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Performance Attributes of Broiler Chicken (*Gallus gallus domesticus*) Supplemented with Fermented Jute Leaves (*Corchorus olitorius*) Under Camiguin Condition

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Abstract

The use of antibiotics in broilers as "growth promoters" has been criticized due to its possible role in the occurrence of antimicrobial resistance in humans. This calls for growing organic broilers by supplementing with fermented plant juice using jute leaves in drinking water. This study aimed to evaluate the performance attributes of broiler chickens supplemented with varying levels of jute leaves in drinking water. The experiment was laid out using Completely Randomized Design with four treatments replicated four times. Significant differences among treatment means were further analyzed using the Duncan's Multiple Range test. Results revealed no significant differences ($P > 0.05$) on the Average Daily feed Intake, Average Total Feed intake, Average Daily Water Intake and Average Total Feed Intake, Average Final Live Weight, Average Final Carcass Weight, Total Weight Gain, and Average Daily Gain of broilers. However, the meat quality showed significant differences in taste, texture, odor, tenderness, and overall acceptability but no significant differences in juiciness. It can be concluded that supplementation of fermented jute leaves can influence the texture, tenderness, taste, odor, and overall acceptability of broilers. The growth performance of broilers as supplemented with jute leaves did not differ significantly with antibiotic supplementation. Therefore, fermented jute leaves can be used in lieu of antibiotics to have a safe broiler meat for human consumption.

Keywords: antibiotics, consumption, growth, meat, taste

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Introduction

Poultry industry is among the fastest industries in the Philippines with significant contribution to the country's agricultural sector (Ybañez et al., 2018; Castro et al., 2018). Broiler production in particular is one of the most progressive animal ventures in the Philippines nowadays (Lambio, 2012; Entrepinoys, 2012) but it has numerous challenges including inefficient management and frequent outbreaks of avian diseases and parasites (Tapdasan et al., 2016; Lim et al., 2017; Resplandor et al., 2018). Despite these problems, poultry raising still offers numerous opportunities for success. Chickens are easy to raise and as family enterprise, offers profitable employment and recreation to the members of the family. When managed properly, broiler production, as a business venture, offers substantial financial reward. Nevertheless, poultry industries continue to produce meat and eggs to cater the needs of people.

Many factors are considered to have some positive effects on the growth performance of broilers. The increased weight in meat of birds is considered to be the main objective of every poultry raiser in order to have profitable production. The growth of broilers is enhanced through vitamins, minerals, and antibiotic supplementation. Antibiotics are widely used in broiler production to treat diseases (Landoni & Albarellos, 2015; Diaz-Sanchez et al., 2015a). However, it has been noted that some poultry raisers are applying it in subtherapeutic doses to prevent occurrence of poultry diseases and promote growth in broilers (Lin et al., 2013; Adebowale et al., 2016). Recurrent use of antibiotics in broilers may pose danger to human and animal health (Van Boeckel et al., 2015). Despite the observed improvement in broiler performance, the use of antibiotics as "growth promoters" has been criticized due to their possible role in the occurrence of antimicrobial resistance in humans (Thanner et al., 2016; Hoelzer et al., 2017; Ferri et al., 2017). Use of antibiotics in poultry has been banned in other countries because of this danger (Millet & Maertens, 2011; McEwen et al., 2017). Great impact to consumers' health and environment has been observed and

this led people to find alternatives to raise chicken without antibiotics (Diaz-Sanchez et al., 2015b).

Many alternatives have been thought to substitute the use of antibiotics in animal diet (McAllister et al., 2018). Knowing the detrimental effect of antibiotic use in livestock and poultry, people are trying to buy products from poultry without antibiotic supplementation (Smith-Spangler et al., 2012; Diaz-Sanchez et al., 2015b). Fermented plant juice is one of the recent alternatives used in poultry raising (Miller et al., 2013; Islam et al., 2016; Vinus et al., 2018). Dietary Supplementation with fermented plant juice has been increasing nowadays due to its beneficial effect to humans and animals (Juskiewicz et al., 2017; Gracia et al., 2018). Other farmers are utilizing plant extract as growth enhancer to broilers in order to produce antibiotic-free products from poultry and livestock (Oleforuh-Okoleh et al., 2015; Diaz Carrasco et al., 2016; Dublado et al., 2016). There are researchers today that are using fermented plant juice like "malunggay", *Moringa oleifera* (Dixit et al., 2016), "alugbati", *Basella alba* (Mohsin, 2015), banana (Oleforuh-Okoleh et al., 2015), and other herbs that improved the performance of birds (Vinus et al., 2018).

"Saluyot" (*Corchorus olitorius)* is an edible leafy vegetable classified under the subfamily Grewioideae of the family Malvaceae "Saluyot" or jute plant is notable with huge contribution to human nutrition (Adebo et al., 2018; Dappah et al., 2018) and now has been tried in animals (Oboh et al., 2015; Kunle et al., 2017; Park et al., 2018). "Saluyot" is an edible vegetable considered safe for human and animal consumption and its leaf extract is known for its medicinal and nutritious value (Islam, 2013; Baang et al., 2015; Aliteg, 2015; Roman, 2016; Rodriguez, 2016; Sule et al., 2017; Gani et al., 2018). "Saluyot" is considered by the Philippines' Department of Science and Technology (DOST) as one of the most nutritious vegetables in the Philippines that contains vitamin A, C and E, thiamin, riboflavin, phosphorus, niacin, potassium, iron, folate, proteins, beta carotene, calcium and dietary fiber which the Department of Health has endorsed for consumption (Sulat, 2010). It also cures dysentery, dyspepsia, and cystitis and serves

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as remedy for prolonged labor in pregnant women (Rodriguez, 2016). The remarkable benefits that can be acquired from "saluyot" are not yet tried in broilers but has been tried in other animals. Thus, it is on this aspect that this research study was done to prove the significant effects of varying levels of fermented jute leaves in the performance attributes of broiler chickens under Camiguin condition.

Materials and Methods

Study site

The study was conducted at the Broiler Project of Camiguin Polytechnic State College Institute of Agriculture, Tangaro Catarman, Camiguin. The experiment was carried out from July to August 2017 to evaluate the performance attributes of broilers supplemented with varying levels of fermented Jute leaves in drinking water.

Preparation of fermented jute leaves

The procedure on the preparation of fermented jute leaves is in accordance with the procedure described in Natural Farming Manual (Jensen et al., 2006). The raw materials for fermented jute leaves preparation were gathered and combined in a ratio of 1:1:1 containing 1 kilo of crude sugar, 1 kilo of jute leaves, and 1 gallon of water. The mixture was placed in a container using bamboo pole and mixed thoroughly until the sugar was dissolved. The container was then covered with manila paper and stringed with rubber band. The container was kept in a cool placed for seven days. The juice was filtered and residues were discarded. The plant juice collected was transferred to a dark bottle and stored in a dark and cool place.

Experimental design, care, and management practices

The experimental cages were washed and disinfected before use. Eighty heads of day-old chicks (*Gallus gallus domisticus*) were randomly assigned into four treatments, T1 (control), T2 (5 ml/L of FJL), T3 (10 ml/L of FJL), T4 (15 ml/L of FJL), each with four replications. The study was laid out in 4 x 4 Experimental Layout in

Completely Randomized Design. The broilers were raised for 30 days and provided with uniform management practices. The birds were exposed to light for 24 hours during brooding for two weeks using an incandescent bulb. After brooding, lighting was only provided during night time. Commercial feeds and water with supplements were supplied *ad libitum* throughout the experimental period. Waterer and feederers were washed daily in the morning before use. As preventive measure of New Castle Disease, birds were vaccinated. Dead birds were properly disposed to prevent spread of diseases. Farm sanitation was strictly observed during the conduct of the study.

Determination of broilers' growth performance in response to fermented jute leaves supplementation

The broilers' performance based on its Average Total Feed Intake (ATFI), Average Daily Feed Intake (ADFI), Average Water Intake (ATWI), Average Daily Water Intake (ADWI), Average Final Live Weight (AFLW), Total Weight Gain (TWG), Average Daily Gain (ADG), Feed Conversion Efficiency (FCE), and Average Final Carcass Weight (AFCW) were gathered, determined based on the formula given, tabulated, and analyzed.

Meat quality determination

Determination of meat quality was based on the sensory evaluation of testing panel on the odor, texture, tenderness, taste, juiciness, and overall acceptability of oven -roasted meat. The rating scales of the sensory evaluation were determined based on Hedonic Rating Scale for Meat Quality. The data gathered were recorded, organized, tabulated and analysed.

Data analysis

Test for Significance was measured using the Analysis of Variance (ANOVA) of Completely Randomized Design and Duncan's Multiple Range Test (DMRT) through ASSITAT Computer package.

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Results and Discussion

A. Broiler's performance based on its ATFI, ADFI, ATWI, ADWI

Table 1 shows that T1 and T3 have the highest ATFI of 2.47 kg, followed by T4 with 46 g. T2 has the lowest total feed intake of 2.43 g. Furthermore, it is shown that T1 has the highest ADFI of 83.33 g, followed by T3 with 82.17 g and T4 with 81.9 g. T2 has the lowest ADFI of 80.83 g. T1 has the highest ATWI of 5061 ml, followed by T2 with 4955.25 ml, and T4 with 4923.25 ml. T3 has the lowest ATWI of 4920 ml. Moreover, it shows that T1 has the ADWI of 168.68 ml followed by T2 with 165.16 ml and T4 with 164.11 ml. T3 has the lowest ADWI of 163.99 ml.

Table 1. Broilers' performance based on its ATFI, ADFI, ATWI, and ADWI as supplemented with fermented jute leaves.

	Parameters			
Treatment	**ATFI (kg/bird)**	**ADFI (g/bird)**	**ATWI (L/bird)**	**ADWI (ml/bird)**
1	2.47	83.33	5061.00	168.68
2	2.43	80.83	4955.25	165.16
3	2.47	82.17	4920.00	163.99
4	2.46	81.91	4923.25	164.11
F-test	ns	ns	ns	ns
CV (%)	2.11	2.12	1.79	1.70

ns - Not Significant; CV - Coefficient of Variation
ATFI - Average Total Feed Intake
ADFI - Average Daily Feed Intake
ATWI - Average Total Water Intake
ADWI - Average Daily Water Intake

It was found that varying levels of fermented jute leaves have no significant effect on the performance of broilers based on Average Total Feed Intake, Average Daily Feed Intake, Average Total Water Intake and Average Daily Water Intake. There was no significant difference ($P > 0.05$) between treatment means. The findings implied that the different levels of fermented jute leaves did not influence the performance of broilers based on its ATFI, ADFI, ATWI, and ADWI.

These results agreed with the study of Bostami et al. (2015) who showed no significant effect on the ADFI of boilers when supplemented with fermented pomegranate byproducts as residue of fruit industry. Their findings also revealed that Average Daily feed intake was not significantly affected with fermented Ginkgo biloba and Camelia sinensis-based probiotics. Karangiya et al. (2016) also showed non-significant effect on feed intake when chickens were fed with garlic.

B. Broiler's performance based on its AFLW, TWG, ADG, FCE and AFCW

Table 2 shows that T4 has the highest AFLW of 1.52 kg followed by T2 and T3 with 1.45 kg while and T1 has the lowest AFLW of 1.44 kg. As to the TWG, T4 has the highest weight gain of 1.47 kg followed by T2 with 1.44 kg while T3 and T1 got the lowest weight gain of 1.39 kg. As to the AGD, T2 got the highest of 48 g followed by T3, T4, and T1 with 46 g. With regard to FCE, T1 has the highest value of 1.81 kg. followed by T 3 with 174 kg, T2 with 1.69 kg, while T4 has the lowest value of 1.68 kg. As to AFCW, T1and T4 have the highest mean value of 1.07 while T2 and T4 obtained the lowest mean value of 1.03 kg. The performance of broilers based on Average Final Live weight, Total Weight Gain, Average Daily Gain, Feed Conversion Efficiency, and Average Final Carcass Weight was not significantly affected with the supplementation of fermented jute leaves. It was shown in the statistical Analysis that there was no significant difference ($P > 0.05$) between treatment means based on the performance of birds on its AFLW, TWG, ADG, FCE, AFCW.

In other studies, plant extracts increased significantly the final body weight and daily body weight gain (Hossain & Yang, 2014; Mahejabin et al., 2015; Attia et al., 2017; Alabi et al., 2017) while the study of Belenli et al. (2016) did not show improvement in live body weight of broilers treated with plant products.

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Table 2. Broilers' performance based on its AFLW, TWG, ADG, FCE, AFCW as supplemented with fermented jute leaves.

Treatment	Parameters				
	AFLW (kg)	TWG (Kg)	ADG (g)	FCE (kg)	AFCW (kg)
1	1.44	1.39	46	1.81	1.07
2	1.45	1.44	48	1.69	1.03
3	21.45	1.39	46	1.74	1.07
4	1.52	1.47	46	1.68	1.03
F-test	ns	ns	ns	ns	ns
CV (%)	7.3	7.3	9.88	8.46	3.58

ns - Not Significant; CV - Coefficient of Variation
AFLW - Average Final Live Weight
TWG - Total Weight Gain
ADG - Average Daily Gain
FCE - Feed Conversion Efficiency
AFCW - Average Final Carcass Weight

C. Meat quality

The evaluation of the meat quality of broilers based on its sensory attributes on odor, taste, tenderness, juiciness, texture, and overall acceptability as supplemented with fermented jute leaves is shown in Table 3. The meat quality of broilers on odor showed that T4 had the highest mean of 3.88 followed by T3 of 3.76, T2 of 3.66 while T1 had the lowest mean of 3.53. The taste of broiler meat revealed that T2 had the highest mean of 4.3, followed by T4 of 4.13, T3 of 3.94 while T1 had the lowest mean of 3.68. The data on tenderness showed that T4 had the highest means of 4.18, followed by T2 of 3.88, T3 of 3.65, while T1 had the lowest mean of 3.51. In the texture of broiler meat, T2 had the highest mean of 4.65, followed by T4 of 4.15, and T3 of 4.06. T1 had the lowest mean of 3.62. On the evaluation on the juiciness of broiler meat, T3 had the highest means of 4.15, followed by T2 of 4.12, and T1 of 4.0. T4 had the lowest mean of 3.90. The sensory evaluation on the overall acceptability showed that T4 had the highest mean of 4.52, followed by T2 of 4.5, T3 of 4.35 while T1 had the lowest mean of 4.15.

Table 3. Meat quality based on the sensory attributes of broilers as supplemented with fermented jute leaves.

	Parameters					
Treatment	**Odor**	**Taste**	**Tenderness**	**Texture**	**Juices**	**Overall Acceptability**
1	3.53[b]	3.68[b]	3.51[b]	3.62 [b]	4.0	4.15[b]
2	3.66[b]	4.3[a]	3.88[ab]	4.65 [b]	4.12	4.5[a]
3	3.76[ab]	3.94[ab]	3.65[ab]	4.06 [a]	4.15	4.35[ab]
4	3.88[a]	4.13[ab]	4.18[a]	4.15 [a]	3.90	4.52[a]
F-test	*	*	*	**	ns	*
CV (%)	5.06	8.86	9.65	4.31	11.98	4.31

** - highly significant
* - significant
ns - not significant

The findings of this study implied that supplementation of "saluyot" leaves had influenced the odor, taste, tenderness, texture, and overall acceptability of broiler meat. According to Adams (1990), fermentation process is a very important process that allows the utilization of microorganisms to break down complex compounds to yield a unique taste and aroma in food. Tamang (2010) further mentioned that the controlled action of selected microorganisms is used to alter the texture of foods which increases the quality and value of raw materials. The fact that fermentation process may alter texture and yield a unique taste and aroma in foods, these factors contributed to the acceptability of the oven-cooked meat of broilers supplemented with fermented jute leaves. The results on the significant effect on texture of broiler meat can be supported by the research findings of Lengkey et al. (2014) who found significant effect on tenderness in broiler meat with fermented feed supplement. They further mentioned that more fermented feed supplement results to more tenderness in meat. Statistical Analysis based on the juiciness of broiler meat had shown no significant differences ($P>0.05$) between treatment means which implied that supplementation of fermented jute leaves did not influence the juiciness of broiler meat. Juiciness of broiler meat in all treatments were comparable.

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Conclusion and Recommendation

The performance attributes of broilers in the production and growth were not affected with the supplementation of varying levels of fermented jute leaves in drinking water. However, the meat qualities of broilers were influenced, particularly the odor, texture, taste, tenderness, and overall acceptability. It is therefore recommended to use fermented jute leaves as water supplements in broilers to improve the quality of meat and produce a more safe meat products of broilers that are free from antibiotics. Similar study may be conducted using higher levels of fermented jute leaves to determine the most effective level of this supplement particularly to its production and growth performance. It is also recommended to further investigate the effect of fermented jute leaves in the profitability aspect of production

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