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## Research Article

### Effects of Drumstick Tree (*Moringa oleifera*) and Lemongrass (*Cymbopogon citratus*) Leaf Extracts on the Growth Performance of Chickens

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#### ABSTRACT

This study aimed to investigate the impact of drumstick tree and lemongrass leaf extracts on the growth performance and economic returns of broilers and kabir chicks by administering the two leaf extracts in their drinking water. A total of 90 straight-run day-old broilers and 90 Kabir chicks were used, and a two-factor complete randomized design factorial experiment with three treatments and six replicates was employed. The birds' weights were measured at one day old, 21 days, and 35 days to determine their body weights and weight development, while feed consumption, feed conversion efficiency, dressing percentage, and livability rates were also measured. Duncan's Multiple Range Test was used to analyze the data. The results revealed that the birds on the control treatment (T0) exhibited inferior performance in all parameters compared to those on T1 and T2. The addition of lemongrass and drumstick tree leaf extract (10ml/liter) to chicken drinking water resulted in reduced feed consumption and improved feed conversion efficiency. The treated chicken also exhibited greater dressing percentages (with or without giblets). At the end of the trial, the cumulative livability rate in the treatment group was significantly ( $P < 0.01$ ) higher than that in the control group. These findings suggest that lemongrass and drumstick tree leaf extracts can promote chicken development.

**Keywords:** Drumstick tree, Lemongrass, Straight-run day-old broiler, Kabir

#### Introduction

The global agribusiness industry is marked by a highly active chicken sector, with poultry production representing the fastest-expanding segment of livestock farming worldwide, particularly in emerging economies (Chang, 2007). In the Philippines, chicken production is poised for growth, driven by rising demand for poultry

products as a consequence of population growth and economic development. However, the country's broiler industry faces competition from cheaper imports due to higher production costs (Chang, 2007). For the industry to expand and remain competitive, it must improve the efficiency of its production systems. Researchers have investigated the use of

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organic or natural feed and water supplements as an alternative to synthetic medications, which are often expensive, difficult to obtain, and can have negative impacts on both animal and human health (Zeweil et al., 2006).

Organic supplements, such as probiotics and herbs, are safer, healthier, and less dangerous for animal and human health. Herbs contain active compounds that can enhance digestion and metabolism, have antibacterial and immunostimulant properties, and improve overall production performance (Ghazalah and Ali, 2008). Essential oils extracted from various plants, including citrus fruits, oregano, pepper, onion, thyme, eucalyptus, and drumstick tree, have been investigated as alternatives to antibiotics to stimulate the immune system and improve gastrointestinal health (Hume, 2009). Drumstick tree has been shown to enhance ruminant feed and improve performance in tropical areas (Sanchez et al., 2006). It is also widely recognized as a natural immunological stimulant and performance enhancer in both animals and humans (Fahey, 2005). Studies have shown that adding a drumstick tree to broiler feed can improve feed consumption, daily weight increase, final weight, and profitability (Lannaon, 2007; Du et al., 2007; Yang et al., 2007). Similarly, lemongrass, which has therapeutic properties such as antimicrobial and bactericidal effects, has been investigated as a viable alternative to antibiotic growth boosters, with promising results (Cross et al., 2007; Demir et al., 2003; Mmereole, 2010).

Given the potential benefits of using organic or natural supplements to improve animal development performance, this study aims to investigate the practical applicability of using lemongrass and drumstick tree leaf extract as feed and water additives in broiler production. If the findings are favorable, the use of these supplements could reduce or even eliminate the negative effects associated with the use of antibiotics, synthetic growth enhancers, and other physiologically active compounds as growth promoters.

## **Methodology**

### ***Preparation of Treatment***

The leaves of the drumstick tree and lemongrass were procured from Mataba,

Aroroy, and M.R. before the commencement of the study. These leaves were priced at P7.50 per kilogram and were extracted by crushing them with a mortar and pestle, followed by straining them through cheesecloth. The resulting extract was transferred to a labeled container and stored in a refrigerator until use to prevent contamination.

### ***Research Design***

The study used a two-factor factorial experiment design utilizing a Completely Randomized Design (CRD). Ninety (90) straight-run day-old broilers and ninety (90) kabir chickens were selected as experimental birds and were randomly assigned to six (6) treatment combinations that were replicated six times. Each replicate consisted of five birds, which were housed in a single cage.

### ***Data Collection and Analysis***

Data on body weight, body weight gain, feed intake, dressing percentage, livability, and revenue over feed and chick cost were collected at 14-day intervals, starting from the brooding period. The collected data were subjected to statistical analysis using a Completely Randomized Design and a two-factor factorial experiment. Duncan's Multiple Range Test was employed to compare the treatment means of the relevant data analysis outcomes.

## **Results and Discussion**

### ***Body Weight of Chickens***

In this study, the effects of lemongrass and drumstick tree leaf extracts on the body weight of two breeds of chickens, broilers (B1) and Kabir (B2), were investigated. The treated groups were given drinking water with leaf extracts at a concentration of 10 mL per liter of water, while the control groups were given plain drinking water. The results showed that the treated groups had higher average body weights than the control groups, indicating that the leaf extracts had a positive effect on chicken development performance. Specifically, the average body weights of the broilers and Kabir in the treated groups were higher than those in the control groups after 21 days of feeding.

Table 1. Average body weight (grams) of chickens given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Feeding Period		
		Initial	21 days	35 days
Broiler (B <sub>1</sub> )	T <sub>0</sub>	91.67	343.33 <sup>b</sup>	891.67 <sup>b</sup>
	T <sub>1</sub>	93.33	380.00 <sup>b</sup>	1,110.00 <sup>a</sup>
	T <sub>2</sub>	95.00	433.33 <sup>a</sup>	1,135.00 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	51.67	125.00 <sup>c</sup>	337.92 <sup>c</sup>
	T <sub>1</sub>	51.67	160.00 <sup>c</sup>	368.33 <sup>c</sup>
	T <sub>2</sub>	50.00	161.67 <sup>c</sup>	385.00 <sup>c</sup>

<sup>a,b,c</sup> Means with the same superscripts are not significantly different (P<0.01).

The findings also revealed a significant interaction between the breed of chicken and the type of leaf extract, indicating that the leaf extracts had a substantial influence on the breed of chicken tested and that the effects differed considerably depending on the breed of chicken examined. The results of this study are consistent with previous research by Fahey (2005) and Garima et al. (2011) demonstrating the growth-promoting benefits of liquid plant extracts.

Moreover, the increased body weight of broilers from 21 days until the end of the trial is comparable to the findings of Portugaliza and Fernandez's study (2012). The supplementation of varied concentrations of drumstick tree aqueous leaf extract increased the actual live weight of broilers and the overall growth performance of broilers, regardless of the quantities used.

In conclusion, the findings suggest that lemongrass and drumstick tree leaf extracts at a concentration of 10 mL per liter of water can improve chicken development performance. The results of this study highlight the potential of plant extracts as a natural alternative to conventional growth promoters in the poultry industry.

**Body Weight Gains of Chickens**

In this study, the effect of adding lemongrass and drumstick tree leaf extract to the drinking water of broiler and kabir chickens on their body weight gain was investigated. The results presented in Table 2 showed that chickens treated with leaf extract in their drinking water had significantly higher body weight gains at the end of the study compared to those in the control group.

Table 2. Average body weight gain (grams) of chickens given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Feeding Period		
		21 days	35 days	Overall
Broiler (B <sub>1</sub> )	T <sub>0</sub>	251.67 <sup>b</sup>	548.33 <sup>b</sup>	800.00 <sup>b</sup>
	T <sub>1</sub>	286.67 <sup>b</sup>	730.00 <sup>a</sup>	1,016.67 <sup>a</sup>
	T <sub>2</sub>	338.33 <sup>a</sup>	701.67 <sup>a</sup>	1,040.00 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	73.33 <sup>c</sup>	212.92 <sup>c</sup>	286.25 <sup>c</sup>
	T <sub>1</sub>	108.33 <sup>c</sup>	208.33 <sup>c</sup>	316.67 <sup>c</sup>
	T <sub>2</sub>	111.67 <sup>c</sup>	223.33 <sup>c</sup>	335.00 <sup>c</sup>

<sup>a,b,c</sup> Means with the same superscripts are not significantly different (P>0.05).

**Feed Consumption of Chickens**

The results showed that there were no significant differences in feed intake between the treatment and control groups for both breeds

of chicken tested. However, the treated group exhibited higher average body weights than the control group, indicating that the treated group was more effective in converting feed into

meat. The analysis of the data on mean cumulative feed intake suggested that there was no significant interaction between chicken breeds and leaf extract types.

Table 3. Average feed consumption (grams) of chickens given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Feeding Period		
		21 days	35 days	Overall
Broiler (B <sub>1</sub> )	T <sub>0</sub>	493.33 <sup>a</sup>	1,991.67 <sup>a</sup>	2,485.00 <sup>a</sup>
	T <sub>1</sub>	490.00 <sup>a</sup>	2,020.00 <sup>a</sup>	2,510.00 <sup>a</sup>
	T <sub>2</sub>	558.33 <sup>a</sup>	2,066.67 <sup>a</sup>	2,625.00 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	196.67 <sup>a</sup>	685.00 <sup>a</sup>	881.67 <sup>a</sup>
	T <sub>1</sub>	201.67 <sup>a</sup>	666.67 <sup>a</sup>	868.33 <sup>a</sup>
	T <sub>2</sub>	206.67 <sup>a</sup>	696.67 <sup>a</sup>	903.33 <sup>a</sup>

<sup>a</sup> Means with the same superscripts is not significantly different (P>0.05).

The addition of leaf extract had a slightly positive effect on feed consumption, possibly due to the nutritional satisfaction of chicken. This finding is consistent with the results of Ashong and Brown (2011) who found that White Leghorn chickens consumed less feed when served with drumstick tree leaf meals. The reduced feed intake in birds treated with Aqueous Moringa Oleifera (Lam) Leaf Extracts (AMOLE) is consistent with the findings of Portugaliza and Fernandez (2012).

The study has several implications for chicken farmers, as it shows that adding lemongrass and drumstick tree leaf extracts to chicken drinking water at a concentration of 10 mL per liter of water can improve chicken development performance. The study's results also suggest that the leaf extracts used in the experiment had a substantial influence on the breed of chicken tested, and the leaf extract effects differed considerably depending on the breed of chicken examined.

Overall, the study demonstrates the potential benefits of using lemongrass and drumstick tree leaf extracts as natural growth promoters in chicken production. However, further research is needed to determine the optimal concentration of leaf extracts to be added to drinking water and to explore the mechanisms underlying the observed effects.

### Feed Conversion Efficiency of Chickens

The study aimed to investigate the effects of lemongrass and drumstick tree leaf extracts on the feed conversion efficiency (FCE) of broiler and kabir chickens. The results, as presented in Table 4, showed that chickens treated with the leaf extracts had a higher FCE than the control group, with the hens on the leaf extract treatments performing better than the control group at an inclusion level of 10 mL/liter concentrations of both lemongrass and drumstick tree. Specifically, after 21 days of feeding, the leaf extracts had a significant (P0.01) effect on the chicken's FCE. Additionally, there was a significant (P0.01) interaction between the breed of chicken and the type of leaf extracts used during this period.

However, after 35 days of feeding, there was no significant (P>0.05) effect on FCE, and there was no significant (P>0.05) interaction between the breed of chicken and the leaf extracts employed as therapy in the research. Nevertheless, the overall results demonstrated that leaf extracts had a substantial (P<0.01) effect on the FCE of broiler and kabir chickens. These findings were supported by previous studies such as David et al. (2012), Safa and El-Tazi (2012), and Ebenebe et al. (2012), which indicated that birds fed M. Oleifera diets outperformed control diets in terms of feed conversion ratio.

Table 4. Average feed conversion efficiency of chicken given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Feeding Period		
		21 days	35 days	Overall
Broiler (B <sub>1</sub> )	T <sub>0</sub>	1.97 <sup>b</sup>	3.65 <sup>a</sup>	2.81 <sup>a</sup>
	T <sub>1</sub>	1.72 <sup>b</sup>	2.78 <sup>a</sup>	2.25 <sup>a</sup>
	T <sub>2</sub>	1.66 <sup>b</sup>	3.06 <sup>a</sup>	2.36 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	2.72 <sup>a</sup>	3.52 <sup>a</sup>	3.12 <sup>a</sup>
	T <sub>1</sub>	1.86 <sup>b</sup>	3.25 <sup>a</sup>	2.56 <sup>a</sup>
	T <sub>2</sub>	1.86 <sup>b</sup>	3.16 <sup>a</sup>	2.51 <sup>a</sup>

<sup>a,b</sup> Means with the same superscripts are not significantly different (P<0.01).

The study's findings showed that the chickens treated with leaf extract in their drinking water converted nutrient-fed meals into body weight more effectively than the control group, which required more feed to convert into 1 kg of body weight. The slightly higher feed conversion efficiency in the hens-fed leaf extracts indicated that they converted feeds better than the control chickens. Thus, the amount of feed consumed to achieve 1 kg body weight in the control group was much greater than in the chicken treated with leaf extract in the drinking water.

In conclusion, the study demonstrated that the use of lemongrass and drumstick tree leaf extracts in the drinking water of broiler and kabir chickens can improve their feed conversion efficiency. The findings suggested that the interaction between the breed of chicken and the type of leaf extracts used may influence the effectiveness of the treatment. However, further research is required to investigate the optimal concentration of the leaf extracts to obtain the maximum benefits in terms of FCE.

### Dressing Percentage

The data presented in Table 5 indicated that chickens given drinking water with lemongrass and drumstick tree leaf extract had significantly (P<0.01) higher dressing percentages than those in the control group. The dressing percentage of broilers (B<sub>1</sub>) given lemongrass and drumstick tree leaf extract in their drinking water was considerably greater than those in the control group, with values ranging from 73.50% to 79.17% with giblets, and 63.50% to 69.17% without giblets. Meanwhile, the dressing percentage of Kabir chickens (B<sub>2</sub>) given lemongrass and drumstick tree leaf extract in their drinking water ranged from 19.33% to 20.67% with giblets, and 14.33% to 15.67% without giblets. The results indicated that the type of leaf extract and breed of chicken had a significant (P<0.01) effect on dressing percentage, and the interaction between them was also significant (P<0.01).

Table 5. Average dressing percentage (%) of chickens (with and without giblets) given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Dressing percentage	
		with giblets	without giblets
Broiler (B <sub>1</sub> )	T <sub>0</sub>	47.50 <sup>b</sup>	37.50 <sup>b</sup>
	T <sub>1</sub>	73.50 <sup>a</sup>	63.50 <sup>a</sup>
	T <sub>2</sub>	79.17 <sup>a</sup>	69.17 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	16.96 <sup>c</sup>	11.96 <sup>c</sup>
	T <sub>1</sub>	19.33 <sup>c</sup>	14.33 <sup>c</sup>
	T <sub>2</sub>	20.67 <sup>c</sup>	15.67 <sup>c</sup>

<sup>a,b,c</sup> Means with the same superscripts are not significantly different (P<0.01).

The results of this study are consistent with previous findings that lemongrass and drumstick tree leaf extract could enhance the performance and production of chickens. The improvement in the dressing percentage of broilers and Kabir chickens could be attributed to the bioactive compounds present in lemongrass and drumstick tree leaf extract. These compounds have been reported to improve nutrient absorption, increase the production of digestive enzymes, and stimulate the immune system of chickens. Moreover, the use of natural additives like lemongrass and drumstick tree leaf extract in poultry diets can reduce the dependence on synthetic growth promoters and antibiotics, which is beneficial for both human health and the environment.

In conclusion, the findings of this study demonstrated that the inclusion of lemongrass and drumstick tree leaf extract in chicken drinking water can significantly improve the dressing percentage of broilers and Kabir

chickens. The results also showed that the effects of lemongrass and drumstick tree leaf extract on dressing percentage varied with the breed of chicken. Further research is needed to investigate the optimal concentration and duration of lemongrass and drumstick tree leaf extract supplementation in poultry diets to achieve maximum benefits.

**Livability Rate**

In a study conducted, it was found that the presence of a 10 mL/liter concentration of leaf extracts had a significant impact on the livability rate of both broiler and Kabir chickens. Mortality was observed in the control group, where chickens were not given any leaf extract and developed Coryza illness after 21 days. The chickens that perished were exposed to environmental conditions that posed health risks. On the other hand, the chickens that were fed with leaf extracts in drinking water recovered from the ailment.

Table 6. Average livability rate (%) of chickens given drinking water with lemongrass and drumstick tree leaf extract

Factor A (Breed of Chicken)	Factor B (Treatment)	Livability Rate
Broiler (B <sub>1</sub> )	T <sub>0</sub>	100.00 <sup>a</sup>
	T <sub>1</sub>	100.00 <sup>a</sup>
	T <sub>2</sub>	100.00 <sup>a</sup>
Kabir (B <sub>2</sub> )	T <sub>0</sub>	86.67 <sup>b</sup>
	T <sub>1</sub>	100.00 <sup>a</sup>
	T <sub>2</sub>	100.00 <sup>a</sup>

<sup>a,b</sup> Means with the same superscripts are not significantly different (P<0.01).

Table 6 showed that there was a significant difference (P<0.01) between the control group and the fowl treated with leaf extracts in drinking water. The data also revealed a significant relationship (P<0.01) between the breed of chicken and the type of leaf extract used. The use of antibiotics as growth promoters and for preventing illness outbreaks has been documented in previous studies. Furthermore, antibiotic-laced water medicine is known to aid in the recovery of diseased birds.

The antibacterial properties of lemongrass and drumstick tree played a crucial role in the recovery of chickens from Coryza illness. This finding was consistent with previous research

conducted by Patell et al. (2011), who discovered that drumstick tree extract possessed antibacterial properties. The drumstick tree was found to possess antimicrobial/biocidal qualities against bacteria, viruses, fungi, and parasites, and it aided in the treatment of various disorders such as circulatory/endocrine diseases, digestive disorders, inflammation, nervous disorders, and skin problems. Similarly, lemongrass was found to possess medicinal properties such as analgesic, antidepressant, antimicrobial, antipyretic, antiseptic, bactericidal, diuretic, fungicidal, insecticidal, nervous system sedative, and tonic. It was used in traditional medicine to treat fever and infectious

disorders. Montala (2006) claimed that it possessed antibacterial and antifungal effects.

Table 6 showed that the livability rate of both broiler and Kabir chickens improved when leaf extracts were added to their drinking water. This finding supports the idea that natural feed additives can be effectively used to increase growth in poultry and animals while avoiding the harmful effects of breeding medication-resistant microorganisms, as seen with antibiotic growth promoters. Kumar et al. (2003) discovered that when herbal supplements were added to broiler meals, mortality rates were lower in the treated groups as compared to birds given the control diet.

In conclusion, the use of leaf extracts in drinking water may boost the immune system of broiler and Kabir chickens, resulting in reduced mortality rates. The antibacterial properties of lemongrass and drumstick tree extracts played a significant role in improving the livability rate of chickens in this study. The findings of this study suggest that natural feed

additives could be a promising alternative to antibiotics as growth promoters and to prevent illness outbreaks in chickens.

### Income over Feed and Chicks Costs

The experiment's findings on the average income over feed and chick cost of chickens provided with drinking water mixed with lemongrass and drumstick tree leaf extract are presented in Figure 1. The results revealed that the use of leaf extract in chickens resulted in a slightly higher net income than the control group. The reduction in treatment cost can be attributed to the increased net revenue from chickens treated with leaf extract. Chickens in the treatment group had a higher gross sales figure because they had a larger body weight compared to those in the control group. The lower net income in the control group can be attributed to higher feed costs and lower gross sales due to lower body weights than those in the treatment group.

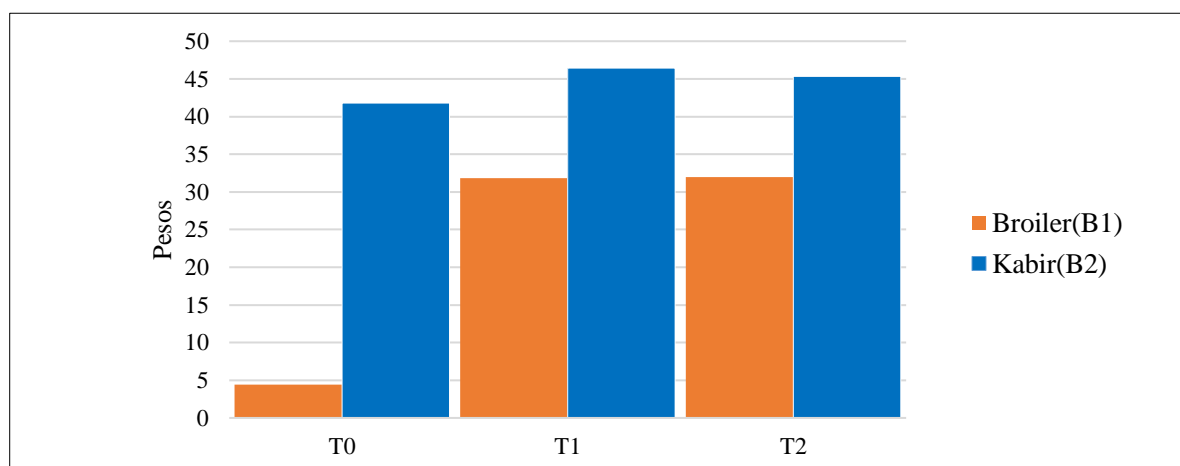


Figure 1. Average net income (P) of chickens given drinking water with lemongrass and drumstick tree leaf extract

### Conclusion

In conclusion, the results of this study demonstrated that the inclusion of lemongrass and drumstick tree leaf extract in drinking water improved the growth performance of chickens in terms of body weight, body weight increase, feed conversion efficiency, and livability rate, regardless of the breed. These findings suggest that the supplementation of drinking water with organic supplements like

lemongrass and drumstick tree leaf extract can enhance the growth performance of chickens compared to the control group. Moreover, the use of these organic supplements could be considered as an alternative to antibiotic growth promoters due to their potential to mitigate disease outbreaks and reduce mortality rates in chickens. Therefore, the results of this study may contribute to the development of organic and sustainable chicken farming practices.

## Recommendations

Based on the findings of this study, it is recommended that poultry farmers consider supplementing their chickens' drinking water with organic supplements such as drumstick trees and lemongrass leaf extract. This can improve the growth performance of chickens, regardless of the breed, as shown by the increase in body weight, body weight increase, feed conversion efficiency, and livability rate. Additionally, because it helped reduce disease outbreaks and mortality rates, using drumstick trees and lemongrass leaf extract as an organic alternative to antibiotic growth boosters is also suggested. However, further research is needed to determine the optimal dosage and frequency of supplementation to achieve the best results.

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