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EFFECT OF SOME FEED ADDITIVES ON MULE DUCKS PERFORMANCE DURING GROWER PHASE

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ABSTRACT

The present study was aimed to investigate the effect of supplemented 3 different commercial probiotics and multi-enzyme commercial in adequate diets on locally produced mule ducks performance during the growing period (6 to 11 weeks of age). A total number of 150 mule ducks at 6 weeks of age, were randomly distributed into five dietary treatments. All diets were equal in all nutrients (18.6%, CP and ME, 3028 kcal / kg diet). The five treatments were: (T1) basal diet (control), basal diet supplemented with multi-enzyme commercial T-protphyt (T2), basal diet supplemented with commercial probiotic and prebiotic Biomin® Impo (T3), basal diet supplemented with probiotic Primalac® (T4), and basal diet supplemented with probiotic Wazn Zad (T5). Live body weight, body weight gain, feed intake, feed conversion ratio, protein efficiency ratio, efficiency of energy utilization, and growth performance index were measured weekly and the entire experimental period. Body measurements (shank length, keel length, and breast circumference) and the correlation between live body weight and body measurements were also measured. At the end of study some blood constituents [cholesterol, triglycerides, high-density lipoprotein cholesterol(HDL), low-density lipoprotein cholesterol (LDL), very low-density lipoprotein cholesterol (VLDL), total protein, albumin, globulin , albumin/globulin ratio, AST, and ALT] and economic efficiency were quantified.

The obtained results can be summarized as follows: at 11weeks of age dietary treatments had no significant effects on live body weight, weight gain, feed intake, feed conversion ratio, protein efficiency ratio, efficiency of energy utilization, growth performance index and body measurements. Pearson correlation coefficient between live body weight and shank length, keel length, and breast circumference was significant ($p \leq 0.01$). No significant differences among treatments in cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), and very low-density lipoprotein cholesterol (VLDL), total protein, albumin, globulin , albumin/globulin ratio, AST, and ALT. All treatments improved the economic efficiency insignificantly as compared to control diet.

Although no significant difference between groups due to the type of feed additives concerning growth performance treats, it was observed that using Biomin Impo and Wazn Zad showed better economic efficiency amounted to 29.5 and 25 % respectively in comparison to control group.

INTRODUCTION

Ducks showed gradually increased attention in the last decades in Egypt for production of meat and hatching egg. Many of growth promoters have been used in poultry feeds and water in order to improve digestion and promote better bird performance such as probiotics, prebiotics, synbiotic and enzymes.

(Havenaar et al., 1992) defined probiotics as a mono or mixed culture of living microorganisms, which beneficially affect the host by improving the properties of the indigenous micro-flora. The physiological effects related to probiotic bacteria include the reduction of gut pH; production of some digestive enzymes and vitamins; production of antibacterial substances, e.g., organic acids, bacteriocins, hydrogen peroxide, diacetyl, acetaldehyde, lactoperoxidase system, lactones and other unidentified substances; reconstruction of normal intestinal microflora after disorders caused by diarrhoeas and antibiotic therapy; reduction of cholesterol level in the blood; stimulation of immune functions; suppression of bacterial infections; improvement of calcium absorption as well as the reduction of faecal enzyme activity (Ouwehand et al., 1999; Holzapfel and Schilling 2002; Zubillaga et al., 2001). A variety of microbial species have been used as probiotics, including species of lactic acid bacteria (*Bifidobacterium, Lactobacillus, Streptococcus, Enterococcus, and Lactococcus species*), *E. coli*, Bacillus sp., fungi [Aspergillus sp.], and yeasts [Saccharomyces sp.] (Patterson and Burkholder 2003).

Prebiotics are nondigestible carbohydrates many of these carbohydrates are short chains of monosaccharides, called oligosaccharides. Some oligosaccharides are thought to enhance the growth of beneficial organisms in the gut, and others are thought to function as competitive attachment sites for pathogenic bacteria. Two of the most commonly studied prebiotic oligosaccharides are fructooligosaccharides [FOS] and mannanoligosaccharides [MOS]. MOS is obtained from the cell wall of yeast Saccharomyces cerevisiae (Griggs and Jacob 2005). FOS can be found naturally in some cereal crops and onions (Bailey et al. 1991).

combined mixtures of probiotics and prebiotics in the same product are called synbiotics (Grajek et al., 2005).

Many enzymes have been found to be beneficial when added to poultry diets containing carbohydrate or protein sources with high levels of nonstarch polysaccharides, such as wheat, and barley. Few studies showed a response to the addition of enzymes to the vegetable diets (corn, soybean meal, and corn gluten meal) which make up the majority of the energy and protein component (Cafe et al., 2002). Exogenous enzymes like carbohydrases and phytases caused improvement in nutrient digestibility; reduction in excretion of nitrogen and phosphorus; increased use of alternative feed ingredients; reduction in the variation of nutrient quality of feed ingredients, and reduction of the incidence of wet litter when feeding diets rich in viscous grains (Bedford 2000).

Several studies investigated the effect of probiotics or prebiotic and enzymes on chicken, turkey and Japanese quail. But, Use of probiotics or prebiotic and enzymes in the waterfowl is scarce. Our study investigated the effects of probiotics or synbiotic and enzymes in vegetable diets based on corn, soybean meal, and corn gluten meal on mule duck performance during grower phase (6 to 11 weeks of age).

MATERIALS AND METHODS

The present study was carried out (during March to April , 2006) at the Agricultural Experiments and Researches Station, Poultry Production Farm, Faculty of Agriculture Mansoura University, Egypt.

Birds and housing:

One hundred and fifty locally produced mule ducks at 6 weeks of age, were randomly distributed into five treatment groups. Each group was sub-divided into three replicates of 10 ducks each. All groups had approximately equal initial live body weight. Ducks were reared under the same managerial conditions in open-sided floor pens. The floor area of each pens was $2.0m^2$. The floor of pens was covered with 5 cm of wheat straw, ducks were subjected to continuous lighting.

Feeding:

Ducks fed vegetable diets based on corn, soybean meal, and corn gluten, the 5 diets were formulated to contain about 18.6% crude protein and 3028 Kcal. ME/Kg. The composition and calculated analysis of the basal diet are shown in table (1). Dietary treatments were T1) basal diet (control), basal diet supplemented with multi-enzyme commercial T-protphyt (T2), basal diet supplemented with commercial probiotic and prebiotic Biomin® Impo (T3), basal diet supplemented with probiotic Primalac® (T4), and basal diet supplemented with probiotic Wazn Zad (T5).

Ducks were given feed and water ad libitum. Each pen supplied by a feeder and a drinker. Antibiotics were excluded from all diets. The active ingredients in feed additives are shown in Table(2). The commercial products were added to the diets according to the dosage recommended by the manufactures at 500 gram T-protphyt, Biomin® Impo, and Primalac® / ton or at 1000 gram Wazn Zad / ton.

Performance of ducks:

Live body weights were recorded at 6, 7, 8, 9, 10, and11weeks of age individually. Weekly body weight gain, feed intake, and feed conversion ratio were calculated during the studied periods. The protein efficiency ratio as weight gain(g) / protein consumed (g), efficiency of energy utilization as ME consumed (Kcal) / Weight gain (g), and growth performance index as Live body weight/bird (kg) **/** FCR **X** 100 were calculated. At the end of the experiment, five birds were selected randomly from each replicate for measuring shank length, keel length and breast circumference for all ducks.

Blood constituents:

At the end of the experiment, blood samples were collected in heparinized tubes, by puncturing the wing veins of three ducks from each treatment. Then, plasma were separated by centrifugation at 4000 r.p.m for 15 minutes and frozen at -20 °C until analysis. Plasma samples were tested colorimetrically using commercial kits according to the procedures outlined by the manufactures, for determination of total protein (Falkner and Meites, 1982), albumin (Doumas , 1971), globulin (calculated by differences between the total protein and albumin concentrations), AST (GOT) and ALT (GPT) (Reitman and Frankel, 1957), cholesterol (Allain et al., 1974), triglycerides (Buccolo G et al., 1973), HDL (Gorden and M, 1977) and VLDL was calculated from triglycerides by dividing the factor 5. The LDL cholesterol was calculated by using the formula: LDL cholesterol = Total cholesterol – HDL cholesterol – VLDL cholesterol.

Economic efficiency:

Feed cost was calculated on the basis of feed intake, cost of the basal diet and prices of feed additives. The cost of body weight gain was calculated on the basis of cost of one kilogram live body weight during experiment **X** body weight gain. The economic efficiency was expressed as a percent of net revenue/ feed cost.

Data Analysis:

The data from the experiment were analyzed as one way ANOVA test using GLM procedure of SAS software (2004), and significant differences between groups were determined by the (Duncan's multiple range test). Differences were considered significant at P ≤ 0.05. The Minitab program were used to measure the correlation between live body weight and Body measurements.

Table (1): The composition and calculated analysis of the basal diet.

Ingredients	%
Ground yellow corn	70.25
Soybean meal, 44%	20
Corn gluten meal, 60%	6
Di-calcium phosphate	2
Limestone	1
Salt	0.3
Vit. &Min. Premix*	0.3
DL-methionine	0.15
Total	100
Calculated analysis**	
ME; kcal/kg	3028
Crude protein, %	18.6
Methionine, %	2.98
Lysine, %	3.0
Calcium, %	0.89
Available phosphorus, %	0.49

*** Each 1 kg contains : 4000 IU vitamin A, 667 IU vit. D3, 3.333 mg vit. E, 1.167 mg vit. K, 0.333 mg vit.B1, 1.667 mg vit. B2, 3.333 mg B3, 0.500 mg vit. B6, 0.003 mg vit. B12, 91,667 mg choline , 0.017 mg Biotin, 0.333 mg folic acid, 10 g Iron, 2.167 g Copper, 18.333 g Znic,20 g Manganese, 167 mg Iodine, 67 mg Cobalt and 67 mg Selenium.**

**** Calculated according to NRC (1994).**

Table (2)The active ingredients in feed additives .

Feed additives	**active ingredients**
T-protphyt [Enzymes]	a product containing a mixture of 100 units phytase, 75 units protease, 20 units lipase and 15 units amylase.
Biomin® Impo [Synbiotic]	Biomin® Impo based on natural raw materials of probiotic, prebiotic and immune stimulating substances. It contains Enterococcus faecium as probiotic, Fructooligosaccharides (Inulin) as prebiotic.
Primalac® [Probiotic]	Primalac is a probiotic. It contains Lactobacillus acidophilus fermentation product dehydrated, Lactobacillus casei fermentation product dehydrated, Bifido bacterium bifidium fermentation product dehydrated, and Enterococcus faecium fermentation product dehydrated.
Wazn Zad [Probiotic]	Wazn Zad is a probiotic. It contains live cell strain of Saccharomyces cerevisiae, methionine and vitamins A, D3,E ,K3, C and B12.

RESULTS AND CONCLUSION

Growth performance for ducks

Means and standard errors of live body weight for mule ducks as affected by the type of feed additives at 6, 7, 8, 9, 10, and 11 weeks of age are shown in Table (3). Live body weights were similar among treatments at 6, 7, 8, 9, 10, and11weeks of age. It was observed that the ducks which consumed the diet supplemented with Wazn Zad had slightly the heaviest live weight at the end of experiment at 11 weeks of age followed by those feed (T3) Biomin® Impo, (T2) T-protphyt, (T4) Primalac®, and (T1) control diet in a descending order. No significant differences in live body weight were absorbed among ducks which fed control diet and those duck fed adequate diet supplemented with yeast culture (Saccharomyces cerevisiae) during the grower period as reported by Samy and Abd El-Samee (2003). Also Angel et al., (2005) and Juskiewicz et al., (2006) reported that birds fed diets containing probiotic were comparable with those birds fed control diets. On the other hand, Jin et al., (2000); Zulkifli et al., (2000)and Rodriguez et al., (2007) showed that probiotic improved live body weight significantly. Kahraman et al.,(2000) indicated that addition of only probiotic or probiotic + antibiotic to the diet had not influence in broiler performance under optimal hygienic conditions. But, in commercial conditions, chicks sometimes subject to bad management and environments and become stressed.

Mahagna et al., (1995) did not find any beneficial effect of enzymes, including amylase and protease, on broiler performance. But, Hong et al., (2002); revealed that addition a cockatiel of amylase, protease and xylanase improved live body weight significantly. Rodehutscord et al., (2006) found that phytase significantly improved the growth of Pekin ducks of both sexes between day 1 and 21, but not between day 22 and 35.

Table (3). Means and standard errors of live body weight (g) at various ages.

Age (weeks)	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
6	1864.0±35.24	1833.3±35.24	1843.3±35.24	1832.6±35.24	1844±35.24
Change %	100	-1.6	-1.1	-1.7	-1.0
7	2140.6±37.91	2113.3±37.27	2080.6±37.91	2092.6±37.27	2103.33±37.27
Change %	100	-1.3	-2.8	-2.2	-1.7
8	2371.7±43.32	2355.3±42.60	2300.3±43.32	2336.0±42.60	2328.66±42.60
Change %	100	-0.6	-3.0	-1.5	-1.8
9	2568.2±47.91	2585.3±47.10	2552.4±47.91	2562.0±47.10	2629.33±47.10
Change %	100	+0.6	-0.6	-0.2	+2.4
10	2726.2±48.71	2770.0±47.90	2774.4±48.71	2746.3±47.90	2850.00±47.90
Change %	100	+1.6	+1.7	+0.7	+4.5
11	2864.1±51.48	2924.6±50.62	2942.0±51.48	2898.6±50.62	3021.3±50.62
Change %	100	+2.1	+2.7	+1.2	+5.5

Means and standard errors of body weight gain during the different periods of the study are shown in Table(4). Although the body weight gain at the 7th and 8th of age did not obviously changed among treatments, the improvement during the rest of experiment was more pronounce in comparison to the control. At the 10 weeks of age, body weight gain had increased significantly (P≤0.05) in ducks fed (T3) Biomin® Impo and (T5) Waznzad as compared to control diet (T1). Where the data of body weight gain were pooled during the period from 6 to 11 weeks of age, the improvement than control birds were 9.2, 10.1, 6.7 and 17.9 % for the birds of (T2),(T3), (T4), and (T5), respectively. The obtained results fairly agree with Samy and Abd El-Samee (2003); Angel et al., (2005) and Murry et al.,(2006)). On the other hand, Xu et al.,(2003); Zhang et al., (2005) and Panda et al., (2006) found that birds fed probiotics diets had increased significantly in body weight gain. Al-Harthi (2006) reported that no changed in body weight gain among birds fed control diet and those fed basal diet plus Avizyme (a cockatiel of amylase, protease and xylanase) or those fed basal diet plus a cockatiel of amylase, protease, xylanase and phytase from 7 to 49 day of age. But, Hong et al., (2002) indicted that ducks fed basal diet supplemented with Avizyme (cockatiel of amylase, protease and xylanase) had increased significantly in body weight gain compared to those duck fed control diet.

Table (4). Means and standard errors of body weight gain (g) at various ages.

Age (weeks)	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
7th	257.0±15.90	280.0±15.90	236.0±15.90	260.0±15.90	259.3±15.90
change%	100	+8.9	-8.1	+1.2	+0.9
8th	230.8±19.35	242.0±19.35	218.3±19.35	243.3±19.35	225.3±19.35
change%	100	+4.8	-5.4	+5.4	-2.4
9th	196.6±25.13	230.0±25.13	254.0±25.13	226.0±25.13	300.6±25.13
change%	100	+17	+29	+14.9	+52.9
10th	158.0±14.10 b	184.6±14.10 ab	223.1±14.10 a	184.6±14.10 ab	220.6±14.10 a
change%	100	+16.8	+41.2	+16.8	+39.6
11th	138.2±9.05	154.6±9.05	168.2±9.05	152.0±9.05	171.3±9.05
change%	100	+11.9	+21.7	+10	+23.9
6-11	998.7±46.76	1091.3±46.76	1099.7±46.76	1066.0±46.76	1177.3±46.76
change%	100	+9.2	+10.1	+6.7	+17.9

Means within each row having similar letter(s) are not significantly different

Table(5) shows the Means and standard errors of daily feed consumption / duck during the different periods of the study. It was observed that daily feed intake were comparable in all treatments at 7th, 8th, 9th, 10th , and 6 to11weeks. But, overall period 6 to11weeks of age birds in (T 5) Waznzad had recorded the heights amount of daily feed intake followed by (T4) Primalac®, and (T2) T-protphyt than those feed control diet (T1) by 7.4, 1.3, 0.4 % respectively. Birds fed (T3) Biomin® Impo had recorded the lowest amount of daily feed intake than other treatments.

The results fairly agree with Yeo and kim (1997); Abdel-Azeem (2002); Samy and Abd El-Samee (2003) who found that no significant differences in feed intake among ducks fed control diet and those duck fed adequate diet supplemented with yeast culture (Saccharomyces cerevisiae) during the grower period. In opposite with Djouvinov et al., (2005) found that feed consumption had increased at 93 days of age for the ducks fed basal diet with probiotic as compared to control diet. On the other hand, Murry et al.,(2006) reported that during 22 to 42, and 1 to 42 days of age feed intake had lower significantly for broilers fed the probiotic.

Al-Harthi (2006) indicted that no significant differences in feed intake among birds fed control diet and those fed a cocktail of amylase, protease, xylanase or fed phytase diet, and those fed a cocktail of amylase, protease, xylanase, and phytase. Also Orban et al., (1999) showed that feed intake were similar among ducks feed control diet and those fed phytase diet. But, Watson et al., (2006) showed that Phytase addition increased feed intake in chicks.

Table(5)Means and standard errors of daily feed intake at various ages.

Age (weeks)	Treatments				
	T1 (control)	T2 Enzymes	T3 Biomin	T4 Primalac	T5 Wazn Zad
7th	205.0±6.86	209.5±6.86	197.0±6.86	195.2±6.86	216.6±6.86
change%	100	+2.2	-3.9	-4.7	+5.6
8th	218.7±7.20	221.4±7.20	209.7±7.20	211.9±7.20	238.0±7.20
change%	100	+1.2%	-4.1%	-3.1	+8.8
9th	232.5±7.98	234.7±7.98	237.0±7.98	252.3±7.98	254.7±7.98
change%	100	+0.9	+1.9	+8.5	+9.5
10th	254.2±6.84	251.9±6.84	249.2±6.84	259.5±6.84	269.0±6.84
change%	100	-0.9	-1.9	+2.1	+5.8
11th	264.5±8.19	263.3±8.19	256.6±8.19	271.4±8.19	282.8±8.19
change%	100	-0.4	-3	+2	+6
6-11	235.0±6.34	236.1±6.34	229.9±6.34	238.0±6.34	252.3±6.34
change%	100	+0.4	-2.1	+1.3	+7.4

Means and standard errors of feed conversion ratio (g feed / g gain) for mule ducks as affected by the type of feed additives at 7th, 8th, 9th, 10th , and 6 to11weeks of age are shown in Table(6).

Table (6)Means and standard errors of feed conversion ratio (g feed / g gain)at various ages

Age (weeks)	Treatments				
	T1 (control)	T2 Enzymes	T3 Biomin	T4 Primalac	T5 Wazn Zad
7th	5.30±0.44	5.24±0.44	5.87±0.44	5.32±0.44	5.89±0.44
change%	100	-1.13	+10.7	+0.4	+11.13
8th	6.68±0.63	6.42±0.63	6.89±0.63	6.22±0.63	7.55±0.63
change%	100	-3.9	+3.1	-6.9	+13
9th	8.28±0.67	7.19±0.67	6.71±0.67	7.92±0.67	6.17±0.67
change%	100	-13.2	-19	-4.3	-25.4
10th	11.29±0.60 a	9.60±0.60 ab	7.93±0.60 b	9.88±0.60 ab	8.66±0.60 b
change%	100	-15	-29.8	-12.5	-23.3
11th	13.40±0.72	11.99±0.72	10.74±0.72	12.52±0.72	11.72±0.72
change%	100	-10.5	-19.8	-6.6	-12.53
6-11	8.25±0.40	7.61±0.40	7.33±0.40	7.87±0.40	7.53±0.40
change%	100	-7.7	-11.1	-4.6	-8.7

Means within each row having similar letter(s) are not significantly different

It was observed that feed additives (probiotics and enzymes) had not significant effects on feed conversion at 7th, 8th, 9th, and 6 to11weeks . But, at the 10 weeks of age feed conversion ratio was reduced significantly (P≤0.05) by (T3) Biomin® Impo and (T5) Waznzad diets as compared to control die. At the end of the trial from 6 to 11 weeks of age feed conversion ratio had decreased as compared to control birds by 7.7, 11.1, 4.6, and 8.7 % for the birds of T2, T3, T4, and T5, respectively. Results obtained were agreed with Angel et al., (2005) and Rodriguez et al., (2007) in probiotic diets and agreed with Huff et al., (1998) and Orban et al., (1999) in enzymes diet. On the other hand, feed conversion ratio had improved significantly by probiotic as showed by Jin et al.,(2000) and Xu et al.,(2003) and by enzymes as showed by Hong et al., (2002).

Means and standard errors of protein efficiency ratio (g gain/ g protein consumed) for mule ducks as affected by the type of feed additives at 7th, 8th, 9th, 10th, and 6 to11weeks of age of age are shown in Table (7) Protein efficiency ratio was similar in all treatments at 7th, 8th, 9th, and 6 to11weeks. But, at 10 week of age protein efficiency ratio had improved significantly (P≤0.05) by Biomin® Impo and Waznzad diets as compared to control diet. During the whole period from 6 to 11 weeks of age protein efficiency ratio had improved as compared to control birds by 7.7, 15.4, 4.0 and 19.2 % for the birds of T2, T3, T4, and T5 respectively. Insignificantly improved in the protein efficiency ratio were found by Abdel-Azeem (2002). Boling-Frankenbach et al., (2001) showed that 1200 units of phytase had no significant effect on protein efficiency ratio in diet varied in Ca and nPP content.

Table (7) Means and standard errors of protein efficiency ratio (g gain/ g protein consumed).

Age (weeks)	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
7th	1.04±0.07	1.02±0.07	0.92±0.07	1.02±0.07	0.92±0.07
change%	100	-1.9	-11.5	-1.9	-11.5
8th	0.81±0.07	0.83±0.07	0.80±0.07	0.88±0.07	0.72±0.07
change%	100	+2.5	-1.2	+8.6	-11.1
9th	0.65±0.07	0.75±0.07	0.82±0.07	0.68±0.07	0.91±0.07
change%	100	+15.3	+26.1	+4.6	+40
10th	0.47±0.04 c	0.56±0.04 abc	0.68±0.04 a	0.54±0.04 bc	0.63±0.04 ab
change%	100	+19.1	+44.7	+14.9	+34
11th	0.40±0.02	0.45±0.02	0.50±0.02	0.43±0.02	0.46±0.02
change%	100	+12.5	+25	+7.5	+15
6-11	0.65±0.03	0.70±0.03	0.75±0.03	0.68±0.03	0.71±0.03
change%	100	+7.7	+15.4	+4	+9.2

Means within each row having similar letter(s) are not significantly differentTable (8) Means and

Means and standard errors of efficiency of energy utilization values are shown in Table (8).

Energy utilization values at the 7th and 8th of age were comparable among treatments. But, during the rest of experiment the improvement was more pronounce in comparison to the control. Efficiency of energy utilization values at the 10 weeks of age had improved significantly (p ≤0.05), ducks which consumed basal diet plus Biomin Impo (T3) had recorded the lowest value followed by those fed T5, T2, T4 and T1. Efficiency of energy utilization values had decreased as compared to control birds at the end of experiment from 6 to 11 weeks of age by 7.8, 11.2, 4.7 and 8.8 % for the birds of T2, T3, T4, and T5 respectively. Our results agree with Abdel-Azeem (2002) and Samy and Abd El-Samee (2003) they found Energy conversion values had decreased significantly by feeding Saccharomyces cerevisiae during the first 2 weeks only, but no significant during grower phase.

Table (8) standard errors of efficiency of energy utilization values (k cal ME consumed / g gain).

Age (weeks)	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
7th	16.07±1.33	15.88±1.33	17.79±1.33	16.13±1.33	17.83±1.33
change%	100	-1.2	+10.7	+0.3	+10.9
8th	20.23±1.90	19.44±1.90	20.86±1.90	18.83±1.90	22.80±1.90
change%	100	-3.9	+3.1	-6.9	+12.7
9th	25.09±2.05	21.77±2.05	20.33±2.05	24.00±2.05	18.68±2.05
change%	100	-13.2	-19	-4.3	-25.5
10th	34.18±1.84 a	29.09±1.84 ab	24.00±1.84 b	29.91±1.84 ab	26.24±1.84 b
change%	100	-14.9	-29.8	-12.5	-23.2
11th	40.57±2.19	36.32±2.19	32.52±2.19	37.91±2.19	35.50±2.19
change%	100	-10.5	-19.8	-6.5	-12.5
6-11	24.99±1.21	23.04±1.21	22.18±1.21	23.82±1.21	22.80±1.21
change%	100	-7.8	-11.2	-4.7	-8.8

Means within each row having similar letter(s) are not significantly different

Growth performance index values for mule ducks as affected by the type of feed additives at 7th, 8th, 9th, 10th , and 6 to11weeks of age are shown in Table(9).

Table (9) Means and standard errors of Growth performance index values (LBW / FCR X 100).

Age (weeks)	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
7th	41.48±3.29	40.33±3.29	35.63±3.29	40.07±3.29	36.06±3.29
change%	100	-2.7	-14.1	-3.4	-13.1
8th	35.86±3.66	36.80±3.66	34.60±3.66	38.49±3.66	31.51±3.66
change%	100	+2.6	-3.5	+7.3	-12.1
9th	31.07±4.20	36.18±4.20	39.21±4.20	32.93±4.20	44.59±4.20
change%	100	+16.4	+26.2	+6	43.5
10th	24.23±2.25 b	29.12±2.25 ab	35.31±2.25 a	27.95±2.25 ab	33.52±2.25 a
change%	100	20.2	+45.7	+15.3	+37.7
11th	21.36±1.70	24.75±1.70	27.49±1.70	23.21±1.70	26.26±1.70
change%	100	+15.9	+28.7	+8.7	+22.9

Means within each row having similar letter(s) are not significantly different

No differences among treatments in growth performance index values. But, at 10 weeks of age growth performance index values was increased significantly (P≤0.05) by Biomin Impo and Waznzad diets as compared to control diet. Where the data of growth performance index were pooled during the period from 6 to 11 weeks of age, the improvement than control birds was 15.9, 28.7, 8.7 and 22.7 for the birds of T2, T3, T4, and T5 respectively. Our results agree with Abd El-Gawad and Rabie (2005) found that performance index was similar among control diet and probiotics diets during 1 to 28, 29 to 42, and 1 to 42 days of age.

Body measurements values (shank length, keel length, and breast circumference) for mule ducks as affected by the type of feed additives at 11 weeks of age are shown in Table (10). Pearson correlation between live body weight and shank length, keel length, and breast circumference are shown in Table (11).

The results showed that no significant differences among treatments in shank length, keel length, and breast circumference. Pearson correlation coefficient between live body weight and shank length, keel length, and breast circumference was significant (p ≤0.01). The correlation between variables are positive. This means that when the shank length, keel length, and breast circumference increases also tends to increase, the live body weight also tends to increase.

Table (10). Body measurements ($\overline{X}$ ± S.E) for mule ducks at 11 weeks of age

Body measurements	T1 (control)	T2 C+T -protphyt	T3 C+ Biomin	T4 C+ Primalac	T5 C+ Waznzad
Shank length (cm)	8.2±0.15	7.8±0.15	8.0±0.15	8.1±0.15	8.0±0.15
Keel length (cm)	17.2±0.29	17.4±0.29	16.5±0.29	16.3±0.29	17.0±0.29
Breast Circumference (cm)	39.73±0.47	38.83±0.47	38.46±0.47	38.86±0.47	38.46±0.47

Table (11). Pearson Correlation according to effect of feed additive type.

Body measurements	LBW	Shank Length	Keel Length
Shank length (cm)	0.377**		
Keel length (cm)	0.405**	0.354**	
Breast circumference (cm)	0.613**	0.398**	0.386**

****Correlation is significant at the 0.01 level**

Plasma lipids content (cholesterol, Triglycerides, high-density lipoprotein [HDL] cholesterol (known as "good" cholesterol), low-density lipoprotein [LDL] cholesterol (is commonly called "bad" cholesterol), and (VLDL) very low density lipoprotein) for mule ducks as affected by the type of feed additives at 11 weeks of age are shown in Table (12).

The results showed that no significant differences among treatments in plasma cholesterol. But, plasma cholesterol had reduced at 2.1 and 1.8% for birds fed Biomin Impo (T3), Primalac (T4), respectively as compared to those fed control diet. Onol et al., (2003) reported that no significant differences in plasma cholesterol among control group and probiotics group. In opposite with Panda et al., (2006) showed that serum cholesterol levels had significantly lower only in broiler fed probiotics. Huff et al., (1998) reported that no significant differences in serum cholesterol among birds fed basal diet and those fed basal diet supplemented with phytase.

Triglycerides had not changed among treatments. Added probiotics (Biomin Impo, Primalac, Waznzad) had reduced triglycerides insignificant at 1.1, 15, and 6.9, respectively. But, added multi- enzymes commercial T-protphyt was increased triglycerides at 15.4%. Our results agree with El-Ghamry and Fadel (2004). On the other hand Panda et al., (2006) noticed that triglycerides had reduced significantly for the broilers fed probiotic as compared to control diet.

Huff et al., (1998) showed that birds fed phytase diet were comparable in triglycerides to those birds fed control diet.

No significant in all treatments in HDL. But, ducks fed Primalac diets (T4) had the highest level in HDL. The current results agree with El-Ghamry and Fadel (2004); Panda et al., (2006).

Plasma low-density lipoprotein cholesterol (LDL) was similar in all treatments. Birds fed Primalac diet had the lowest in level LDL. Kannan et al. (2005) reported that LDL cholesterol level was similar among birds fed prebiotics and those birds fed control diet. But, El-Ghamry and Fadel (2004) and Panda et al., (2006) indicted that LDL had reduced significantly in birds fed probiotic as compared to control diet.

No differences among treatments in VLDL. But, ducks fed Primalac diet (T4) had the lowest level in VLDL ,and followed by those feed Waznzad and Biomin Impo at 15.6, 7, and 1.1% respectively. Birds were fed T-protphyt increased insignificantly at 15.4 % as compared to control group. Panda et al., (2006) reported that VLDL had reduced significantly in birds fed probiotic.

Table (12). Plasma lipid content ($\bar{X}$ ± S.E) as affected by feed additive type

Plasma lipid content	Treatments				
	T1 (control)	T2 Enzymes	T3 Biomin	T4 Primalac	T5 Wazn Zad
Cholesterol mg/dl	135.76±11.56	150.93±11.56	132.86±11.56	133.33±11.56	161.86±11.56
Change %	100	+11.2	-2.1	-1.8	+19.2
Triglycerides mg/dl	124.83±11.56	144.10±11.56	123.43±11.56	105.40±11.56	116.10±11.56
Change %	100	+15.4	-1.1	-15	-6.9
HDL mg/dl	85.56±9.81	72.06±9.81	57±9.81	101.76±9.81	72.06±9.81
Change %	100	-15.8	-33.4	+18.9	-15.8
LDL mg/dl	25.25±12.79	50.05±12.79	50.78±12.79	10.50±12.79	66.56±12.79
Change %	100	98	101.1	-58.4	+163.6
VLDL mg/dl	24.96±3.78	28.81±3.78	24.68±3.78	21.07±3.78	23.22±3.78
Change %	100	+15.4	-1.1	-15.6	-7

Plasma total protein, albumin, globulin, albumin/globulin ratio and AST(GOT), and ALT(GPT) for mule ducks as affected by the type of feed additives at 11 weeks of age are shown in Table (13). Total protein were comparable in all treatments. Added probiotic improved total protein at 2.3, 5.3, and 17.6 % for ducks fed Biomin Impo, Primalac, and Waznzad diets, respectively. El-Ghamry and Fadel (2004) reported that total protein were comparable among birds fed probiotic and those birds fed control diet. In opposite with Abdel-Azeem (2002) and Panda et al., (2006) found increased in total protein by probiotic.

No significant differences among groups in plasma albumin. But, plasma albumin had improved by added feed additives. Albumin had the highest in Waznzad diet followed by T-protphyt, Biomin Impo, and Primalac diet at 30, 5.6, 4.3, and 1.3%. Onol et al., (2003) showed that albumin were similar among birds fed probiotic and those birds fed control diet. but Abdel-Azeem (2002) reported that albumin increased by probiotic.

Plasma globulin were similar in all treatments. Globulin had increased without any significant by added Primalac or Waznzad at 10 and 3 %, respectively. Abdel-Azeem (2002) noted increased globulin by probiotic. But, El-Ghamry and Fadel (2004) showed that no significant difference in globulin between birds fed probiotic and those birds fed control diet.

No significant differences among treatments in Albumin / globulin ratio. Albumin / globulin ratio had increased by added enzymes, Biomin, and Waznzad at 21.7, 2.5, and 25%, respectively as compared to control diet. El-Ghamry and Fadel (2004) reported that no significant in Albumin / globulin ratio between probiotic group and control group. But, Abdel-Azeem (2002) showed that Albumin / globulin ratio had lower by probiotic.

No significant changes among treatments was observed in plasma AST and ALT. El-Ghamry and Fadel (2004) and Panda et al., (2006) reported no significant in AST and ALT between probiotic group and control group. But, Abdel-Azeem (2002) showed insignificant between probiotic and control diet in GOT and GPT.

Table (13). Plasma biochemical parameters ($\overline{X}$ ± S.E) as affected by feed additive type.

Plasma biochemical parameters	Treatments				
	T1 (control)	**T2 Enzymes**	**T3 Biomin**	**T4 Primalac**	**T5 Wazn Zad**
T. protein g/dl	4.30±0.28	4.16±0.28	4.40±0.28	4.53±0.28	5.06±0.28
Change %	100	-3.2	+2.3	+5.3	+17.6
Albumin g/dl	2.30±0.18	2.43±0.18	2.40±0.18	2.33±0.18	3.00±0.18
Change %	100	+5.6	+4.3	+1.3	+30
Globulin g/dl	2.00±0.24	1.73±0.24	2.00±0.24	2.20±0.24	2.06±0.24
Change %	100	-13.5	0	+10	+3
Alb/Glob Ratio	1.20±0.19	1.46±0.19	1.23±0.19	1.06±0.19	1.50±0.19
Change %	100	+21.7	+2.5	-11	+25
AST U/L	11±1.41	13±1.41	10±1.41	10±1.41	13±1.41
Change %	100	+18.1	-9.1	-9.1	+18.1
ALT U/L	17±1.40	17.33±1.40	17±1.40	16±1.40	16.66±1.40
Change %	100	+1.9	0	-5.9	-2

Results presented in Table (14) showed that economic efficiency of the different treatments. No changes among all treatments in economic efficiency. But, all treatments had highest economic efficiency compared with the control. The relative net revenue/ feed cost (economic efficiency)100, 118, 129.5, 108, and 125% for (T1) control, (T2) T-protphyt, (T3) Biomin Impo, (T4) Primalac, (T5) Waznzad respectively. Samy and Abd El-Samee (2003) indicated that addition of Saccharomyces cerevisiae to adequate diet had not affecting economic efficiency. Rodriguez et al., (2007) reported that the cost of production was lower in the probiotic-treated than in the control.

But, Abdel-Azeem (2002) showed that economical efficiency increased significantly in broiler fed Saccharomyces cerevisiae.

Table (14). Economic efficiency ($\overline{X}$ ± S.E) in all treatments as effected by feed additive type.

Treatments	Mean ± Standard Error
T1	48.1±7.82
Difference %	100
T2	56.8±7.82
Difference %	+18
T3	62.3±7.82
Difference %	+29.5
T4	52.0±7.82
Difference %	+8
T5	60.3±7.82
Difference %	+25

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تأثير بعض إضافات الغذاء على أداء البط البغال أثناء مرحلة النمو

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أجريت الدراسة لدراسة تأثير إضافة ثلاثة أنواع تجارية من البروبيوتك و مخلوط تجارى إنزيمي في العلائق الكافية في محتواها من العناصر الغذائية علي أداء البط البغال المحلي أثناء فترة النمو (من ٦ إلي ١١ أسبوع من العمر). استخدم عدد ١٥٠ بطة بغال عمر ٦ أسبوع وقسمت عشوائياً إلي ٥ معاملات غذائية: عليقه الكنترول&عليقه لكنترول + المخلوط الإنزيمي&عليقه الكنترول + البيومين إيمبو& عليقه الكنترول+ البريمالاك & عليقه الكنترول + وزنزاد.

سجل وزن الجسم أسبوعياً لكل بطة وكذلك حسب الزيادة في وزن الجسم- العلف المستهلك- معامل التحويل الغذائي- كفاءة الاستفادة من البروتين- كفاءة الاستفادة من الطاقة و معامل الأداء أسبوعي.تم قياس بعض مقاييس الجسم(طول الساق وطول عظمة القص ومحيط الصدر) وكذلك معامل الارتباط بينهم وبين وزن الجسم. تم تجميع عينات دم لقياس الكولسترول & الترای جليسريد& البروتين الدهني عالي الكثافة [HDL] (الكولسترول المفيد)& البروتين الدهني منخفض الكثافة [LDL] (الكولسترول الضار) & بروتين منخفض الكثافة جداً & في البروتين الكلي والالبيومين والجلوبيولين والنسبة بين الالبيومين إلي الجلوبيولين& AST& ALT.

<u>يمكن تلخيص النتائج كالتالي</u>

عند الأسبوع ١١ من العمر لا يوجد فرق معنوي في كلاً من وزن الجسم- الزيادة الوزنية- العلف المستهلك- كفاءة الاستفادة من البروتين- كفاءة الاستفادة من الطاقة- معامل الأداء وكذلك بين مقاييس الجسم. معامل الارتباط بين مقاييس الجسم ووزن الجسم معنوي(٠,٠١ ≥ P). لا يوجد فرق معنوي بين المعاملات في الكولسترول & الترای جليسريد& البروتين الدهني عالي الكثافة [HDL] (الكولسترول المفيد)& البروتين الدهني منخفض الكثافة [LDL] (الكولسترول الضار) & بروتين منخفض الكثافة جداً(VLDL) و البروتين الكلي والالبيومين والجلوبيولين والنسبة بين الالبيومين إلي الجلوبيولين عند ١١ أسبوع من العمر.

علي الرغم من عدم وجود فروق معنوية بين المعاملات الغذائية المختلفة إلا أن استخدام البيومين ايمبو والوزنزاد حسنا الكفاءة الاقتصادية بمقدار ٢٥٩,٥ و٢٥ % علي التوالي مقارنة بعليقة الكنترول. وبالتالي يمكن للمربين الاستفادة من البيومين ايمبو والوزنزاد خلال الفترة من ٦- ١١ أسبوع من العمر لتحسين الكفاءة الاقتصادية.