EGG PRODUCTION PERFORMANCE OF IMPROVED PHILIPPINE MALLARD DUCKS (*Anas platyrhynchos*) FED DIETS SUPPLEMENTED WITH FRESH TRICHANTHERA (*Trichanthera gigantea*) LEAVES

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ABSTRACT

The nutritional values and feeding trial of fresh Trichanthera (*Trichanthera gigantea*) leaves for Improved Philippine Mallard Duck (IPMD) layers were examined. Proximate, calcium, phosphorus and energy contents of Trichanthera were analyzed. Its effects on egg production, fertility and hatchability were analyzed when used as part of a ration of IPMD on early lay performance. For the feeding trial, a total of 108 IPMD were randomly assigned in three treatments following Completely Randomized Design (CRD); each treatment had three replication with 12 ducks (2 drakes and 10 ducks) per replicate. The treatments were: without Trichanthera, with 50 g Trichanthera/duck/day and with 100 g Trichanthera/duck/day. When expressed on dry matter (DM) basis, Trichanthera contained 93.30% DM, 19.59% crude protein, 11.89% crude fiber, 2.33% crude fat, 20.15% ash, 4.47% calcium, 0.25% phosphorus and 2,310 kcal ME/kg. The combined intake of feed and Trichanthera was higher (*P*<0.01) for IPMD fed 100 g Trichanthera/duck/day and had numerically higher egg production (85.88%) than their counterparts. Gain in weight of the IPMD during the seven-week period was not influenced (*P*>0.05) by Trichanthera feeding. Egg quality, egg classification, fertility and hatchability of eggs, and quality of hatchling were not affected by Trichanthera. Numerically, higher IOFC (Php 47.43/duck) was attained from IPMD fed 100 g of Trichanthera/duck/day.

Key words: dietary supplement, Improved Philippine Mallard Duck, income over feed cost, litter-floor and Trichanthera

INTRODUCTION

Eggs are the most important product from the Philippine duck industry. Ducks are next to chicken in terms of economic importance as source of eggs as well as meat. Still, problems including insufficient space for free-range operations, quality breeder ducks, unstable supply of ready-to-lay pullets, high cost of feeds, fluctuating prices of eggs and limited research studies being conducted on duck raising are regarded as constraints to the

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industry (Agriculture, 2016). These problems explain why the volume of production has been declining for the past five years, which dropped to an average of 5.42 percent (PCAARRD, 2016).

Since there is a significant increase in the domestic utilization of duck products, the prospect for the development of the industry is promising. With this, Improved Philippine Mallard Duck (IPMD) was developed, a product of continuous selection and breeding of the traditional Pateros duck (Parungao, 2017). However, the development of IPMD necessitates the development of feed and feeding system to attain consistent egg production performance and product quality.

Traditionally, supplementation of protein to ducks during egg production is practiced. Unfortunately, sources of supplement such as snails and small shrimps have become scarce. In this regard, there is a need to explore for potential locally available plants as protein source to lessen feed cost and increase the profit of duck raisers (Lacayanga, 2015). Trichanthera (*Trichanthera gigantea*), also known as Nacedero, can be considered for this purpose. It is a fodder tree that adapts well in tropical conditions, grows easily between plantation crops. Its protein content ranges from 17% to 22% on DM basis and has high calcium content compared to other fodder trees (Rosales, 1997; Garcia *et al*., 2008). Therefore, the study was conducted to assess the proximate composition, calcium, phosphorus and energy value of Trichanthera and its effects on egg production, fertility and hatchability when used as part of the ration of IPMD on early lay performance.

MATERIALS AND METHODS

A total of 108 25-week old IPMD with an average weight of 1.50 kg were used in the study. They were randomly assigned to three experimental treatments following Completely Randomized Design (CRD). Each treatment had three replicates with ten ducks and two drakes for each replicate. The experimental treatments were: 1) Basal diet (BD) only, 2) BD + 50 g fresh Trichanthera leaves/duck/day and 3) BD +100 g fresh Trichanthera leaves /duck/day.

Green Trichantera leaves were gathered using pruning shear. After harvest, the leaves were immediately chopped and offered together with the basal diet. The basal diet (Table 1) was least-cost formulated to contain the recommended nutrients for laying ducks for optimal performance (Datuin, 2003). The diet was in mash form and was mixed using a rotary-type electric feed mixer.

Dried samples of 150 g Trichanthera were placed in separate zip-lock plastic bags marked and sealed and were sent by courier service to UPLB for proximate, energy, calcium and phosphorus analyses.

To calculate the overall ADG and uniformity, IPMD were weighed individually at d 0 (start of the experiment) and at d 49 (end of the experiment). The uniformity of the IPMD was determined at the initial and final day of the study. It was calculated by getting the weight of the ducks plus or minus 10% of the mean body weight over the number of ducks weighed multiplied by 100. Total feed offered and feed refusal at the end of each period was also weighed. Additionally, feed spillages from the drinkers and feeders were recovered to calculate for overall ADFI. To calculate for overall ADFI of Trichanthera, leaves left at the end of the day were weighed. FCR was calculated by dividing ADFI with the egg mass. Egg mass was calculated by multiplying egg weight by hen-day egg production.

Table 1. Ingredient and nutrient composition (as fed basis) of duck layer diet.

Item	Price/kg (Php)	Basal Diet
Ingredient, %		
Yellow Corn	17.00	53.27
Soybean meal, USHP	40.00	26.82
Rice bran, D1	13.00	4.21
Molasses, coarse	18.00	4.41
Palm oil, refined	65.00	1.00
Limestone, coarse	7.00	4.00
Limestone, fine	6.00	3.81
Salt	7.00	0.35
Monodicalcium phosphate	30.00	1.39
Vitamin premix[1]	975.00	0.03
Mineral premix[2]	109.00	0.15
Choline chloride	93.00	0.10
DL-Methionine	224.00	0.11
L-lysine	75.00	0.30
Ethoxyquin	325.00	0.02
Toxin binder	19.00	0.02
Total	100.00	100.00
Calculated composition, %		
ME (kcal/kg)	--	2700
CP	--	18.00
Crude fiber	--	4.00
Crude fat	--	2.42
Met	--	0.40
Met+Cys	--	0.71
Lys	--	1.22
Thr	--	0.67
Trp	--	0.21
Ca	--	3.50
P, available	--	0.40
Diet Cost/kg, Php	--	24.53

[1]The vitamin premix provided the following quantities of vitamins per kg of complete diet: vit. A, 65,000,000 IU; vit. D3, 5,000,000 IU; vit. E, 100,000 mg; vit K3, 10,000 mg; vit. B1, 10,000 mg; vit. B2, 27,000 mg; vit. B6, 15,000 mg; vit. B12, 200 mg; niacin, 200,000 mg; folic acid, 5,000 mg; pantothenic acid, 60,000 mg; and biotin, 1,000 mg.

[2]The mineral premix provided the following quantities of minerals per kg of complete diet: iron, 80,000 mg, copper, 10,000 mg, zinc, 80,000 mg, manganese, 70,000 mg, cobalt, 200 mg, selenium, 200 mg and iodine, 800 mg.

Egg composition and egg quality were estimated based on hen-day egg production, albumen height, yolk color score and weight, shell weight and albumen weight. A total of 3,463 eggs were collected every 6:00 am and weighed to estimate the egg weight. A total of 72 eggs were evaluated for egg composition and egg quality in the last two weeks (post-peak production) of the study. Furthermore, the fertility of eggs was determined during the first candling (9th day of incubation) using a candler. A second candling (18th day of incubation) was also done before hatchability. The newly hatched ducklings were individually classified into normal or with abnormalities (e.g. navel condition and physical deformities).

The cost per kilogram of Trichanthera was based on the time devoted in gathering of leaves. Income over feed cost (IOFC) was calculated as the difference of the total sale value of eggs and cost of feeds consumed per hen-housed.

Data were analyzed using ANOVA of STAR (Statistical Tool for Agricultural Research). The least-significant differences (LSD) test was used to determine significant differences between treatment means at $P = 0.05$.

RESULTS AND DISCUSSION

The analyzed proximate, energy, calcium, and phosphorus values (Table 2) generally typified the chemical composition of Trichanthera and were in most cases in agreement with those in the literature (Table 3). Results indicate that the crude protein and calcium in Trichanthera were of main interest in the study where it was expected to influence eggshell synthesis by IPMD. The amount of crude protein was high and consistent with those in the literature (Jaya *et al*., 2008). It is also regarded that Trichanthera contains a high amount of essential amino acids and that most of the crude protein is true protein (Rosales 1996; Rosales, 1997). On the other hand, the crude fiber and gross energy values were lower. It

Table 2. Proximate, energy, calcium and phosphorus content of Trichanthera leaves on DM basis.

Item	Amount
Proximate, %	
Moisture	6.70
Ash	20.15
Crude protein	19.59
Crude fiber	11.89
Crude fat	2.33
Nitrogen free extract	39.34
Calcium, %	4.47
Total phosphorus, %	0.25
Energy, kcal/kg	
Gross energy	3665
Metabolizable energy	2310

Table 3. Published proximate or chemical composition of Trichanthera.

Parameters	A[1]	B[2]	C[3]
Proximate, %			
Dry matter	20.00-26.90	78.90	88.44
Moisture	-	-	11.56
Crude protein	17.90-22.50	23.90	18.21
Crude fiber	-	23.80	12.50
Ether extract	-	2.50	2.66
Ash	-	24.30	21.80
Nitrogen-free extract	-	25.50	-
Ether extract	-	2.50	2.66

[1]Tricanthera values as fed; [2, 3]-Tricanthera values in DM basis
A-Rosales (1997); B- Sarwatt *et al.* (2003); C- Jaya *et al.* (2008)

is recognized that these differences can be attributed to samples used for analysis, which had been influenced by season, variety, fertilization, irrigation, soil type and environment (Oelberg, 1956; Adebayo *et al*., 2017) where the Trichanthera was grown.

There were no significant (*P*>0.05) differences among groups regarding the production parameters, except for daily feed intake in which lower value (*P*<0.01) was observed for IPMD in the control group and IPMD offered 50g /duck/day compared with their counterpart (Table 4). Final weight of birds fed without Trichanthera was significantly different (*P*=0.01) with those fed with Trichanthera. Uniformity was comparable among groups.

Results indicate that the differences in feed intake could be explained per unit change in Trichanthera intake (McDonald *et al*., 2010). It was also considered that *ad libitum* feeding influenced the feed consumption of IPMD under litter-floor management, yet it did not deteriorate egg production and egg size (Avens *et al*., 1979).

The significantly lower final weight of the IPMD fed with 100 g Trichanthera was apparently associated with other factors like physiological since IPMD were layers, thus, they were not required to be overfed. These ducks had the highest egg production, with satisfactory FCR. As such, factor from Trichanthera can be ruled out, especially so that their intake for Trichanthera was low. However, uniformity of body weight of not less than 70% is regarded as satisfactory in poultry (Welten, 2016).

There were no differences in quality and composition of eggs between IPMD fed with and without Trichanthera. Statistical analyses show that the kind of ration did not significantly (*P*>0.05) influence egg classification (Table 5). This finding indicated that Trichanthera as part of the IPMD ration did not influence the quality of yolk, albumen and eggshell, irrespective of the feeding level. Likewise, Trichanthera was not a factor for yolk color. Trichanthera had a moderate amount of CP and a very high amount of calcium. It was evident that at the level of intake of Trichanthera, the IPMD had egg material and shell synthesis including deposition of yolk pigment comparable without Trichanthera.

Results indicate that there were no toxic factors from Trichanthera that negated egg size. It was noteworthy though that there was a preponderance for large size eggs, irrespective of the IPMD ration. Furthermore, dietary factors such as energy, methionine and linoleic

Table 4. Comparative production performance, body weights and uniformity of IPMD with and without fresh Trichanthera leaves.

Item	Treatment			*P*-Value
	Without	50g/ duck/ day	100g/ duck/ day	
Production performance				
HD egg production, %	77.92	78.01	85.88	0.13
ADFI + Trichanthera ADFI, g/day	171.07[b]	170.28[b]	180.00[a]	0.01
FCR (Feeds + Trichanthera), g/day	3.93	5.24	3.99	0.43
Egg weight, g	68.96	66.92	68.09	0.30
Egg mass, g	54.09	52.92	58.89	0.15
Body weights and uniformity				
Initial weight, g	1478	1422	1611	0.07
Initial weight uniformity ,%	66.67	77.78	55.56	0.70
Final weight, g	1533[a]	1437[b]	1398[b]	0.01
Final weight uniformity, %	100.00	77.78	88.89	0.58
Gain in weight, g/day	9.23	7.98	2.31	0.75

[ab] Within a row, means without a common superscript differ ($P<0.05$).

which affected egg size, were comparable among diets (March and MacMillan, 1989; Ruan *et al*., 2015; Fouad *et al*., 2016).

The fertility and hatchability of eggs were not affected ($P>0.05$) by the inclusion of Trichanthera (Table 6). There were no differences in the classification of ducklings regarding their quality and weight. The present data indicate that the egg fertility of the IPMD exceeded 80% for mallard ducks (PCARRD, 2006), irrespective of their ration. Hatchability can be influenced by breed or strain of ducks, temperature and humidity and turning of eggs during incubation (King'ori, 2011). The breed can be an utmost considered factor such that heavy breeds like ducks, were less efficient in the deposition of thiamine into the egg which was necessary for the embryonic development and hatchability (Wilson, 1997). However, Trichanthera did not affect embryonic mortality and hatchability yet it was unclear what particular factor influenced the low hatchability in the present study.

The results present a high percentage of good quality hatchlings indicating the quality of their ration. Good quality chicks hatched from eggs weighed at least 40 g, but good uniformity could be obtained on the average from eggs weighing 48 g-50 g (for breeder standards). It can also be determined by having clear and bright eyes, homogenous size, alert and free from leg deformities with a clean navel (Cazaban, 2005). Their weight was comparable to the initial weight of Pekin (47.05 g) and Muscovy (46.39 g) ducklings (Rashid *et al*., 2009).

The IPMD fed with and without Trichanthera did not differ in eggs produced. However, IPMD fed with 100 g/duck/day had the highest sale value of eggs but had the highest feed consumed. Overall, the highest income over feed cost (IOFC) can be derived

Table 5. Comparative quality, composition and classification of egg produced from IPMD with and without fresh Trichanthera leaves.

Item	Treatment			*P*-Value
	Without	50g/ duck/ day	100g/ duck/ day	
Egg quality and composition				
Albumen height, mm	8.32	8.51	8.34	0.83
Albumen weight, g	40.50	40.42	40.00	0.96
Yolk weight, g	23.75	23.08	21.75	0.14
Yolk color score, DSM units	6.67	7.63	7.25	0.10
Eggshell weight, g	7.79	7.50	7.33	0.22
Egg weight, g	72.05	71.00	69.09	0.48
Egg classification, %				
No weight (<47 g)	0.20	0.10	0.00	0.56
Small (48-56 g)	1.02	2.00	2.65	0.40
Medium (57-65 g)	18.78	29.36	22.21	0.31
Large (66-74 g)	57.55	55.96	55.21	0.84
Extra-large (75-83 g)	21.94	12.49	19.56	0.40
Jumbo (84≥)	0.51	0.10	0.37	0.28

Table 6. Comparative reproductive performance of IPMD with and without fresh Trichanthera leaves.

Item	Treatment			*P*-Value
	Without	50g/ duck/ day	100g/ duck/ day	
Fertility and hatchability, %				
Fertility	89.66	95.17	88.92	0.09
Hatchability	69.00	72.35	72.20	0.90
Classification and weight of ducklings				
Good quality hatchlings, %	83.63	100.00	95.52	0.38
Body Weight, g	44.38	44.13	45.12	0.63

from eggs produced by IPMD fed with 100 g Trichanthera with a value of Php 47.43 per duck compared with its counterparts (Table 7). The results indicated that Trichanthera is affecting egg synthesis to attain optimal sale value of eggs. Predictably, the feed cost increased with decreasing Trichanthera, but there is an economic advantage of including Trichanthera to a diet which in turn be profitable when it will be adopted into a larger farm scale. However, it was only based on the production for the first seven weeks from the point of lay.

In conclusion, Trichanthera leaves contained moderately high crude protein, high

Table 7. Income over feed cost of IPMD with and without fresh Trichanthera leaves.

Item	Treatment			*P*-Value
	Without	50g/ duck/ day	100g/ duck/ day	
Eggs produced[1], pcs.	38	39	42	0.32
Sale value of eggs[2], Php	247.00	253.50	273.00	0.21
Feed consumed[3], kg	8.41[a]	7.96[b]	8.60[a]	<0.00
Feeds consumed, PhP	206.39[a]	195.35[b]	211.01[a]	<0.00
Trichanthera consumed[4], kg		1.30	1.22	
Trichanthera consumed, Php		15.56	14.56	
Feeds and Trichanthera consumed, Php	206.39[b]	210.92[b]	225.57[a]	<0.00
IOFC, PhP	40.61	42.58	47.43	0.11

[1]Average egg production per bird for 7 weeks.
[2]Suggested retail price per egg is based on Paul's Balut Industry as of January 2018. Price per fresh egg is PhP 6.50.
[3]Average feed consumed per bird for 7 weeks and diet cost per kg is PhP 24.53.
[4]Trichanthera cost per kg is PhP 12.00 but may vary depending on the number of chopping hours of Trichanthera.
[ab] Within a row, means without a common superscript differ ($P<0.05$).

calcium and low in energy. Trichanthera as part of the ration supported satisfactorily the production and reproduction performance of IPMD. Moreover, feeding Trichanthera increased IOFC.

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