobin Concentration, g/L	481.20 ± 28.65	484.20 ± 49.06	442.62 ± 46.68	1.49^{NS}
Thrombocytes, 10^{9}/L	148.80 ±84.05	157.40 ± 74.50	164.50 ± 51.34	0.05^{NS}

^{NS} = Not significant at a 5% level of confidence

IV. CONCLUSION AND RECOMMENDATIONS

The use of *Trichanthera gigantea*, a locally available plant-based protein source can be a potential replacement to soybean meal for free-range chickens. The practical diet can be made available in lieu of the scarcity of imported feedstuff and commercial chicken feeds. The present findings also demonstrated that the feeding of free-range chicken with FMDALM is a better option for heritage chicken.

Further verification trials can be done with diets containing FMDALM at higher inclusion rates. It is also suggested to conduct a feeding experiment on other chicken breeds using FMDALM-based diets. Moreover, key parameters includingsensory attributes, dressing percentage, digestibility, antioxidant status, and reduced oxidative stress markers can be included in the future investigation.

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