A comparison of growth performance and feed cost of broilers fed diets supplemented with a phytogenic growth promoter or an AGP

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Introduction

Use of sub-therapeutic levels of antibiotic as growth promoters (AGP) in food animal production has well over fifty years of history. A recent meta-analysis (Cardinal *et al.*, 2019) reported that the use of AGP improved the feed efficiency by 3.48% and has 0.03$ of per bird economic impact. Consequently, among a range of other factors such as better genetic make-ups and management conditions, use of AGP has been identified as one of the major reasons for higher availability, affordability and the popularity of broiler meat in many counties, including Sri Lanka. However, many countries have banned the use of AGP in food animals due to its strong relationship with the development of resistant of pathogenic bacterial strains both in human and other animals (Tang *et al*., 2017). Sweden was the first country to impose restrictions on AGP, followed by EU which banned the AGP usage in 2006. Now, many leading broiler producers such as Brazil, China, India, Thailand and Vietnam have imposed restrictions on AGP. Recently Sri Lanka also banned AGP. Apart from regulatory restrictions, there is a growing public demand for livestock products that are free from potentially harmful additives including AGP and hormones. In these circumstances, poultry industry is under pressure to sustain the growth and financial performance using diets free from AGP. A range of phytogenic feed additives, essential oil mixtures, prebiotics and probiotics have been tested as alternatives to AGP, with varying success. This study compared the growth performance and feed cost of the broilers fed diets with either Emerald; a commercially available phytogenic growth promoter or AGP, to determine the suitability of Emerald as an alternative to AGP.

Martials and methods

A total of 1800 day-old broiler chicks were allocated into 36 floor pens. Giving completely randomize experiment with 12 replicate pens per each treatment, pens were randomly assigned into one of the three dietary treatments. Treatments were;
T1. Broiler chick booster crumbles, starter crumbles and finisher pellets with Emerald

T2. Same (T1) diets but with a commercial AGP, but without Emerald,

T3. Same (T1) diets without either Emerald or AGP (negative control).

Ingredient and nutrient compositions of the feeds and the additives used for each treatment is shown in Table 1.

Chicks were brooded for seven days using gas brooder. During brooding period, feeding trays were used. Subsequently two feeders were placed in each pen. One automatic drinker (auto can) was provided for each pen. Feed intake was recorded daily. Birds were weighed weekly. Portioning data, digestive track data and deboning data of ten randomly selected from each pen were collected at the processing plant.

Table 1. Ingredient composition, estimated nutrient levels and the cost of feed formulations

Ingredient		**Chick booster crumble 1-14d**	**Starter crumbles 15-21d**	**Finisher pellets 22-35d**
Maize %		33	32	31
Rice %		20	21	22
Rice polish %		5	5	5
Oil %		1.4	2.4	4.4
SBM %		33	28	24
MBM %		4	6	7
Premix %		3.6	5.6	6.6
Formulation Cost Rs/kg)[1]	-AGP-Emerald	75.33	74.94	74.56
	+AGP-Emerald[3]	75.50	75.45	74.80
	+Emerald-AGP[2]	75.96	75.57	75.20
Nutrient composition (Estimated)				
Protein (min) (%)		22.0	20.0	19.0
Fat (min) (%)		3.5	4.0	5.0
Ash (max) (%)		7.0	7.0	5.5
Fiber (max) (%)		5.0	5.0	7.0
Calcium (%)		1.0 – 1.05	1.0-1.05	0.9-0.95
Phosphorous (%)		0.60	0.60	0.65
Methionine (min) (%)		0.60	0.54	0.49
ME (min)(kcal/kg)		3000	3050	3150

[1.] As of Jan 2020

[2.] Emerald (Igusol Advance SA, Spain) at 150g/ton. According to the manufacturer, Emerald contains a standardized combination of active ingredients of cinnamon and other aromatic substances.

[3.] AGP=Flavocombi (a mixture of flavophospholipol and Bacillus licheniformis), at 150g/ton

Data were analyzed as a completely randomized design, using SPSS. Significant main effects were compared using DMRT procedure.

Results

Both diets supplemented with Emerald and AGP significantly improved the live weights on day 14, compared to negative control (Table 2).

Table 2. Effects of AGP and Emerald supplementation on growth performance and feed cost of broilers from day 1-35

Parameter	Treatment			SEM	P value
	AGP	Emerald	Negative control		
Live weight (g)					
Day 1	40.90	41.20	41.40	0.35	0.37
Day 7	164.66	171.82	168.16	1.33	0.07
Day 14	480.26^{a}	493.43^{a}	464.55^{b}	6.80	0.00
Day 21	926.31^{ab}	937.93^{a}	902.82^{b}	11.55	0.01
Day 28	1544.69^{ab}	1580.39^{a}	1526.30^{b}	18.76	0.02
Day 35	2052.74	2059.58	1969.47	49.76	0.14
Cumulative feed intake (g/bird)					
Day 21	1343.50^{a}	1356.14^{a}	1308.11^{b}	16.82	0.02
Day 28	2365.06^{ab}	2396.23^{a}	2328.34^{b}	25.22	0.03
Day 35	3671.80	3669.52	3590.28	40.26	0.08
Weight gain (g)					
Day 1-35	2011.84	2018.38	1928.07	49.86	0.14
FCR					
Day 1-7	1.65^{a}	1.53^{b}	1.50^{b}	0.05	0.02
Day 7-14	1.31^{b}	1.29^{b}	1.37^{a}	0.02	0.01
Day 1-35	1.82	1.82	1.87	0.04	0.46
Feed cost (Rs)					
Feed cost per bird	275.57^{a}	276.69^{a}	268.43^{b}	3.02	0.02
Feed Cost per kg of LW	136.97^{b}	137.08^{b}	139.22^{a}	0.71	0.03

Subsequently on day 21 and 28 as well, diet with Emerald, reported significantly higher live weight compared to negative control. Except on day 14, live weight of the birds fed with

AGP was not significantly different from those fed T3 (growth promoter-free diet). Compared to those fed negative control diets, birds fed Emerald reported higher feed intake by day 21 (p=0.02), day 28 (p=0.03) and 35 (p=08). During day 1-7, Emerald and negative control diets gave significantly better FCR, than those fed AGP. Though AGP and Emerald had positive effects on growth performance during early stages of the production cycle, the final live weight on day 35, weight gain from day 1-35 and FCR of the birds fed Emerald or AGP were not significantly different from those fed negative control diets. However, it needs to be noted that birds fed Emerald reported the highest live weight, weight gain and the best FCR which in turn was similar to that of AGP fed birds.

Percentage weights of skin on thigh, skinless breast, wings, drumstick and offcut and, the weight of gastro intestinal tract, intestine, proventriculus and ceaca were not significantly affected by the dietary treatments. Feeding of diets free from AGP or Emerald reported significantly lower feed cost per bird. However, feed cost per kg of live weight gain of the birds fed AGP or Emerald diets were approximately 2 Rs lower than those fed negative control diet. Interestingly, debone meat yield percentage of the broilers fed Emerald (49.9%) and AGP (48.4%) were significantly higher than those fed negative control diet (45.7%).

Discussion

In agreement with the findings of this study, a recent meta-analysis (Cardinal *et al*., 2019) also reported that AGPs have positive impacts on growth performance only during early stages of growth (1-21d), but not later stages of growth (22-42d). The present study observed significant positive impacts due to AGP and Emerald on feed intake and live weight up to day 28 and on FCR up to day 21. It is well known that the positive impacts of AGP are attributed to improved gut health. Emerald also, being a mixture of essential oils may improve the gut health and in turn the growth performance. It is suggested that compared to older birds, young birds may be more benefited by the AGP and alternatives such as Emerald since they are more susceptible to unfavorable gut environmental conditions. In line with Akyildiz *et al.* (2016), this study also observed only a numerical improvement in growth performance of the broilers of later stage, due to Emerald and AGP. Naveenkumar *et al*. (2017) have reported that AGP produced no positive impacts in the absence of health problems. Therefore, the good hygienic and management conditions prevailed under the experimental conditions could be a reason for not to have significant impacts due to AGP and Emeralds on growth performance during the later stage of the growth.

The improvement of FCR due to AGP and Emerald reported herein is lower than that reported by Cardinal *et al*. (2019) in their meta-analysis (3.84%). Due to both to the reduced feed intake and the formulation cost, feeding of diets free from AGP or Emerald reduced the feed cost per bird by 7-8 Rs (by 2.7-2.75%). However, due to better FCR, feed cost per kg of live weight gain was reduced by 2 Rs (1.4%) due to Emerald and AGP. Cardinal *et al*. (2019) in their meta-analysis reported a much lower (0.8%) per bird feed cost reduction due to AGP usage. Considering the comparable growth performance and feed cost between the broilers fed diets with Emerald and AGP, the study suggests Emerald as an alternative to AGP. Advantage of Emerald over negative control diet and AGP diet will be further enhanced due to the significantly higher meat yield of the reported by the birds fed with Emerald diet, compared to those fed negative control or AGP diet.

Conclusions

This study concludes both AGP and Emerald improves the growth performance of broilers up to day 28 but not thereafter. Compared to the feeding of growth promoter free diets, diets with either Emerald or AGP resulted in numerically better growth performance parameters at lower feed cost per kg of live weight gain from day 1-35. The tested phytogenic growth promoter, Emerald is concluded to be a suitable alternative to AGP.

References

AKYILDIZ, S., OZCAN, N. AND DENLI, M. (2017) Efficacy of herbal extracts on growth performance, serum biochemistry and intestinal selected bacterial population in broilers. Scientific Papers: Series D, Animal Science-The International Session of Scientific Communications of the Faculty of Animal Science 60.

CARDINAL, K. M., KIPPER, M., ANDRETTA, I. AND RIBEIRO, A. M. L. (2019) Withdrawal of antibiotic growth promoters from broiler diets: performance indexes and economic impact. *Poultry science* **98(12):** 6659-6667.

NAVEENKUMAR, S., KARTHIKEYAN, N., BABU, R. N., VEERAMANI, P. AND SIVARAMAKRISHNAN, S. (2017) Effect of organic acid salts as an alternative to antibiotic growth promoters on the production performance of commercial broiler chicken. *Int. J. Curr. Microbiol. App. Sci*. **6(9):** 3470-3480.

TANG, K. L., CAFFREY, N. P., NÓBREGA, D. B., CORK, S. C., RONKSLEY, P. E., BARKEMA, H. W., POLACHEK, A. J., GANSHORN, H., SHARMA, N., KELLNER, J. D. AND GHALI, W. A. (2017) Restricting the use of antibiotics in food-producing animals and its associations with antibiotic resistance in food-producing animals and human beings: a systematic review and meta-analysis. *The Lancet Planetary Health* **1(8)**: e316-e327.