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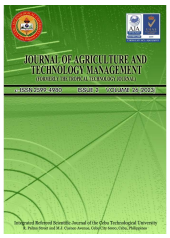

Original article

Water spinach (*ipomoea aquatica*) and madre de agua (*trichnatera gigantea*) is a potential feed supplement in broiler chicken production

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ABSTRACT

Supplementation is the extra nutritional materials that provide health and profitability issues. This experiment evaluated the effects of water spinach (Ipomoea Aquatica) and Madre de aqua (Trichantera gigantea) as feed supplements for broiler chickens. Forty-five (45) day-olds broiler chickens were randomly allocated to three dietary treatments using a completely randomized design (CRD). The treatment consisted of three replicates and five birds per replicate. From 8-35 days (about 1 month 4 and a half days), the chickens were exposed to three different experimental treatments: Treatment 0 pure commercial feeds(control), Treatment 2-commercial feeds + 25% freshwater spinach (Ipomoea Aquatica), and Treatment 3- commercial feeds + 25% fresh Madre de Agua (Trichantera gigantea). The selected parameters of proximate analysis of feed composition of treatments were analyzed, such as crude protein, crude fat, moisture, and ash. Feed consumption was recorded daily, and feed conversion ratio (FCR) and cost-benefit ratio were calculated once. On day 35, three birds from each treatment group with almost similar body weights were selected for slaughtering carcass yields determination. There were no significant differences in broiler chickens' feed consumption, body weight, and feed conversion ratio (FCR). Further, carcass yield among the treatments revealed no significant effects. However, water spinach and Madre de Agua had no adverse impact on broiler chickens' growth performance and carcass yield. Thus, it can be a potential component of the ration and can be replaced by the lower cost and widely available water spinach and Madre de Agua.

KEYWORDS: *Broiler, Carcass, growth, Trichantera gigantea, Ipomea Aquatica*

1 INTRODUCTION

Poultry production facades a high feed cost of 70-75% of the total cost of production (Köseand Öztürk, 2017). The increase in feed price may consequently imply a rise in total productioncost. Thus, a reduction in the profit margin of the broiler industry. Foliage proteins extracted from organically grown crops, especially legumes, could be attractive as animal feed (Santamaría-Fernández, M., & Lübeck, M. 2020).

Leaf meals offer poultry producers a feed resource that is inexpensive and high in protein (Gulizia, J. P., & Downs, K. M. 2020). As studied by Janvier et al. (2021), the use of water spinachIpomea aquatica as a supplement that lyophilized water spinach powder has a good amount of carbohydrates (58.15%), ash (12.39%), protein (4.01%), and fat (4.46%) content. The powder also possessed a high antioxidant property of 77.25% and a total phenolic content of 32 µg/ ml. (Joshi et al., 2021). Moreover, Jack (2021) revealed that Trichanthera gigantea was densified and fed to growing lambs, which resulted in similar feed intakes, digestibility, and growth performance in developing lambs to that of commercial concentrates. The microbial biomass of Trichanthera gigantea leaf meal was 60% above the average yield for the other species (Jack et al., 2021).

Information on using water spinach and Madre de Agua was limited as feed supplement for fowl. Hence, the study aims to evaluate broiler chicken's growth performance and carcass quality supplemented with Madre de Agua and water spinach. The study was conducted to assess the broiler chickens' growth performance, carcass yield and the cost -benefit ratio using the Madre de Agua and Water spinach leaf meal of broiler chicken.

2 MATERIALS AND METHODS

The experimental site, design, animals, and management

The experiment was conducted at the Cebu Technological University-Tuburan Campus,Tuburan Cebu. This study was arranged using a completely randomized design (CRD) experimental set-up.D). 45 broiler chickens were weighed and randomly assigned to three experimental treatments. The treatments consisted of 3 replicates, having five birds per replicate and were

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raised under the related management form. The birds were given feed and drinking water and libitum throughout the experimental period.

Experimental diets and preparation of Water spinach and Madre de Agua

The broiler chickens were given three experimental diets from 8 to 35 days. These were T0- commercial feeds (control), T1- commercial feeds + 25% fresh Madre de Agua, and T2 commercial feeds + 25% freshwater spinach. The diets retained a constant ratio of energy and protein to meet the requirements of broiler chickens. Fresh water spinach and Madre de Agua were collected within Cebu Technological University –Tuburan Campus farm and were washed thoroughly, chopped into 1.5 cm size, weighed, and given directly to the broiler chickens.

Data

Daily feed consumption was recorded, and the body weight of each bird was recorded weekly until the last day of the study. The average feed consumption, body weight, and feed conversion ratio was calculated weekly. After 35 days (about 1 month 4 and a half days), the broilers were slaughtered for carcass evaluation.

Three birds were selected in each treatment group with comparable body weights. The birds at 34 days' feeds were withdrawn for 24 hours, but the water was still available. To exclude the possible influence of stress, the birds were stunned and slaughtered immediately after being taken out of the cages. In the slaughtering process, birds were manually de-feathered and eviscerated, and the carcasses were immersed in chilled water for 1 hour. The carcass was removed from the chiller, hung to drip, and cut into various parts. Empty carcasses, breast, thigh, wing, liver, heart, gizzard, ribs, and back were weighed, and their yield was computed as a percentage of live weight at slaughter.

Furthermore, cost-benefit ratio was calculated using the formula of total present value of future benefit includes (profit or the income) divide the total present value of future cost includes (materials and wages) wallstreetmojo.com (Undated) for five-year projection through the durability of materials being used during the production process.

Statistical Analysis

All the data were computed, consolidated, and transferred to M.S. Excel for tabulation Analysis of Variance (ANOVA) was analyzed for significant differences among treatments.

3 RESULTS AND DISCUSSIONS

Proximate Analysis of Water Spinach and Madre de Agua

The proximate analysis of freshwater spinach and Madre de Agua mixed with commercial feeds are shown in Table 1. Based on the result from a pure booster, starter and finisher feed had the highest crude protein (21.50, 19.50, and 18.00) content compared to the replacement of 25% Madre de Agua (18.62, 17.68, and 17.54) and water spinach leaves (18.62, 17.90 and 17.39) respectively. However, both Madre de Agua and water spinach revealed a higher percentage than pure commercial feeds in terms of crude fat and moisture content. Furthermore, no ash content had been detected on pure commercial feeds, opposite to the given treatments.

Growth Performance

The broilers' cumulative feed consumption, body weight, and feed conversion ratio (FCR)are shown in Figures 1, 2 and 3. There were no significant differences among the dietary treatments on the feed consumption, body weight, and feed conversion ratio of broilers from week 1 to week four feeding.

Carcass Yield

The carcass, breast, thigh, wing, liver, heart, ribs, back, and gizzard weights of broilers are shown in Table 2. Similar to the growth parameters, there were no significant differences among the dietary treatments from week 1 to week four feeding.

Cost-Benefit Analysis

The cost-benefit analysis result is presented in Table 4, wherein feeds with water spinach and Madre de Agua vary from the influence of 1.48 and 1.62. The replacement of 25% trichantera gigantea revealed the highest among the treatments, followed by water spinach. Moreover, the pure commercial feed had the lowest.

Proximate Analysis

Selected proximate analyses of water spinach and Madre de agua used in this study areshown in Table 2. Foliage meals containing high content of protein have been incorporated into broiler diets. Besides being rich in protein, leaf meals also comprise a wide variety of biologically active components that may serve as growth-promoting and health-improving agents for broiler chickens (Sugiharto et al., 2019). It was revealed that the crude protein, crude fat, moisture, and ash analysis from booster to finisher stages of the water spinach and Madre de Agua varies slightly. The Control group had the highest compared to 25% water spinach and Madre de Agua in terms of crude protein content. This implicates that commercial feeds formulated meet the requirements of the poultry chicken whereas the replacement of 25% water spinach and trichantera were offered fresh leaf meal and shows higher percentage in terms of fats and ash content compared to commercial feeds.

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Table 1. Selected Feed Stages Analysis with Inclusion of Ipomea Aquatica and Trichantera gigantea.

Treatments	Crude Protein %	Crude Fat	Moisture %	Ash%
Pure Booster Feeds	21.50	4.00	12.00	-
Pure Starter Feeds	19.50	3.00	12.00	-
Pure Finisher Feeds	18.00	6.00	12.00	-
BooSter with (*Ipomea aquatica*)	18.62	4.11	25.08	5.37
Booster with (*Trichantera gigantea)*	18.62	7.54	22.82	4.48
Starter with (*Ipomea aquatica*)	17.90	7.16	25.35	4.25
Starter with (*Trichantera gigantea*)	17.68	7.27	22.08	4.58
Finisher with (*Ipomea aquatica*)	17.39	7.54	22.82	4.48
Finisher with (*Trichantera gigantea*)	17.40	7.67	22.16	4.47

***Laboratory Analysis@ Regional Feed Analysis Laboratory, Guadalupe Cebu City, Philippine

Treatments	Week 1	Week 2	Week 3	Week 4	Mean
T0	347.14	544.76	621.90	766.67	570.1
T1	329.38	538.10	623.33	766.67	564.3
T2	340	553.57	623.14	766.67	570.8
p-value	*.903*	*.884*	*.941*	*1.00*	

Figure 1. Weekly mean values of feed consumption of broiler chickens fed

Treatments	Week 1	Week 2	Week 3	Week 4	Mean
T0	306.67	598	942	1,264	777.66
T1	303.33	592	919.33	1,114	732.16
T2	280.67	648	1,010	1,188	781.66
p-value	.641	.416	.406	.194	

Figure 2. The weekly mean value of body weight gain of broiler chickens fedwater spinach and Madre de agua as a feed supplement

Treatments	Week 1	Week 2	Week 3	Week 4	Mean
T0	1.073	0.9165	0.6898	0.6159	0.8238
T1	1.194	0.968	0.7218	0.7162	0.9
T2	1.319	0.9025	0.6321	0.6838	0.88
p-value	0.571	0.829	0.421	0.316	

Figure 3. Weekly mean values of feed conversion ratio of broiler chickens fed with water spinachand Madre de agua as a feed supplement

Table 2. The carcass quality of broiler chickens fed with different diets was used in the study.

Treatments	Carcass Weight (g)	Breast Weight (g)	Thigh Weight (g)	Wing Weight (g)	Liver Weight (g)	Heart Weight (g)	Ribs and Back Weight (g)	Gizzard Weight (g)
T0	609.65	261.89	242.25	83.77	32.62	7.23	214.34	18.94
T1	820.44	284.16	229.04	91.03	30.75	6.28	201.31	18.97
T2	803.44	259.99	237.77	89.84	28.53	7.25	216.09	18.81
p value	*0.048*	*0.631*	*0.834*	*0.659*	*0.332*	*0.227*	*0.774*	*0.998*

Feed Consumption

Figure 1 presents the weekly feed consumption of broiler chickens fed with both 25% Madre de Agua and Water spinach as a feed replacement. A not significant result was observed in the feed consumption from the first week to the fourth week of the experimental study. These results are synonymous to the findings of Libatique (2021) on broiler chicken fed with Trichantera gigantea that ranges inclusion of (5,10 and 15 %) revealed that from week 1 to week 4, the feed consumption mean ranges from (101.11 to 461.38 grams) respectively. Synonymous results were reported by Naghshi et al. (2021). Including 5-15% of Azolla did not

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Table 3. Material and cost on broiler chicks supplemented with water spinach and Madre de agua

Needed Items	Control (T0)	25% Water Spinach (T1)	25% Madre de agua (T2)
Feeds	2,209.05	1,540.25	1,555.23
Housing	1,000.00	1,000.00	1,000.00
Electricity	25.00	25.00	25.00
Water	50.00	50.00	50.00
Labor	30.00	30.00	30.00
Medicine	15.00	15.00	15.00
Waterer & Federer	405.00	405.00	405.00
Broilers	855.00	855.00	855.00
Total Cost	**4,589.05**	**3,920.25**	**3,935.23**
Percent Savings Compared to Control		**14.57%**	**14.25%**

@1 USD-equivalent to 54.43 as of October 2022

Table 4. Cost–Benefits ratio on broiler chicks supplemented with water spinach and Madre de agua

Treatments	Present Value of Benefit Expected from the Broiler Chicken	Current Value of Cost Benefit from the Broiler Chicken	Amount
T0 (Control)	22,945.25	28,349.75	1.2355389
T1 (25% Water Spinach)	19,601.23	29,157.28	1.4875231
T2 (25% Madre de agua)	19,676.13	31,903.88	1.6214511

significantly affect the broiler's feed consumption. Related results were conducted by Maulana et al. (2021) who reported no significant differences in feed intake of water spinach straw and concentration in each group of body weight ($P>0.05$) of sheep, which contrasted with the present study. However, Wafar & Tarimbuka (2016) reported that the daily feed intake of the rabbits was significantly ($p<0.05$) influenced by the inclusion level of water spinach from 2.50% to 12.50%, respectively. Furthermore, since the leaves used are fresh and succulent, it stimulates the appetite in birds, which increases feed consumption (Oluyemi & Roberts, 1988). However, as Alleman and Leclercg(1997) reported, broilers fed on the low protein diet had no differences observed compared to feed consumption among the control group. The feed conversion ratio was higher on a low protein diet, like the present in week 4.

Feed Conversion Ratio

The feed conversion ratio of broilers chicken fed with both 25% trichanthera gigantea leaf meal and water spinach are presented in Figure 3. The feeding of TGLM and WSLM did not significantly influence the feed conversion ratio. From week 1 to week four, the mean value for 25% water spinach ranged from 1.194 to 0.7162. In comparison, the 25% trichantera gigantea had 1.319 to 0.6838. Moreover, in the control group, it ranges from 1.073 to 0.6159, respectively. However, as studied by Libatigue., et al., TGLM contradicted the present study shows significantly influenced the feed conversion ratio wherein the bird's FCR with means of 1.51 and 1.69, respectively, at 15% inclusion.

Furthermore, the data show a regular decrease as the rate of inclusion decreases in terms of feed conversion ratio, which indicates that the broiler chickens performed well during the duration of the study. This is comparable with the findings of Siswanto I S et al. (2017) that the FCR of birds fed with a higher level of Azolla become poorer because of the high fiber and lignin content in the ration. The increasing level of trichanthera gigantea positively affected birds' feed conversion ratio and efficiency (Buctot, 2018).

Body Weight of Broiler Chickens

Figure 2 shows the weekly body weight of birds fed with freshwater spinach and Madre de agua leaves with no significant differences among treatments. Related results revealed no significant difference in weight gain of quails supplemented with 10ml to 30ml of fermented kangkong juice and ranging the weight from 45.87g to 79.97g from week1 to week 4 (Ampode, 2019). Moreover, FKJ contained 15-94%, as Anadon et al. (2005) confirmed. However, Buctot (2018) revealed that broilers fed with a 15% inclusion of T.gigantea leaf meal produced weight gain resulting in excellent feed conversion efficiency. Also, added T. gigantea promotes a faster growth rate with a mean value of (1,533.30g to 1,628.84g) even at lower feed consumption. Furthermore, the influence of the semi-replacement of commercial sheep ration with Trichanthera gigantea leaves were verified. This replacement contributed to a significant improvement in weight gain (4.70g, 2.40g, and 1.44g), dressing yield (34.9%, 40.3%, and 37.4%), and carcass weight (5.12g, 7.1g, 5.97g) in lamb (Balraj et al., 2018). Nguyen Thi-Thuy and Ogle (2005) suggested that the lack of effect of the green feeds on the growth rate, feed conversion, and meat quality was probably

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because the basal diet was already well balanced in significant nutrients.

Carcass Yield of Broiler Chickens

The diet of Ipomea aquatic leaves, either as a primary or additional feed ingredient, could result in a positive effect on the production performance and health of both dairy ruminants and meat ruminants through its high nutritional content of protein, metabolizable energy, dry matter (D.M.), digestibility, palatability, and bioactive compounds (Kusumah., et al. Undated). Table 3 shows the carcass yield of broilers supplemented with Trichantera gigantea and Ipomea Aquatica revealed no significant difference among treatments. The carcass weight of the control group (709.69g) had the lowest weight, while water spinach had the highest, followed by trichnatera leaf meal (820.44 and 803.44 grams). Moreover, the weight result varies in the breast, thigh, wing, liver, heart, rib and back, and gizzard. As reported by Libatique (2021) indicates no significant differences between treatments for dressing percentage with and without giblets, with mean values ranging from 73.09% to 74.35% and 67.67% to 69.68%, respectively, of broilers fed a ration with various levels of Trichantera gigantea. The findings of Languido et al. (2020) showed that the inclusion of oregano leaf meal does not affect the dressing percentage of broilers.

Cost–Benefit Ratio

The cost-benefit ratio (CBR) was to analyze and to describe the relationship between the Costs and benefits of the project's nature. In general rule, CBR above 1.0 connotes a higher return on investment, while below it means the opposite. As shown in Table 5, water spinach and Madre de Agua at 25% replacement of commercial feeds had results of 1.48 and 1.62 cost and benefit ratios, respectively, revealing the potential benefits of raising broiler chickens. According to Ezeh and Arene (1994), the cost-benefit analysis of cassava root meal production with 1.41 indicates broiler production's good response in which the result not so far from using 25% water spinach and Madre de Agua on broiler production.

4 CONCLUSION

According to the present findings, there were no significant effects on growth performances and carcass quality among dietary treatments. There were no antagonistic effects on growth performance and carcass yield of broiler chickens fed with 25% freshwater spinach and trichanthera leaves replacement of commercial feeds. Therefore, concluding the feasibility of using such crop's leaves as a low-cost alternative feed for broiler's diet. Other studies related to such plants as feed to other poultry and livestock species should be conducted to get a holistic knowledge and data for optimizing other potentials of the said plant as livestock feed.

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