GROWTH PERFORMANCE AND SOME PHYSIOLOGICAL MEASUREMENTS OF GROWING RABBITS FED DIETS SUPPLEMENTED WITH EITHER ANTIBIOTICS OR PROBIOTICS

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SUMMARY

Experimental study was conducted to investigate the effect of using of antibiotics such as virginiamycin and zinc bacitracin or probiotics such as bioaction and yeast culture (*Saccharomyces cerevisiae*) as growth promoters in growing rabbit diets and their influences on growth performance, nutrients digestibility, carcass traits, some physiological traits and economic efficiency. Seventy- two growing New Zealand White rabbits aged 35 days were randomly assigned into 6 experimental groups of 12 rabbits each. Each group was divided into four replicates, each of 3 rabbits. The first group was fed the basal diet and served as control, while the groups from 2 to 6 received the basal diet supplemented with 20 mg virginiamycin, 100 mg zinc bacitracin, 1g bioaction, 1.5 g yeast or 3 g yeast/kg diet, respectively. The experimental period was extended for 8 weeks.

The results obtained revealed that: -

1- Growth promoters supplementation to rabbits diet improved significantly final live body weight, daily weight gain and feed conversion ratio.
2- Digestibility coefficients of DM, OM, CP, EE and CF% increased significantly in all supplemented groups except the group supplemented with high level of yeast.
3- The highest values of DCP% and TDN were recorded for group with1.5 g yeast/kg diet.
4-The protein efficiency ratio (PER) was significantly improved by feed additives administration compared to the control diet.
5-Econimical efficiency and performance index were significantly improved in all supplemented groups compared to the control one.
6- Dressing percentage (edible parts weight %) and carcass weight % were significantly increased in all supplemented groups than those of control group.
7- Most of alimentary canal traits were not affected by supplementation except, caecum weight%, caecum length.
8- Antibiotics and Probiotics addition was associated with a decrease in stomach and caecum pH.
9- Total plasma proteins were significantly higher in all supplemented groups than those of control group.
10- Feed additives administration resulted in a significantly decrease in levels of total lipids, cholesterol, GPT, GOT, urea in blood plasma and ammonia concentration in caecum.
11- The lowest ($P<0.01$) level of TVFA's was recorded in the control group compared to the all other experimental groups.

Generally, antibiotics and probiotics used under the conditions of this study could be considered as growth promoters for growing rabbits, specially yeast at a level of 1.5g/kg diet.

***Keywords:** antibiotics, probiotics, growing rabbit, digestibility, carcass, blood plasma*

INTRODUCTION

Growth promoters are non-nutritional compounds given to animals to improve the growth rate and feed efficiency through different modes of action (Radwan et al., 1996).

Development of the digestive immune system is progressive and the presence of useful flora is indispensable to good maturation especially for the diversification of the antibody repertoire (Lanning et al., 2000). For that many studies have been made to see whether the ingestion of living micro- organisms in the diet might stimulate the immune defenses, subsequently improve animal performance (Fortun- Lamothe and Drouet- Viard., 2002).

Probiotics are biological feed additives that provide live not only yeast given orally to alter intestinal flora resulted improvement in body gain and feed efficiency (Hollister *et al.,* 1990). Probiotics as growth promoters exert their beneficial effects by producing antibiotics substances inhibiting the harmful bacteria metabolism as well decrease intestinal pH (Makled, 1991., Radwan et al., 1996 El- Adawy *et al.,* 2000 and Soliman *et al.,* 2000). Probiotics has been reported to improve livability, body gain and feed utilization of growing rabbits (Gippert *et al.,* 1992 and Abdel- Azeem et al., 2004).

Use of antibiotics in animal nutrition might have unfavorable side effects, however; they are still mainly used in the control of cocidiosis and enteritis, although these substances are also considered to have growth promoting properties (Elwinger et al., 1998).

Antibiotics have been used widely as growth promoters particularly of antimicrobial properties (El- Sayaad., 1997, Soliman *et al.,* 2000 and Abou El-Ella *et al.,* 2001). Mode of action of antibiotics as feed additives is mainly related to stimulate growth of animal by eliminating undesirable micro-organisms that produce toxins or metabolic products that irritate and increase the thickness of the intestinal wall that decrease the absorption of nutrients (Stutz, et al., 1983 and Engberg, *et al.,* 2000). Virginiamycin (Vir) is an antibiotic produced by the selected strain of streptomycin virginia (Radwan et al., 1998). Tissue residues of Vir are uncommon because the activity of Vir is strictly isolated to the intestinal tract (Pantaleon and Chvier., 1969). Virginiamycin used as growth promoters stimulate growth promotion and improve feed efficiency by alteration intestinal mircoflora as reported by several authors (Belay et al., 1991, Radwan *et al.,* 1996 and El- Adawy, *et al.*, 2000).

King (1976) and Hudd (1983) illustrated that zinc bacitracin could be used in the diet of rabbits to improve the digestion without residues left in the carcass meat because it is not absorbed from the alimentary tract due to its large molecule size. El- Adawy *et al.,* (2000) suggested that probiotics could replace antibiotics as growth promoters, but not in the treatment of disease. On the other hand, Ayyat (1993) as well as El- Adawy *et al* (2000) mentioned that the results of several studies on the use of either antibiotics or probiotics as growth promoters in rabbit diets are so variable or conflicting.

The present study was carried out to evaluate the growing rabbit diets containing either Virginiamycin, zinc bacitracin, bioaction or two levels of yeast and the beneficial effects of using such materials on the performance of growing rabbits.

MATERIALS AND METHODS

This work was carried out at the Center of Agriculture Studies and

Consultations (CASC), Rabbit production Unit, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

A total number of seventy-two, unsexed, New Zealand White (NZW) weaned rabbits, (5 weeks old) were randomly divided into six experimental groups (12 rabbits/group). Each group was subdivided into four replicates of 3 rabbits. Initial body weights of all groups were almost equal. The first group (control group) was given a commercial pelleted diet (Basal diet), while the groups from 2 to 6 received the basal diet supplemented with either 20 mg virginiamycin, 100mg zinc bacitracin,1g bioaction, 1.5g yeast (Saccharomyces Cerevisiae) or 3g yeast/kg diet, respectively. The basal experimental diet was formulated and pelleted at Atmida Company to cover the nutrient requirements of rabbits recommended by NRC (1977) and Cheeke (1987).

The rabbits were housed in galvanized metal wire cages provided with feeders and automatic drinking system and were kept under the same managerial and hygienic conditions.

The experimental period was extended for 8 weeks. Ingredients and chemical composition of the basal diet is presented in Table (1). Individual live body weight, feed consumption and feed conversion ratio were recorded at weekly intervals during the experimental period (5-13 weeks of age).

At 13 week of age, a digestibility trial was carried out. The animals (4males /experimental group) were housed individually in metabolic cages for 7 days as a preliminary period and 5 days as a collection period. Amounts of feed were offered and faeces of each animal were taken daily during the collection period. The analysis of the experimental diet and faeces were carried out according to A.O.A.C (1990). The total digestible nutrients (TDN) was calculated according to the classic formula (Cheeke *et al.,* 1982).

Blood samples were collected from the experimental treatments as well as from the control (4 rabbits/ group) at the end of the experiment. The blood samples were collected in heparinized tubes and centrifuged at a speed of 3000 rpm for 15 minutes and blood plasma was stored frozen till biochemical analysis. Total proteins, albumin, total lipids, total cholesterol, urea, transaminase enzymes activities (GOT and GPT) were determined in the blood plasma colorimetrically using available commercial kits purchased from Diamond Diagnostics Company, Egypt. The globulin values were obtained by subtracting the values of albumin for the corresponding values of total proteins.

After complete bleeding of rabbits, pelt, viscera and tail were removed, then carcass, giblets, (heart, kidney, caul, mesenteric fat) were weighed. Dressing percentage included relative weights of carcass, giblets and head. While, non-carcass fat included relative weights of heart, kidney, caul and mesenteric fat.

Values of pH for stomach and caecum contents were measured immediately by using a digital pH meter. The volatile fatty acids and ammonia concentration in caecum were determined according to Conway (1958).

Data were statistically analyzed by using SAS program (1995). According to the following model. $Y_{ij} = \mu + T_i + e_{ij}$
Where:

Y_{ij} = The observation on the Ith treatment

μ = Overall mean

T_i = Effect of the Ith treatment

e_{ij} = Random error treatment

Duncan's Multiple Range test (1955) was also used for the comparison among means of the experimental groups. The Economical efficiency (EE) was calculated according to the following equation: EE = A-B/B X 100

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

Ingredients	%
Clover hay	33.00
Yellow corn	21.00
Wheat bran	30.10
Soybean meal (44% CP)	14.00
Limestone	1.13
Premix*	0.30
Common salt	0.30
DL-Methionine	0.17
Total	100.00
Chemical analysis (as fed basis)	
A- Determined analysis: -	
Dry matter (DM%)	91.95
Organic matter (OM%)	81.29
Crude protein (CP%)	17.11
Crude fiber (CF%)	14.21
Ether extract (EE%)	3.95
Crude ash (%)	10.66
Nitrogen free extract (N.F.E.) (%)	46.02
B- Calculated analysis:-	
DE (kcal/kg)	2629
Methionine + cystine (%)	0.67
Lysine (%)	0.86
Calcium (%)	1.02
Total phosphorous (%)	0.60

*** One Kilogram of premix provides: 2000.000 IU vit. A, 150.000 IU vit. D, 8.33g vit. E, 0.33g vit K, 0.33g vit. B1, 1.0g vit. B2, 0.33g vit. B6, 8.33g vit. B5, 1.7 mg vit. B12, 3.33g Pantothenic acid, 33mg Biotin, 0.83g Folic acid, 200g Choline chloride, 11.7g Zn, 12.5g I, 16.6 mg Se, 16.6 mg Co, 66.7g Mg and 5g Mn.**

where A is selling cost of obtained gain (LE per kg) and B is the feeding cost of this gain. The performance index (PI) was calculated according to the equation described by North (1981) as follows: PI = Live body weight (Kg)/ Feed conversion x 100

RESULTS AND DISCUSSION

Growth performance and economical evaluation: -

Mean values for live body weight, daily weight gain, feed consumption and feed conversion from 5-13 weeks of age are shown in Table (2). Both final body weight and daily weight gain were significantly ($P<0.01$) improved by antibiotics or probiotics supplementation as compared to the control diet. The highest average final body weight and daily weight gain were recorded for the group fed diet supplemented with low level (1.5g/kg diet) of yeast followed by those fed the basal diet plus 100mg zinc bacitracin (ZB). Besides, the mean daily feed consumption in the groups supplemented with 100mg ZB or low level of yeast were higher ($P<0.01$) in comparison to the other experimental groups, which recorded intermediate feed conversion ratio. The best-feed conversion ratio was obtained by increasing the level of yeast from1.5 to 3g/kg diet. However, the highest ($P<0.01$) level of feed consumed to produce one kilogram of body weight was recorded for the control group. These results support those obtained by (Zahran, *et al.*, 1996, El- Adawy *et al.*, 2000, Hammad and Gamaa, 2001, Aziza and Gomaa, 2002 and Gomaa, *et al.*, 2003). They reported that Virginiamycin, zinc bacitracin and yeast administration in rabbit diets improved significantly final body weight, daily weight gain and feed conversion ratio as compared to the basal diet. The highest improvement in final body weight and/or daily weight gain in the groups fed the basal diet plus 1.5g yeast or 100mg ZB could be due to the increase in feed consumption of these groups than those of the other supplemented groups. This result is in contrast with those of King (1976) who reported that daily feed consumption of rabbit did not differ significantly by ZB administration. In fact the improvement in final body weight, daily weight gain and feed conversion rate in all supplemented groups as compared to the control one might be attributed to an increase in the efficiency of nutrients absorption and/or nutrients utilization (Fairley *et al.*, 1985) by using such as antibiotics or probiotics.

Addition of virginiamycin, bioaction and 3g yeast to growing rabbit diets resulted in a highly significantly increase in protein efficiency ratio (PER) followed by the groups supplemented with either ZB or 1.5g yeast compared to the control group. The same trend was obtained for efficiency of energy utilization (EEU).

Data of economical evaluation are summarized in Table (2). Both economical efficiency and performance index were significantly improved by growth promoters supplementation. The best economical efficiency was obtained for the group supplemented with 1.5g yeast followed by those fed diet with 100 mg ZB, while the best performance index was for the group with high level of yeast (3g). These results are in harmony with those obtained by El- Adawy *et al* (2000) who postulated that the highest economical efficiency value was obtained in the probiotics supplemented groups compared to the groups supplemented with antibiotics or the control group.

Table (2) : Growth performance of growing rabbits as affected by supplements of different experimental growth promoters.

Items	Treatments						
	Control	Virginia	Zinc bacit	Bioaction	1.5g Yeast	3g Yeast	Significance
No. of rabbits	12	12	12	12	12	12	
Live body weight (g): -							
Initial body weight	618.7±4.70	619.0± 2.08	618.0±5.03	617.3 ±5.84	618.0±2.52	618.0±0.58	NS
At 9 week	1288.3^{b}±14.2	1427.7^{a}±19.0	1428.0^{a}±38.1	1446.0^{a}±33.5	1452.3^{a}±41.9	1452.0^{a}±31.1	*
At 13 week	1906.0^{c}±16.3	2029.0^{b}±15.4	2116.0^{ab}±40.6	2060.0^{ab}±27.5	2150.7^{a}±16.8	2093.0^{ab}±49.3	**
Body weight gain (g/day): -							
5-9 weeks	23.9^{b}±0.67	28.9^{a}±0.69	28.9^{a}±1.42	29.6^{a}±1.31	29.8^{a}±1.48	29.9^{a}±1.12	*
9-13 weeks	22.1^{b}±0.41	21.5^{b}±0.13	24.6^{a}±0.26	21.9^{b}±1.02	24.9^{a}±1.15	22.9^{ab}±0.77	*
5-13 weeks	23.0^{c}±0.35	25.18^{a}±0.28	26.8^{ab}±0.74	25.8^{ab}±0.60	27.4^{a}±0.26	26.3^{ab}±0.89	**
Feed consumption (g/rabbit/day):							
5-9 weeks	82.2±3.38	88.3±2.92	90.3±4.62	92.3±3.47	94.2±4.74	91.2±4.00	NS
9-13 weeks	102.1^{a}±1.65	91.3^{b}±2.64	108.6^{a}±1.83	91.1^{b}±3.14	110.0^{a}±5.70	91.8^{b}±1.66	**
5-13 weeks	92.1^{b}±0.86	89.8^{b}±2.54	99.5^{a}±3.22	91.7^{b}±1.76	102.2^{a}±0.50	91.5^{b}±2.82	**
Feed conversion ratio (FCR): -							
5-9 weeks	3.4^{a}±0.06	3.1^{b}±0.03	3.1^{b}±0.03	3.1^{b}±0.04	3.2^{b}±0.03	3.1^{b}±0.03	**
9-13 weeks	4.6^{a}±0.07	4.3^{bc}±0.14	4.4^{ab}±0.07	4.2^{bc}±0.06	4.4^{ab}±0.05	4.02^{c}±0.07	**
5-13 weeks	4.0^{a}±0.04	3.6^{c}±0.06	3.7^{b}±0.02	3.6^{c}±0.03	3.7^{b}±0.05	3.5^{c}±0.02	**
Protein Efficiency Ratio (PER):-							
5-13 weeks	1.5^{c}±0.01	1.7^{a}±0.03	1.6^{b}±0.01	1.7^{a}±0.01	1.6^{b}±0.02	1.7^{a}±0.01	**
Efficiency of Energy Utilization (EEU):-							
5-13 weeks	10.6^{a}±0.11	9.5^{c}±0.17	9.9^{b}±0.05	9.4^{c}±0.08	9.9^{b}±0.14	9.2^{c}±0.03	**
Economical Efficiency (%):-							
5-13 weeks	194.9^{b}±3.01	227.3^{a}±6.61	238.7^{a}±12.70	227.6^{a}±9.80	248.3^{a}±6.42	232.7^{a}±13.96	*
Performance Index:-							
5-13 weeks	47.6^{b}±0.87	56.9^{a}±0.74	56.9^{a}±0.82	57.9^{a}±1.17	57.7^{a}±1.24	60.2^{a}±0.84	**

Means within the same row with different superscripts are significantly different at $P \leq 0.05$.
NS = Not significant * ($P \leq 0.05$) ** ($P \leq 0.01$).

Nutrients digestibility coefficients and nutritive values:-

Mean nutrients digestibility coefficients and nutritive values are presented in Table (3). The results showed that, all supplemented groups recorded a significant (P< 0.01) increase in nutrients digestibility coefficients of DM, OM, CP, EE and CF% as compared to control, except the group supplemented with 3g yeast/kg diet which showed intermediate values. The digestibility coefficient value of NFE was comparable between all the experimental groups, except the bioaction group, which showed the highest (P<0.05). In terms of nutritive values, the highest (P<0.01) DCP and TDN values were obtained in the group fed the basal diet plus 1.5g yeast, while the other supplemented groups were almost similar. Control group as well as the group with 3g yeast recorded the lowest values of DCP and TDN.

These results confirmed those obtained by (Radwan *et al.,* 1996, Zahran, *et al.,* 1996, El- Adawy *et al.,* 2000 and Gomaa, *et al.,* 2003). They reported that addition of antibiotics as well as probiotics to rabbit diets improved significantly digestibility coefficients of nutrients and nutritive values. Also, Abdel- Azeem *et al* (2004) reported that Yea-sacc administration (0.2 or 0.3%) to the growing rabbit diets improved significantly the digestibility coefficients of DM, OM, CP and CF as well as the nutritive values of DCP and TDN as compared to the rabbits fed the same diets without Yea-Sacc supplementation. However, Ghaudhary *et al* (1995) found that yeast administration to rabbit diets of different fiber content had no effect on digestibility coefficients of nutrients. These differences in the obtained results between authors may be due to the environmental conditions.

The beneficial effect of antibiotics or probiotics on nutrients digestibility coefficients is mainly related to the inhibiting effect of certain intestinal harmful bacteria that produce toxins and decrease intestinal pH (Sissons, 1988 and Engberg *et al.,* 2000). Moreover, antibiotics have useful effects in modification of gut bacterial population (Cheeke, 1987) as well as increase absorption and sparing of nutrients (Ghazala *et al.,* 1990).

Carcass traits:

Mean values of carcass traits as affected by antibiotics or probiotics administration are illustrated in Table (4). Dressing percentage as well as carcass weight % were significantly (P<0.05) increased by supplementation. The highest carcass weight and dressing percentages were recorded for the group supplemented with 20 mg Virginamycin while the lowest values were those of the control group. This result is in accordance with the findings of (Radwan *et al.,* 1996, El- Sayaad, 1997, El-Adawy *et al.,* 2000 and Gomaa *et al.,* 2003). However, Zahran *et al* (1996) found that carcass weight and dressing percentage were insignificantly affected by zinc bacitracin. Neither antibiotics nor probiotics exerted any significant effect on the percentage weights of edible parts, head, blood, heart fat, Kidney fat, caul fat and total non-carcass fat. Virginiamycin group had the lowest (P<0.05) percentage of offal weights. On the other hand, addition of probiotics was associated with a significant decrease in the mesenteric fat percentage than those of control. These results were in agreement with those obtained by (Radwan *et al.,* 1996, El- Sayaad, 1997, El- Adawy *et al.,* 2000) who reported that the differences in most carcass traits due to antibiotics or probiotics supplementation in rabbit diet were

Table (3): Nutrients digestibility coefficients and nutritive values as affected by supplements of different experimental growth promoters.

Items	Treatments						
	Control	**Virginia**	**Zinc bacit**	**Bioaction**	**1.5g Yeast**	**3g Yeast**	**Significance**
Nutrients Digestibility Coefficients:-							
DM	66.9^{b}±0.24	74.6^{a}±2.21	72.3^{a}±0.54	72.6^{a}±0.42	74.1^{a}±1.27	67.5^{b}±2.04	**
OM	67.8^{c}±0.67	75.7^{a}±2.10	73.9^{ab}±2.19	73.6^{ab}±1.75	74.8^{a}±0.34	68.7^{bc}±1.88	**
CP	64.5^{c}±0.75	72.6^{b}±0.73	72.6^{b}±1.24	70.7^{b}±0.48	76.2^{a}±0.96	66.7^{c}±0.94	**
EE	77.3^{b}±0.66	86.8^{a}±0.50	87.2^{a}±0.95	83.3^{ab}±1.49	86.7^{a}±3.35	86.7^{a}±3.17	**
CF	37.6^{c}±1.01	59.5^{a}±4.07	58.2^{a}±2.57	58.8^{a}±3.08	60.8^{a}±1.08	49.0^{b}±1.93	**
NFE	81.8^{b}±0.51	85.2^{ab}±0.97	82.2^{b}±1.77	87.5^{a}±0.90	85.1^{ab}±1.10	83.3^{b}±0.36	*
Nutritive Values: -							
DCP	11.0^{c}±0.13	12.4±0.12	12.4^{b}±0.21	12.1^{b}±0.08	13.0^{a}±0.17	11.4^{c}±0.16	**
TDN	59.7^{d}±0.87	67.1^{ab}±0.84	65.6^{bc}±0.65	67.4^{ab}±0.55	68.0^{a}±1.04	63.6^{c}±0.58	**

a,b,c,d: Means within the same row with different superscripts are significantly different at $P \leq 0.05$.
*** ($P \leq 0.05$) ** ($P \leq 0.01$).**

Table (4). Carcass traits and digestive tract measurements of growing rabbit groups as affected by supplements of different experimental growth promoters.

Traits	Treatments						
	Control	Virginia	Zinc bacit	Bio action	1.5g Yeast	3g Yeast	Sign.
Dressing percentage	61.9^{b}±0.94	66.6^{a}±1.26	63.9^{ab}±1.11	63.6^{ab}±1.31	64.0^{ab}±0.73	63.2^{ab}±1.21	*
Carcass weight (%)	50.7^{b}±1.26	56.6^{a}±1.24	54.0^{ab}±1.41	54.6^{a}±1.27	53.8^{ab}±0.13	54.1^{ab}±0.61	*
Head weight %)	7.5±. 0.44	6.7±0.05	6.6±0.30	5.7+1.68	6.8±0.39	5.5±0.93	NS
Giblets weight (%)	3.6±0.25	3.3±0.06	3.4±0.13	3.4+0.20	3.4±0.18	3.6±0.13	NS
Heart weight %)	0.30±0.04	0.28±0.02	0.24±0.02	0.26±0.01	0.26±0.02	0.25±0.01	NS
Liver weight (%	2.7±0.22	2.5±0.08	2.51±0.12	2.48±0.21	2.5±0.13	2.7±0.10	NS
Kidneys weight (%)	0.6±0.03	0.54±0.03	0.53±0.01	0.57±0.03	0.59±0.05	0.58±0.02	NS
Spleen weight (%)	0.07±0.01	0.06±0.01	0.06±0.02	0.06±0.01	0.06±0.01	0.05±0.01	NS
Offal weight (%)	38.1^{a}±0.9	33.4^{b}±1.3	36.1^{ab}±1.1	36.4^{ab}±1.3	36.0^{ab}±0.7	36.9^{ab}±1.1	*
Heart fat weight (%)	0.19±0.03	0.23±0.03	0.20±0.04	0.17±0.04	0.21±0.01	0.21±0.02	NS
Kidneys fat weight (%)	0.51±0.15	0.52±0.13	0.66±0.15	0.60±0.14	0.60±0.11	0.49±0.13	NS
Mesenteric fat weight (%)	0.46^{a}±0.03	0.35^{ab}±0.14	0.35^{ab}±0.13	0.26^{b}±0.09	0.19^{b}±0.01	0.25^{b}±0.02	*
Caul fat weight (%)	0.13±0.03	0.20±0.03	0.17±0.04	0.18±0.07	0.21±0.04	0.20±0.08	NS
Total non-carcass fat (%)	1.0±0.18	1.3±0.12	1.3±0.27	1.4±0.29	1.2±0.21	1.5±0.27	NS
Empty stomach weight (%)	1.3±0.22	1.0±0.08	1.1±0.12	1.2±0.06	1.1±0.16	1.2±0.19	NS
Empty intestine weight (%)	3.4±0.41	3.0±0.07	3.2±0.19	3.3±0.20	2.8±0.19	3.1±0.19	NS
Empty caecum weight (%)	1.5^{a}±0.07	1.2^{bc}±0.04	1.3^{bc}±0.13	1.3^{bc}±0.11	1.2^{c}±0.07	1.3^{bc}±0.12	*
Empty appendix weight (%)	0.24±0.05	0.30±0.02	0.23±0.01	0.30±0.03	0.29±0.03	0.31±0.03	NS
Caecum length (Cm)	34.9^{ab}±3.3	30.1^{b}±1.0	36.5^{ab}±2.2	33.3^{ab}±1.3	33.0^{ab}±2.0	38.1^{a}±2.4	*
Long appendix (Cm)	9.9±0.43	10.6±0.52	9.5±0.54	11.2±1.82	11.6±0.75	10.6±0.38	NS
Blood Wt (%)	3.0±0.30	3.1±0.17	2.9±0.29	2.8±0.16	2.8±0.28	3.4±0.20	NS
pH Caecum	6.7^{a}±0.18	6.2^{b}±0.31	6.1^{b}±0.19	6.1^{b}±0.11	6.0^{b}±0.04	6.2^{b}±0.06	*
pH Stomach	2.6±. 0.28	2.4±0.55	1.9±0.35	1.7±0.11	2.0±0.22	2.3±0.53	NS

a,b,c: Means within the same row with different superscripts are significantly different at P≤0.05. NS =Not significant. * (P≤0.05).

insignificant. With respect to alimentary canal traits, Table 4 showed that percentage of empty stomach, empty intestine and empty appendix weights and also appendix length were not affected by supplementation. However, percentage of empty caecum weight, caecum length and caecum pH were significantly differed among all the treated groups. The lowest percentage of empty caecum weight was found in the group supplemented 1.5g yeast, while the longest caecum was recorded in the group with 3g yeast. Although, statistically insignificant, antibiotics and/or probiotics administration was associated with lower stomach pH, but the decrease was significant in caecum pH. It could be noticed insignificant trend toward reduced the empty alimentary tract weight in the supplemented groups as compared to the control group. This slight reduction was associated with a significant increase in carcass weight and dressing percentage. Similar results were observed by (Radwan *et al.,* 1996, El- Sayaad, 1997, El- Adawy *et al.*, 2000 and Gomaa *et al.*, 2003). King (1974) attributed the decrease in empty weight of alimentary tract to the reduction in the thickness of intestinal and caecum wall as a result to antibiotics effect which in turn facilitating the uptake of essential nutrients. The decrease noticed in the pH of stomach and caecum as a result to supplementation might induced an improvement in digestibility coefficient of nutrients and maintaining the acidic condition in the hindgut optimal for better-feed utilization.

Blood components: -

Data presented in Table (5) show that the total plasma proteins and albumin levels were significantly higher in all supplemented groups than those of control group. Probiotics addition was accompanied with the highest value of plasma globulin, which reflects the good immunity status of the animal. This agrees with the finding of El-Tantawy *et al* (2001) who found that the rabbit fed diet supplemented with flavomycin or lacto-sacc had higher total plasma proteins level than the control group. They also suggested that increased total plasma proteins level might reflect an increase in the hepatic function, thus antibiotics and probiotics may act through affecting the metabolic rate besides its effect on the gastro-intestinal microbial activity. Data in Table (5) show that growth promoters supplementation resulted in rabbits with a significant reduction in plasma levels of total lipids, cholesterol, GPT, GOT, urea, urea-nitrogen and ammonia concentration in caecum. These findings mean that addition of these growth promoters improved liver functions of rabbits. Gomaa *et al* (2003) reported that yeast administration to rabbit diet associated with significant decrease in serum level of urea. With respect to TVFAs, the rabbits fed diet supplemented with bioaction or yeast had the highest ($P<0.01$) level of TVFAs, followed by the group received virginiamycin then those of zinc bacitracin, which kept the caecum acidic and prevented changes in microflora.

It may be concluded from the present results that virginaimycin and zinc bacitracin as antibiotics as well as bioaction and yeast (up to 1.5g/kg) as a probiotics can be used as growth promoters in growing rabbits diet to improve efficiency of feed utilization and rabbit performance. The best results in this study were obtained by the group supplementing with 1.5g yeast. Thus probiotics as a natural source could replace antibiotics as growth promoters to avoid their side effects.

Table (5) : Blood components and caecum activity of experimental growing rabbit groups as affected by supplements of different experimental growth promoters

Parameters	Treatments						Sign.
	Control	Virginia	Zinc bacit	Bioaction	1.5g Yeast	3g Yeast	
Blood components:-							
Total Proteins (g/dl)	$7.8^{b}\pm0.21$	$8.3^{a}\pm0.28$	$8.4^{a}\pm0.25$	$8.6^{a}\pm0.24$	$8.6^{a}\pm0.19$	$8.7^{a}\pm0.30$	*
Albumin (g/dl)	$4.1^{b}\pm0.16$	$4.7^{a}\pm0.32$	$4.9^{a}\pm0.33$	$4.6^{a}\pm0.20$	$4.5^{a}\pm0.13$	$4.8^{a}\pm0.28$	*
Globulin (g/dl)	$3.7^{b}\pm.0.08$	$3.7^{b}\pm0.16$	$3.5^{b}\pm0.19$	$4.0^{ab}\pm0.12$	$4.2^{a}\pm0.09$	$4.0^{ab}\pm0.15$	*
A / G ratio	$1.1^{b}\pm0.04$	$1.3^{ab}\pm0.13$	$1.4^{a}\pm0.16$	$1.2^{b}\pm0.06$	$1.1^{b}\pm0.03$	$1.2^{b}\pm0.10$	*
Total Lipids (mg/dl)	$368.1^{a}\pm9.21$	$301.3^{b}\pm10.48$	$314.6^{b}\pm3.40$	$298.7^{b}\pm10.17$	$321.4^{a}\pm4.36$	$300.2^{b}\pm21.45$	**
Total Cholesterol(mg/dl)	$153.1^{a}\pm3.41$	$84.3^{c}\pm2.11$	$112.3^{b}\pm2.67$	$118.5^{b}\pm0.98$	$88.9^{c}\pm7.87$	$111.2^{b}\pm0.95$	**
GPT.(μ/L)	$17.1^{a}\pm2.11$	$11.2^{b}\pm2.53$	$7.9^{bc}\pm1.12$	$5.4^{c}\pm0.92$	$11.39^{b}\pm1.97$	$6.9^{c}\pm0.43$	**
GOT.(μ/L)	$27.7^{a}\pm2.95$	$19.7^{b}\pm1.72$	$13.4^{b}\pm0.86$	$13.33^{b}\pm0.88$	$16.9^{b}\pm0.76$	$17.2^{b}\pm0.44$	**
Urea (mg/dl)	$31.8^{a}\pm0.81$	$25.0^{bc}\pm1.72$	$25.9^{b}\pm2.10$	$19.4^{c}\pm1.01$	$22.3^{bc}\pm0.58$	$21.4^{bc}\pm1.86$	**
Urea-Nitrogen (mg/dl)*	$14.6^{a}\pm0.37$	$11.5^{bc}\pm0.79$	$11.9^{b}\pm0.97$	$8.9^{c}\pm0.46$	$10.3^{bc}\pm0.27$	$9.8^{c}\pm0.85$	**
Caecum activity: -							
TVFAs (mg.eq/100ml)	$3.9^{d}\pm0.71$	$9.8^{bc}\pm1.05$	$8.0^{c}\pm1.02$	$13.2^{ab}\pm1.88$	$13.9^{ab}\pm1.87$	$14.8^{a}\pm0.56$	**
Ammonia-nitrogen mg/100ml)(	$14.1^{a}\pm0.93$	$9.4^{b}\pm0.87$	$10.0^{b}\pm0.35$	$10.7^{b}\pm0.15$	$9.8^{b}\pm0.53$	$10.4^{b}\pm1.40$	*

a, b,c, d: Means within the same row with different superscripts are significantly different at $P\leq0.05$. * ($P\leq0.05$) ** ($P\leq0.01$).
Urea-Nitrogen (mg/dl)=Urea value * 0.46

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تأثر الأداء الإنتاجي وبعض المقاييس الفسيولوجية للأرانب النامية المغذاة علي علائق بها بعض المضادات الحيوية والمعضدات الحيوية.

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أجريت هذه التجربة لدراسة إمكانية استخدام المضادات الحيوية مثل فيرجينا ميسين وزنك باستراسين أو المعضدات الحيوية مثل البيواكشن والخميرة الجافة كمحفزات نمو في علائق الأرانب النامية وتأثيراتها على الأداء الإنتاجي والمعاملات الهضمية ومواصفات الذبيحة وبعض المقاييس الفسيولوجية والكفاءة الاقتصادية. استخدم في هذه الدراسة عدد ٧٢ أرنب نيوزيلاندى ابيض عمر ٣٥ يوم ووزعت عشوائيا على ٦ مجاميع تجريبية كل مجموعة تجريبية قسمت إلى أربع مكررات (٣ أرانب لكل مكرر). المجموعة الأولى غذيت على العليقة القاعدية بينما المجاميع الأخرى من ٢-٦ أعطيت العليقة القاعدية مع ٢٠ملليجرام فيرجينا ميسين أو ١٠٠ ملليجرام زنك باستراسين أو واحد جرام بيواكشن أو ١,٥ خميرة جافة أو ٣ جرام خميرة جافة/١كجم علف على التوالي.

وكانت النتائج المتحصل عليها كالآتي:-

١- تحسن وزن الجسم الحي ومعدل النمو اليومي ومعدل التحويل الغذائي مع إضافة محفزات النمو المختلفة.

٢- وجود زيادة معنوية في المعاملات الهضمية للمادة الجافة والعضوية ومستخلص الأثير والألياف الخام في كل المجاميع المضاف إليها محفزات النمو ماعدا المجموعة التي أضيفت لها ٣ جم خميرة جافة مقارنة بالمجموعة الضابطة (الكنترول).

٣- أظهرت الأرانب المغذاة على ١,٥ جم خميرة جافة/كجم علف أعلى قيم للنسبة المئوية للبروتين المهضوم ومجموع المركبات الغذائية المهضومة.

٤- لوحظ تحسن معنوي في الكفاءة النسبية للبروتين عند إضافة محفزات النمو مقارنة بالمجموعة الضابطة.

٥- لوحظ تحسن معنوي للكفاءة الاقتصادية ودليل النمو عند إضافة محفزات النمو إلى علائق الأرانب النامية مقارنة بالمجموعة الضابطة.

٦- لوحظ زيادة معنوية في نسبة التصافي والنسبة المئوية لوزن الذبيحة عند إضافة محفزات النمو مقارنة بالمجموعة الضابطة.

٧- لوحظ عدم وجود فروق معنوية بين المجاميع التجريبية المختلفة في مقاييس القناة الهضمية ما عدا النسبة المئوية لوزن الأعور وطوله ورقم الحموضة له.

٨- يصاحب إضافة المضادات الحيوية و المعضدات الحيوية انخفاض معنوي في رقم الحموضة الخاص بالمعدة والأعور.

٩- ارتفعت قيم البروتين الكلى لبلازما الدم في المجاميع المعاملة بينما انخفضت مستويات كل من الكوليسترول والليبدات الكلية ووظائف الكبد واليوريا وتركيز الامونيا في الأعور مقارنة بالمجموعة الضابطة.

١٠-سجلت المجموعة الضابطة (كنترول) اقل قيم لتركيز مجموع الأحماض الدهنية الطيارة معنويا مقارنة بالمجاميع المعاملة.

وعموما يمكن نستخلص أن إضافة المضادات الحيوية والمعضدات الحيوية تحت هذه الدراسة كمحفزات نمو في علائق الأرانب النامية يمكن أن يكون لها تأثيرا إيجابيا على الأداء الحيوي والإنتاجي للأرانب النامية خاصة عند إضافة المعضدات الحيوية كالخميرة بمعدل ١,٥ جم / كجم عليقه.