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Research Article

Supplementary Effect of Ensiled Ficus Fruit [*Ficus nota* (Blanco) Merr.] on The Growth Performance in Mallard Ducks [*Anas platyrhynchos* (Linnaeus), 1758]

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ABSTRACT

A study was conducted to determine the effects of supplementing the ensiled ficus (EFF) fruit on the growth performance of mallard ducks. One hundred seventy-five (175) day old straight-run mallard ducklings were assigned with the following diets: A (control), B (5% EFF inclusion), C (10% EFF inclusion), D (15% EFF inclusion), and E (20% EFF inclusion) following Randomized Complete Block Design (RCBD) with cage location as blocking factor. Data were run in general linear model of SAS v.9.4. TS1M8 and difference among treatments were determined using trend comparison and declared significant at α=0.05. Results showed the ensiling can improve the chemical composition of the ficus fruits and make it favorable to mallard ducks when supplemented. The effect of supplementing EFF in mallard ducks showed a general increase in VFI with higher inclusion rate of EFF with comparable BW and WG. However, FCR was a bit higher with ducks given increasing EFF supplement. Lastly, RFCC was also lower in diets with EFF compared to the control group.

Keywords*: Ensiled, Ficus fruits, Growth performance, Mallard ducks*

Introduction

Huge quantities of cereal grains are utilized as source of energy in the ration making this as the most expensive component of feedstuffs for livestock and poultry. This brings opportunity to utilize non-traditional feed resources to partially close the feed supply shortfall. Among these non-traditional feed resources include the ficus fruit (*Ficus Nota* (Blanco) Merr*,)* which is widespread in the tropical countries. Ficus fruits is characterized as round, green, or brownish fruits grown in a dense cluster all over the trunk and branches. When ripe, the fruits can be eaten raw, while the soft, young leaves can be prepared like spinach (Polinag 2003). It is known for their therapeutic use. The tree's leaves, fruit, bark, roots, and latex are abundant sources of naturally occurring antioxidants, particularly phenolic compounds, and flavonoids, which are crucial in preventing a variety of diseases and conditions linked to oxidative stress, such as cancer, cardiovascular

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diseases, and neurodegenerative disorders (Sirisha et al. 2010). Unfortunately, the nutritional value of the Ficus fruit is not yet well known and studied. The available research papers for Ficus fruit focused on its medicinal components. However, some ficus species are currently studied for their potential contribution in animal feeding. In the study of Santiago, & Mayor (2014) on Pakiling (*Ficus odorata*), they claimed that it contains a possible functional food ingredient because of its high levels of dietary fiber, carbohydrates, proteins, and minerals that are pertinent to the creation of probiotic nutraceuticals. Another study of Wendeln et. al., (2000) reported that *Ficus bullenei* and *Ficus yoponensis* have high concentration of carbohydrates and metabolic energy. Moreover, due to a higher concentration of phytochemical compounds, all ficus plant species possess potent antioxidant. The presence of numerous bioactive phytochemical compounds plays an important role in livestock and poultry nutrition and have significant medicinal value. Principal phytochemicals found in ficus species include polyphenols, phenolic acids, flavonoids, anthocyanins, glycosides, carotenoids, and water-soluble vitamins (Nawaz et. al., 2020). The study of Mapatac, (2015) on the ficus fruits concluded that it contains bioactive compounds like flavonoids, alkaloids, formic acid, glycosides, saponins, and tannins and may be potentially source of antibiotics.

The use of plant-based feed material is still restricted due to the presence of various antinutritional factors such as phytic acids, trypsin inhibitors, oxalates, saponins, tannins, etc. (Kaur, et al., 2012). Ficus species are known to have antinutritional contents. According to the evaluation of Bamikole, (2004) on five species of ficus namely; *F. mucoso, F. thonningi, F polita, F. religiosa,* and *F. benjamina* it contains tannin, saponin, phytic acid, and oxalic acid. The basic approach to reduce the antinutritional factors is through fermentation like ensiling prior application to the animals.

As there are limited literature available on the utilization of ficus fruit in poultry, particularly ensiled form as feed in ducks, it is therefore worth investigating to determine its potential, capitalizing in its inherent bioactive properties. Hence, this study was conducted to changes in chemical composition of raw and EFF, and to determine the effect of supplementing EFF in the growth performance and economics in mallard ducks.

Materials and Methods

Animal Research Ethics

The animals used in this study followed the procedures based on the Institutional Animal Care and Use Committee (IACUC).

Source and Collection of Ficus Fruits

Ficus fruits were sourced within Baybay City, Leyte, Philippines A botanist was consulted for verification of the species of ficus tree. The collected ficus fruits were washed and ensiled for at least 21 days following the ratio 2 kg fruits and 1 kg molasses (Adajar, 2021)

Procurement and Duckling management

A total of 175-day old, unsexed ducklings were purchased from a reliable source. These birds were fully vaccinated upon procurement. Before the arrival of the day-old ducklings, the environment was prepared by putting commercial feed on the feeder. To reduce stress condition during transportation, the newly arrived ducklings received an appropriate dose of dextrose and multivitamin powder, dissolved in the drinking water. The duck house was installed with an artificial light bulb for 15 hours duration to keep them warm. These were distributed to assigned cages. The design of the cage was appropriate for the environmental circumstances given in the duck study site. To improve biosecurity, the area was properly cleaned and disinfected. About five (5) days of vacancy were observed to allow the cages to further dry. The cage was measured 150 cm x 100 cm x 150 cm to accommodate five (5) ducklings per cage for three (3) months to determine the growth performance of the ducklings. The cages were also installed with rice hulls as litter materials, feeder, and waterer. Feeds were given twice a day every morning and afternoon using the prescribed treatments. Ensiled ficus fruit was supplemented in the commercial ration for starter and grower ducks.

Dietary Treatments and Design.

A total of 175 -day old ducklings were used in this study. The experiment was laid out in Randomized Complete Block Design (RCBD) with seven (7) blocks based on location of cages and five (5) ducks per cage. The following were the dietary treatments of this study; A – Commercial feed alone; B – 5% EFF; C – 10% EFF; D – 15%EFF; and E 20% EFF.

Chemical Assays of Raw and EFF

The raw ficus fruits (RFF) and EFF were analyzed and determined the dry matter (DM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF), and Ash.

Statistical Analysis

Data were analyzed in one-way analysis of variance (ANOVA) in RCBD using general linear model of SAS 9.4 TS1M8 edition. Post hoc analysis was conducted using trend comparison and declared significant at P<0.05. The results were presented as mean values and standard error of the means.

Results and Discussion

Chemical Composition

Table 1 shows the chemical composition of Raw Ficus Fruit (RFF) and Ensiled Ficus Fruit (EFF). The chemical analysis of RFF and EFF showed that EFF has the higher %DM (72.5%) compared to RFF (60.26%), higher %CP (4.40%) compared to RFF (1.32%), higher %EE (27.42%) versus to RFF (23.53%), and higher %ash (1.35%) than to RFF (0.15%). However, the neutral detergent fiber (NDF) of RFF was higher at 51.92% compared to EFF (29.74%).

Table 1. Chemical composition of Raw Ficus fruit and Ensiled Ficus fruit

Nutrient Composition	RFF	EFF
DM, %	60.26	72.50
CP, %	1.32	4.40
EE, %	23.53	27.42
ASH, %	0.15	1.35
NDF, %	51.92	29.74

The chemical analysis showed that ensiling of ficus fruit could increase the chemical composition. The ensiling of feed material with the addition of molasses can improved the fermentation and preservation process. The study of El Hajji et al (2022) demonstrated that ensiling of *Ficus indica* with the addition of molasses improved the chemical composition of ficus fruit by reducing the undesirable microorganisms during the preservation process. The reduction in NDF of the EFF compared RFF was also done by the fermentation and preservation process. According to the study of Mciteka (2008), the fermentation of *Fuscicaulis cladode* through ensiling with molasses could reduce the fiber content of the plant.

Growth Performance of the Mallard Ducks
Voluntary Feed Intake

The Table 2 shows the average voluntary feed intake (VFI) of the mallard ducks supplemented with EFF at 5%, 10%, 15% and 20% inclusions compared to the control group. Significant differences were observed in week 2 (p<0.0001) and week 4 (p=0.00124). Both week 2 and week 4 had a linear trend (p<0.0001 and p=0.0232, respectively). In week 6, there was no significant differences observed between the control and EFF supplementation in mallard ducks (p=0.0784). However, when total VFI was taken, significant differences were observed (p<0.0001) in mallard ducks given an increasing level of EFF supplementation. Also, the trend when taken as total VFI was positively linear (p<0.0001) towards higher level of EFF supplementation. This data favorably showed higher VFI among the mallard ducks given a diet supplemented with increasing levels of EFF.

The VFI of ducks is based on the palatability of an animal feed. The Oregon State University (2016) defined palatability as an animal's inclination towards a specific type of feed when given options. The palatability of feed for

animals is only relevant when there is a selection of feed available. It is influenced by aspects like texture, fragrance, juiciness, hairiness, leaf percentage, fertilization, sugar content, and other variables. Since the ficus fruits were subjected to ensiling, it was assured to be more palatable when given to ducks. In the study of Ridla et al., (2015), they concluded that there was an increase in palatability of ensiled rice bran and had significant increase in BW gain and a consequent decreased in water consumption. Ensiling process of feed can increase the palatability by breaking the linkages between the fiber and protein. This was confirmed by an increase in crude protein level as the ensiling length increased (Hang and Preston, 2007). Then the addition of molasses in silages increased palatability (McDonald et. al 2002). This is confirmed by the study of Fasuyi and Olumuyiwa (2012) that ensiling of rice husk before adding to broiler ration had beneficial effect in terms of growth performance and carcass characteristics. Ficus fruit contains antinutritional factor (ANF) and it was the main reason to ensile the ficus fruits before supplementing it to the ducks. Ensiling ficus fruits may reduce or eliminates the ANFs in ficus fruits (Chakraborty et al, 2019). According to Tien et al (2014), ensiled feed material can increase the palatability of feed. They concluded that ensiled banana pseudo-stem improved the feed intake, growth rate, and FCR.

Body Weight, and Weight Gain

The Table 3 shows the body weight (BW) of the mallard ducks supplemented with EFF. As shown, there were no significant differences observed in week 2 (p=0.3604), week 4 (p=0.9478), and week 6 (p=0.7176). Similarly, no differences in weight gain (WG) were observed in mallard ducks at week 2 (p=0.6974), week 4 (p=0.6431), and total WG (p=0.4076) (Table 4). A tendency, however, was seen at week 6 (p=0.0955) with higher inclusion rate (20% EFF) getting higher BW (161.29g).

The supplementation of EFF had no negative effects on the BW and WG on mallard ducks. Studies for foraging birds consuming ficus fruits had a promising result. The study of Tsega et al (2016) confirmed that broilers consuming ficus fruit like *Ficus indica* can improved the ADG, WG, VFI, and FCR. In another study of Belete et al (2016) they concluded that supplementing ficus fruit like *Ficus sycomorus* can enhance the growth performance and egg quality characteristics of layer chickens. The Ficus fruits contain phytochemical compounds (PC) which can enhance the production and performance of a poultry species. The presence of PCs in ficus fruits, such as carotenoids, which are known as one of the most abundant and extensively distributed lipid-soluble pigments with increased product quality and health-promoting benefits, facilitates the inclusion of carotenoids as a feed additive in the chicken diet (Mapatac, 2015). Another PC present in the ficus fruit is antioxidant, it serves as stimulants in poultry, fostering improved health, growth performance, and product quality (Mahfuz et. al., 2021). These PC compounds are enhancing the immune system and growth performance of the bird. However, the weight gain of the ducks was decreasing due to the seasonal molting. Molting season of mallard ducks can cause significant decrease in live body weight (Awad et al. 2014). Since the mallard ducks were housed indoor during the study, they undergo several molting from starter to grower. Rearing ducks indoor could molt several times compared to ducks reared outside and outdoor ducks are much heavier than indoor ducks (Butler and McGraw, 2009). The decreased in daily weight of the ducks was not totally cause by the presence of ANFs may also be due to seasonal molting.

Feed Conversion Ratio

The Table 5 shows the feed conversion ratio (FCR) of the mallard ducks supplemented with EFF compared to control diet. The FCR is the basis of the efficiency of the bird to convert feed in muscle. The goal is to have a lower FCR in a production to achieve better feed efficiency in the birds. As shown, significant differences were observed in ducks supplemented with EFF in week 2 ($p<0.0001$). The trend in week 2 is linear ($p<0.0001$) where A (control) had the lowest FCR (3.90) compared to the diet with EFF supplementation. The FCR of the mallard ducks increased as the inclusion of EFF in-

creased. In week 4, there was no significant differences observed between the control and EFF supplementation in mallard ducks (p=0.6787). Similar observation was noted in week 6 (p=0.3483) with no differences in FCR. However, when overall FCR was taken, a significant difference was observed (p=0.0103) in mallard ducks given increasing level of EFF supplementation. Also, the trend when taken as overall FCR was linear (p=0.0303) with higher level of supplementing EFF having higher FCR values.

The ducks are known to have a capability to consume high fiber feed material due to its complex gastrointestinal tract that can ferment feeds in their cecum. It was perfect to use ducks as the experimental animal to determine its growth performance with EFF. The results showed no comparative advantage of EFF supplementation in mallard ducks in BW, and WG. Likely this was attributed to the presence of ANFs in the ficus fruit which can decrease the growth performance of the ducks. Some ANFs reported in ficus fruit are saponins, tannins, glycosides, and alkaloids (Mapatac, 2015). Tannins have the ability to bind proteins, carbohydrates, and minerals thus, inhibiting the process of digestion and absorption. It can decrease the activity of digestive enzymes by forming complexes (Yegrem, 2021). Saponins reduce the ability of the body to efficiently absorb nutrients and negatively impact the performance of an animal. Saponins have the ability to hinder the absorption of nutrients. Additionally, it has the ability to inhibit the absorption of glucose and volatile fatty acids (Yegrem, 2021). According to the study of Singh et al, (2023), they concluded that tannins and saponins had a negative effect on the growth performance of the animals. They can impair the nutrient absorption, compromised organ function, and other adverse physiological consequences. Glycosides are produced in plant to act as the defensive mechanism against invaders like herbivores, insects, and microorganism (bacteria and fungi). The effect of this in animals may cause severe problem in digestion and absorption. Glycosides can lower the stomach pH which usually denatures the enzymes present in the stomach that are required to activate the harmful precursors (Papanikou, 2019). Another ANF are the alkaloids which are present in plants for protection against predators and regulate their growth. Animals exposed to alkaloids are more likely to experience negative health outcomes, such as decreased appetite, decreased weight, impaired fertility, and mortality. It has the potential to lighten an animal's carcass weight and stunt its development (Coufal-Majewski, 2017). These ANFs can affect the nutrition of the ducks with its presence in the ration. In the study of Adeola and Bedford (2004), they concluded that the addition of ANFs component to high-viscosity wheat-based diet helped alleviate the decline in growth performance, along with reductions in viscosities of the digesta in the duodenum and ileum. This proves that presence of ANFs in animal feeds can cause significant loss in the growth performance and feed efficiency. Meanwhile, fermentation through ensiling of the ficus fruit may have reduced the ANFs, but test to measure extent of ANF reduction in concentration must be performed to validate this claim.

Table 2. Voluntary Feed Intake (g) of the mallard ducks supplemented with varying levels of ensiled ficus fruit

VFI	Treatments					SEM	Treatment	P-value	
	A	B	C	D	E			Linear	Quadratic
Week 2, g	1105.96	1293.22	1358.92	1443.51	1477.70	39.26	0.0001	0.0001	0.2034
Week 4, g	1215.84	1139.56	1328.34	1299.45	1320.76	55.32	0.0124	0.0232	0.5642
Week 6, g	673.40	566.34	720.07	774.68	802.41	64.75	0.0784	0.1022	0.1921
Total VFI, g	2995.19	2999.11	3407.34	3517.64	3600.87	93.81	0.0001	0.0001	0.5198

Table 3. The Body weight (g) of the mallard ducks supplemented with varying levels of ensiled ficus fruit.

BW	Treatments					SEM	Treatment	P-value	
	A	B	C	D	E			Linear	Quadratic
Week 2, g	667.96	709.39	673.89	686.11	674.79	15.46	0.3604	0.7855	0.3517
Week 4, g	974.21	990.25	978.57	977.04	971.32	19.92	0.9478	0.9670	0.6139
Week 8, g	1128.1	1101.25	1107.64	1133.44	1132.61	22.01	0.7176	0.8109	0.2172

Table 4. Weight gain (g) of mallard ducks supplemented with varying levels of ensiled ficus fruit.

WG	Treatments					SEM	Treatment	P-value	
	A	B	C	D	E			Linear	Quadratic
Week 2, g	371.63	383.33	375.21	382.86	365.09	10.46	0.6974	0.5867	0.8469
Week 4, g	306.25	280.86	299.25	290.93	296.54	14.67	0.6431	0.6112	0.4826
Week 6, g	137.76	111.00	138.04	156.41	161.29	13.97	0.0955	0.1742	0.1015
Total WG, g	815.64	775.19	812.5	830.19	822.91	23.06	0.4074	0.3949	0.1769

Table 5. Feed conversion ratio (g) of mallard ducks supplemented with varying levels of ensiled ficus fruit.

FCR	Treatments					SEM	Treatment	P-value	
	A	B	C	D	E			Linear	Quadratic
Week 2, g	3.90	4.39	4.59	4.69	5.16	0.11	0.0001	0.0001	0.0777
Week 4, g	3.85	3.81	4.16	3.81	4.05	0.25	0.6787	0.7920	0.4663
Week 6, g	4.97	5.08	5.31	4.97	5.00	0.35	0.3483	0.7254	0.1004
Overall FCR, g	4.24	4.43	4.69	4.49	4.74	0.11	0.0103	0.0303	0.0656

Economic Analysis

Return Above Feed and Chick Cost

The return above feed and chick cost (RAFCC) and of mallard ducks supplemented with EFF is shown in Table 6 at ₱148.69 RAFCC was obtained in Diet A (control). However, as the level of supplementation increased the amount of RAFCC decreased due to lower dressing weight and higher VFI of the ducks supplemented with EFF compared to control group. It should be noted that the ducks were harvested at grower stage which was considerably young and has not yet reached fattening stage. To extent its feeding may improve further its BW & its RAFCC.

Table 6. Return above feed and chick cost of mallard ducks supplemented with varying level of ensiled ficus fruit in the diet

ITEM	TREATMENTS				
	A	B	C	D	E
Sales of Mallard Duck					
Dressed ducks, Kg	0.74	0.73	0.71	0.70	0.68
Price/Kg DW, Php	450	450	450	450	450
Subtotal, Php	335.15	328.82	319.31	316.06	304.81
Expenses					
Feed Cost/ Kg	136.46	138.82	154.64	158.66	164.07
Chicks/head, Php	50	50	50	50	50
Molasses, L	0	2.38	4.75	7.13	9.50
Subtotal, Php	186.46	191.19	209.39	215.79	223.57
RAFCC, Php	**148.69**	**137.63**	**109.92**	**100.27**	**81.25**

Conclusion

The ensiling can improve the chemical composition of the ficus fruits and make it favorably to mallard ducks when supplemented. The effect of supplementing EFF in mallard ducks showed a general increase in VFI with higher inclusion rate of EFF with comparable BW and WG. However, FCR was a bit higher with ducks given increasing EFF supplement. Lastly, RFCC was also lower in diets with EFF compared to the control group.

Recommendation

To elucidate further effects of EFF, it is recommended to continue the supplementation in later duck stages (fattening, pre-lay and laying) to possibly explore full potential of the bioactive compounds present in Ficus fruit. Bioassays of its inherent ANFs and PCs are also worthy for an investigation in future studies.

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