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Growth performance of mallard duck fed with ariwat (*Tetrastigma harmandii* Planch) leaf meal

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Abstract

The study was conducted to evaluate the growth performance of mallard ducks fed with ariwat (*Tetrastigma harmandii* Planch) leaf meal. A total of 200 3-day old ducks were distributed to 5 dietary treatments and replicated four times with 10 ducks per replication laid out using the complete randomized design (CRD). The study's findings show that the nutritional content of ariwat leaves is 12.78% crude protein, 25.33% crude fiber, 3.97% crude fat, 17.75% moisture, 20.18% ash, and mineral analysis shows 1.07% calcium and 0.76% phosphorus. The various levels of ariwat leaf meal have no significant effect on mallard ducks' body weight, gain in weight, total feed consumed, FCR, or FCE. However, including 12% ariwat leaf meal in the mallard ducks' ration resulted in an average return of Php 154.08, indicating the possible usage of ariwat as a feed ingredient in mallard ducks, and therefore recommended.

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Introduction

Duck meat and eggs are one of the most widely consumed animal origin food in various parts of the world, across a wide variety of cultures, traditions and religions (Ismoyowati and Sumarmono, 2019). In the Philippines, duck production is highly profitable due to the increasing demand for various types of duck meat and eggs, contributing directly to Standard Development Goals (SDG) 2: Zero Hunger (Lagasca *et al.*, 2023). Although, they rank only second to chicken in terms of egg and meat production, its importance in the Philippine poultry industry lies on its provision of employment and income-generating opportunities for Filipinos, particularly those in the rural areas (PCAARRD, 2016). This supports SDG 1 (No Poverty), as duck production is essential in creating livelihoods and alleviating poverty, particularly in rural areas where other income opportunities may be limited. Ducks are considered one of the most adaptable avian species that are of commercial significance due to their ability to subsist under a wide range of climatic and nutritional conditions. Ducks are shown to be relatively hardy and resistant to common avian diseases, and feed on a variety of food (Chang *et al.*, 2003).

The Pateros Mallard duck, locally known as pato or itik, is the most popular breed raised in the Philippines. It is prized for its high egg production, non-sitting behavior, and large egg size. With black, brown, or gray plumage, it can lay around 175 eggs per year. According to Chang *et al.* (2005), 90% of duck egg production is used for balut making. While some ducks are raised for meat, demand is low due to their tough, coarse texture and fishy taste.

According to the Philippine Statistics Authority (PSA) report for 2024, the total duck population as of October 1, 2024, was 5,908 birds. This marks a decrease of 27.87% compared to the 8,191 ducks recorded on the same date in 2023. Mallard duck production in resource-limited areas is hindered by several feeding challenges. High costs of commercial feed, which comprises grains, proteins, and supplements, can significantly impact farmers' profitability. Moreover, limited access to quality feed materials, especially during off-peak seasons or in regions with underdeveloped agriculture; can lead to nutrient deficiencies and reliance on less desirable or costly alternatives (Karangiya *et al.*, 2016). This may be attributed to the increasing prices of raw materials such as corn and soybean, which are the base ingredients for most concentrated diets. According to Goromela (2009), feed costs are about 70% of the total production costs. Due to the growing demand for poultry products, challenges in the availability of feed ingredients hinder successful poultry production. To address this concern, the potential of novel ingredients for use in feed formulation needs to be tapped and promoted to increase productivity (Teves *et al.*, 2016).

To improve and sustain the poultry industry's sustainability and alleviate rising feed costs, researchers are exploring alternative and affordable feed ingredients that are sourced locally.

This aligns with the findings of Melesse *et al.* (2017), who emphasized the potential of such resources to address the industry's challenges. In line with this research, Nor *et al.* (2022) suggest that indigenous leaves could provide a sustainable and cost-effective solution for poultry nutrition.

Ariwat (*Tetrastigma harmandii* Planch), which are native in Philippines, have demonstrated potential as a multi-purpose ingredient for various applications, including food supplements, fertilizers, and animal feed. Nutritional analyses have revealed a substantial concentration of essential nutrients in both young and mature leaves. These leaves are rich in macronutrients such as crude protein (3.80%), crude fat (1.37%), and crude fiber (5.20%). Additionally, they contain significant amounts of micronutrients, including nitrogen (1.99%), phosphorus (0.18%), potassium (3.28%), calcium (0.30%), manganese (28 ppm), iron (207 ppm), zinc (41 ppm), and copper (9 ppm) (Opeña *et al.*, 2021). Ariwat leaves can be used as alternative to commercial feed, and a potential solution to high feed cost. Utilization of such resources, especially in regions with limited access to

imported feed ingredients can help duck raisers to improve their profitability and remain competitive in the market.

Additionally, incorporating ariwat leaf meal into mallard duck diets can help to reduce the carbon footprint associated with feed production and transportation. By using locally sourced feed ingredients, farmers can decrease their reliance on long-distance transportation, which can reduce greenhouse gas emissions. Thus, optimization of ariwat can contribute significantly to sustainable agriculture and the achievement of several Sustainable Development Goals (SDGs). By incorporating this local, indigenous resource into their feed, farmers can promote responsible consumption, reduce environmental impact, and contribute to food security and climate action. Utilizing indigenous resource for animal feed reduces waste and promotes resource efficiency, thus aligning with SDG 12 (Responsible Consumption and Production). It also contributes to SDG 2 (Zero Hunger) by increasing food security through improved animal productivity and potentially supports SDG 15 (Life on Land) by promoting sustainable agricultural practices.

Materials and methods

Two hundred 3-day old ducks were randomly distributed to five (5) treatments and replicated four times with 10 ducks per replication. The ducks were fed with 5 dietary treatments of ariwat leaf meal (ALM) which described as follows: Treatment 1- 0% ALM, Treatment 2- 3% ALM, Treatment 3- 6% ALM, Treatment 4- 9% ALM, and Treatment 5- 12% ALM.

The experimental poultry house was designed wherein the experimental animals was reared under complete confinement production system with a total area of 168 meters square subdivided into 20 pens with a 1 meter hallway. The height of the building from floor to ceiling is 2 meters and the floor area per pen is 1.2 × 3 meters each. It was established with the use of locally available materials such as lumber, black canvass for the roof, plastic net, bamboo, sacks and gabion wire for the division of pens, and other usable materials.

Proper hygiene and sanitation were observed throughout the study. All facilities and other materials such as feeders and drinkers were cleaned and disinfected with disinfectant diluted in water following the manufacturer's guidelines before the start and twice a week during the study, this was done to eliminate the disease-causing microorganisms and prevent the birds from the diseases.

Fresh ariwat leaves was harvested at various locations within the locality. The collected leaves were thoroughly cleaned and air dried using a plastic net after harvested. The dried leaves are then selected by removing small branches and dirt and then shredded using an electric shredder machine. Sample was sent to DA-CVIAL, Tuguegarao City for the proximate and mineral analysis of the leaves. The shredded ariwat leaves are weighed using a digital scale and thoroughly mix up with other feed formulation using the appropriate amount of ariwat leaves for each treatment.

The experimental diet was formulated to meet the recommended nutrients for mallard duck following the standard set by PCCAARD Philippine Recommends for Poultry and Livestock Feed Formulation.

The ducks were fed *ad libitum* on the first to third week and switched to restrict feeding on the fourth week following the Philippine recommends feeding guide of ducks.

The introduced feed was weighed and recorded daily in each pen for every treatment and the left-over feed was also weighed and recorded. The drinking water of the ducks were made fresh and available at all times.

Data gathered

The growth performance of mallard ducks in 5 dietary treatments were evaluated in terms of body weight, gain in weight, feed consumption, feed conversion ratio and feed conversion efficiency.

The income over feed and duck cost was computed to determine the economic profitability of the ducks per treatment. All data gathered was analyzed using the Analysis of Variance following Complete Randomized Design. The statistical software for Agricultural Research (STAR 2.0) was used to analyse the data gathered.

Results and discussion

The proximate and mineral analysis was done at the Department of Agriculture-Cagayan Valley Integrated Agricultural Laboratory, Tuguegarao City. Proximate analysis revealed nutritional content of ariwat leaf meal with 12.78% crude protein, 25.33% crude fiber, 3.97% crude fat, 17.75% moisture, 20.18% ash and mineral analysis with 1.07% calcium and 0.76% phosphorus. The nutritional and mineral analysis test method and reference method and nutritional contents is shown in the Table 1.

There were no significant differences among the treatments in terms of final weight, total gain in weight, FCR, and FCE of the broilers fed with different levels of ariwat leaf meal.

Non-significant differences were observed among the treatments on the final weight of the mallard ducks with a mean value ranging from 748.3 to 772.475grams. Treatment 1(0% ALM), Treatment 2 (2% ALM), Treatment 3 (4% ALM), Treatment 4 (6% ALM), Treatment 5 (8% ALM), obtained a final weight with a mean value of 748.3 grams, 772.475 grams, 758.65 grams, 736.725 grams and 767.325 grams respectively. This indicates that all the treatments had the same effect on the final weight of the experimental animals.

The total gains in weight of the experimental animals among all treatments are comparable with each other. Numerically, Treatment 2 (2% ALM) obtained the highest total gain in weight with mean value of 666.98 grams but not statistically significant among T1 (0% ALM) which obtained a mean value of 646.15 grams, T3 (4% ALM) with a mean value of 652.38 grams, T4 (6% ALM) with a mean value of 630.97 grams and T5 (8% ALM) which obtained a men value of 659.4 grams indicating a comparable performance between the treatments.

Statistically, the cumulative feed consumption of the mallard ducks fed with different levels of ariwat leaf meal showed a non-significant difference among the treatments with a mean value ranging from 1990.13 grams to 2062.83 grams. The treatment 2 with 2% ariwat leaf meal obtained the highest feed consumption among the treatments while the treatment 1 with 0 % of ariwat leaf meal has the lowest feed consumption in between the treatments.

Non-significant differences were observed among the treatments in terms of FCR of the experimental animals, where T1 (0% ALM) and T2 (2% ALM) had the same mean value of 3.09 which are also not significantly different with T3 (4% ALM), T4 (6% ALM), and T5 (8% ALM) with mean values of 3.16, 3.2, and 3.12 respectively. This shows that, feeding ariwat leaf meals had no significant effect in terms of FCR (Table 2).

There were also non-significant differences among all treatments in terms of FCE with a mean value ranging from 31.28 to 32.45. Treatment 1 numerically the highest FCE with a mean value of 32.45 followed by Treatment 2 with a mean value of 32.33, which is also not significantly the same with Treatment 5 and Treatment 3 which obtained a mean value of 32.04 and 31.68 and Treatment 4 with the lowest mean value of 31.28.

The insignificant differences in all growth performance parameters of the mallard ducks specifically in terms of final weight, total gain in weight, total feed consumed, FCR and FCE indicates the potential of ariwat leaf meal inclusion on feed formulation of mallard ducks.

Table 1. Proximate and mineral analysis test method

Proximate and mineral analysis	Test method	Reference method	Nutritional contents %
Crude protein	Semi-automatic Kjeldahl method	AOAC official method 984.13	12.78
Crude fiber	ANKOM filter bag technique	In-house method	25.33
Crude fat	ANKOM filter bag technique	In-house method	3.97
Moisture	Gravimetric method	AOAC official method 934.0	17.75
Ash	Gravimetric method	AOAC official method 942.05	20.18
Calcium	Atomic absorption	AOAC official method 368.08	1.07
Phosphorus	Spectrophotometry method	AOAC official method 965.17	0.76

The temperature recorded was 250C±3 and a relative humidity of 40- 60%

Table 2. Growth performance of mallard ducks fed with ariwat leaf meal (ALM) (g per bird)

Production performance	Treatments of ALM levels					
	1	2	3	4	5	CV (%)
Initial body weight (g)	102.15	105.50	106.25	105.70	107.90	6.05
Final body weight (g)	748.3	772.475	758.65	736.725	767.325	3.79
Total gain in weight (g)	646.15	666.98	652.38	630.97	659.4	4.26
Total feed consumed (g)	1990.12	2062.82	2059.32	2016.95	2059.72	2.65
FCR	3.09	3.09	3.16	3.2	3.12	3.43
FCE (%)	32.45	32.33	31.68	31.28	32.04	3.48

Table 3. Return above feed and duck cost (per bird)

Particulars	T1	T2	T3	T4	T5
Final weight, (g)	748.3	772.475	758.65	736.725	767.325
Return for ducks, (Php)	224.49	231.74	227.60	221.02	230.20
Cost of ducks, (Php)	40.00	40.00	40.00	40.00	40.00
Price of mallard duck per kilo, (Php)	300.00	300.00	300.00	300.00	300.00
Cost of starter , (Php)	42.8	40.9	40.2	38.0	37.0
Total amount of ariwat, (kg)	---	0.56	1.12	1.68	2.24
Cost of ariwat, (Php)	---	2.8	5.6	8.4	11.2
Total feed consumed kg	1.990	2.063	2.059	2.017	2.060
Total cost of feed, (Php)	85.22	84.43	82.73	76.67	76.12
Income over feed and duck cost	139.27	147.31	144.86	144.35	154.08

The result shows that feeding rations with or without ariwat leaf meal produces comparable final weight, total gain in weight, total feed consumed, FCE and FCR.

The income over feed and duck cost is presented in Table 3. The income was computed based on the final weight of the ducks which is multiplied by the prevailing price of mallard ducks at 300 Php/kg less the expenses of feeds and ducks. The income over feed and duck cost obtains the highest return at Treatment 5 (12%ALM) with 154.08 Php, followed by Treatment 2 (3%ALM) with 147.31 Php, Treatment 3 (6% ALM) with 147.31 Php, Treatment 4 (9%ALM) with 144 .35 Php, and Treatment 1 with the lowest return of 139.27 Php.

Conclusion

The study's concluded that the nutritional content of ariwat leaves is 12.78% crude protein, 25.33% crude fiber, 3.97% crude fat, 17.75% moisture, 20.18% ash, and mineral analysis shows 1.07% calcium and 0.76% phosphorus. The various levels of ariwat leaf meal have no significant effect on mallard ducks' body weight, gain in weight, total feed consumed, FCR, or FCE. However, including 12% ariwat leaf meal in the mallard ducks' ration resulted in an average return of Php 154.08, indicating the possible usage of ariwat as a feed ingredient in mallard ducks, and therefore suggested.

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