

Full Length Research Paper

Effects of a commercial mixture of herbal essential oils and vitamins (Provital®) and an organic acid (Totacid®) on performance and economical efficiency in broilers: A field study

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A farm study was carried out to evaluate the inclusion of a commercially available blend of herbal essential oils (Provital) and an organic acid (Totacid) on productive performance and economical efficiency of broiler chickens. A total of 31,800 day old straight run broiler chickens (Ross 308) were allocated to three experimental treatments in three houses (10,600 birds per each) in a commercial farm for 50 days. Dietary treatments were a diet with no additive as control and diets containing 1 g/kg provital (A mixture of essential oils) or 1 g/kg Totacid. Birds fed on diets containing Provital and Totacid had numerically higher body weight than control and consumed lower feed. Inclusion of Provital and Totacid decreased feed conversion ratio noticeably and caused a noticeable reduction in mortality. Financial analysis showed that supplementation of diet with these additives increased return to investments and the returns were 18 and 10 times more than costs for Provital and Totacid, respectively. In conclusion, results of the present study showed that Provital and Totacid could be effective in enhancing broiler performance and the cost of adding them into the diet is very lower than the returns.

Key words: Broiler, essential oil, organic acid, provital, totacid.

INTRODUCTION

The use of antibiotics as growth promoters has been banned in recent decade because of development of antibiotic resistant bacteria and their residue in animal products and the potential harmful effects on human health. Therefore, there is increasing interests to find alternatives for antibiotics in recent years. Pro and prebiotics, enzymes, acidifiers, phytogetic and herbal products have been investigated as alternatives to

antibiotic in animal feed (Yang et al., 2009). Many beneficial effects for bioactive herbal derivatives and essential oils (EO's) has been reported including increase in digestive enzymes secretion and activities (Jang et al., 2006), improving gut health by selectively growth stimulating effects on useful bacterial species and inhibition of pathogens (Bölükbaşı et al., 2007; Rahimi et al., 2011) and improving immune system status (Bayram

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et al., 2007). Therefore, EO of herbs could be considered as a potential replacement for antibiotic growth promoters. As the bioactive substances in various medicinal plants are different, the inclusion of a mixture of herbal EO may be more effective than a single herbal product (Khaligh et al., 2011). There are some reports of the effect of single herbal medicinal plants in broiler diet, however the studies with a mixture of EO's is limited. Alçiçek et al. (2004) showed that inclusion of 48 mg/kg of an EO's mixture in broiler diet had beneficial effects on body weight gain, feed conversion ratio and carcass yield. Furthermore, it has been showed that organic acids have growth promoting properties and can be used as alternatives to antibiotics (Patten and Waldroup, 1988; Kopecký et al., 2012).

Although there is sufficient literature on the growth promoting effects of EOs and organic acids, however, lots of studies with EO's evaluated a single EO and published reports on the effect of a mixture of EO's is still limited, and the effect of organic acids on performance of poultry varies considerably. Also, there is little information in the literature to evaluate the EO's and organic acids in the field by emphasis on financial efficiency. Therefore, the present study was carried out to evaluate the effect of a mixture of vitamins and EO's and a mixture of organic acids in a field trial on the productive performance and economical efficiency in broiler chickens.

MATERIALS AND METHODS

A total of 31,800 one-day old straight run broiler chickens (Ross 308) were allocated to three commercial houses (10,600 birds per each) and each house assigned to one of the experimental diets. Diets included a control diet with no additive, a diet supplemented with a mixture of vitamins and EO's (Provital®, a combination of vitamins A, C, E and selenium, and EO's of Anis and Ginger, commercially available product, Tehran Dane Co. Tehran, Iran) and a diet supplemented with organic acid (Totacid, a mixture of citric acid, propionic acid and calcium propionate, commercially available product, Tehran Dane Co. Tehran, Iran). Provital and Totacid were included 1 g/kg in pre-starter, starter and grower diets and 0.5 g/kg in finisher diets. Diets were isocaloric and isonitrogenous and formulated to meet broiler requirements according to Ross 308 manual. The ingredients and chemical composition of the diets are presented in Table 1. The experimental diets were in pellet form and water was provided *ad libitum*. The experiment lasted for 50 days. Overall live body weight and feed intake was measured for each house at the end of experiment, then average body weights, feed intake, and feed conversion ratio values were calculated. Mortality was recorded daily and then overall mortality of each house calculated as a percentage. The costs and gross income of each house was used for calculation of the economical efficiency in each house on behalf of mentioned additives.

RESULTS AND DISCUSSION

Productive performance

The effect of inclusion of Provital and Totacid in the diet

on productive performance of broiler chickens has been shown in Table 2. Inclusion of Provital in the diet increased body weight numerically and resulted in 11.8% reduction in the feed intake and 12.2% reduction in the feed conversion ratio when compared to the control birds. Supplementation of diet by Provital also decreased mortality by 3.2%, when compared to the control diet. The improved body weight and feed conversion ratio by addition of this mixture of EOs could be related to increased efficiency of feed utilization through antimicrobial effects against harmful and pathogen intestinal microflora (Lee et al., 2004) and improving digestion process via stimulation of digestive enzymes in intestine mucosa and of pancreas (Plate and Srinivasan, 2000).

The lower mortality in the birds fed with diet containing Provital might be attributed to the antioxidant and immune stimulatory effects of vitamin E, C and selenium in combination with EO's. The antioxidant activity of Vitamin E, C and selenium has well been proven and there are some reports that EO's could exert antioxidant properties in chickens (Wang et al., 2008; Zhang et al., 2009) and may enhance immune status. There are limited reports in the literature to evaluate the mixture of vitamins and EOs in the field trials. In line with our findings, Wall (2011) has done two field trials with a mixture of EOs and reported increased daily gain and feed conversion efficiency to a similar degree as an antibiotic growth promoter.

Inclusion of Totacid in the diet resulted in a minor increase in the body weight, decreased feed intake by 3.2% and improved feed conversion ratio by 4%. It is generally accepted that organic acids and their salts lower feed and gastric pH, reduce intestinal colonization with pathogens, increase the activity of proteolytic enzymes, increase the absorption of minerals and affect the mucosal morphology (Giannenas, 2006). The improved body weight and feed conversion ratio by addition of Totacid shows that this product could exert some of mentioned effects in the broiler chickens and can be used safely and effectively as an additive in broiler chickens diet.

Financial analysis

The financial analysis of production in birds fed with diets containing Provital and Totacid has been shown in Table 3. Investments for one-day old broiler chickens, diet and additives per unit and for overall production in each house has been included in analysis. Some investments such as vaccines, energy and etc. were constant and were not included in the Table 3. The gross return and return to investment have been calculated for each house, and the extra return in houses received additives in comparison to the control house has been determined. Addition of the Provital to the diet resulted in 109899286

Table 1. Feed ingredients and chemical composition of experimental diets.

Ingredients (%)	Pre starter	Starter	Grower	Finisher 1	Finisher 2
	1-10 d	10-20 d	20-35 d	35-45 d	45-slaughter
Corn	45.66	35.06	31.27	26.94	26.42
Soybean meal	39.36	34.2	30.31	23.36	20.29
Wheat	5	20	25	35	37
Oil	2.39	2.54	2.53	2.56	2.59
Marivandaneh premix*	0	6	9	10.74	12.64
Corn gluten meal	3	0	0	0	0
Limestone	1.1	0.6	0.57	0.44	0.37
DCP	2.36	0.48	0.38	0	0
Salt	0.37	0.38	0.38	0.35	0.3
DL-Methionine	0.23	0.21	0.2	0.17	0.12
L-lysine	0.2	0.13	0.03	0.04	0.07
L-Threonine	0.13	0	0	0	0
Mineral premix	0.1	0.1	0.1	0.1	0.1
Vitamin premix	0.1	0.1	0.1	0.1	0.1
Anti coccidian	0	0.2	0.2	0.2	0
Calculated composition					
ME (Kcal/kg)	2930	2920	2920	2960	2969
CP (%)	23.5	21.2	20	18	17
Ca (%)	1.1	1	0.96	0.94	0.89
Ap (%)	0.56	0.5	0.48	0.47	0.44
Na (%)	0.16	0.16	0.16	0.16	0.16
Cl (%)	0.31	0.28	0.27	0.25	0.23
Lysine (%)	1.45	1.24	1.12	0.96	0.9
Met+cys (%)	1	0.88	0.88	0.75	0.68
Thr (%)	1	0.78	0.75	0.67	0.63
Arg (%)	1.5	1.33	1.25	1	0.99
Linoleic acid (%)	1.21	1.14	1.16	0.86	1.19

*Its chemical composition is: ME (1790 kcal/kg), Cp (15%), Ca (6%), Ap (3%), Na (0.01%), Cl (0.02%), lysine (0.3%), Met+Cys (0.3%) and Thr (0.4%).

Table 2. The effects of Provital and Totacid on productive performance of broiler chickens at 50 days of age.

Treatment	Body weight (g)	Feed intake (g)	Feed conversion ratio (g/g)	Mortality (%)
Control	2670	6361	2.38	9.3
Provital	2685	5611	2.09	6.1
Totacid	2700	6156	2.28	8.5

Rials more return than the control house. Also, supplementation of diet with Totacid resulted in 41905540 Rials more return than the control house. The return to investment for Provital inclusion in the diet was more than Totacid (67993746 Rials). Such increases in return to investments in birds that received Provital and Totacid is well in line with lower feed intake, better feed conversion ratio and less mortality in these groups.

Conclusion

The results of the present study showed that Provital (a mixture of vitamins and EO's) and Totacid (A mixture of organic acids) could be effective in enhancing broiler performance, and the cost of adding them into the diet was much less than those returns. Therefore, they represent an exciting opportunity for poultry producers to

Table 3. Financial analysis of production in broilers fed with diets containing Provital and Totacid.

Item	Unit cost/price (1000 Rials)	Overall in house (1000 Rials)		
		Control	Provital	Totacid
Investments*				
Day old chicks	12.2	129320	129320	129320
Average feed cost (kg)**	13.1	842457.201	755181.123	818532.540
Provital (kg)	195	-	6045	-
Totacid (kg)	140	-	-	4340
Total	-	971777.201	890546.123	952192.540
Gross return				
Live body weight (kg)	43.1	1106235.201	1136005.017	1128556.260
Return to investment				
	-	134458.18	24558.894	176363.72
Extra return than control house				
		0	109899.286	41905.54

*Costs for another items including vaccines, energy and etc. were constant for houses and not included in calculations.**Half of the feed costs for mortality considered in overall house costs calculations.

improve bird performance using such natural products.

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Conflict of Interests

The author(s) have not declared any conflict of interests.

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