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EFFECT OF SOME DIETARY GROWTH PROMOTERS ON GROWING RABBITS PRODUCTIVITY

Dorra, Tork M. I.; M. M. Khalifa and Raghda M. Ahmed
Poultry Production Dept., Fac. of Agric., Mansoura University

ABSTRACT

The present work was carried out in order to study the effects of diet supplementation withy Zinc-Bacetracin (0.5 g/kg), Porzyme (1.0 g/kg) and Primalac (1.0 g/kg) as different feed additives for NZW growing rabbits on their growing performance, feed utilization, carcass traits, blood plasma constituents as well as feed cost and economic efficiency.

The obtained results can be summarized as follows:- All feed additives slightly increased live body weight at 13 weeks of age, and Zinc-Bacetracin supplemented group was the best. Daily weight gain was not significantly affected by feed additives type through the study. The feed additives supplemented group were slightly better than the control group at 7-10, 10-13 and 7-13 weeks of age. The feed additives supplementation significantly ($p \leq 0.01$) increased daily feed intake of rabbits at most ages studied. The same trend was found at the periods 7-10, 10-13 and 7-13 weeks of age. Feed conversion ratios were slightly better in the feed additives supplemented groups than the control at all ages. The PCR, EEU and PI values of the feed additives supplemented groups were slightly better than that of the control group at all intervals. Digestibility coefficients of all nutrients and nutritive value (TDN and DCP) were not significantly affected by the type of feed additives. The relative weight of all carcass and offal traits were not significantly affected with feed additives supplementation. Although, the relative weight of edible parts (dressed weight) did not obviously changed, its absolute weight was significantly ($p \leq 0.01$) increased. Most of plasma constituents slightly changed among dietary treatments without any consistent trend. The addition of all feed additives to the control diet reduced feed cost/kg gain and elevated the economic efficiency than the control.

The obtained results showed that the enzyme preparation (Porzyme) and probiotics (Primalac) are good alternatives for antibiotic (Zinc-bacetracin) as growth promoters in rabbit diets.

Keywords: Rabbits, growth, feed utilization, plasma constituents, digestibility, feed additives, feed cost, economic efficiency, carcass.

INTRODUCTION

For many years, poultry industry has been looking for improvement of production indexes and broiler growth through breeding changes. The using of growth promoters in rabbit and poultry production has increased in order to improve the net return of the breeders. These growth promoters include antibiotics, enzymes , pre- and probiotics .. etc.

There is currently world trend to reduce the use of antibiotics in animal food due to the contamination of meat products with antibiotic residues (Menten, 2001). Recently, alternatives for substituting these traditional growth promoters have been evaluated and probiotics and enzymes have been the most studied. Antibiotics have been used widely as growth promoters particularly of antimicrobial properties (EL-Sherbiny *et al.,* 1990; Dorgham *et al.,* 1994 and Radwan *et al.,* 1996).

Enzymes are the most important factors of digestion. They are protein molecules, which can catalyse and improve an acceleration of fodder

digestion. Enzyme secretion takes place mainly in the stomach, liver and small intestines. The development of enzymes' secretion system is not a quick process; the animal even with a completely developed digestion system has to overcome an adaptation stage. For this reason a young, small animal being in a stressful state is more sensitive to the illnesses of digestion process, grows more slowly (Fuller, 1989; Fotso *et al.,* 2000).

Several studies reported the beneficial effect of dietary addition of bacteria (Vörös and Vörös, 1998, Hamrany *et al.,* 2000), bacteria+yeast (Aquilar *et al.,* 1999), bacteria+yeast+enzyme (Duperray, 1991, Vörös and Gaál, 1992, Gippert *et al.,* 1996, Maertens *et al.,* 1994, Kamra *et al.,* 1996., Kermauner and Štruklec, 1997) and bacteria+herb extract (Goby *et al.,* 2000, EL-Adawy *et al.,* 2002) on health status and zootechnical traits in rabbits. The present study aimed to investigate the effects of Zinc-Bacetracin, Porzyme and Primalac addition to growing rabbit diets on their performance, feed utilization, carcass traits, blood plasma constituents and economic efficiency.

MATERIALS AND METHODS

The present study was carried out at the Rabbits Farm of TOCTAD which located about 15 Km to the north of Mansoura city during the period from November, 2006 to January, 2007.

Forty-eight New Zealand White (NZW) male rabbits at 7 weeks of age were used in this study. These rabbits were divided into four groups each of 12 individuals. The four groups had nearly equal means of live body weight. Each group was assigned to one of four experimental diets.

Table (1):- Composition and chemical analysis of the experimental diet.

Items	Values (%)
Ingredients	
Yellow corn	20.00
Wheat bran	29.00
Clover hay	30.00
Soy bean meal (44 % CP)	16.00
Molasses	3.00
Limestone	1.15
Vitamin and mineral premix*	0.30
Bone meal	0.20
Salt	0.35
Chemical analysis:**	
Dry matter (DM)	89.94
Organic matter (OM)	82.36
Crude protein (CP)	17.17
Crude fiber (CF)	13.45
Ether extract (EE)	3.27
Nitrogen free extract (NFE)	48.46
Digestible energy (Kcal/kg)	2600
Ash	7.58

*** Each kg of vitamin and mineral mixture contained: Vit A. 2000.000 IU; E 10 mg; B1 400 mg; B2 1200 mg; B6 400 mg; B12 10 mg; D3 180000 IU; Colin Chloride 240 mg; Pantothenic acid 400 mg; Niacin 1000 mg; Folic acid 1000 mg; Biotin 40 mg; Manganese 1700 mg; Zinc 1400 mg; Iron 15 mg; Copper 600 mg; Selenium 20 mg; Iodine 40 mg and Magnesium 8000 mg.**

**** Calculated after NRC (1977).**

The basal complete pelleted diet was manufactured at the Poultry Production Unit, Research and Experimental Center, Faculty of Agriculture, Mansoura University. The composition and chemical analysis of the basal diet are shown in Table 1. During manufacturing the basal diet supplemented with Zinc-Bacetracin (0.5 g/kg) as antibiotic and Porzyme (1.0 g/kg) as enzyme preparation or Primalac (1.0 g/kg) as probiotics. The basal diet which was not supplemented by any feed additive served as control. Table (2) shows the active ingredients in each feed additives

Table (2):- The active ingredient in feed additives.

Feed additives	Active ingredients
Zinc-Bacetracin (Antibiotic)	Zinc Bacitracin premix 15% powder (granular): 150mg/g potency (6000 units) Zinc bacitracin
Porzyme (Enzymes)	Each gram of Porzyme contain 10 unit cellulase, 250 unit β-glucanase, 400 unit xylanase and 1000 unit α-amylase.
Primalac (Probiotic)	Lactobacillus acidophilus fermentation product dehydrated, Lactobacillus casei fermentation product dehydrated, Bifido bacterium bifidium fermentation product dehydrated and Enterococcus faecium fermentation product dehydrated

Young rabbits were housed individually in galvanized wire cages. Each cage (30 cm wide × 50 cm depth × 35 cm height) was supplied by a stainless steal nipple for drinking as well as a feeder enable us to measure the individual feed intake. The fresh water was available all the time. The rabbits were fed ad-libitum the assigned experimental diet. Feed intake and live body weight were determined weekly on individual basis.

At 13 weeks of age 3 males of each treatment were chosen randomly for slaughtering. They were fasted for 18 hours before slaughtering. Rabbit were slaughtered according to the standard technique of Cheeke (1987). Total edible parts included hot empty carcass, head, liver, kidneys and heart. All traits were calculated as percentage of the pre-slaughter weight. During slaughtering, blood samples were collected in heparinized tubes. Blood plasma was separated with centrifugation at 3500 rpm for 15 minutes and then stored at -20 ˚C until analysis. The concentration of plasma total protein, total lipids, cholesterol, glucose , ALT, AST, albumin and globulin were determined colorimetrically using commercial kits (Bio Merieux, France).

At the 13th week of age 3 rabbits from each treatment were housed in metabolic cages, which enable us to calculate the individual feed intake and collecting the excreted feces. Feces were collected daily for 5 consecutive days. The total feed consumed was determined. Feces were cleaned from any shaded hair and scattered feed. The excreted feces were pooled, well mixed and sampled for chemical analysis according to A.O.A.C. (1995).

Individual live weight and feed intake were weekly recorded. Feed conversion ratio was calculated as feed (g)/ gain (g).

Performance index (PI) according to North (1981), protein conversion ratio (PCR), efficiency of energy utilization (EEU), feed cost/ kg gain and economic efficiency were calculated at the periods as follows:-

$$PI = \frac{Live\ body\ weight\ (Kg)}{Feed\ conversion\ ratio} \times 100 \quad ,$$

$$PCR = \frac{Body\ weight\ gain\ (g)}{\text{Pr}otein\ consumed}$$

$$EEU = \frac{DE\ consumed\ (kcal)}{Weight\ gain\ (g)},$$

$$Feed\ \text{cost}/kg\ gain = Feed\ conversion \times Cost\ of\ one\ kg\ diet\ ,$$

and

$$Economic\ efficiency\ (\%) = \frac{\text{Pr}ice\ of\ kg\ gain - Feed\ \text{cost}/kg\ gain}{Feed\ \text{cost}/kg\ gain} \times 100$$

apparent nutrients digestibility, digestible energy (DE) and total digestible nutrients (TDN) were calculated after Cheeke *et al.,* (1982).

All chemical analysis for feed and feces as well as the blood plasma analysis were conducted at the Laboratory of Poultry Production Department, Faculty of Agriculture, Mansoura University.

Statistical analysis carried out by the one-way analysis of variance using SAS, (2004). Significant differences between means were determined by Duncan's New Multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

1. Growth performance traits:-

Live body weight:-

The addition of Zinc-Bacetracin, Porzyme and Primalac to the rabbits diet had no significant effects on live body weight of rabbits from 7 to 13 weeks of age. It was observed that the rabbits fed diets supplemented with feed additives had slightly heavier live body weights than those fed the control diets. The addition of Zinc-bacetracin resulted in the best results of live body weight at the last 3 weeks of the experiment Table 3.

Table (3):- Means and standard errors ($\overline{X} \pm SE$) of live body weight of rabbits as affected by feed additives type at 7-13 weeks of age.

Age (wks.)	Treatment (Additives type)				Significance
	Control	Antibiotic	Enzyme	Probiotic	
7	1042.1±33.26	1026.0±87.69	1044.2±46.93	1016.7±40.98	NS
8	1252.1±41.34	1241.3±52.82	1165.0±103.96	1214.6±43.02	NS
9	1470.8±48.25	1475.0±60.93	1495.8±53.73	1454.6±48.95	NS
10	1682.0±55.82	1702.9±65.94	1792.2±60.26	1690.0±55.52	NS
11	1879.2±52.03	1916.7±77.36	1915.8±61.00	1879.2±53.36	NS
12	2077.3±55.07	2141.7±82.23	2112.1±65.69	2102.5±55.23	NS
13	2277.7±53.57	2376.7±84.46	2355.8±67.65	2350.8±56.23	NS

Daily weight gain:-

Daily weight gain values at the intervals 7-10, 10-13 and 7-13 weeks are shown in Table 4. It was found also that the rabbits fed Zinc-Bacetracin,

Porzyme and Primalac-supplemented diets had slightly better values than those of the control diet by about 5.8, 6.1 and 5.2% at 7-10 weeks, 11.1, 4.4 and 9.0% at 10-13 weeks and by 9.1, 5.9 and 7.7% at 7-13 weeks, respectively.

Daily feed intake:-

At the intervals 7-10 and 10-13 weeks it was observed that the treatments significantly differed as regards daily feed intake. However, at 7-13 weeks, the differences among treatments become not significant. The control group consumed daily less amount of feed than the groups of Zinc-Bacetracin, Porzyme, Primalac by about 7.7, 4.2 and 8.3% at 7-10 weeks, by 10.4, 2.0 and 0.6% at 10-13 weeks and by 9.3, 3.2 and 4.5% at 7-13 weeks, respectively, (Table 4).

Feed conversion ratio:-

The rabbits of the control diet ranked the second and third among all groups in respect of feed conversion ratio at the intervals 7-10 and 10-13 weeks, respectively. Throughout the whole experimental period 7-13 weeks, the four groups of rabbits had approximately equal values of feed conversion ratio. This means that the addition of feed additives under the conditions of the present study had no effects on feed conversion ratio, (Table 4).

Table (4):- Means and standard errors ($\overline{X} \pm SE$) of daily weight gain, daily feed intake and feed conversion ratio of rabbits as affected by feed additives type at different intervals of age.

Intervals (wks.)	Treatment (Additives type)				Significance
	Control	Antibiotic	Enzyme	Probiotic	
Daily weight gain:-					
7-10	30.47±1.51	32.23±4.81	32.32±1.18	32.06±1.97	NS
10-13	28.87±1.01	32.08±1.80	30.14±1.35	31.47±1.18	NS
7-13	29.49±0.75	32.16±2.53	31.23±0.96	31.77±0.87	NS
Daily feed intake:-					
7-10	98.5±3.22 ^{c}	107.0±1.94 ^{ab}	102.8±1.75 ^{bc}	107.4±2.51 ^{ab}	*
10-13	110.6±2.16 ^{B}	123.5±3.32 ^{A}	112.9±1.61 ^{B}	111.3±1.78 ^{B}	**
7-13	104.5±2.36	115.2±2.20	107.9±1.41	109.4±1.70	NS
Feed conversion ratio:-					
7-10	3.23±0.14	3.32±0.11	3.22±0.12	3.44±0.13	NS
10-13	3.87±0.14	3.92±0.13	3.81±0.14	3.58±0.12	NS
7-13	3.54±0.09	3.58±0.20	3.48±0.10	3.46±0.06	NS

a, b and c:- means within each row having similar letter(s) are not significantly different at $p \leq 0.05$

Protein conversion ratio (PCR):-

The rabbits consumed diets supplemented with antibiotic, enzyme and probiotics showed better weight gain values per each unit of protein consumed than those fed the control diet by about 24.3, 17.9 and 11.0% at 7-10 weeks, by -1.2, 1.8 and 8.3% at 10-13 weeks and by 11.1, 9.4 and 9.9% at 7-13 weeks, respectively Table 5.

Efficiency of energy utilization (EEU):-

Differences in EEU due to the effect of feed additives type at all intervals were not significant. It must be mentioned that all feed additives when added to the basal diet resulted generally in slightly improvement of EEU at the intervals 7-10 and 10-13 weeks of age. Throughout the whole

experimental period 7-13 weeks, the EEU was slightly improved for rabbits fed diets supplemented by antibiotic, enzyme and probiotics than that of the control where the digestible energy needed for one unit of weight gain was less by about 6.2, 8.3 and 9.0%, respectively Table 5.

Performance index (PI):-

It was observed that the supplementation of antibiotic, enzyme and probiotics preparation to the basal diet of rabbits increased PI values than the control group by about 1.9, 13.1 and 6.0% at 7-10 weeks, by 9.1, 16.5 and 23.7% at 10-13 weeks and by 21.1, 12.8 and 13.4, respectively, Table 5.

Table (5):- Means and standard errors ($\bar{X} \pm SE$) protein efficiency ratio (PER), efficiency of energy utilization (EEU) and performance index (PI)of rabbits as affected by feed additives type at different intervals of age.

Intervals (wks.)	Treatment (Additives type)				Significance
	Control	Antibiotic	Enzyme	Probiotic	
Protein efficiency ratio (PER):-					
7-10	1.73±0.06	2.15±0.29	2.04±0.07	1.92±0.08	NS
10-13	1.69±0.05	1.67±0.05	1.72±0.06	1.83±0.06	NS
7-13	1.71±0.04	1.90±0.14	1.87±0.05	1.88±0.04	NS
Efficiency of energy utilization (EEU):-					
7-10	8.84±0.31	7.86±0.58	7.54±0.27	8.04±0.31	NS
10-13	9.05±0.32	9.17±0.31	8.91±0.32	8.37±0.27	NS
7-13	8.89±0.20	8.34±0.47	8.15±0.23	8.09±0.14	NS
Performance index (PI):-					
7-10	46.81±3.64	47.72±3.55	52.93±3.45	49.63±3.70	NS
10-13	58.54±3.07	63.84±3.96	68.20±3.77	72.43±5.33	NS
7-13	59.94±3.07	72.61±3.96	67.62±3.77	67.96±5.33	NS

The growth performance traits were positively affected by preparation addition to rabbit diets as reported by Selin *et al.,* (2004) and Samaha (2007). However, Eiben *et al.,* (2004) and Mostafa (2008) obtained no obvious effects. Moreover, Hassan (2005), EL-Hindawy *et al.,* (1993) and Tag EL-Din *et al.,* (1999) showed that probiotics addition improved most of growth traits. The addition of antibiotics to rabbit diets resulted in better results than the control diets as found by Richard *et al.,* (2000), Ayyat (1993), Pinheiro *et al.,* (2004) and Abou-EL-Zahab *et al.,* (1992).

2. Digestibility and nutritive values:-

The digestibility values of OM were nearly similar for all groups where it ranged from 68.04 to 69.60%. The CP digestibility was slightly improved with the addition of Zinc-Bacetracin, Porzyme and Primalac to the control diet by about 7.0, 3.2 and 1.2%, respectively. The EE digestibility was nearly equal for all groups except that of Porzyme-supplemented group which had the least value. The addition of all feed additives to the control diet had slightly positive effects on CF digestibility. The opposite trend was found with NFE digestibility where the control group had slightly higher value than the feed additives groups, Table 6. The addition of feed additives to the rabbit diets had no significant effects on DCP and TDN values. It must be mentioned that the addition of Zinc-Bacetracin, Porzyme and Primalac to the control diet increased DCP value by about 7.2, 3.3 and 1.3%, respectively.

On the other hand, the opposite situation was found with TDN where the control group had the best value among all groups Table 6.

Digestibility coefficient were not affected by enzyme preparations in rabbit diets as reported by Bolis *et al.,* (1996), Fernandez *et al.,* (1996) and Amber and Osman (2001) or by antibiotics supplementation such as Pinheiro *et al.,* (2004) and Skrivanova *et al.,* (1999). The beneficial effects of Lacto-Sacc on fiber digestion and hence on nutritive values as DCP or TDN were found by Hollister *et al.,* (1990), EL-Gaafary *et al.,* (1992), Yamani *et al.,* (1992) and EL-Hindawy *et al.,* (1993 and 1994).

Table (6):- Means and standard errors ($\overline{X} \pm SE$) of apparent digestibility coefficient and nutritive values of rabbits as affected by feed additives type at different intervals of age.

Items	Treatment (Additive types)				Significance
	Control	Antibiotic	Enzyme	Probiotic	
Apparent digestibility coefficient:-					
OM	69.60±0.69	68.04±7.04	68.50±1.34	68.40±2.36	NS
CP	70.73±1.80	75.80±4.78	73.06±0.72	71.63±2.19	NS
EE	80.30±0.83	81.45±7.61	77.41±4.37	80.44±3.05	NS
CF	49.27±0.72	54.76±1.69	52.59±1.11	52.81±3.35	NS
NFE	74.12±1.06	68.08±10.28	70.70±2.01	70.76±2.11	NS
Nutritive value:-					
DCP	12.14±0.31	13.02±0.82	12.54±0.12	12.30±0.38	NS
TDN	60.60±0.56	59.37±6.28	59.58±1.09	59.62±2.07	NS

3. Carcass traits:-

The fasted live body weight at slaughter was slightly less in the control group than the other groups. The head weight and percentage of head for Primalac-supplemented group were significantly ($p \geq 0.05$) higher than the other three groups which were nearly similar in these traits. The liver weight and percentage of the groups fed diet supplemented by the three feed additives were nearly similar and were higher than those of the control group, but, the differences were significantly ($p \geq 0.05$)only for liver weight Table 7.

Although the empty carcass weight differed significantly ($p \geq 0.01$) among treatments, where the antibiotic-supplemented group had the heaviest value and the control had the lightest one, it was observed that the relative carcass weight slightly changed among treatment. The feed additives-supplemented groups had nearly similar values of edible parts weight and all were significantly ($p \geq 0.01$) heavier than that of the control group. However, the dressing percentages of all groups were nearly equal. As regards the weights and percentages of fur and blood loss, the treatment had no obvious effects on them Table 7.

The addition of exogenous enzymes (Tawfeek, 1996 and Amber and Osman, 2001) or probiotics (Ayyat, 1993 and Radwan *et al.,* 1996) had positive effects on some carcass traits. Moreover, the probiotics supplementation had no obvious effects (Tag EL-Din *et al.,* 1999).

Table (7):- Means and standard errors ($\overline{X} \pm SE$) of carcass traits of rabbits as affected by feed additives type at 7-13 weeks of age.

Traits		Treatments (Additives Type)				Significance
		Control	Antibiotic	Enzyme	Probiotic	
Fasted live	wt.	2268.3±4.41	2371.7±25.22	2346.7±57.83	2353.3±49.10	NS
Head	wt.	145.0±2.89 ^{b}	148.3±3.33 ^{b}	146.7±6.67 ^{b}	165.0±2.89 ^{a}	*
	%	6.4±0.14 ^{b}	6.3±0.17 ^{b}	6.3±0.16 ^{b}	7.0±0.02 ^{a}	*
Liver	wt.	63.3±4.41 ^{b}	78.3±1.67 ^{a}	76.7±1.67 ^{a}	76.7±4.41 ^{a}	*
	%	2.8±0.20	3.3±0.07	3.3±0.11	3.3±0.25	NS
Hot empty carcass	wt.	1150.0±5.77 ^{C}	1200.0±5.77 ^{A}	1181.7±10.14 ^{AB}	1166.7±7.26 ^{BC}	**
	%	50.7±0.20	50.6±0.65	50.4±1.52	49.6±0.88	NS
Edible parts	wt.	1358.3±6.00 ^{B}	1426.7±4.41 ^{A}	1405.0±7.69 ^{A}	1408.3±7.26 ^{A}	**
	%	59.9±0.29	60.2±0.74	59.9±1.53	59.9±1.16	NS
Blood	wt.	75.0±5.00	78.3±6.01	83.3±6.01	85.0±5.00	NS
	%	3.3±0.22	3.3±0.27	3.6±0.34	3.6±0.16	NS
Fur	wt.	410.0±11.55	396.7±6.67	403.3±13.64	413.33±12.02	NS
	%	18.1±0.50	16.7±0.12	17.2±0.37	17.56±0.20	NS

a, b and c:- means within each row having similar letter(s) are not significantly different at $p \leq 0.05$

4. Blood plasma constituents:-

The addition of Zinc-Bacetracin, Porzyme and Primalac to rabbit diets resulted in elevating the total protein content of plasma by about 15.5, 13.6 and 17.0%, and globulin by about 56.4, 39.4 and 68.1% than the control, respectively. However, the albumin content was slightly affected. Hence, the A/G ratio was decreased with addition of all feed additives than the control group Table 8. The addition of Porzyme and Primalac to the diets slightly increased plasma content of glucose than the control group by about 11.8 and 3.3%, respectively. However, the Zinc-Bacetracin addition had negative effect. The differences in plasma content of glucose due to feed additives supplementation were not significant. The plasma contents of total lipids, cholesterol and alkaline phosphatase were not obviously affected by feed additives type. All groups had nearly equal values of AST and ALT except Zinc-Bacetracin supplement group where it had significantly ($p \geq 0.05$) less value of ALT than the other groups Table 8.

Table (8):- Means and standard errors ($\overline{X} \pm SE$) of Blood Plasma Constituents of rabbits as affected by feed additives type at 7-13 weeks of age.

Blood Plasma Constituents	Treatments (Additives Type)				Significance
	Control	Antibiotic	Enzyme	Probiotic	
TP g/dl	2.64±0.05	3.05±0.06	3.00±0.12	3.09±0.33	NS
Albumin g/dl	1.70±0.02	1.58±0.17	1.86±0.02	1.51±0.08	NS
Globulin g/dl	0.94±0.27	1.47±0.22	1.31±0.09	1.58±0.29	NS
A/G ratio	1.81±0.03	1.17±0.32	1.30±0.08	1.02±0.18	NS
Glucose mg/dl	1184.92±132.59	990.48±106.98	1324.60±89.70	1223.81±73.92	NS
TL g/l	9.77±0.18	9.69±0.12	8.66±0.54	9.35±0.21	NS
Chol. mg/dl	73.99±16.13	78.48±14.39	59.88±1.76	76.85±4.47	NS
ALT IU/L	12.67±3.33 ^{a}	6.00±0.58 ^{b}	13.33±0.33 ^{a}	14.00±0.58 ^{a}	*
AST IU/L	28.67±0.88	26.67±1.45	28.67±0.88	26.67±0.66	NS

a, b and c:- means within each row having similar letter(s) are not significantly different at $p \leq 0.05$

Feed cost and economic efficiency:-

The feed cost of kg gain was obviously reduced than the control group with the addition of the basal diet by Zinc-Bacetracin, Porzyme and Primalac by about 5.8, 5.9 and 6.6%, respectively. Similarly, the economic efficiency was improved in comparison to the control by about 8.5, 8.7 and 9.8% for the group of Zinc-Bacetracin, Porzyme and Primalac, respectively.

Feed cost and economic efficiency were improved as found by Tawfeek (1996), Amber and Osman (2001) and Ahmed (2005) with enzyme supplementation, EL-Sayaad (1997) withantibiotics and Tag EL-Din *et al.,* (1999) and amber *et al.,* (2004) with probiotics supplementation to rabbit diets at the growing period.

Table (9):- Feed cost /kg weight gain and economic efficiency as affected by feed additives type at 7-13 weeks of age.

Items	Control	Antibiotic	Enzyme	Probiotic
Price of kg diet	1.100	1.105	1.130	1.130
Feed Conversion	3.803	3.567	3.484	3.458
Feed cost/kg gain	4.183	3.942	3.937	32.907
%	100	94.24	94.12	93.4
Change than Control (%)	---	-5.76	-5.88	-6.6
EE %	258.59	280.52	281.00	283.93
	100	108.48	108.67	109.80

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تأثير بعض منشطات النمو الغذائية على إنتاجية الأرانب النامية

ترك محمد إبراهيم دره، معوض محمد خليفة، رغدة محمد فتحي أحمد
قسم إنتاج الدواجن – كلية الزراعة – جامعة المنصورة

أجريت هذه الدراسة بهدف بحث تأثير إضافة المضاد الحيوي زنك باستراسين (٠,٥ جرام/كجم) و المركب الإنزيمي بورزيم (١ جم/كجم) و المنشط الحيوي بريمالاك (١ جم/كجم) كإضافات غذائية مختلفة لعلائق الأرانب النيوزيلندي الأبيض على أداء النمو، الاستفادة من الغذاء، صفات الذبيحة، مكونات بلازما الدم بالإضافة إلى تكاليف التغذية و الكفاءة الاقتصادية. ويمكن تلخيص النتائج المتحصل عليها فيما يلي:-

حسنت كل الإضافات الغذائية قليلا وزن الجسم عند عمر ١٣ أسبوع وكانت مجموعة الزنك الأفضل بين كل المجموعات. لم تتأثر معنويا الزيادة اليومية في وزن الجسم بنوع الإضافة الغذائية طوال فترة الدراسة. تميزت المجموعات ذات الإضافات الغذائية بقيم أفضل قليلا عن مجموعة الكنترول في الفترات ٧-١٠، ١٠-١٣ و ٧-١٣ أسبوع من العمر. أدت الإضافات الغذائية إلي زيادة معنوية (مستوى ١%) في استهلاك العلف اليومي للأرانب عند معظم الأعمار المدروسة وقد وجد نفس الاتجاه في الفترات من ٧-١٠، ١٠-١٣ و ٧-١٣ أسبوع من العمر. كانت معدلات التحويل الغذائي أفضل قليلا في المجموعات المعاملة عما في الكنترول أثناء الفترات. كانت قيم معدل تحويل البروتين وكفاءة استخدام الطاقة ودليل الأداء في المجموعات المغذاة على علائق بها الإضافات الغذائية أفضل قليلا مما في مجموعة الكنترول في كل الفترات. لم تتأثر معنويا معاملات هضم العناصر الغذائية والقيمة الغذائية (المركبات الكلية المهضومة والبروتين الخام المهضوم) بنوع الإضافة الغذائية. لم تؤثر الإضافة الغذائية معنويا على الأوزان النسبية لكل صفات الذبيحة والفضلات المدروسة مع أن الوزن النسبي للأجزاء الكلية المأكولة لم تتأثر بوضوح فقد كان الوزن المطلق لها أعلى معنويا في المجموعات المعاملة عن مجموعة الكنترول. اختلفت قليلا معظم مكونات بلازما الدم بين المعاملات الغذائية دون أي اتجاه ثابت. أدت الإضافات الغذائية إلى تقليل تكاليف التغذية لكل كجم نمو ورفعت كذلك من الكفاءة الاقتصادية لها عن مجموعة الكنترول.

أشارت النتائج المتحصل عليها أن المركب الإنزيمي بورزيم والمنشط الحيوي بريمالاك تعتبر بدائل جيدة للمضاد الحيوي زنك باستراسين كمنشط للنمو في علائق الأرانب.