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# The effects of different growth promoters on performance and carcass characteristics of broiler chickens

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**This research was conducted to study the efficacy of different growth promoter's on the productive performance and carcass yield of broiler chickens. 840 male ROSS and 308 hybrid chickens were used according to completely randomize the design in six treatments and one control (Five growth promoters and control). Thus, there were six groups of chickens: group 1; control diet (without any promoter's), group 2; control diet + antibiotic, group 3; control diet + probiotic, group 4; control diet + prebiotic, group 5; control diet + phytobiotic and group 6; control diet + symbiotic. The productive indicators evaluated were: feed intake, weight gain, feed conversion ratio (FCR). The carcass yield and the main portions (breast, thigh and abdominal fat) was also determined. In all current studies, there wasn't any significant difference between treatments in body weight gain (P > 0.05) but all of them had beneficial effect compared to control. Lowest feed conversion ratio was observed in probiotic group and caused more efficient feed intake. Treatments vs. control increased carcass yield significantly but the difference between treatments was not significant. Breast and thigh was not affected by treatments and there wasn't any significant difference between treatments and control group. Lowest abdominal fat were seen in antibiotic group. According to our results, probiotic and symbiotic appeared to be superior compared to other growth promoters.**

**Key words:** Growth promoters, performance, carcass, broiler.

## INTRODUCTION

Nutrition is the most expensive factor in poultry production; therefore to reduce the cost of raising, one should improve the feed efficiency. The use of food additives as growth promoters in poultry nutrition is one way to accomplish this goal. Growth promoters used to stimulate growth, protect the health of poultry and to

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maintain the maximum potential are added to the poultry diets (Adams, 1999). Antibiotics are the chemical products obtained from certain strains of micro-organisms at low concentrations that can inhibit the growth of other micro-organisms, and may even cause their death. In the past, the use of antibiotics in food, as treatment and either at a lower level of care (as growth promoters) was widespread (Visek et al., 1987 and Shane, 2005), but the use of antibiotics in livestock and poultry may increase bacterial resistance. So in recent years, the use of antibiotics as additives in animal feed has been banned or restricted and the use of other additives as alternative compounds considered by livestock industry, especially in poultry industry has been. Probiotics are live microbial compound that stimulates the growth of beneficial micro-organisms and have very positive impact on the health of the host animal. Therefore, these materials are totally against antibiotics (Modir et al., 2001). The beneficial effects of probiotic supplementation can improve growth and has positive effects on livestock and poultry, increase food consumption, improve nutrient digestion and absorption, increase egg production, health improvement and reducing pathogenic enzymes secretion (Cole et al., 1987). Prebiotics are complex carbohydrates that with entering the digestive system, established suitable setting for beneficial micro-organisms of the digestive tract; therefore have a positive effect on the health of the host (Cummings and Macfarlane, 2002). Prebiotic mechanism stabilize the intestinal flora by stimulating the growth of beneficial bacteria, preventing the growth of undesirable bacteria, reducing serum cholesterol and improving immune responses (Gue et al., 2004). Synobiotics are the combination of prebiotics and probiotics and have properties of these two together; they have the effect such as reduced pH, preventing *Salmonella* infection, positive effect on performance and microbial population of the gastrointestinal tract, daily weight gain and also increase the final weight (Etuk et al., 2007). Liong et al., (2006) reported that the using of Synobiotics can cause concentration of organic acids, reduce cholesterol level and change the population of beneficial poultry intestinal bacteria. Pelica et al., (2004) also reported that improvement of poultry performance and strengthened immune system can be attributed to Synobiotics. Awad et al., (2008) showed that Synobiotics can cause better glucose absorption in poultry and have affect on stomach and intestines extent. Cho et al., (2006) reported that phytobiotics can increase the ration's protein and dry matter digestibility. Sirvydis et al., (2003) also reported that food containing phytobiotics have important influences on the development of physiological processes. This material increases the metabolism of proteins, fats and carbohydrates and improves growth rate of broiler chickens, also average daily gain, final body weight and feed conversion ratio improves. This experiment was designed to compare the effects of growth promoting additives such as; Avilamycin, Gallipro, immunoval, Digestarom and mixed Gallipro and immunoval on performance and carcass characteristics of male Ross 308 broilers.

## MATERIALS AND METHODS

The trial was conducted at one of the Amol's Zarbal farm in the summer of 2013. In this study, 840 Ross and 308 male broilers were used. The project included 6 treatments (control, antibiotic, probiotic, prebiotic, phytobiotic and Symbiotic) and 4 replicates for each treatment. Thus, there were 24 experimental units; each had 35 chicks. A basal diet based on nutritional requirements for the Ross 308 commercial strain include starter (1 to 10 days), grower (11 to 28 days) and finisher diet (29 to 42 days) were adjusted using UFFDA software. Composition of the basal diet is reported in Table 1. Avilamycin as antibiotic was added at a rate of 100 g per ton of basal diet. Probiotic that was used in this study as feed additives with Gallipro. Its commercial name derived from the Bacillus subtilis brand (DSMZ 17299) according to the manufacturer's recommended level of 200 ppm was added to the diet. Prebiotic that was used in this study with immunoval. Its commercial name formed from Beta-glucan and manan oligosaccharides was added to basal diets at a rate of 2 kg/ton and afterwards was added at a rate of 1 kg/ton in the first week of the rearing period. Phytobiotic used in this experiment with Digestarom brand as herbal preparation to the level of 150 ppm was added to the basal diet. As symbiotic treatment, immunoval and Gallipro both in listed values were added to the basal diet. During the experiment, the chickens were given water and feed ad libitum. Temperature and humidity were adjusted accordingly to raising chickens Ross 308 standard. Light intensity was equal in halls. Antibiotics consumption was discontinued one week before slaughter. Feed intake, body weight gain and feed conversion ratio were measured weekly and the weight of each experimental unit's fatality was recorded daily. At the end of experiment, 42 days from each experimental unit, 2 chicks weighing close to average weight of the experimental unit (pen) were selected and after slaughter, carcass traits (carcass weight, breast weight, thigh and abdominal fat) were measured. Statistical models for the project were:

$$Yijk = \mu + Ti + eijk$$

That Yijk was each of the observations (performance), μ was the total mean, Ti was the effect of each treatment (probiotic, prebiotic, antibiotics, phytobiotic and Symbyotic) and eijk was the residual effect or error. Data were analyzed by using SAS statistical software (Version. 9.1) and GLM procedure. Average comparison was performed by using Duncan's multiple range tests in the statistical level of 5%.

## RESULTS AND DISCUSSION

The results of performance parameters (feed intake,

**Table 1.** Composition of experimental diets in different rearing periods (%).

| Diet composition | 1 to 10 days | 11 to 28 days | 28 to 42 days |
|---|---|---|---|
| Corn | 55.2 | 62.37 | 66.56 |
| Soy bean meal (44%) | 38.1 | 27.16 | 23.44 |
| DCP | 2 | 1.90 | 1.65 |
| Slaughter by-products powder | 2 | 5.00 | 4.00 |
| Fatty acid | 0.31 | 0.78 | 1.11 |
| DL-Methionine | 0.04 | 0.26 | 0.21 |
| L-Lysine | 0.03 | 0.21 | 0.18 |
| L-Threonine | 0.01 | 0.05 | 0.04 |
| Mineral vitamin Premix | 0.50 | 0.50 | 0.50 |
| Salt | 1 | 0.9 | 1.2 |
| Sodium Bicarbonate | 0.20 | 0.27 | 0.24 |
| Formaycin gold | 0.01 | 0.1 | 0.1 |
| Oyster powder | 0.40 | 0.45 | 0.72 |
| Salinomycin | - | 0.05 | 0.05 |
| Zeolite | 0.2 | - | - |
| **Chemical composition of calculated nutrient (%)** | | | |
| Metaboisable energy (kcal/kg) | 2890 | 3000 | 3050 |
| Crude Protein | 21.30 | 19.20 | 17.51 |
| Calcium | 1.01 | 0.86 | 0.81 |
| Available phosphorus | 0.48 | 0.40 | 0.35 |
| Sodium | 0.16 | 0.18 | 0.18 |
| Arginine | 1.41 | 1.23 | 1.10 |
| Lysine | 1.38 | 1.15 | 1.05 |
| Methionine | 0.70 | 0.55 | 0.48 |
| Methionine+cysteine | 1.03 | 0.88 | 0.78 |
| Threonine | 0.91 | 0.78 | 0.70 |
| **Vitamin premix** | | | |
| Vitamin A: 7200 mg | | Vitamin $D_3$: 1600 mg | |
| Vitamin E: 14400 mg | | Vitamin $B_1$: 700 mg | |
| Vitamin $B_2$: 2640 mg | | Vitamin $B_3$: 3920 mg | |
| Vitamin $B_5$: 11880 mg | | Vitamin $B_6$: 1176 mg | |
| Vitamin $B_9$: 400 mg | | Vitamin $B_{12}$: 6 mg | |
| Vitamin $H_2$: 40mg | | Vitamin $K_3$: 800 mg | |
| Anti-oxidant: 400 mg | | Choline chloride: 100000 mg | |
| Carrier(wheat bran): 1000 gm | | | |

weight gain and feed conversion) for each of the starter, grower, finisher and overall periods are listed in Table 2. Symbiotic Group (immunoval + Gallipro) have more intake in each period and in the entire period of rearing ($P < 0.05$). Probiotic group (Gallipro) on days 11 to 28 had the lowest intake, although no significant differences were observed in feed intake between control treatment and the other treatments (except Symbiotic) ($P > 0.05$). In the final period, the probiotic treated group had a lower feed intake than in the other group ($P < 0.05$). The results showed that probiotic treatment has the lowest feed intake between days 1 to 42 in comparison with other treatments. In 1 to 10 days, antibiotic treatment, probiotic and Symbiotic had better weight gain than other treatments have. In the growth period, prebiotic group showed less weight gain than other treatments ($P < 0.05$). But in the final period, phytobiotic (digestarom) and control groups showed less weight gain ($P < 0.05$). Early

**Table 2.** Growth-stimulating effect on feed intake, body weight gain and feed conversion in broilers.

| Source of variation (days) | Treatment | Antibiotic (avilamicin) | Probiotic (Gallipro) | Prebiotic (immunoval) | Phytobiotic (digestarom) | Symbiotic (Gallipro+ immunoval) | SEM |
|---|---|---|---|---|---|---|---|
| **Feed intake (g)** | | | | | | | |
| 1 to 10 | 277.37$^{c}$ | 283.68$^{b}$ | 277.008$^{c}$ | 280.66$^{bc}$ | 277.20$^{c}$ | 287.19$^{a}$ | 0.95 |
| 11 to 28 | 1332.66$^{b}$ | 1330.91$^{b}$ | 1292.25$^{c}$ | 1322.35$^{b}$ | 1335.16$^{b}$ | 1375.90$^{a}$ | 6.25 |
| 29 to 42 | 2177.32$^{ab}$ | 2199.589$^{a}$ | 2149.97$^{b}$ | 2231.74$^{a}$ | 2216.74$^{a}$ | 2179.04$^{a}$ | 14.98 |
| 1 to 42 | 3787.36$^{b}$ | 3814.17$^{ab}$ | 3719.47$^{c}$ | 3834.75$^{a}$ | 3829.10$^{a}$ | 3860.13$^{a}$ | 16.49 |
| **Weight gain (g)** | | | | | | | |
| 1 to 10 | 177.67$^{c}$ | 201.47$^{a}$ | 199.48$^{a}$ | 194.64$^{ab}$ | 187.35$^{b}$ | 197.81$^{a}$ | 1.24 |
| 11 to 28 | 629.94$^{b}$ | 592.77$^{bc}$ | 637.01$^{ab}$ | 568.82$^{c}$ | 672.90$^{a}$ | 679.12$^{a}$ | 9.66 |
| 29 to 42 | 1.91.64$^{b}$ | 1147.07$^{a}$ | 1145.74$^{a}$ | 1154.79$^{a}$ | 1.96.74$^{b}$ | 1.70.40$^{a}$ | 13.51 |
| 1 to 42 | 1899.25$^{b}$ | 1941.31$^{a}$ | 1982.23$^{a}$ | 1918.25$^{a}$ | 1956.99$^{ab}$ | 2047.33$^{a}$ | 20.18 |
| **Feed convertion ratio** | | | | | | | |
| 1 to 10 | 1.56$^{a}$ | 1.4$^{ab}$ | 1.38$^{c}$ | 1.44$^{b}$ | 1.48$^{ab}$ | 1.45$^{b}$ | 0.015 |
| 11 to 28 | 2.11$^{b}$ | 2.24$^{a}$ | 2.02$^{c}$ | 2.32$^{a}$ | 1.98$^{c}$ | 2.02$^{c}$ | 0.029 |
| 29 to 42 | 1.99$^{a}$ | 1.91$^{bc}$ | 1.87$^{c}$ | 1.93$^{b}$ | 2.02$^{a}$ | 1.87$^{c}$ | 0.027 |
| 1 to 42 | 1.99$^{a}$ | 1.96$^{b}$ | 1.87$^{c}$ | 1.99$^{a}$ | 1.95$^{b}$ | 1.88$^{c}$ | 0.018 |

Means that have been shown in a row with dissimilar letters indicate statistically significant differences ($p < 0.05$).

in the study, the probiotic and control groups showed the lowest and highest Feed Conversion Ratio (1.38 and 1.56, respectively). Thus, probiotic treatment in this period has shown the best performance ($P < 0.05$). In the growth period, antibiotic and prebiotic group had the highest FCR, but in this course, no significant difference in feed conversion ratio in Probiotics, Photobiotic and Symbiotic treatments was observed ($P > 0.05$). In the final period, control and phytobiotic treated groups showed the highest FCR while the probiotic and symbiotic groups showed lowest FCR in this study. In the entire period, the control and prebiotic group had the highest FCR ($P < 0.05$). However, there was no significant difference between these two treatment groups ($P > 0.05$). In other words, in the whole course, probiotic and Symbiotic treatment groups had lowest FCR (1.87 and 1.88, respectively) and the best performance among the other treatment groups were. The main results of carcass traits examined in this study are shown in Table 3. Carcass yields were not affected by any of the treatments, so that all the treatments significantly had better carcass production performance versus control treatment ($P < 0.05$). Although among the control and antibiotic treatment, there was no significant difference in terms of carcass production ($P > 0.05$). Breast and thigh weight as a percentage of carcass weight was not affected by any of treatments ($P > 0.05$). Thus, no significant difference was observed between treatments and control groups in these traits. On the other hand, data from this trial showed that treatment with antibiotic, probiotics, and symbiotic have less effect on abdominal fat while the highest percentage of abdominal fat was observed in phytobiotic and control groups. Growth stimulants as feed additives are added to poultry diet to enhance growth rate and the economic meat production (Bunyan et al., 1997). Studies have shown that the use of growth stimulants have a positive impact on the growth of broiler chickens (Milligan et al., 1995 and Denli et al., 2003). Yang et al., (2009) reported that adding antibiotics in broiler chicken diets improves body weight gain, feed intake and feed conversion ratio. Bedford, (2000) found that the antibiotics as growth promoters are in direct contact with intestinal microflora, because these compounds had no effect on the Sterile Animals. Intestinal microflora by interaction with nutrient digestion may cause a significant effect on the host animal nutrition, health and performance of their growth (Barrow et al., 1992). When pathogens are attached to the intestinal mucosa, intestinal functions are strongly influenced (Droleskey et al., 1994) and the immune system is threatened (Neish et al., 2002). Chickens that were grown in germ-free condition rather than normal chicks that grew to bacteria and viruses exposure had 15% higher growth rate (Klasing et al., 1987). As shown in Table 2 in this study Avilamycin treatment compared to the control treatment except of the growing season has

**Table 3.** Effects of different treatments on carcass weight, breast, thigh and abdominal fat percentage at the end of the period.

| Source of variation (%) | Treatment | Antibiotic (avilamicin) | Probiotic (Gallipro) | Prebiotic (immunoval) | Phytobiotic (digestarom) | Symbiotic (Gallipro+ immunoval) | SEM |
|---|---|---|---|---|---|---|---|
| Carcass efficiency | 63.27[b] | 64.08[ab] | 67.92[a] | 67.31[a] | 68.40[a] | 67.93[a] | 1.41 |
| Breast | 29.58[a] | 30.37[a] | 29.67[a] | 29.88[a] | 30.73[a] | 30.04[a] | 0.74 |
| Thigh | 28.24[a] | 29.62[a] | 29.60[a] | 29.26[a] | 28.06[a] | 29.76[a] | 0.56 |
| Abdominal fat | 2.11[a] | 1.68[c] | 1.74b[c] | 1.87[b] | 1.93[ab] | 1.71[bc] | 0.06 |

Means that have been shown in a row with dissimilar letters indicate statistically significant differences ($P < 0.05$

increased weight. However, in order to prevent antibiotic resistance in humans against pathogenic bacteria and also remove residual antibiotics in poultry products, the abuse of antibiotics in poultry production was prohibiting. The results of the present study showed that probiotic treated group showed greater weight gain than the control group. There is many evidence showing that the use of probiotics in poultry diets improves immune function, improved body weight, diarrhea decrease and feed conversion ratio (Reid and Friendship, 2002 ; Patterson and Burkholder, 2003). Two basic probiotics mechanisms are included; competitive removal and combination with beneficial bacteria. Competition for substrate, producing antimicrobial metabolites which inhibit the growth of pathogens, and the competition for binding sites is also. Probiotic Supplements, especially *Lactobacillus* species have positive effects on resistance to infectious agents such as Clostridium (Decroos et al., 2004) and Campylobacter populations (Stern et al., 2001). According to the normal intestinal microflora studies, supplementations with probiotics have highly variable results according to origin and species. Cecal population of coliform bacteria in the gut of chicks treated with *Lactobacillus* decreased significantly. However, other population of bacterial species was not affected (Watkins and Kratzer, 1984 and Jin et al., 1998). Murry and colleagues, (2006) reported that chickens treated with probiotics containing *Lactobacillus* had greater number of *Lactobacillus* and had fewer *Clostridium perfringens* than that of the control group. Received different answers may be very complicated because it has a strong bond with the environment also. For example, in heat stress condition, body weight gain of female poultry treated with the *Lactobacillus* probiotic increased by 12%. However, feed conversion and mortality rates were also increased; 4 and 29% (Zulkifli et al., 2000). Fritts et al., (2000) studied the use of probiotic products containing Bacillus subtilis (C-3102) in chickens feeding for 42 days and observed that their body weight gain and feed conversion ratio improved. Growth-promoting effects of specific species of probiotics compared to antibiotics have been fitted in several experiments (Cavazzoni et al., 1998; Zulkifli et al., 2000 and Mountzouris et al., 2007).

## Conclusion

As a general conclusion it can be expressed that stimulant effects of probiotics depends on probiotic species, the using level of probiotics, age of birds and using method (through water or feed). Prebiotic have benefits in comparism with probiotics, because they stimulate the growth of bacteria that are present in the intestinal flora naturally, hence they are naturally adaptive to the intestinal environment (Snel et al., 2002). Most of prebiotic products derived from Fructo oligosaccharides (oligofructose, inulin) (Patterson and Burkholder, 2003), Gluco oligosaccharides, Stachyose, Oligocytoxan and Malto oligosaccharides, effects have been studied in Poultry diets (Zhan et al., 2003; Gao and Shan, 2004; Jiang et al., 2006 and Huang et al., 2007). Gibson and Roberfroid, (1995) reported that prebiotic can alter the metabolism of bacteria in mice from protolithic to be Sacccharolytic. The optimal dose for probiotics to exert its maximum stimulus activity still remains uncertain although higher levels (0.8%) of inulin and short-chain oligosaccharides reduces the growth performance, digestibility of amino acids and energy metabolism (Biggs et al., 2007). The results of this study showed that the use of probiotics (immunoval) causes more weight gain and feed conversion. However, it seems that probiotic amount is much less to exert their desired and absolute effects. Worldwide, extensive research on phytobiotics as a biological compound and as an alternative to antibiotics is done. Compared to synthetic antibiotics or inorganic chemical compounds, these products are mainly derived from plant origin, hence are natural products that are less toxic (Wang et al., 1998). Phytobiotics via two mechanisms of antimicrobial and immune system support have positive effects on growth performance and health of animals. Known photobiotic compounds have

antimicrobial properties (Cowan, 1999). Polysaccharides are known as a source of anti-microbial compounds (Xue and Meng, 1996). It has been demonstrated that the use of herbal compounds improve growth performance, reduce coliform population and improves blood and cellular immune responses in chickens infected with *Mycoplasma galiisepticum* or *Eimeria tenella* (Gao et al., 2004; Pangasa and Singla 2007; Pangasa et al., 2007 and Singla et al., 2007). Windisch and Kroismayr, (2006) reported that phytobiotic used as feed additives in poultry diets increases the secretion of digestive track. Despite the above, action mechanism of photobiotics as a complementary compounds is unknown. Four factors may have a role on photobiotic effect as a growth additive; part of the plant that are used, resource, time and compatibility rate with other dietary components (Yang et al., 2009). The results of the present study showed that in comparison with the control, treatment using phytobiotic increased performance (improved weight gain and feed conversion). However, the performance of probiotic treatment is lower than phytobiotic (Table 2). The results of this study showed that the use of Symbiotic (Gallipro + immunoval) in poultry diets significantly improved body weight gain and feed conversion ratio. Similarly Panda et al., (2000) study showed that during the trial period (1 to 42 days) chicks that their diets were contain *Lactobacillus Sporogenes* (as probiotics) have more daily gain and more appropriate feed conversion ratio. It was also reported that adding prebiotic such as fructo-oligosaccharides and Mannan oligosaccharide improve poultry performance (Iji et al., 2001; Yusrizal and Chen, 2003 and Yang et al., 2009). Basically, probiotic and prebiotic composition may have more advantages than any of them could have because prebiotics may increase growth and cloning of probiotic strains. In the present study, the improvement in growth performance observed in symbiotic treatment can be a proof of this assertion. According to the results obtained in present study, it can be found to have many benefits for broiler production by adding various growth stimuli. It is clear that adding probiotics and symbiotics to poultry diets caused positive effect on performance and carcass weight produced. However, the additives level used must be examined carefully because it will be influenced by many factors. Although further studies to confirm the present findings and other aspects of the growth drivers in poultry, are been examined.

## Conflict of Interest

The authors have not declared any conflict of interest.

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