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Effect of Powdered Lemon Grass (*Cymbopogon citratus*) as Feed Supplement on the Growth Performance of Native Chicken

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Abstract

This study was conducted to determine the growth performance of the native chicken using different levels of powdered lemon grass as feed supplement in the diet. The study utilized 128 unsexed native chickens were randomly distributed into 4 experimental treatments with 4 replications and 8 birds per treatment using Randomized Complete Block Design (RCBD). The different levels of powdered lemon grass in treatments were T1 (Control) – 0%, T2 –1%, T3 –1.5%, and T4 - 2.5% powdered lemon grass, respectively. The results revealed that there is no significant difference in the body weight gain and feed conversion ratio of the native chicken among the experimental animals. In the feed consumption, there is a highly significant difference among the treatment mean during week 2 and 8, and significant difference on week 4, 11 and 12. These findings suggest that the inclusion of powdered lemongrass influenced the feed consumption of the chickens, particularly in certain periods of the study. This implies that while powdered lemongrass, particularly at 1%, appeared to enhance feed consumption during specific weeks. In terms of the average daily gain, results revealed a significant difference only in week 14. The result suggests that while the inclusion of powdered lemongrass in the diet did not significantly affect ADG during the early and middle stages of growth, it exhibited a notable positive effect in the later stages. This indicate a cumulative or delayed impact of lemongrass supplementation on growth performance, which becomes evident as the birds approach maturity. Based on the findings stated above, it can be concluded that the body weight, feed consumption, FCR and ADG of the experimental birds were affected by the different inclusion levels of powdered lemon grass. Inclusion of 1% lemon grass powder in feedstuff is recommended as it enhanced the overall growth performance of native chickens.

Keywords: *Cymbopogon citratus*, Native Chicken, Randomized Complete Block Design (RCBD)

Introduction

The poultry sector is possibly the fastest growing and most flexible of all livestock sectors. Driven primarily by very strong demand, it has expanded, consolidated and globalized over the past 15 years in countries of all income levels. Livestock is fundamental to the livelihoods of about one billion of the world's poorest people. Rural poultry, in particular, is essential for the livelihood of many resource-poor farmers often being the only asset they possess.

Philippine native chicken has been the main source of meat and eggs for Filipino farmers (World Poultry, 2000 in Dusaran & Cabarles, 2005) [12]. The role of indigenous chicken in Philippine agriculture and the entire economy is well-recognized. It will, to a large extent, remain a significant contributor to the continuous supply of meat and eggs and extra income for many rural Filipino farmers. Its meat is highly preferred by many Filipino consumers because of its distinct taste, leanness, and pigmentation. It also provides them additional income as well as source of protein. It serves as a form of savings or insurance for the farmers against periodic shortages as well as for resource diversification.

Nowadays, native chicken is being displaced in the supply chain by hybrid chickens. This is, however, an opportunity for small-scale farmers to raise native chicken and generate incremental benefits by supplying the emerging market for this commodity. The native chicken has evolved in a way that it multiplied and survived in a marginal environment even with minimal management. More importantly, the meat of the native chicken has a unique flavor and texture which consumers prefer and for which they are willing to pay a premium price. The native chicken will, undoubtedly, remain an important source of high-quality protein food and additional income for many of our small rural farmers.

Medicinal plants have been traditionally sourced for the treatment of various diseases, in both humans and animals. A number of dietary herbs, plant extracts and essential oils have been studied for their antimicrobial and growth promoting abilities in poultry (Cross *et al*., 2007) [9]. When incorporated into broiler diets, some herbal supplements have improved growth performance, feed conversion efficiency and carcass and meat quality in broilers, with reduced feed cost.

Lemongrass (*Cymbopogon citratus)* is an aromatic perennial tropical plant that can grow as high as 3.5 meters with long thin leaves. It is widely used herb in tropical countries. *Cymbopogon* is a genus of about 55 species, which are indigenous in tropical and semi tropical areas of Asia and are cultivated in South and Central America, Africa and other tropical countries. It belongs to tufted perennial C4 grasses with numerous stiff stems arising from a short, rhizomatous rootstock, as with citrus flavor, and can be dried and powdered or used fresh. The name *Cymbopogon* is derived from the Greek words "kymbe" (boat) and "pogon" (beard), referring to the flower spike arrangement. Among the different varieties of *Cymbopogon* Lemongrass (*Cymbopogon citratus)* is the most commonly used in the Philippines known as *Tanglad.*

Lemon grass is an aromatic perennial tall grass with rhizomes and densely tufted fibrous root (Barbosa *et al*., 2008; Oloyede *et al*., 2009) [5, 25]. Besides being used for fragrance and flavoring, it is also widely used as traditional medicine, especially in Brazilian folk medicine, as it has no toxic properties (Lucia *et al*., 1986).

Lemongrass *(Cymbopogon citratus)* contains flavonoids, phenolic compounds, terpenoids and essential oils (such as citral α, citral β, nerol geraniol, citronellal, terpinolene, geranyl acetate, myrecene and terpinol methylheptenone) which may be responsible for its different biological activities such as anti-bacterial, anti-diarrheal, anti-fungal antioxidants, and as a growth promoter (Sariozkhan *et al*., 2016) [33].

According to Thorat *et al*. (2017) [39], Lemon grass dried leaves contain 71.03% moisture, 3.83% crude protein, 2.94% ash, 4.76% crude fat, 9.30% crude fibre and 20.73% carbohydrate. The leaves of the plant produce yellow or amber color and aromatic essential oil (such as citral α, citral β, nerol geraniol, citronellal, terpinolene, geranyl acetate, myrecene and terpinol) when squeezed (Adejuwon & Esther, 2007) [2].

This study aims to prove that Lemon grass is not only use as flavorings to many dishes like in chicken and medicinal health to people, but it can also lessen the feed cost production upon the supplementation of lemon grass as growth promoters to native chicken. It may also serve as anti-bacterial, anti-diarrheal, anti-fungal, antioxidant, and antimicrobial, antipyretic, antiseptic, bactericidal, fungicidal, and insecticidal and also to lessen the mortality rate and sickness of native chicken. According to Huang *et al*., (1992), some herbal supplements have improved growth performance, feed conversion efficiency and carcass and meat quality in broilers, with reduced feed cost.

This study was conducted to determine the effects of powdered lemon grass as feed supplement on the growth performance of the native chicken in terms of body weight, feed consumption, feed efficiency average of daily gain and production income.

Materials and Methods

The study utilized 128 unsexed native chickens, randomly assigned to four experimental treatments with four replications per treatment, and eight birds per replicate, following a Randomized Complete Block Design (RCBD). The treatments included varying levels of powdered lemongrass as a substitute for soybean meal in the feed. Treatment 1 (Control) consisted of 0% powdered lemongrass and 31%, 28%, and 24% soybean meal for the starter, grower, and finisher stages, respectively. Treatment 2 included 1% powdered lemongrass and 30%, 27%, and 23% soybean meal, while Treatment 3 contained 1.5% powdered lemongrass and 29.5%, 26.5%, and 22.5% soybean meal. Finally, Treatment 4 included 2.5% powdered lemongrass and 28.5%, 25.5%, and 21.5% soybean meal for the corresponding growth stages.

The data gathered in this study include the growth performance of the native chicken in terms of body weight, feed consumption, average daily gain and feed conversion ratio. Data gathered were analyzed statistically using Analysis of Variance (ANOVA). Significant results that are significant were subjected to additional statistical analysis using Pairwise Mean Comparison which is the Least Significant Difference Test (LSD). Statistical Tool for Agricultural Research software was also used.

Result and Discussion

Body Weight Gain

Body weight is an important economic and biological index that describes the growth and development of animals. The average body weight of Darag native chickens over the 14-week feeding period is presented in Table 1. The highest mean final body weight of the Darag chickens was 1,135.04g, observed in T2 – 1% powdered lemongrass, while the lowest was 997.67g, observed in T3 – 1.5% powdered lemongrass. This implies that the effects of 1% powdered lemongrass in T2 resulted in heavier weights, as this treatment consistently produced the highest body weights throughout the 14-week period.

However, the analysis of variance failed to detect any significant difference in body weight gain among the experimental animals from weeks 1 to 14, which suggests that the different rations of powdered lemongrass did not significantly influence the body weight of Darag native chickens. Although T2 outperformed the control and other treatments, the lack of significant differences in later stages indicates that, while lemongrass may boost early growth, its long-term effects on body weight may not be as dramatic.

An experiment conducted by Mmereole (2010) [22] evaluated the effects of dietary inclusion of lemongrass leaf meal (LGLM) on the growth performance of broiler chickens and its ability to serve as a viable alternative to antibiotic growth promoters. The study also found that the inclusion of LGLM in poultry diets resulted in significantly higher body weight and body weight gain compared to other treatments.

Similarly, Tekeli (2011) [36] noted that chicks fed a diet supplemented with lemongrass oil (LGO) recorded significantly higher weight gains. This improvement may be attributed to increased total feed consumption and the active antimicrobial and antioxidant compounds in LGO. The study by Mukhtar *et al*. (2012) also revealed significant improvements in the body weight gain of broilers when their diets were supplemented with various levels of LGO

compared to the control group. Khattak *et al*. (2014) reported that the inclusion of lemongrass leaf meal in broiler diets improved body weight gain and positively affected the feed conversion ratio.

In addition, the findings of Parade *et al*. (2019) [3] showed that the highest cumulative body weight of 2,635.45g was obtained in broilers from the T4 group, which received 1.5% lemongrass leaf meal, while the lowest cumulative body weight (2,473.25g) was observed in the control group (T1) at the end of the 6th week. A similar trend was observed by Tiwari *et al*. (2018), who found that the total weight gain of birds was higher in experimental groups receiving LGO compared to the control group without LGO. Results from broiler birds under four different treatments revealed significant differences in body weight gain during all weeks of the study.

Table 1: Weekly body weight gain in grams of native chicken

Week	T1	T2	T3	T4	F	P	CV*%*
I	210.33	191.92	180.88	173.50	4.19	0.0302*	8.27
1	402.62	483.62	337.08	411.42	1.26	0.3304 ns	26.09
2	448.17.	527.54	377.00	455.25	1.26	0.3310 ns	24.23
3	494.54	570.33	422.75	504.12	1.45	0.2766 ns	20.13
4	565.67	626.75	483.96	572.92	1.44	0.2803 ns	17.47
5	601.75	680.08	537.25	626.96	1.36	0.3033 ns	16.66
6	*681.17*	746.25	587.25	687.75	1.80	0.2009ns	14.52
7	725.13	802.83	620.83	740.08	2.07	0.1573 ns	14.52
8	769.25	838.50	678.83	784.38	1.59	0.2434 ns	13.70
9	810.96	867.67	730.92	824.29	1.30	0.3194 ns	12.38
10	841.71	917.38	784.58	868.	1.14	0.3714 ns	12.13
11	892.71	957.42	826.38	916.79	1.09	0.3923 ns	11.73
12	983.50	1012.12	876.33	965.42	1.28	0.3244 ns	10.78
13	1024.25	1081.96	938.46	1033.17	1.13	0.3764 ns	11.02
14	1054.12	1135.04	997.67	1094.67	1.14	0.3729 ns	10.27

Ns not significant
* significant at P ≤ 0.05
** Highly significant at P ≤ 0.01
Legend:
T1 (Control) – 0% of powdered lemon grass
T2 – 1% of powdered lemon
T3 – 1.5% of powdered lemon grass
T4 – 2.5% of powdered lemon grass.

Feed Consumption

Feed consumption refers to the total amount of feed consumed by the experimental birds from starter to finisher stage. The highest average cumulative feed consumption of 843.96g was observed from the native chicken in T2 – 1% powdered lemon grass while the lowest average measuring 836.46g was found in T1 – 0% (Control) as shown in Table 2.

The analysis of variance revealed a highly significant difference among the treatment mean during week 2 and 8, and significant difference on week 4,11 and 12. These findings suggest that the inclusion of powdered lemongrass influenced the feed consumption of the chickens, particularly in certain periods of the study. This implies that while powdered lemongrass, particularly at 1%, appeared to enhance feed consumption during specific weeks, it did not have a consistent effect throughout the study. This may point to the potential for lemongrass supplementation to boost feed intake during particular growth stages, but its overall impact on feed consumption warrants further investigation.

Supporting studies, such as Tekeli *et al*. (2011) [36], noted that chicks fed on diets supplemented with lemongrass oil (LGO) recorded significantly higher weight gain. This improvement may be attributed to the increased total feed consumption and the active compounds in lemongrass, which have antimicrobial and antioxidant properties.

Similarly, Mukhtar *et al*. (2012) found that broilers fed diets supplemented with various levels of LGO consumed significantly more feed compared to those on a control diet. This aligns with the trend seen in the current experiment, where lemongrass-supplemented groups (especially T2) generally showed higher feed consumption than the control group.

Table 2: Weekly feed consumption in grams of native chicken

Week	T1	T2	T3	T4	F	P	CV%
1	129.46	132.88	132.33	133.12	1.49	0.2679ns	2.10
2	171.96	179.25	174.58	179.58	12.65	0.0005 **	1.18
3	227.67	229.71	229.17	230.29	1.13	0.3775 ns	0.9259
4	280.62	288.54	280.08	284.21	5.74	0.0113 *	1.15
5	331.33	334.79	331.79	333.21	1.26	0.3318 ns	0.8351
6	373.12	413.12	380.96	397.33	1.74	0.2111 ns	6.89
7	*439.79*	445.67	444.46	442.50	3.49	0.0502ns	0.6201
8	506.04	513.67	509.00	512.83	9.02	0.0021 **	0.4617
9	561.42	563.67	557.71	561.42	2.39	0.1202 ns	0.5698
10	604.92	611.08	607.79	608.42	3.03	0.0713 ns	0.4785
11	668.54	673.33	669.92	671.38	5.44	0.0135 *	0.2622
12	720.83	727.96	726.42	726.38	4.87	0.0192 *	0.3908
13	777.29	788.33	779.42	777.96	1.97	0.1721 ns	0.9364
14	836.46	843.96	843.42	841.54	3.40	0.0534 ns	0.4404

Ns not significant
* significant at P ≤ 0.05
** Highly significant at P ≤ 0.01
Legend:
T1 (Control) – 0% of powdered lemon grass
T2 – 1% of powdered lemon
T3 – 1.5% of powdered lemon grass
T4 – 2.5% of powdered lemon grass.

Feed Conversion Ratio

Feed Conversion Ratio (FCR) refers to the ability of birds to convert the feed they consume into body weight gain. The data presented in Table 3 shows the feed efficiency of native chickens treated with varying amounts of powdered lemongrass over a 14-week period. The FCR is expressed as the amount of feed consumed per unit of body weight gained, with lower values indicating better efficiency.

In the current study, the highest final feed conversion ratio of 0.8640g was observed in T3 – 1.5% powdered lemongrass. On the other hand, the lowest feed conversion ratio of 0.7471g was recorded in T2 with 1% powdered lemongrass. These results indicate that chickens fed a higher concentration of lemongrass powder (T3) had a less efficient feed conversion compared to those fed a lower concentration (T2).

However, the analysis of variance did not reveal any statistically significant differences in feed conversion ratio among the treatments across all weeks. This suggests that while lemongrass might have slight effects on feed conversion, it does not significantly alter the overall efficiency of feed utilization in Darag native chickens.

The present study contradicts the findings observed by Parade *et al*. (2019) [3] where broilers receiving 1.5% lemongrass leaf meal had better feed conversion ratios than those on a control diet. In this study, significant improvements were noted in broilers' FCR, indicating that

higher levels of lemongrass leaf meal can enhance feed conversion. Similarly, Mukhtar *et al*., (2012) found significant improvements in FCR when lemongrass oil was added to broiler diets at various concentrations.

In contrast, Thayalini *et al*., (2011) [37] reported that the inclusion of 2% lemongrass leaf in broiler diets had no significant effect on FCR, a finding that aligns with the current study, which failed to detect significant differences in feed conversion across treatments.

Table 3: Weekly feed efficiency in grams of native chicken

Week	T1	T2	T3	T4	F	P	CV%
1	*0.3263*	0.2799	0.4766	0.3387	1.76	0.2080ns	35.91
2	0.3871	0.3449	0.5531	0.4103	1.59	0.2437 ns	33.82
3	0.4635	0.4076	0.6112	0.4657	1.80	0.2000 ns	26.62
4	0.4979	0.4644	0.6300	0.5037	1.62	0.2363 ns	21.81
5	0.5546	0.4978	0.6598	0.5366	1.67	0.2254 ns	19.05
6	0.5502	0.5608	0.6836	0.5836	1.14	0.3719 ns	19.21
7	0.6088	0.5599	0.7582	0.6013	2.36	0.1225 ns	17.87
8	0.6602	0.6185	0.7861	0.6564	1.82	0.1969 ns	15.90
9	0.6947	0.6554	0.7899	0.6834	1.44	0.2808 ns	13.81
10	0.7214	0.6716	0.7993	0.7044	1.25	0.3362 ns	13.41
11	0.7514	0.7086	0.8344	0.7362	1.22	0.3442 ns	12.94
12	0.7350	0.7231	0.8498	0.7565	1.57	0.2490 ns	12.00
13	0.7612	0.7315	0.8525	0.7578	1.27	0.3299 ns	12.11
14	0.7958	0.7471	0.8640	0.7725	1.25	0.3355 ns	11.30

Ns not significant
* significant at P ≤ 0.05
** Highly significant at P ≤ 0.01
Legend:
T1 (Control) – 0% of powdered lemon grass
T2 – 1% of powdered lemon
T3 – 1.5% of powdered lemon grass
T4 – 2.5% of powdered lemon grass.

Average Daily Gain

The Average Daily Gain (ADG) is defined as the average amount of weight a market animal will gain each day during the feeding period (Kinder, 2016) [8]. The ADG of native chickens during the experimental period is shown in Table 4. Among the treatments, experimental birds in Treatment 4 (2.5% powdered lemongrass) achieved the highest mean ADG of 8.79g during Week 14, while the lowest ADG of 4.27g was observed in Treatment 1 (Control). However, analysis of variance (ANOVA) revealed that a significant difference was observed only in Week 14, whereas no significant differences were found from Week 1 to Week 13. The implication of this result suggests that while the inclusion of powdered lemongrass in the diet did not significantly affect ADG during the early and middle stages of growth, it exhibited a notable positive effect in the later stages. This may indicate a cumulative or delayed impact of lemongrass supplementation on growth performance, which becomes evident as the birds approach maturity. It implies that the bioactive compounds in lemongrass might require longer periods to exert their full effect on growth, nutrient absorption, or metabolic processes.

This trend aligns with the findings of Tiwari *et al*. (2018), where although broilers fed with lemongrass oil diets exhibited varying ADG levels, no significant effects were observed among the diet groups. However, the study concluded that lemongrass oil could serve as a viable alternative to antibiotic growth promoters, enhancing production performance without adverse effects. Likewise, Mukhtar *et al*. (2012) reported that broilers supplemented with lemongrass oil exhibited significantly higher feed intake and improved body weight gain compared to the control group. This improvement was attributed to the essential oils enhancing feed efficiency and nutrient utilization, supporting the delayed yet significant impact observed in the current study.

Additionally, Shah *et al*. (2011) [16] emphasized the role of essential oils, including those found in lemongrass, in improving feed palatability and stimulating appetite. The bioactive compounds in lemongrass enhance digestive enzyme activity, improve gut health, and promote efficient digestion and absorption of nutrients, ultimately leading to better growth performance.

Table 4: Average daily gain in grams of native chicken

Weeks	T1	T2	T3	T4	F	P	CV%
1	*27.47*	41.67	22.32	33.99	1.20	0.3518 ns	48.74
2	6.51	6.27	5.70	6.26	0.08	0.9678 ns	38.24
3	6.62	6.11	6.54	6.98	0.13	0.9381 ns	29.77
4	10.16	8.06	8.74	9.83	0.60	0.6267 ns	27.22
5	5.15	7.62	7.61	7.72	0.71	0.5655 ns	42.25
6	11.35	9.45	7.14	8.68	2.03	0.1635 ns	26.79
7	*6.28*	8.08	4.80	7.48	1.43	0.2819 ns	36.38
8	6.30	5.10	8.29	6.33	2.44	0.1146 ns	25.99
9	5.96	4.17	7.44	5.70	2.10	0.1543 ns	31.84
10	4.39	7.10	7.67	6.25	1.47	0.2715 ns	37.11
11	7.29	5.72	5.97	6.96	0.41	0.7476 ns	36.40
12	12.97	7.82	7.14	6.95	2.78	0.0868 ns	39.36
13	5.82	9.98	8.88	9.68	3.48	0.0504 ns	23.74
14	4.27	7.58	8.46	8.79	5.23	0.0154 *	24.86

Ns not significant
* significant at P ≤ 0.05
** Highly significant at P ≤ 0.01
Legend:
T1 (Control) – 0% of powdered lemon grass
T2 – 1% of powdered lemon
T3 – 1.5% of powdered lemon grass
T4 – 2.5% of powdered lemon grass.

Conclusion

The study concluded that the inclusion of powdered lemongrass in the diets of native chickens positively influenced various growth metrics, including body weight, feed consumption, and average daily gain (ADG), particularly at 1% inclusion level. However, the overall feed efficiency did not show significant variation among treatments. The findings suggest that lemongrass can serve as a beneficial dietary supplement, particularly enhancing growth performance and daily gain metrics in native chickens. Thus, incorporating powdered lemongrass into chicken feed is recommended to improve growth outcomes effectively.

Recommendations

Based on the results of the study, it can be recommended to use 1% powdered lemon grass in in chicken feed to maximize growth performance of the native chicken. Repetition of the same study using higher ratio of powdered lemon grass is also recommended and may be conducted in an extended timeframe to see better results. Small-scale poultry farmers should consider incorporating lemongrass into their feeding strategies to improve growth rates and overall productivity of native chickens. Furthermore, the use of lemon grass as feed supplement in fresh, dry and oil form is further recommended.

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