EVALUATION OF LEMON GRASS (*Cymbopogon citraturs*) OIL AS A GROWTH PROMOTER ON BROILER CHICKEN

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ABSTRACT

A study was carried out to evaluate the different levels of lemon grass oil as a growth promoter on the growth performance of broiler chicken at Regional Agriculture Research Station, Parwanipur, Bara from December 2017 to January 2018 for 36 days. A total of 180 day old chicks were procured from Shivam Hatchery Birgung. Control group (T_1) was fed with concentrate feed without lemon grass oil inclusion whereas T_2, T_3 and T_4 groups were fed concentrate feed treated with lemon grass oil at the rate of 200, 400 and 600 ml/100 kg feed, respectively. Experimental birds were provided ad libitum amount of starter feed from 0 to 21 days and finisher feed from 22 to 36 days twice a day. Feed intake was recorded daily and body weight gain was measured in 7 days interval. Experiment revealed that FCR was found highest in T_3 (1:1.44 kg) and lowest in T_4 (1: 1.51 kg) which was also non-significant among diet groups. Similarly, the total weight gain of experimental bird was found higher in T_3 (2385.13 g) followed by T_1 and T_2 (2279.46 and 2271.86 g, respectively).

Keywords: Broiler, growth performance, lemon grass oil, Nepal

INTRODUCTION

About 68% of people in Nepal depend on agriculture for their livelihoods which contributes about 34% of Total Gross Domestic Productions. Agriculture in Nepal is subsistent in nature and crops are mostly integrated with livestock. Livestock is one of the important sources of cash income for farm a household which contributes 29% of agriculture GDP and about 11.5% of total national GDP (MoAD, 2072/73).

Poultry meat is an important source of high quality protein, minerals and vitamins to balance the human diet. Broiler farming has several advantages: firstly the initial investment is low, and there is a faster return from the investment. Since, broilers have high feed conversion ratio, only a minimum amount of feed is required for per unit body weight gain in comparison to other

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livestock species. Demand of poultry meat is high compared to sheep and goat meats. The total population of poultry in Nepal is estimated to be about 68.63 million and producing 55041 mt. meats per annum (Krishi diary, 2017).

Due to increases in population, income and living standards, consumers' demand shifts to more poultry meat consumption. The poultry industry is presently studying on alternatives to meet these consumers' demands. Also, scientists are trying much more efforts to respond to these expectations. On the other hand, they want to make sure this does not decrease the quality of the end product or ignore animal welfare. Nowadays, increasing of consumer awareness for safety poultry products and from stable to table approach tended the consumers' preferences towards to healthy animals' products. Performance enhancers until recently called growth promoters are used to improve animal growth rate and/or feed conversion ratio. One of the feed additives used to increase the performance of poultry are herbs. These herbs are the dried leaves of aromatic plants, usually found without stems (Peter, 2012). In particular, with the ban on the use of antibiotics to increase growth, studies on plant-based alternatives have increased. Lemon grass contains flavonoids, phenolic compounds, terpenoids (Burkill, 1996) and essential oils (such as citral α, citral ß, nerolgeraniol, citronellal, terpinolen e, geranyl acetate, myrecene and terpinolmethylheptenone) which may be responsible for its different biological activities such as antibacterial, antidiarrheal, antifungal, antioxidants, and as a growth promoter (Shah *et al.*, 2011). There are few scientific studies on the use of lemon grass or its secondary metabolites for performance enhancing purposes in poultry, especially in broilers (Mmereole, 2010; Mukhtar *et al.*, 2012; Thayalini *et al.*, 2011), pigs (Tartrakoon *et al.*, 2002) and rabbits (Omer *et al.*, 2010). Mmereole (2010) and Mukhtar*et al.*, (2012) reported that lemon grass could be an alternative to antibiotics.

According to the International Journal of Poultry Science, lemon grass oil (LGO) is considered as a viable alternative to antibiotics for the broiler and have been studied as alternative for microbial and growth promoting abilities in the poultry, and that resulted minimized feed expense in the production (Russo, 1992). Several studies carried out abroad showed that incorporating LGO in broiler diet as a supplement would stimulate the growth performance of broilers (Cross *et al.*, 2002; Bampidis *et al.*, 2005). Mukhtar *et al.* (2012) reported that broilers fed diets supplemented with different levels of LGO significantly consumed more feed and improved body weight gain compared to the control group.

In Nepal, there is a paucity of information regarding the use of LGO as a growth promoter. Keeping in view of the above facts, this study was designed to

evaluate the effect of different level of LGO inclusion in broiler diet for growth promotion.

MATERIALS AND METHODS

EXPERIMENTAL SITE AND BIRDS' MANAGEMENT

The experiment was carried out on Cobb 500 broiler chickens at Regional Agricultural Research Station, Parwanipur, Bara from December 2017 to January 2018 to evaluate the effect of different level of LGO inclusion in diet as a natural growth promoter on the growth performance of broiler chicks. One hundred and eighty day old birds were procured from Shivam Hatchery, Birgung, Parsa and were allocated into four treatments with three replications having 15 birds in each replication by using Completely Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine at the rate of one drop to each bird against Ranikhet at the first week.

DIET COMPOSITION

Compound feed was procured from Shakti Feed Industry of Birgung, Parsa and treated with lemon grass oil at the rate of 200, 400 and 600 ml/100 kg feed for T_2, T_3 and T_4, respectively. T_1 was as a control group. Lemon grass oil was procured from Herbs Production and Processing Plant of Ministry of Forest and Soil Conservation, Jadibuti, Kathmandu. The samples of treated and untreated feeds were brought to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis.

CHEMICAL ANALYSIS

Respective samples were analyzed for dry matter (DM), organic matter (OM), total ash (TA), crude protein (CP), crude fibre (CF) contents. The dry matter was determined by oven drying at 100^0C for 24 hours. Crude protein was analyzed using the Kjeldahl method. Ash content was determined by ashing at 550^0C in a muffle furnace for 16 hours (AOAC, 1980). Crude fibre of the samples was determined using the Van Soest method (Goering and Van Soest, 1970).

EXPERIMENTAL DIETS

The following experimental diets were administrated to the birds as shown in Table 1.

Table 1: Experimental diets

Treatment	Diet
1	Adlib concentrate feed without lemon grass oil
2	Adlib concentrate feed treated with lemon grass oil @ 200 ml/100 kg feed
3	Adlib concentrate feed treated with lemon grass oil @ 400 ml/100 kg feed
4	Adlib concentrate feed treated with lemon grass oil @ 600 ml/100 kg feed

FEEDING SCHEDULE

Concentrate mixture was given on group basis and provided to the experimental birds twice a day in the morning and evening in adlib amount for both periods (starter 0- 21 days and finisher 22-36 days). Clean drinking water was provided in adequate amount.

OBSERVATION RECORDING

The trial period was of 36 days. Quantity of concentrate mixture given daily to the birds in group weighed daily and refusal was weighed in the next morning. The body weight gain measurement was done in group basis (replication wise) in seven days interval in the morning before feeding.

DATA ANALYSIS

Data of feed intake and body weight gain was analyzed by *One Way Annova* test for every measurement using statistical package SPSS, Version 16.

RESULTS AND DISCUSSION

CHEMICAL COMPOSITION OF CONCENTRATE MIXTURE

The chemical composition of feeds used in experiment is presented in Table 2.

Table 2: Chemical composition of the feeds (on DM basis)

Treatment	DM	OM	TA	CP	CF	Gross energy, Kcal
Starter feed (1-21 days)						
1	89.31	94.68	5.32	18.07	5.53	
2	89.50	94.58	5.42	18.59	6.47	
3	89.19	97.31	2.69	18.12	7.16	
4	89.01	94.39	5.61	18.35	5.91	
Finisher feed (22-36 days)						
1	93.48	92.99	7.01	14.67	7.18	
2	92.95	94.35	5.65	14.14	5.44	
3	94.09	94.04	5.96	14.76	5.29	
4	93.6	93.63	6.37	14.41	7.43	
Lemon grass oil	**NA**	**NA**	**NA**	**7.79**	**NA**	**8701.26**

FEED INTAKE

The average feed intake of experimental birds is given in Table 3.

Table 3: Feed intake of experimental birds, g (Mean ± SD)

TRT	O day	7 days	14 days	21 days	28 days	36 days	Cumulative feed intake, g	FCR
1	5.44 ±1.35	40.08 ±1.08	77.82 ±1.57	125.24 ±3.37	165.46 ±2.70	176.93 ±1.02	3330.95	1.46
2	4.30 ±0.33	36.08 ±0.65	76.93 ±2.20	124.53 ±4.10	166.57 ±3.24	187.33 ±1.09	3354.04	1.47
3	4.70 ±0.60	39.02 ±0.90	76.30 ±1.44	123.11 ±6.22	168.39 ±1.48	199.82 ±1.32	3443.17	1.44
4	5.19 ±0.70	38.22 ±1.98	77.37 ±1.42	128.48 ±2.43	161.90 ±7.06	184.84 ±1.93	3377.33	1.51
Mean	**4.91 ±0.84**	**38.35 ±1.87**	**77.10 ±1.55**	**125.34 ±4.18**	**165.58 ±4.34**	**187.23 ±1.46**	**3376.37**	**1.47**
P Value	**P>0.05**	**P<0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**

Table 3 showed that in the 7th days of experiment, highest feed intake per bird was observed in T_1 (40.8 g) followed by T_3 and T_4 (39.02g and 38.22 g,

respectively) which was significant ($p<0.05$) among diet groups. In the 14th days of experiment, feed intake per bird of T_1 and T_4, and T_2 and T_3 was almost similar (77.82g and 77.37 g, respectively, and 76.93g and 77.3 g respectively) which were non-significant among diet groups. In the 21st days of experiment, highest feed intake per bird was noted inT_4 (128.48 g) followed by T_1 and T_2 (125.24 g and 124.53 g, respectively) which was also non-significant among diet groups. Similarly, in the 28th days of experiment, highest feed intake per bird was observed in T_3 (168.39 g) followed by T_2 and T_1 (166.57g and 165.46 g, respectively) which was non-significant among diet groups. Likewise, in the 36thdays of experiment, again highest feed intake per bird was found to be in T_3 (199.82 g) followed by T_2 and T_4 (187.33g and 184. 84 g, respectively), however, it was non-significant among diet groups. The cumulative feed intake per bird was found higher in T_3 (3443.17 g) followed by T_4 and T_2 (3377.33g and 3354.04 g, respectively) which was also non-significant among diet groups. The FCR was highest in T_3 (1:1.44 kg) and lowest in T_4 (1: 1.51 kg) which also non-significant among diet groups.

BODY WEIGHT GAIN

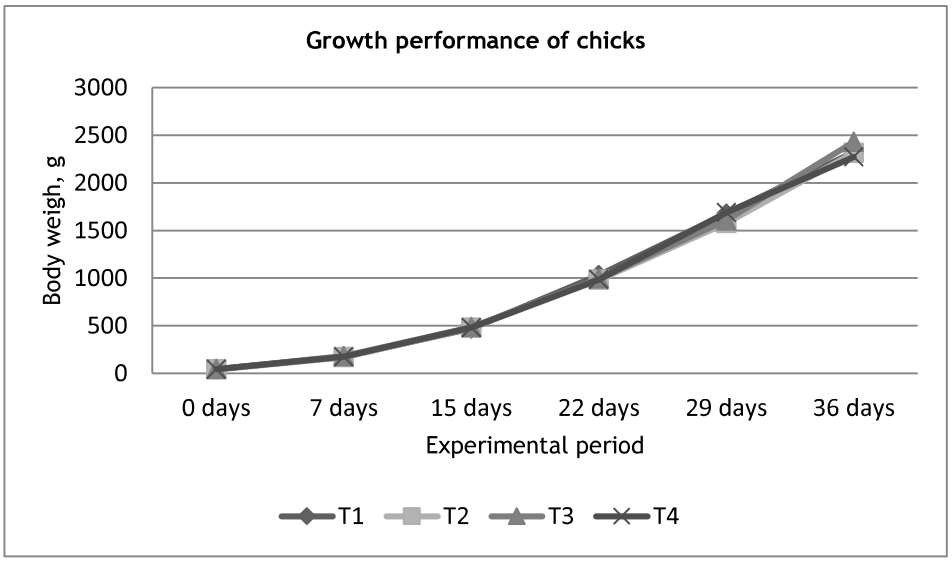
The average growth performance of experimental birds in given in Table 4.

Table 4: Weight gain of experimental birds, g (Mean ± SD)

TRT	Initial weight	7 days	14 days	21 days	28 days	36 days	Total weight gain, g	ADG
1	44.97	177.77	471.1	1033.0	1677.77	2324.0	2279.46	63.31
	±1.03	±10.18	±23.41	±35.27	±21.42	±1.01	±101.36	±2.81
2	43.64	171.10	479.99	984.44	1577.77	2316.0	2271.86	63.10
	±0.75	±3.85	±17.63	±36.71	±86.75	±83.35	±82.61	±2.29
3	45.99	182.22	486.66	997.77	1606.66	2431.0	2385.13	66.25
	±1.96	±3.84	±24.03	±63.36	±141.10	±1.24	±126.01	±3.50
4	44.22	175.55	482.21	986.66	1688.88	2273.0	2229.10	61.85
	±1.23	±3.85	±26.94	±80.82	±16.77	±6.67	±7.10	±0.24
Mean	**44.70**	**176.66**	**479.99**	**1001.0**	**1637.77**	**2336.0**	**2291.39**	**62.62**
	±1.45	**±6.66**	**±20.69**	**±52.98**	**±86.70**	**±98.20**	**±97.99**	**±2.73**
P Value	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**	**P>0.05**

Table 4 showed that highest body weight of bird in the 7th day of experiment was observed in T_3 (182.22 g) followed by T_1 and T_4 (177.77 and 175.55 g, respectively). In the 14th day of experiment, again highest body weight was monitored in T_3 (486.66 g) followed by T_4 and T_2 (482.21 and 479.99 g, respectively). In the 21st day of experiment, higher body weight was found in T_1 (1033 g) followed by T_3 and T_4 (997.77 and 986.66 g, respectively). Similarly, in the 28th day of experiment, bird of T_4 weighed higher (1688 g) than that of T_3 and T_1 (1606.66 and 1677.77 g, respectively). Likewise, by the end of experiment at 36th days, higher weight was found in the T_3 (2431 g) followed by T_1 and T_2 (2324 and 2316 g, respectively). Inclusion of LOG did not affect significantly on body weight gain during experiment period from initial to end of the experiment for 36 days (Fig.1). The total weight gain of experimental bird was found to be higher in T_3 (2385.13 g) followed by T_1 and T_2 (2279.46 and 2271.86 g, respectively). Average daily gain of experimental birds noted higher in T_3 (66.25 g) followed by T_1 and T_2 (63.31 and 63.1 g, respectively).

Figure 1. Body weight gain trend of experimental birds



According to the various literatures, body weight gain and feed intake of experimental birds is correlated with addition of LGO in feed but experiment did not reveal that in our experiment, however, an assumption was taken. Our experiment revealed that broilers fed diets treated with 600 ml /100 kg feed had less feed intake (3377.33g) than that of 400 ml/100 kg feed (3442.17g) which was statistically non-significant. These findings were in agreed with Alcicek*et al.*, (2004).

Similarly, experiment revealed that the body weight gain was also higher (2385.13 g) in T_3 where LGO was included 400 ml / 100 kg feed compared to the control group (2279.46 g). This result was in the line of Tekeli (2011), where he noted that chicks fed on diet with supplemented LGO recorded significantly heavy weight gain, This improve may be attributed to the increase in total feed consumption, the active compounds, antimicrobial and antioxidant activities of the LGO. These results are in agree with Tekeli (2011) and Mukhtar (2011) where their experiment revealed significantly improve in feed conversion ratio for broilers fed diets supplemented with various levels of LGO compared with control group.

Khattak *et al.*, (2014) reported that the inclusion of lemon grass in the broiler diet improves the body weight gain with positive effects on feed conversion ratio. Mukhtar *et al.*, (2012) reported that 50, 100 and 150 ml /kg feed supplementation of lemon grass oil in broiler diets increased feed consumption.

Mmereole (2010) conducted an experiment to evaluate the effects of dietary inclusion of lemon grass leaf meal (LGLM) on growth performances of broiler chickens and its ability to be utilized as a viable alternative to antibiotic growth promoters. The experiment involved two hundred and seventy day-old Abor-acre broiler chickens randomly separated into 3 experimental diet groups, with each being replicated 3 times. Ninety day-old birds were randomly allocated into three groups and each group had 30 replicate. The diet groups were: $T_{1:}$ control (basal diet), $T_{2:}$ basal diet +1% LGLM and $T_{3:}$ basal diet+1% Teramycin antibiotic growth promoter. The results obtained indicated that the performances of the birds placed on control diet (T_1) were significantly ($p<0.05$) lower in all parameters than those placed on T_2 and T_3. The results further indicated that final body weight of the birds on T_2 (1895.56 g) was quantitatively higher than that of the birds in T_3 (1875.92 g), the difference was not significant. With respect to feed intake and feed conversion ratio, it was observed that there were no significant differences between the birds in T_2 and T_3.

Mukhtar *et al.*, (2012) conducted an experiment on broiler chicks for 42 days formulating five experimental diets (A, B, C, D and E). Diets A was control, diet B was supplemented with antibiotic (Neomycin 16 mg/kg) while diets C, D and E were supplemented with (LGO) at 50,100 and 150 mg/kg, respectively. Result obtained showed that addition of LGO significantly improved ($p<0.05$) body weight gain, feed intake and feed conversion ratio of broiler chicks as compared to the control group. Non-significant differences were noted among broilers fed on diets supplemented with LGO and antibiotic supplemented groups, respectively. Results revealed non-significant differences among all

treatment groups regarding carcass dressing percentages giblet, commercial cuts (breast, drumstick and thigh) and percentage of their separable tissue, meat chemical composition and subjective meat quality parameters. Economically the addition of LGO improved the performance of broiler chicks and resulted in economic benefits. Moreover, this study showed that LGO when added as a growth promoter in broiler diets had a similar effect as that with antibiotic without any adverse effects.

Tiwari *et al.,* (2017) conducted an experiment on broiler chicken and reported that inclusion of LGO at the rate of 400 ml/100 kg feed improved the weight gain, reduced birds mortality and reduced the period of broiler harvesting.

CONCLUSION

Inclusion of lemon grass oil as a growth promoter in broiler diet is one of the option to enhance the production performance of broiler chicken. Inclusion of lemon grass oil at the rate of 400 ml/100 kg feed had beneficial effect than that of 200 and 600 ml/100 kg feed, however, cost benefit analysis should be carried out. Therefore, further study is suggested to ascertain the cost of production.

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