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EFFECT OF ENZYMES AND PROBIOTIC MIXTURESUPPLEMENTATION TO THE DIET OF GROWING FEMALE RABBITS ON PERFORMANCE AND CARCASS CRITERIA

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ABSTRACT:A factorial design (3breeds x 3 Supplemented diets) of the present study was determined. A total number of eighty one New Zealand White (NZW), California (CA) and Ve-Line (VL) growing rabbit females strains at 30 days old wassimilarly body weights averaged (550 g ± 33) and was distributedinto9 groups (G1 toG9), eachofthreeequalreplicates. G1 to G3 (Enz0) for NZ, CA and VL strains, respectivelywere served as controls. G4 to G6 (Enz1) for NZ, CA and VL strains, respectively were supplemented with 1 g Veta-zyme/kg commercial diet, while the G7 to G9 (Enz2) were supplemented with 2 g Veta-zyme/kg commercial diet. The experiment was terminated when rabbits were 72 days old. Body weights (BW), body weight gain (BWG) and feed intake (FI) were recorded. Feed conversion ratio (FCR) was calculated. At the end of the experiment, 6 femalesfor each group were slaughtered to determine carcass criteria. The obtained results could be summarized as follows: No significant differences in BWG, FI and FCR among different strains were observed. Supplementing Enz1 or Enz2in growing diets exceeded significantly ($P \leq 0.05$) exceeded BW, BWG and FCR than those of Enz0during the experimental period(30 to 72 days of age). However, the improvement in FCR and increasing in BW and BWG were higher in Enz1 groups than those of Enz2 ones. Veta-zyme supplementedin diet had no affect on FI.There were no significant differences in carcass criteria under study due to strains or Veta-zyme supplement todiet except liver weight percentage. Conclusively, from these results could be concluded that supplemental Veta-zyme at the levels of 1g/kg diet for different growing female three rabbit strains improved growth performance.

Key Words: Rabbits, strains, enzymes, growth performance, carcass criteria.

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INTRODUCTION

Bedford (2000) indicated that enzyme supplementation in poultry diets improved the nutritional value of cereal grains and their by-products. Feed cost represents 60-70% of rabbit rearing costs (Makkar et al., 1990) and as consequence, maximizing utilization of nutrients is essential to the profitability and sustainability of rabbit production. Several studies have been attempted for incorporating exogenous enzymes into rabbit diets to improve nutrients availability, however in most trials, rabbits appeared less responsive (Falcão-e-Cunha et al., 2007).

Most of the trials that were performed during the last decade (Tawfeek, 1996; García et al., 2005; Falcão-e-Cunha et al., 2007) could not detect any significant effect of enzymes on rabbit's performance. The only exception was the decrease in mortality rateGarcía et al., (2005) found with proteases and proteases + xylanases. Some positive results were also obtained by other researchers: Eiben et al. (2004), testing cellulase and got improvements in feed conversion ratio and mortality of rabbits weaned at 23 days of age. It is interesting to note that in some trials enzymes supplementation improved fiber digestibility, such was the case in the studies of Gutiérrez et al. (2002a). The latter authors got significant improvements when cellulase and enzyme pool (xylanase, β-glucanase, β-gluccosidase, pentosanase, myloglucosidase, acid and neutral protease) was added on NDF (+5%) and ADF (+13%) digestibilities, yet at the same time getting reductions of digestible and metabolizable energies, and nitrogen balance, in comparison with the control diets.

Since the European Union banned most of the antibiotic growth promoters in animal nutrition due to cross and multiple resistance (Neu, 1992), much research has been conducted to explore the use of multi-enzymes as effective substitutes. In some studies the ability of enzymes to be used as alternative growth promoters has already been proven and thus started to play a decisive role in nutrition of poultry. However, there is no data on studies evaluating the performances of different rabbit strains under Veta-zyme supplementation. For this reason, the aim of the present study performed to evaluate the effect Veta-zyme supplementation (Amylase, Protease, Cellulase and Lactobacillus acidophilus) in commercial diet of different female rabbit strains on growth performance traits and carcass criteria.

MATERIALS AND METHODS

Experimental design:

A trial was carried out at the Poultry Research Farm, Faculty of Agriculture, South Valley University, Qena, Egypt, from April to May. A factorial design (3strains x 3 Supplemented diets) of the present study was determined. A total number of eighty one growing New Zealand White (NZW), California (CA) and Ve-Line (VL) rabbit female strains at 30 days of age was similarly body weights averaged (550 g ± 33) and was distributedinto9 groups (G1 toG9), eachofthreeequalreplicates and each replicate contains 3 rabbits from the same strain. G1 to G3 (Enz0) for NZW, CA and VL strains, respectively were kept untreated and served as controls. G4 to G6 (Enz1) for NZW, CA and VL strains, respectively were supplemented with 1 g Veta-zyme/kg commercial diet, while the G7 to G9 (Enz2) were supplemented with 2 g Veta-zyme/kg commercial diet (Recommended levels of manufacturer, respectively). VETA–ZYME PLUS® product was purchased from local market (International Free Trade Co., Cairo, Egypt). VETA–ZYME PLUS® as a multi enzymes product containing; Each 1 g contains Amylase 550 U, Protease 2000 U,

Cellulase 400 U, Lactobacillus acidophilus 200 millions colony forming units (CFU), Carrier: Calcium Carbonate up to 1 g.

The environmental climatic conditions:

Each three rabbits from the same strain were allocated in a cage (60 × 50 × 35 cm for length, width and high, respectively) for 72 days of age in a closed system house using controlled system. Rabbit females were kept at 65% relative humidity and 22 °C temperature. The photoperiod was 12 hours per day and light intensity ranged from 5 to 10 Luxes. Feed and water were available ad libitum. All growing rabbit females were kept under similar adequate managerial and hygienic conditions until the end of the experiment (72 days old).

The experimental diets:

All females rabbits received ad libitum a balanced commercial diet (Composition and chemical analysis are shown in Table, 1). The diet is formulated to contain adequate levels of nutrients for growing rabbits as recommended by the National Research Council, (NRC, 1977).

Traits study:

Rabbits of each replicate were individually weighed every week, feed intake of each replicate was also calculated weekly between the amount of feed supplied and the remaining feed, and then it was every three weeks calculated. Body weight gain (BWG) of each replicate was calculated every three weeks between the final and initial rabbit weight. Feed conversion ratio was calculated every three weeks by dividing total feed consumed in a cage by the total weight gain of its rabbits.

Carcass criteria:

At the end of the experiment (72 days of age), six rabbits per group (two per replicate) were chosen, weighted and slaughtered to complete bleeding for carcass evaluation. Rabbits were fasted, and then were sacrificed. After slaughtering, the internal organs were removed from the body where the heart, liver, spleen and pancreas were weighed. Head was individually weighed. Dressing (included the liver and heart) and head weightswere calculated as percentage of pre-slaughter live body weight, while body organs (heart, liver, spleen and pancreas) were calculated as percentage of carcass weight.

Statistical analysis:

A factorial design (3breeds x 3 Supplemented diets) of the present study was determined. Data was subjected to analysis of variance using General Linear Quadratic effects of Veta-zyme supplementation model described in SAS User's Guide (SAS Institute, 2005).The following model was fitted: $Yijk = \mu + Si + Ej + SEij + eijK$. Where:Yijk = observed value of the concerned treatment. μ = observed mean for the concerned treatment.Si = effect due to Strains. Ej= effect due to Enzymes. SEij = interaction effect due to Strains and Enzymes. eijk = the error related to individual observation. Duncan's multiple range test (Duncan, 1955) was used to detect differences among means of different groups,

RESULTS

Growth performance traits:

Concerning the strains effect, data presented in Table 2 showed that no significant differences in body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) among different rabbit female strains {New Zealand White (NZW), California (CA) and Ve-Line (VL)} were observed under study atagesstudiedexcept at 51 to 72 days of age for FI . The FI for VL strain significantly ($P \leq 0.05$) exceeded those of CA strain,from 51 to 72 days of age, while, there were no significant differences in FI between CA and NZW strains. Concerning the Veta-zyme supplemental effect, data presented in

Table 2 showed that using 1 or 2 g Veta-zyme/kg diet (Enz1 or Enz2, respectively) improved significantly ($P \leq 0.05$) body weight (BW), BWG and FCR than those of un-supplemented diet (Enz0) at 30 to 72 days of age. However, the improvement in FCR and increasing in BW and BWG were higher in Enz1 diet than those of Enz2 diet. Veta-zyme supplemental in diet had not affect on FI. Concerning the interaction between Veta-zyme supplementation and strains effect, data presented in Table 3 showed that using Enz2 for VL strain (G9) exceeded BW as compared to other groups at 72 days of age. The BWG of G5 and G9 increased than other groups at the period from 30 t0 72 days of age. The G2, 7 and 8 significantly ($P \leq 0.05$) decreased FI than other groups during the period from 30 to 72 days of age. In general, supplemental Enz1 or Enz2 diets for G4 to 9 improved FCR than other groups (G1 to 3). The improvement in FCR were higher with G9 and G5 (using Enz2 of VL and Enz1 of CA strains) than other treatments.No deaths occurred of rabbits in all groups at all ages studied.

Carcass criteria:

As shown in Table 4, CA strain had significantly higher liver percentage than those of VL and NZW strains. No significant differences were observed in dressing, heart, pancreas, spleen and head percentages among different strains (NZW, CA and VL). The results presented in Table 4 show that, Enz2 diet hadsignificantly higher liver weight percentage than those of Enz1, while there were no significant differences in liver weight percentage between Ezn0 and Ezn2. The supplemental Ezn1 or Ezn2 in commercial diet had not affect on dressing, heart, pancreas, spleen and head weights percentages. No significant differences in carcass criteria (carcass weight and dressing, liver, heart, pancreas, spleen and head weights percentages) among all groups (G1 to G9) were observed (Table 5).

DISCUSSION

Theincreaseinbody weight (BW) and body weight gain (BWG) of female rabbits supplemented with Veta-zyme at 1 or 2 g/kg commercial diet areinagreementwiththe findings of Eiben et al.(2002), Gidenne et al. (2002) and Cachaldora et al. (2004). Gidenne et al. (2002), reported that the improvement in live BW and BWG of the rabbits fed enzymes may be due to the enhancing effect of enzymes in microflora growth in gut and cecum as well as increase in volatile fatty acids production and organic matter digestibility. Eiben et al. (2002) found that feeding rabbit's diet supplemented with Cellulase enzymes significantly improved weight gain from 23 to 63 and from 63 to 77 days of age, by 17 and 3%, respectively. Also, Gutiérrez et al. (2002b) showed that addition of enzymes has improved BWG of young rabbits, from 25 to 39 days of age, (by 3.1%).

Moreover, Eiben et al. (2004) found that addition of exogenous enzymes in diets of growing rabbits had not affect daily weight gain from day 23 to 77 and BW at 77 days. This agrees with the finding of Bersenyi et al. (2002), who reported that, amylase supplementation of rabbit diets had not affect daily weight gain. Also, García-Palomares et al. (2006) citied that the addition of proteases (1 g/kg) to New Zealand × Californian rabbits in the diet containing 16% crude protein had no effect on growth performances traits (BW, BWG, FC and FCR) in the periods 35 to 49 and 49 to 63 days. García et al. (2005) showed that the supplementation with protease decreased the mortality rate in the first 14 d-period after weaning by a reduction of nitrogen flow at ileum. However, this effect could not be tested in the present study because of the absence of mortality in all groups. The dietary addition of proteases could also help to reduce nitrogen flow but mainly in the postweaning period when animals have a limited enzymatic capacity

to hydrolyse the protein (Dojana etal., 1998). Accordingly, the results of García-Ruiz et al. (2006) showed that the dietarysupplementation with proteases was effective in the reduction of nitrogen ileal flow both for sunfloweror soybean based diets.

The present results of feed intake (FI) agree with the fendings of Eiben et al., (2004), who reported that the cellulase supplementation (cellulase11.99 to 52.80 FPU/kg) in diets growing rabbits from 23 to 77 days of age did not affect FI. In contrast, Eiben et al. (2002) found that the average FI of rabbits, during growth period was decreased due to adding enzymes. Theobtainedresults, showed that supplemental Enz1 or Enz2 diets of female rabbits significantly ($P \leq 0.05$) improved FCR than those of Enz0 at 30 to 72 days of age and also that using Enz1 or Enz2 of G4 to 7 and G9 improved FCR than other groups (G1 to 3).These areinagreementwiththe findings of Valente et al. (1999). The enhancement in FCR as a result of adding enzymes may be due to the effect of enzymes in improving the digestibility of nutrients (Valente et al., 1999). Eiben et al. (2004) reported that supplementation of diet for early-weaned rabbits with a Cellulase complex reaching 35.20 and 52.80 FPU/kg enzyme activity affects positively the FCR between 23 and 77 days of age. This agrees with the finding of Cachaldora et al. (2004), who conducted that enzyme supplementation has beneficial effects on feed efficiency of fattening rabbits.

Contemporary administration of Lactobacillus acidophilus, Streptococcus faecium and S. cerevisiae increases the digestibility of the diet (Gippert et al., 1992; Yamani et al., 1992; El –Hindawy et al.,1993; Kamra et al., 1996), reduces the incidence of enteric diseases (Hollister et al., 1990; Tawfeek and El –Hindawy, 1992), especially in conjunction with rations having a high starch content (Nieves-Delgado et al., 1992), increases weight gain (Gippert et al., 1992; Yamani et al., 1992; Ayyat et al., 1996) and improves feed conversion (Hollister et al., 1990). Similarly to Luicke et al. (1992).Also Kamra et al. (1996) found no positive change in performance in spite of increased protein digestibility.

Yamani et al. (1992) found that, a pelleted diet supplemented with probiotic improved crude fiber digestibility and weight gain in New Zealand White Rabbits during the growing period, but it not significantly improved FCR. In growing rabbits, Amber et al. (2004), supplementing Lactobacillus acidophilus (Probiotic), found a positive effect on average daily gain (+9.6%) and on FCR (-6.5%) while no effect was observed on mortality rate. The same author found improvements in the digestibility of nutrients, in particular crude fiber, due to a modification in caecalmicroflora resulting from an increase in cellulolytic bacteria counts (CFU/mL). Lactobacilli are notably absent from the normal intestinal flora of the rabbit (Cheeke, 1987). The use of Lactobacilli as a Probiotic medication for sick rabbits is common. While, Lactobacillus acidophilus may well be able to survive the rabbit's gastric pH, its usefulness is widely debated. The combined microbial flora of the cecum breaks down ammonia, urea, proteins, and enzymes from the small intestine and cellulose (preferentially in that order). These microbes also have the ability to metabolize xylan and pectin (De Blas and Gidenne, 1998). The products of this metabolism are the protein and enzyme structures of the microbes themselves (which are later digested as cecotrophs), and byproducts of microbial fermentation referred to collectively as volatile fatty acids (acetic, formic, propionic, and butyric acids). These volatile fatty acids (VFAs) are actively absorbed through the cecal and colonic walls and utilized by the rabbit as energy sources, as is the case in ruminants.

There were no significant effects in carcass criteria under study due to strains or

Veta-zyme supplemental in diet except liver percentage. CA strainhadsignificantly higher liver percentage than those of VL and CA strains.The groups fed diet supplemented with Enz2 diet hadsignificantly higher liver percentage than those of Enz1. In literature, there is no information available on effects of Veta-zyme on carcass traits.

CONCLUSIONS

It may be concluded from the current study that the addition of commercial enzyme mixture (Veta-zyme) at the level of 1g/ kg commercial diet for growing female rabbit strains has a beneficial effect on growth performance due to improvement in body weight, body weight gain and feed conversion ratio.

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

	Experimental diets[1]		
	ENZ0	**ENZ1**	**ENZ2**
Ingredients (%):			
Alfalfa hay	34.9	34.8	34.7
Soybean meal (44% CP)	12.5	12.5	12.5
Corn meal	22.5	22.5	22.5
Whole sunflower meal	7.0	7.0	7.0
Barley meal	14.0	14.0	14.0
Wheat bran	5.0	5.0	5.0
Beet molasses	1.2	1.2	1.2
Calcium carbonate	1.372	1.372	1.372
Calcium diphosphate	0.671	0.671	0.671
Sodium chloride	0.5	0.5	0.5
Dl-methionine	0.057	0.057	0.057
Premix[2]	0.3	0.3	0.3
VETA–ZYME PLUS[3]	0.0	0.1	0.2
Total	100.0	100.0	100.0
Calculated chemical analysis (% as dry matter):			
Dry matter	89.20	89.20	89.20
Ash	8.80	8.80	8.80
Ether extract	5.30	5.30	5.30
Crude fiber	14.90	14.90	14.90
Crude protein	17.30	17.30	17.30
Nitrogen free extract	63.70	63.70	63.70
Digestible energy (Kcal/ kg diet)	2603.42	2603.42	2603.42

[1]Enz0, Ezn1 and Ezn2 were supplemented with zero, 1 and 2 g Veta-zyme/kg commercial diet, respectively.

[2]Vitamin and mineral premix at 0.3% of diet supplies the following per kg of diet: Vit. A 1200 IU, ; 500.000 IU.T3; 0.67 mg Vit.K3;0.67 mg Vit B1; 2.0 mg Vit.B2; 0.67 mg Vit.B6; 0.0004 mg Vit.B12; 16.7 mg Pantothenic acid; 0.07 mg Biotin; 1.67 mg Folic acid; 400 mg Choline chloride; 22.3 mg Zn; 10 mg Mn; 25 mg Fe; 1.67 mg Cu; 0.25 mg I; 0.033 mg Se and 133.4 mg Mg.

[3]VETA–ZYME PLUS as a multi enzymes product containing; Each 1 g contains Amylase 550 U, Protease 2000 U, Cellulase 400 U, Lactobacillus acidophilus 200 millions colony forming units (CFU), Carrier: Calcium Carbonate up to 1 g.

Table (2): Body weight (g), body weight gain (g), feed intake (g) and feed conversion ratio (g feed/ g gain) of growing female rabbit strains received Veta-zyme supplementation.

Items Treatment groups	Body weight			Body weight gain			Feed intake			Feed conversion ratio		
	Initial 30 d	51 d	72 d	30-51 d	51-72 d	30-72 d	30-51 d	51-72 d	30-72 d	30-51 d	51-72 d	30-72 d
NZW	539±26	1222±25	1885^{ab}±37	683±25	663±35	1346±37	2153±55	3043^{ab}±39	5195±94	3.16±0.11	4.71±0.61	3.87±0.18
CA	539±46	1246±36	1842^{b}±53	707±37	596±55	1303±53	2094±29	2958^{b}±33	5051±44	2.97±0.10	5.10±0.55	3.91±0.25
VL	572±27	1277±30	1976^{a}±48	705±31	699±37	1404±49	2134±21	3169^{a}±46	5305±29	3.04±0.17	4.63±0.45	3.82±0.29
P-value	0.1232	0.4673	0.0444	0.2080	0.2492	0.2130	0.6008	0.0504	0.1436	0.6650	0.7688	0.9436
Enz0	550±9	1224±20	1781^{b}±16	674±20	557^{b}±21	1231^{b}±17	2132±58	3075±53	5207±103	3.17±0.10	5.52±0.21	4.23^{b}±0.08
Enz1	557±5	1273±26	1997^{a}±41	716±27	724^{a}±27	1440^{a}±43	2161±15	3054±26	5215±39	3.04±0.18	4.23±0.17	3.63^{a}±0.10
Enz2	543±5	1248±42	1925^{a}±60	705±42	677^{b}±63	1382^{a}±58	2089±20	3043±110	5131±115	2.96±0.07	4.69±0.66	3.75^{a}±0.05
P-value	0.2289	0.5384	0.0008	0.6229	0.0185	0.0036	0.4943	0.8938	0.6751	0.6034	0.2562	0.0502

aand b Means±SE withineachcolumn foreachdivision(body weight, body weight gain, feed intake and feed conversion ratio)with nocommonsuperscriptsare significantlydifferent(P≤0.05).

Values in each column are means for 3 replicates of each group (9 females per each).

d: Day

NZW, CA and VL were New Zealand White, California and Ve-Line rabbit female strains, respectively.

Enz0, Ezn1 and Ezn2 were supplemented with zero, 1 and 2 g Veta-zyme/kg commercial diet, respectively.

Table (3): Effect of interaction of growing female rabbit strains received Veta-zyme supplementation on body weight (BW), body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR).

Treatment groups Items	Enz0			Enz1			Enz2			P-value
	G1 (NZW)	G2 (CA)	G3 (VL)	G4 (NZW)	G5 (CA)	G6 (VL)	G7 (NZW)	G8 (CA)	G9 (VL)	
BW (g) :										
Initial 30 d	535±8	535±9	580±21	558±13	543±8	572±4	523±7	540±5	564±6	0.1238
51 d	1274±43	1187±19	1210±31	1200±34	1307±55	1313±39	1192±52	1243±93	1309±76	0.4798
72 d	1799^{cde}±40	1757^{de}±22	1788^{cde}±17	1954^{abcd}±69	2043^{ab}±80	1994^{abc}±74	1903^{bcde}±71	1726^{e}±99	2147^{a}±65	0.0038
BWG (g) :										
30-51 d	739±39	652±20	630±33	642±36	764±57	741±40	669±50	703±96	745±76	0.5533
51-72 d	525^{cd}±47	570^{bcd}±17	578^{bcd}±41	754^{ab}±44	736^{abc}±39	681^{abcd}±60	711^{abc}±53	483^{d}±49	838^{a}±47	0.0052
30-72 d	1264^{bc}±43	1222^{bc}±24	1208^{bc}±21	1396^{abc}±73	1500^{a}±85	1422^{ab}±75	1380^{abc}±68	1186^{c}±75	1583^{a}±68	0.0006
FI (g) :										
30-51 d	2236^{a}±35	2035^{c}±18	2123^{abc}±13	2175^{ab}±9	2131^{abc}±15	2176^{ab}±14	2047^{bc}±12	2115^{abc}±16	2103^{abc}±14	0.0432
51-72 d	3108^{b}±22	2969^{c}±13	3146^{ab}±25	3048^{bc}±22	3010^{bc}16	3102^{b}±12	2973^{c}±11	2895^{c}±12	3259^{a}±40	0.0001
30-72 d	5344^{a}±73	5004^{b}±32	5269^{a}±65	5223^{a}±73	5141^{a}±37	5278^{a}±55	5020^{b}±33	5010^{b}±32	5362^{a}±75	0.0001
FCR (g feed/g gain) :										
30-51 d	3.03^{bc}±0.6	3.12^{b}±0.06	3.37^{a}±0.06	3.39^{a}±0.06	2.79^{d}±0.05	2.94^{bcd}±0.12	3.06^{b}±0.04	3.01^{bcd}±0.06	2.82^{cd}±0.12	0.0001
51-72 d	5.92^{a}±0.29	5.21^{b}±0.23	5.44^{b}±0.26	4.04^{c}±0.12	4.09^{c}±0.23	4.56^{c}±0.17	4.18^{c}±0.10	5.99^{a}±0.23	3.89^{c}±0.12	0.0001
30-72 d	4.23^{ab}±0.35	4.09^{ab}±0.29	4.36^{a}±0.17	3.74^{abc}±0.17	3.43^{c}±0.17	3.71^{bc}±0.11	3.64^{bc}±0.08	4.22^{ab}±0.12	3.39^{c}±0.12	0.0128

a,b, c, dande Means ±SEwith different superscripts in the same column are significantly different (P≤0.05).

Values in each column are means for 3 replicates of each group (9 females per each).

d: Day

NZW, CA and VL were New Zealand White, California and Ve-Line rabbit female strains, respectively.

Enz0 (G1 to 3), Ezn1 (G4 to 6) and Ezn2 (G7 to 9) were supplemented with zero, 1 and 2 g Veta-zyme /kg commercial diet, respectively.

Table (4): Carcass criteria of growing female rabbit strains received Veta-zyme supplementation in commercial diets.

Items Treatment groups	Live weight (g)	Carcass (g)	Dressing[1] (%)	Liver (%)	Heart (%)	Pancreas (%)	Spleen (%)	Head (%)
NZW	2100^{ab}±117	1519±89	72.38±1.75	5.83^{b}±0.83	0.48±0.04	0.53±0.03	0.12±0.04	8.81±0.61
CA	1933^{b}±228	1397±199	72.11±2.12	6.65^{a}±1.09	0.48±0.04	0.56±0.03	0.12±0.02	8.63±0. 53
VL	2120^{a}±150	1551±145	73.15±4.08	6.22^{b}±0.85	0.49±0.09	0.52±0.02	0.11±0.03	8.21±0.57
P-value	0.0481	0.0992	0.7321	0.0140	0.1096	0.5235	0.2549	0.5687
Enz0	2001±186	1456±142	72.38±1.04	5.96^{ab}±0.98	0.49±0.03	0.55±0.20	0.12±0.03	8.38±0.42
Enz1	2099±212	1546±213	73.46±4.20	6.29^{b}±0.80	0.48±0.07	0.51±0.04	0.11±0.03	8.66±0.78
Enz2	2042±165	1465±110	71.79±2.07	6.44^{a}±1.07	0.48±0.06	0.56±0.02	0.12±0.02	8.60±0.61
P-value	0.5663	0.3949	0.4645	0.0238	0.7802	0.3520	0.1598	0.5646

aandb Least squares means ±SEwithineachrowforeachdivision(carcass criteria)withnocommonsuperscriptsare significantlydifferent(P≤0.05).

Values in each row are means for 6 rabbits of each group.

NZW, CA and VL were New Zealand White, California and Ve-Line rabbit female strains, respectively.

Enz0, Ezn1 and Ezn2 were supplemented with zero, 1 and 2 g Veta-zyme/kg commercial diet, respectively.

[1]Dressing weight (%) = {Carcass weight + Giblets weight (liver and heart weights)} / pre-slaughter weight X 100

Table (5): Effects of interaction of growing rabbit female strains received Veta-zyme supplementation on carcass criteria.

Treatment groups Items	Enz0			Enz1			Enz2			P-value
	G1 (NZW)	G2(CA)	G3 (LV)	G4 (NZW)	G5 (CA)	G6 (VL)	G7 (NZW)	G8 (CA)	G9 (VL)	
Live weight (g)	1966±267	2126±128	1941±142	2166±87	2146±243	1985±291	2123±197	1961±±142	2043±175	0.7460
Carcass (g)	1423±200	1541±77	1405±135	1556±66	1610±243	1473±323	1511±98	1387±93	1497±126	0.7939
Dressing[1] (%)	72.34±0.80	72.52±0.92	72.28±1.67	71.84±0.31	74.86±4.83	73.69±6.34	71.32±2.04	70.78±1.99	73.28±1.97	0.8228
Liver (%)	5.76±1.06	6.10±0.87	6.03±1.16	5.77±0.65	6.88±0.48	6.22±1.15	5.97±1.26	6.96±0.52	6.40±1.40	0.3286
Heart (%)	0.49±0.01	0.48±0.03	0.50±0.05	0.48±0.04	0.48±0.07	0.49±0.10	0.47±0.08	0.48±0.02	0.48±0.03	0.1287
Pancreas (%)	0.61±0.02	0.54±0.02	0.49±0.02	0.47±0.02	0.48±0.05	0.57±.010	0.59±0.04	0.61±0.02	0.50±0.03	0.1660
Spleen (%)	0.12±0.04	0.12±0.01	0.11±0.02	0.12±0.03	0.11±0.03	0.10±0.05	0.12±0.01	0.12±0.01	0.11±0.02	0.3247
Head (%)	8.49±0.35	7.99±0.38	8.66±0.28	8.81±0.46	8.35±1.02	8.82±0.95	8.30±0.48	8.98±0.17	8.54±0.94	0.6900

Values in each row are means for 6 rabbits of each group.

NZW, CA and VL were New Zealand White, California and Ve-Line rabbit female strains, respectively.

Enz0 (G1 to 3), Ezn1 (G4 to 6) and Ezn2 (G7 to 9) were supplemented with zero, 1 and 2 g Veta-zyme/kg commercial diet, respectively.

[1]Dressing weight (%) = {Carcass weight + Giblets weight (liver and heart weights)} / pre-slaughter weight X 100

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الملخص العربي

تأثير إضافةمخلوط إنزيماتوبروبيتك في عليقة إناث الأرانب النامية على الأداء ومعايير الذبيحة

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أجريت هذه التجربة لدراسة تأثيرإضافة المنتج التجارى فيتا-زيم (مخلوط لبعض الإنزيمات + بكتريا حمض اللاكتيك) في العلف علي آداء إناث الأرانب النامية . وتم إستخدام عدد واحد وثمانين من إناث أرانب النيوزيلندي الأبيض (NZW) ، الكاليفورنيا (CA) ، والفيلاين (VL) عند عمر ٣٠ يوما ، ووزعت علي ٩ مجموعات (من G1 الي G9) وأشتملت كل مجموعة علي ثلاث مكررات. وإستخدمت المجاميع من G1 الي G3 لسلالات NZW ، CA ، VL علي التوالي كمجموعات للمقارنه بدون إضافة الفيتا-زيم (Enz0)، بينما المجاميع من G4 الي G6 لنفس السلالات علي التوالي تم إضافة الفيتا-زيم بمعدل ١ جرام/كيلوجرام عليقة(Enz1). والمجاميع من G7 الي G9 لنفس السلالات علي التوالي تم إضافة الفيتا-زيم بمعدل 2 جرام/كيلوجرام عليقة(Enz2). وتم إعطاء المستويات المضافة في العلف طوال فترة التجربة (حتي عمر ٧٢ يوم). وتم قياس أوزان الجسم ومعدل الزيادة في الوزن والغذاء المأكول وكفاءة التحويل الغذائي. وعند نهاية التجربة تم ذبح ٦ إناث من كل معاملة لتقدير معايير الذبيحة.وأمكن تلخيص النتائج المتحصل عليها كالتالي:لم تلاحظ أى إختلافات معنوية ما بين السلالات المختلفة في معدل الزيادة وزن الجسم ، والغذاء المأكول وكفاءه التحويل الغذائي. ولوحظ أن كلا من Enz1 أو Enz2أدي الي زيادة معنوية في وزن الجسم ومعدل الزيادة في الوزن وكذلك تحسنت كفاءة التحويل الغذائي عن المجاميع المقارنة من عمر ٣٠ الي ٧٢ يوم ، والتحسن كان واضحا مع المستوي Enz1 عن المستوي Enz2 . ولم تلاحظ أي إختلافات معنوية ما بين السلالات أو إضافةالفيتا-زيم في مقاييس الذبيحة بإستثناء وزن الكبد. وبصفة عامة نستخلص أن إضافة الفيتا-زيم التجاري في العلف عند مستوي ١ جرام/ كيلو جرام عليقة يحسن الاداء للإناث النامية لكل السلالات الثلاثة المختلفة للأرانب.