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Combined effect of drumstick (*Moringa oleifera*) and lemongrass (*Cymbopogon citratus*) on growth performance of broilers

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Abstract
An experiment was conducted at poultry unit in college of Agriculture Latur, to determine the combined effect of Drumstick (*Moringa oleifera*) and Lemongrass (*Cymbopogon citratus*) powder on growth performance and economical of feeding. Eighty day- old chicks were divided into four dietary treatments i.e., T_1: Basal diet feeding, T_2: Basal diet + 0.5% Drumstick powder, T_3: Basal diet+0.5% Lemongrass powder and T_4: Basal diet + 0.5% Drumstick + 0.5% Lemongrass powder of combination with four replication and five birds have each replication. Result of experiment showed significant difference ($P<$ 0.05) in feed intake, live weight, body weight gain and feed conversion ratio between treatments. The study concluded that addition of drumstick powder at the 0.5 per cent and 1 per cent mixture of Drumstick and lemongrass in broiler diet improved growth performance of broiler and economical and profitable for broiler production.

Keywords: Growth performance, feed intake, feed conversion ratio, serum lipid profile, economics

Introduction
Antibiotics have been used widely to prevent infections and poultry diseases and for the improvement of meat and egg production. However, use of antibiotics is restricted due to drug resistance in bacteria, drug residue in carcass and also alteration of natural gut micro flora. Recently many countries tend to minimize or prohibit the use of antibiotics because of their deleterious side effects on both animals and human. Consequently, the of use of natural promoters such as probiotics, prebiotics, symbiotics, enzymes, toxic binders, organic acids, oligosaccharides, phytogenics, and other feed additives, to enhance the growth and performance of broiler chickens have been advocated compounds. The lemongrass metabolites as oil (LGO) is considered as a viable alternative to antibiotics for the broiler and have been studied as an alternative for microbial and growth promoting abilities in the poultry and that resulted minimized feed expense in the production chain Drumstick *(Moringa oleifera*): Moringa is a potential plant that could be used to enhance immune response and to improve intestinal health of broiler chicken. The leaves of *Moringa* has high protein content which is between 20-33% on a dry weight basis, the protein is of high quality having significant qualities of all the essential amino acid.

Materials and Methods
The present research work was undertaken to study the combined effect of drumstick and lemongrass supplementation on growth performance of broilers. The present study was carried out in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra state. Day old eighty, commercial straight run broiler chicks (Vencobb-430) strains were obtained from Huma hatcheries Latur (Maharashtra). Weighted (46.71+0.02g) wing banded and randomly allocated into four treatments groups with four replications and each replication have five birds. The concentration of the administrated Additives in four experimental diets were as follows: T_1 – 100 parts of standard broiler ration without supplement (control), T_2 - 99.50 part standard broiler ration + 0.5 part drumstick leaf meal, T3 - 99.50 part standard broiler ration + 0.5 part lemongrass leaf meal and T_4 - 99.00 part standard broiler ration + 0.5 part mixture of drumstick leaf meal + 0.5part of lemongrass leaf meal.

Table 1: Chemical composition of drumstick and lemongrass leaf meal on dry matter basis

Sr. No.	Ingredient	Percentage	
		Drumstick	Lemon grass
1.	Protein	27.31	26.80
2.	Fats	4.00	2.96
3.	Carbohydrate	46.25	42.30
4.	Fiber	6.50	8.00
5.	Moisture	4.00	4.58
6.	Ash	3.20	3.00

All the broiler chicks were fed with ground maize first two days of age. Chicks feed standard feed purchased from market for three periods of 2-10 days birds fed with pre-starter, 11-21 days birds fed with broiler starter and 22-42 days birds fed with broiler finisher. The diets were fed *ad-libitum* to experimental groups by adding required amount of lemongrass leaf meal as per treatment. The per cent ingredient composition of experimental broiler ration that is for pre-starter, starter and finisher in Table 1.

Chemical Analysis

The chemical analysis of the experimental broiler ration were carried out as per A.O.A.C. (1995) for all the proximate principles.

Statistical Analysis

The treatment wise data on cumulative body weight gain in body weight, feed consumption and feed conversion ratio, water intake and blood serum constituents were subjected to analysis of variance of complete randomized design (Snedecor and Cochran 1982).

Results and Discussion

Growth performance

The mean average cumulative body weights of broilers in the treatment groups T_2 was significantly ($P< 0.05$) higher as compared to those in T_1, T_2, were as at par with T_4 group. It could be seen that highest cumulative body weight of 2630.25 g obtained in T_2 group broiler receiving 0.5 per cent drumstick leaf meal powder followed by 2615g with 1.00 per cent mixture of drumstick and lemongrass in T_4 and 2476 g with 0.5 per cent lemongrass leaf meal in T_3 and lowest cumulative body weight i.e. 2428 g in T_1 control at the end of 6th week.

Table 2: Body weight gain of broiler chicks (g/bird/week) as affected by addition of drumstick and lemongrass leaf meal.

Items		Drumstick	lemongrass	Drumstick + lemongrass		
5%	0%	0.5%	0.5%	1%	SE	CD at
1st week	134.79	143.60	137.79	142.06	6.35	N.S
2nd week	259.80	269.80	262.25	267.50	11.03	N.S
3rd week	399.20	420.00	424.00	422.00	15.69	N.S
4th week	499.75	540.00	502.00	537.00	22.66	N.S
5th week	439.75	590.00	500.00	585.00	30.5	N.S
6th week	628.00	620.00	604.00	615.00	32.5	N.S
Total	2361.29[a]	2583.40[b]	2430.04[ab]	2568.56[b]	54.51	159.61*

(Significant ($P< 0.05$) means under each class in the same column with different superscripts differ significantly)

The statistical analysis on the weekly body weight gain of broiler birds under four different treatments during each week observed non significant ($P< 0.05$) difference during all the weeks from first week to sixth week. After the sixth week it was see from the Table 2 that the total gain in body weight of bird among treatment groups T_2 and T_4 was significantly superior ($P< 0.05$) as compared to T_1 control group, and T_3 group. Average gain in body weight in T_2 and T_4 did not differed significantly with and T_3 group. The treatment T_1 control (2361.29 g) was significantly lower as compared to the treatments i.e. T_2 (2583.40 g), T_4 (2568.56 g) were as numerically lower than T_3 (2430.04 g). The average body weight gain of 2583.40 g obtain in T_2 group was significantly superior over T_1 (2361.29 g) where as was at par to treatment T_2 and T_4 at 5 percent level of significance on the perusal of Table 2, it was seen that highest gain in body weight of 2583.4 g was obtained in T_2 group broilers receiving 0.5 per cent drumstick leaf meal followed by 2568.56 g with 1 per cent mixture of drumstick and lemon grass leaf meal in T_4 2430.04 g with 0.5 per cent lemon grass leaf meal in T_3 and lowest body weight gain i.e. 2361.29 g in T_1 control at the end of 6th week.

Feed intake (g/bird)

The total average feed consumption per bird ranged from 4280.01 g to 4660.79 g during experimental period of 6 week. Were non significant differences among the all treatment groups except fourth and fifth week. At the end of experiment the total feed consumed by different treatment groups broiler chicks as T_2 group consumed significantly ($P< 0.05$) lower quantity of feed (4280.01 g) as compared to T_1 (4660.79 g) and T_3 (4645.43 g).

Table 3: Feed intake of broiler chicks (g/bird) as affected by addition of drumstick and lemongrass leaf meal.

Items		Drumstick	lemongrass	Drumstick + lemongrass		
	0%	0.5%	0.5%	1%	SE	CD at 5%
1st week	160.75	148.00	155.00	150.00	8.07	N.S
2nd week	330	312	328	314	17.17	N.S
3rd week	720	690	718.30	692	26.74	N.S
4th week	1128.02[b]	1020.81[a]	1124.21[b]	1022.20[a]	30.02	*
5th week	1146.05[b]	1042.49[a]	1144.58[b]	1042.81[a]	30.19	*
6th week	1176.02	4280.01	4645.43	4290.48	36.83	*
Total	4660.79[b]	4280.01[a]	4645.43[b]	4290.48[a]	64.17	*

(different value with no common superscript are significantly different ($P< 0.05$) within a column).

It could be seen that highest feed consumption of 4660.01 g was obtained in T_1 control group broilers followed by 4645.43 g with receiving 0.5 per cent lemon grass leaf meal in T_3, 4290.48 g in T_4 and lowest feed consumption i.e. 4280.01 g in T_2 at the end of 6th week. It showed that the birds fed with 0.5% level in addition of drumstick leaf meal had lowest feed consumption rate in the broiler birds. The results are in agreement with different workers who have that reported that herbals additions in the broiler's diet had a significant positive effect on feed consumption. In present experiment it was clearly noted that in treatment that the 0.5% level of *Moringa oleifera* was lowest feed consumed group of broiler chicks it might be due to moringa have slightly bitter taste. But there was increasing the feed conversion ratio of treatment 0.5% level of *Moringa oleifera* leaf meal addition in broiler ration as similar result obtain in 1% level mixture of *Moringa oleifera* and *Cymbopogon citratus* feed additives Lemon grass treatment giving positive effect on feed consumption increases the feed consumption rate per bird it may be due to lemon grass improving feed taste having diet palatability, enhancing appetite of poultry and the quicker passage and digestion of nutrients through the digestive effect of these natural products.

Feed conversion ratio (FCR)

Experimental birds in T_1 group showed significantly ($p<$ 0.05) higher average FCR as compare to T_2, T_3 and T_4 groups (Table 4). the average feed conversion ratio from first to sixth week ranged from 1.65 to 1.96 which was significantly ($P<$ 0.05) higher in T_1 (1.96) as compared to T_2 (1.65), T_4 (1.67where as at par with T_3 (1.91) group. the best feed conversion ratio of 1.65 obtained in T_2 group broilers inclusion of 0.5per cent drumstick leaf meal followed by 1.67 with 1 per cent mixture of drumstick and lemongrass leaf meal in T_4, 1.91 in T_3 group inclusion of 0.5 per cent lemon grass leaf meal and poor in feed conversion i.e.1.97 in T_1 control at the end of 6th week.

The results obtained in the correspondence with the results of this may be attributed to birds fed with drumstick leaf meal based diets adequately utilized the nutrients they consumed. Results of this experiment are synergetic effect of herbal mixture of drumstick and lemon grass and reported significant effect ($P<$ 0.05) on live weight and feed conversion on broiler ration. The results obtained in the correspondence with the results of this may be attributed to birds fed with drumstick leaf meal based diets adequately utilized the nutrients they consumed.

Table 4: Effect of natural feed additives on feed conversion ratio of broiler chicks

Items	Drumstick		lemongrass	Drumstick + lemongrass		
	0%	0.5%	0.5%	1%	SE	CD at 5%
1st week	1.19	1.02	1.13	1.06	0.05	N.S
2nd week	1.27	1.15	1.25	1.17	0.06	N.S
3rd week	1.80	1.64	1.69	1.64	0.06	N.S
4th week	2.26[b]	1.89a	2.23[b]	1.90[a]	0.05	*
5th week	2.57[c]	1.76[a]	2.29[b]	1.78[a]	0.05	*
6th week	1.87[ab]	1.72[a]	1.94[b]	1.73[a]	0.03	*
Total	1.96	1.65	1.91	1.67	0.03	*

(Different value with no common superscript are significantly different ($P<$ 0.05) within a column)

Results of this experiment are synergetic effect of herbal mixture of drumstick and lemon grass and reported significant effect ($P<$ 0.05) on live weight and feed conversion on broiler ration. Najafi and Taherpou (2014) who revealed that supplemented with feed additives as a ginger and cinnamon ($p<$ 0.05) feed intake and improved ($p<$ 0.05) feed conversion ratio compared to the control group Similar result was also obtained by Safa and Eltazi, (2014) and showed that the diet with 1% ginger powder had significantly ($P<$ 0.05) best feed conversion ratio. Kafi *et al*. (2017) [7] also recorded lower FCR in turmeric supplemented group as compare to other groups.

Economics of broiler production

The profit was evaluated by considering total amount of feed consumed by broilers under T_1 control, drumstick and lemon grass leaf meal added broiler ration. Other factors such as cost of day old chicks, medicine, vaccines and litter material were common for all the treatments and control groups. However, the cost of labors, electricity etc. was not considered in calculating the economics of broiler production, being the post graduate research work. The average body weight of bird at the end of 6th week was 2361.29, 2583.3, 2430.04 and 2568.56 g/bird in the treatments T_1, T_2, T_3 and T_4, respectively. The birds were sold at the rate 82 Rs/ Kg. and price realized from the birds was 193.62, 211.92, 199.98 and 210.49 ₹ in the treatments T_1, T_2, T_3 and T_4, respectively. The highest price realized from the treatment T_2 i.e. 211.92 Rs. followed by T_4 (210.49 Rs.), T_3 (199.98 Rs.) and lowest price realized from the treatment T_1 control (193.62 Rs.).The net profit per bird was highest in T_2 (Rs.64.71), followed by T_4 (Rs.59.7), T_3 (Rs. 41.85) and lowest for T_1 control (Rs. 38.59).

Table 5: Economics of broiler production per bird

Particulars		Treatments		
	T1	T2	T3	T4
Cost of day old chicks (Rs.)	20	20	20	20
Drumstick Consumed per bird (g)	0	10.7	-	-
Lemongrass Consumed per bird (g)	0	-	11.61	-
Drumstick and Lemon grass Consumed per bird (g)	0	0	0	21.45
Cost of Drumstick (Rs./g)	0	0.24	0	0
Cost of Lemon grass (Rs./g)	0	0	0.28	0
Cost of feed additives (Rs)	0	2.56	3.25	5.57
Av. Total feed consume per bird (g)	4660.79	4280.01	4645.43	4290.48
Cost of feed (Rs./g)	27.9	27.9	27.9	27.9
Cost of feed consumed per bird (Rs)	130.03	119.65	129.88	120.22
Total cost of feed consumed per bird (7+10)	130.03	122.21	133.13	125.79
Av. Body weight gain at the end of 6th week (g)	2361.29	2583.3	2430.04	2568.56
Feed consumption per kg live weight (g)	1974.91	1658.91	1919.59	1675.96
Cost of feed per kg weight gain	55.09	46.28	53.55	46.75
Cost of medicine, vaccine and litter material per bird	5	5	5	5
Cost of production per bird	155.03	147.21	158.13	150.79
Av. Price realize @ Rs. 82 per kg live weight	193.62	211.92	199.98	210.49
Net profit bird Rs.	38.59	64.71	41.85	59.7

The observation indicated that the performance of broilers in T_2 group was superior to that of the control and 0.5 per cent level of lemon grass leaf meal in broiler diet. This might be due to improved feed conversion efficiency on supplementation of *Moringa oleifera* and also due to rich nutrient content of *Moringa oleifera* and treatment T_4 addition mixture of drumstick and lemon grass leaf meal also giving good profit as compared to treatment T_1 and T_3 it may be due to containing maximum protein, rich nutrients, than singly giving feed additives it increased the feed efficiency of broiler feed consumption by natural plant material.

Serum constituents

The serum constituents like glucose, cholesterol, triglyceride, high density lipoprotein (HDL), low density lipoprotein (LDL), LDL and HDL ratio, total protein, albumin and globulin were estimated at the end of experiment and the results are presented in Table.6

Table 6: Effect of dietary treatment of drumstick and lemon grass on serum constituents of broiler chicks

Items	Drumstick		lemongrass		Drumstick + lemongrass	
	0%	0.5%	0.5%	1%	SE	CD at 5%
Glucose (mg/dl)	120.50	120	121.75	93.50	3.15	*
Cholesterol (mg/dl)	134.50	136.35	130	136.25	7.49	N.S
Triglyceride (mg/dl)	136.75	130.50	130.50	129	14.2	N.S
HDL (mg/dl)	82.25	93.25	92.50	89.75	6.08	N.S
LDL (mg/dl)	22.75	21.00	23.00	23.00	37.00	N.S
LDL/HDL Ratio	0.40	0.35	0.38	0.90	0.27	N.S
Total protein	2.32^a	2.37^a	2.41^a	2.80^b	0.06	*
Albumin(mg/dl)	1.20^a	1.54^b	1.49^b	1.19^a	0.04	*
Globulin(mg/dl)	1.31^b	1.29^b	0.94^a	1.65^c	0.06	*

The level of glucose in serum of birds at 42nd day in T_1, T_2, T_3 and T_4 was 120.50, 120.00, 121.75 and 93.50 mg/dl respectively. The level of glucose in T_4 was significantly lower than T_3, T_1 and T_2 groups. Higher glucose level was found in T_3 (121.75 mg/dl), followed by T_1 (120.50 mg/dl), T_2 (120.00mg/dl) and lowest level of glucose was found in T_4 (93.50mg/dl). Results indicated that the concentration of glucose decreased with mixture of drumstick and lemon grass leaf meal. Cholesterol serum of broilers at 42nd day in T_1, T_2, T_3 and T_4 was 134.50, 136.35, 130.00 and 136.25 mg/dl, respectively. The levels serum triglyceride at 42nd day in T_1, T_2, T_3 and T_4 were 136.75, 130.50, 130.25 and 129.00 mg/dl, respectively. Triglyceride was highest in T_1 (136.75 mg/dl) and lowest in T_4 (129.00 mg/dl) i.e. control group without supplemented with lemon grass leaf meal and drumstick leaf meal and had quantitatively higher level of serum triglyceride than other three groups. The result shows that, triglyceride level was good in treatment T_4 (129.00) i.e. these results could be evidence of the synergetic effect of herbal mixture (drumstick and lemon grass) on plasma triglyceride reduction. Bamidele *et al.* (2012) [2] who reported that significant reduction in cholesterol with addition of 0.5 per cent garlic than as per result lemon grass was is beneficial for cholesterol maintenance. Mukhtar *et al*. (2012) [9] also supported to these findings and reported that, cholesterol lower significant for group of lemon grass leaf meal feeding of broiler.

Conclusion

The addition of 0.5 per cent of drumstick in broiler ration was beneficial in improving live weight and weight gain. The addition of 0.5 per cent of drumstick in broiler diet improved feed conversion ratio. The addition of mixture of 1 per cent mixture drumstick and lemon grass in broiler diet increases the level of water intake weekly. The addition of 0.5 per cent drumstick, lemongrass and mixture drumstick and lemon grass in broiler diet reduces the level of triglyceride and glucose whereas increases the level of HDL, LDL/ HDL ratio, total protein, albumin and globulin. Addition of 0.5 per cent drumstick and 1 per cent mixture of drumstick and lemon grass leaf meal i.e. (0.5% drumstick + 0.5% lemongrass) are economical

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