Zagazig J. Agric. Res., Vol. 44 No. (1) 2017 215-227

Animal and Poultry Production

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

EFFECTS OF BREED, PROBIOTIC AND THEIR INTERACTION ON GROWTH PERFORMANCE, CARCASS TRAITS AND BLOOD PROFILE OF GROWING RABBITS

Ahmed F. Mohamed*, Gh.A. El-Sayiad, F.M. Reda and E.A. Ashour

Poult. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 27/11/2016 ; Accepted: 01/01/2017

ABSTRACT: This study was performed to investigate the effects of breed, probiotic (as growth promoter agent) and their interactions on growth performance traits, carcass traits and serum biochemistry of growing rabbits from 5 to 13 weeks of age. A 2 × 5 factorial design experiment was performed including two rabbit breeds: New Zealand White (NZW) as forgin breed and Baladi Black (BB) and five treatments of probiotics. Seventy five growing rabbits with in breed were divided into 5 treatments (15 rabbits in each) were fed on the basal diet and treated as follows; the first group was untreated with probiotics (T_1), the second group was given a dose of 1 ml of *Bifidobacterium bifiduim* fresh culture suspension containing 1×10^7 CFU (T_2), the third group was given a dose of 1 ml of *Lactobacillus acidophilus* fresh culture suspension containing 7×10^6 CFU (T_3), the fourth group was given a dose of 1 ml of bacterial mixture (*Bifidobacterium bifiduim and Lactobacillus acidophilus*) fresh culture suspension containing 3.5×10^7 CFU (T_4) and the fifth group was given a dose of 1 ml of *Saccharomyces cerevisiae* (T_5), in each group. The results showed that the live body weight, body weight gain and relative weight gain of growing rabbits were significantly ($P<0.05$ or 0.001) affected with breed types at the most of the experimental periods studied. Breed type was insignificantly affected on feed intake during all the experimental periods, except that only significant ($P<0.01$) effect, during the period of 5-7 weeks of age. Breed type significantly ($P<0.05$, 0.01 and 0.001) affected on feed conversion ratio during the periods of 5-7, <9-11, <11-13 and 5-13 weeks of age. However, breed type significantly ($P<0.001$) affected all blood components studied where BB rabbits generally recorded the higher values of RBC count, WBC count, hemoglobin, hematocrit, total protein, albumin and liver enzymes (ALT and AST) than the NZW rabbits. Breed type had a significant effect ($P < 0.001$) on all studied carcass traits, except carcass and dressing percentages. In general, probiotics treatment groups were significantly ($P<0.01$ or 0.001) affected on rabbits live body weight at most experimental periods. All probiotic treatments increased significantly live body weight as compared with control group. All probiotic treatment groups significantly ($P\leq0.05$ or 0.001) affected on feed conversion ratio. In general, probiotic treatments improved significantly ($P\leq0.05$ or 0.001) feed conversion ratio. Probiotics treatments affected significantly ($P<0.001$) on all blood components studied, except globulin level. Moreover, most probiotic treatments were increased significantly ($P<0.001$) carcass traits studied as compared with control group. Interaction between breed type and kind of probiotics treatments were insignificantly effected on growth performance of rabbits at all the experimental periods studied.

Key words: Breed, probiotic, performance, carcass, blood, rabbit.

INTRODUCTION

Rabbits have been recognized to have a very important role in supplying humans with animal protein (Parker, 2012). Simple biological characteristics, short breeding cycle, high prolificacy and better feed conversion efficiency logically place rabbit just below poultry

* **Corresponding author. Tel.:** +201022268925
E-mail address: a.fikry@yahoo.com

(Hasanat *et al.,* 2006). However, improved feed formulation and strategies for enhancing the production potential of rabbit, especially in tropical and subtropical regions of the world have not been fully exploited (Falcão-e-Cunha *et al.,* 2007). Rabbit has a quite high dressing percentage when compared to ruminants, ranging between 50 - 65% (Roiron *et al.,* 1992). Genetics are important factors of high impact on rabbit carcass and meat quality (Moura *et al.,* 2001). Feed efficiency is one of the most commercially important traits because post-weaning feeding accounts for around 40 % of total cost (Armero and Blasco, 1992). Efficiency of meat production can be improved by firstly applying diversity of rabbit breeds through characterization. Other possibilities to reduce production costs by using of high performance stock. Also, the use of healthy stock is an important factor to achieve a more economical and constant production level for the rabbit breeder.

Probiotics come under the category of safe ingredients classified by Food and Drug Administration as reported by Bansal *et al.* (2011). Probiotics are nonpathogenic bacteria that exert a beneficial influence on the health or physiology (or both) of the host, it neither has any residues in animal production nor exerts any antibiotic resistance by consumption (Rajput and Li, 2012). Various kinds of probiotics, as natural biological response modifiers, have the ability to enhance host defense mechanisms against infections and have been evaluated based on preventive and therapeutic effects on infectious diseases (El-Abasy, 2002).

Probiotics, such as yeast, are essentially live microorganisms that are "direct fed" to the animal *via* the daily ration (Oso *et al.,* 2013). They added that, these bacteria promote a healthy digestive system, working with the microbes already residing in the digestive tract, as well as allowing for more microbial growth. With the improved microbial environment, animals fed rations supplemented with probiotics have the ability to utilize feed more efficiently, thus, increasing weight gain, as well as boost the immune system, and therefore, overall health of the animal (Samanta *et al.,* 2011).

Recently, consumers have expressed their dissatisfaction with utilization of antibiotics in animal rations to promote weight gain, as they push for more "naturally" raised animal meat products. It is now thought that the addition of prebiotic and probiotic supplements, which are sometimes included in human diets, in animal rations can increase feed efficiency, promote weight gain, and provide various other health benefits (Oso *et al.,* 2013).

Therefore, the objective of this study was intended to evaluate the potential use of probiotics, which could be used in rabbit feeding on the growth performance, carcass characteristics and biochemical profile of two breeds of rabbits, under intensive management condition.

MATERIALS AND METHODS

The present study was carried out in the researcher's own Rabbit Farm, El-Qenayat, Sharkia Governorate, from October up to December 2014.

A 2 × 5 factorial design experiment was performed including two breeds of rabbit: New Zealand White (NZW) as forgen breed and Baladi Black (BB) as local breed from 5 to 13 weeks of age and five treatments of probiotics were used.

Seventy five growing rabbits with in breed divided into five main groups (15 rabbits in each) and each one includes 3 replicates (5 rabbits in each one), in each breed, the first group was untreated with probiotics (T_1), the second group was given a dose of 1 ml of *Bifidobacterium bifiduim* fresh culture suspension containing 1×10^7 CFU (T_2), the third group was given a dose of 1 ml of *Lactobacillus acidophilus* fresh culture suspension containing 7×10^6 CFU (T_3), the forth group was given a dose of 1 ml of bacterial mixture (*Bifidobacterium bifiduim* and *Lactobacillus acidophilus*) fresh culture suspension containing 3.5×10^7 CFU (T_4) and the fifth group (T_5) was given a dose of 1 ml of *Saccharomyces cerevisiae.*

During the experimental period, animals were housed in windowed Rabbitry, provided with a three-level pyramid design cages (50 × 60

× 35 cm), made of galvanized wire net. Each cage was equipped with an automatic drinker nipple and a manual feeder. Before starting the experiment, all cages were cleaned and disinfected by fire. The relative humidity was 70 ± 10% and the temperature was 20 to 27°C moreover, light period was 14 hours per day. Manure was dropped from cages on the building floor and removed every morning by using water flushing.

All rabbits were kept under similar managerial and environmental conditions and were offered experimental diets *ad-libitum* in pellet form, with the same commercial pelleted ration as shown in Table 1. Tap fresh water was automatically available all the time by stainles steel nipples.

Individual live body weight, daily weight gain, relative weight gain = (Final body weight – Initial body weight)/Initial body weight) × 100, daily feed intake and feed conversion ratio were biweekly recorded, during the experimental period.

At the end of the experimental period (13 weeks of age), 3 rabbits were randomly chosen from each treatment around the mean for each treatment. Assigned rabbits were fasted for 12 hours before slaughtering and were individually weighed as pre-slaughtering weight. Animals were slaughtered by cutting the jugular veins of the neck by sharp knife, upon the completion of bleeding. After skinning, the carcasses were weighed and the weights of kidneys, liver, heart as a giblet weight and lungs were recorded and expressed as g kg^{-1} of slaughter weight. Carcass percentage = carcass weight × 100/live body weight. Dressing percentage = (carcass weight plus giblets weight) × 100/live body weight.

At the same time of slaughter test, blood samples from three rabbits of each treatment were collected using vacutainer tubes containing heparin as anticoagulant under aseptic conditions to determine the total erythrocyte (RBCs), leukocyte (WBCs) counts, the hemoglobin (Hb) and Hematocrit. Other blood samples were led to coagulate and centrifuged at 3500 rpm for 15 min to obtain serum and serum samples were kept in Eppendorf tubes at -20°C until analyzed. The following serum biochemical parameters were determined: Total protein (TP), Albumin (ALB), Globulin, Aspartate Aminotransferase (AST) , Alanine Aminotransferase (ALT) and (GLB) where GLB = (TP-ALB) were estimated in serum using commercial biodiagnostic kits provided from Biodiagnostic Company (29 El-Tahrir St. Dokki, Giza, Egypt) and a spectrophotometer (Shimadzu, Japan).

Analysis of variance for the data was accomplished by a factorial design of 2x5 using the SAS General Liner Models Procedure (SAS, 2002) where the effects of breed type, probiotic treatments and their interactions were in consideration (Snedecor and Cochran, 1982). The following statistical model was used:

$$Y_{ijk} = \mu + B_i + P_j + (BP)_{ij} + e_{ijk}$$

Where:

Y_{ijk} is an observation, μ is the overall mean, B_i is the fixed effect of breed type (i=1,…2), P_j is the fixed effect of probiotic treatment (j=1,…5), BP_{ij} is the interaction effect of breed type and probiotic treatments (ij= 1,….10) and e_{ijk} is random error. Means were tested for significant differences by using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth Performance

Live body weight and relative body weight gain

The results presented in Table 2 show that the live body weight of rabbits was significantly ($P < 0.05$ or 0.001) affected by breed type at most the experimental periods studied. At 5 weeks of age, live body weight (BW) of NZW rabbits was significantly ($P<0.001$) higher than BB rabbits, while BB rabbits were higher significantly ($P < 0.05$ or 0.001) than NZW rabbits at 9, 11 and 13 weeks of age.

The breed type significantly ($P<0.05$, 0.01 and 0.001) affected relative body weight gain and relative weight gain at the most of the experimental periods studied. The BB rabbits recorded the higher relative gain values than the NZW rabbits at all experimental periods (Tables 3 and 4).

Table 1. Ingredients and chemical composition of the basal diet used during the experimental period

Item	(%)
Ingredient	
Barley	32.00
Wheat bran	21.00
Soy bean meal (44%)	10.00
Hay	22.00
Berseem straw	6.00
Decorticated cotton-seed meal	3.00
Molasse	3.00
Limestone	1.00
Salt	0.34
Minerals and vitamins concentrate:*	0.30
DL-Methionine	0.06
Anti-coccidian and antibiotic.	1.30
Total	100.00
Calculated analysis: **	
Crude protein	16.30
Crude fiber	13.20
Ether extract	2.50
Digestible energy, K Cal / Kg	2600

* Premix provided per kg of complete diet: vitamin A, 12,000 IU; vitamin D3, 1000 IU; vitamin E acetate, 50 mg; vitamin K3, 2 mg; biotin, 0.1 mg; thiamin, 2 mg; riboflavin, 4 mg; vitamin B6, 2 mg; vitamin B12, 0.1 mg; niacin, 40 mg; pantothenic acid, 12 mg; folic acid, 1 mg; choline chloride, 300 mg; iron, 100 mg; copper, 20 mg; magnesium, 50 mg; cobalt, 2 mg; iodine, 1 mg; zinc, 100 mg; selenium, 0.1 mg.

** Calculated according to NRC (1977).

Table 2. Live body weight (g) of rabbits ($\overline{X}$ ± SE) at different ages as affected by breed type, probiotic treatments and their interactions

Item	5 wks	7 wks	9 wks	11 wks	13 wks
New Zealand White (NZW)	662.0±3.8	1047.4±9.6	1405.8±18.1	1700.4±27.5	1843.2±32.1
Baladi Black (BB)	619.3±1.1	1064.1±7.7	1443.8±16.1	1749.2±25.2	1920.4±33.1
Breed type	***	NS	*	*	***
T_1 (Control)	639.7±9.9	1013.1±8.2^b	1327.2±16.1^c	1578.9±21.4^c	1694.5±19.6^d
T_2	637.8±9.7	1073.1±8.9^a	1477.8±9.4^a	1824.5±21.9^a	2014.7±16.7^a
T_3	632.8±7.3	1072.0±14.2^a	1454.9±19.8^a	1784.6±21.3^a	1977.9±27.3^a
T_4	647.8±11.7	1072.2±8.7^a	1459.7±19.8^a	1754.6±23.9^a	1898.0±28.7^b
T_5	645.3±12.4	1048.3±12.7^a	1404.5±22.5^b	1681.7±29.4^b	1824.0±31.4^c
Probiotic treatment	NS	**	***	***	***
Interactions	NS	NS	NS	NS	NS

Means in the same column within each classification bearing different letters are significantly different at ($P < 0.05$)

NS: Not significant * = ($P \leq 0.05$) ** =($P \leq 0.01$) *** =($P \leq 0.001$)

Table 3. Relative body weight gain of rabbits ($\bar{X}$ ± SE) at different periods as affected by breed type, probiotic treatments and their interactions

Item	5-7 weeks	<7-9 weeks	<9-11 weeks	<11-13 weeks	5-13 weeks
New Zealand White (NZW)	58.28 ± 1.67	34.19 ± 0.88	20.90 ± 0.66	8.38 ± 0.42	178.68 ± 5.58
Baladi Black (BB)	71.82 ± 1.29	35.64 ± 0.82	21.12 ± 0.66	9.75 ± 0.70	210.07 ± 5.27
Breed type	***	NS	NS	*	***
T_1 (Control)	58.63 ± 3.58^{c}	31.01 ± 1.13^{c}	18.96 ± 0.66^{b}	7.34 ± 0.45^{c}	165.38 ± 6.82^{d}
T_2	68.45 ± 2.92^{a}	37.74 ± 0.56^{a}	23.44 ± 0.96^{a}	10.46 ± 0.71^{ab}	216.39 ± 6.73^{a}
T_3	69.49 ± 2.48^{a}	35.72 ± 0.73^{ab}	22.69 ± 0.83^{a}	10.86 ± 1.34^{a}	212.92 ± 6.93^{a}
T_4	65.85 ± 3.81^{ab}	36.15 ± 1.56^{ab}	20.20 ± 0.38^{b}	8.17 ± 0.60^{c}	193.81 ± 9.25^{b}
T_5	62.84 ± 4.41^{bc}	33.95 ± 0.94^{bc}	19.74 ± 0.93^{b}	8.48 ± 0.66^{bc}	183.38 ± 8.68^{c}
Probiotic treatment	**	**	**	**	***
Interactions	NS	NS	NS	NS	NS

Means in the same column within each classification bearing different letters are significantly different at (P < 0.05).
NS: Not significant * = (P≤0.05) ** = (P≤0.01) *** =(P≤0.001)

Table 4. Daily feed intake (g) of rabbits ($\bar{X}$ ± SE) at different periods as affected by breed type, probiotic treatments and their interactions

Item	5-7 weeks	<7-9weeks	<9-11 weeks	<11-13 weeks	5-13 weeks
New Zealand White (NZW)	69.72±1.03	74.54±1.34	68.84±1.21	57.86±2.53	67.74±1.00
Baladi Black (BB)	74.91±1.03	74.75±1.71	65.89±1.48	61.36±3.29	69.23±0.97
Breed type	***	NS	NS	NS	NS
T_1 (Control)	69.92±2.72	69.80 ± 0.95^{b}	64.52±1.16	53.21±3.31	64.37 ± 0.93^{b}
T_2	71.09±0.81	74.61 ± 0.64^{ab}	68.73±2.79	63.17±2.68	69.40 ± 0.89^{a}
T_3	73.97±1.00	75.16 ± 2.36^{ab}	69.01±3.00	68.08±6.81	71.55 ± 1.37^{a}
T_4	74.28±1.79	78.13 ± 2.06^{a}	67.98±1.68	54.69±3.85	68.77 ± 1.85^{a}
T_5	72.30±2.58	75.52 ± 3.81^{ab}	66.59±2.03	58.89±3.79	68.32 ± 1.32^{a}
Probiotic treatment	NS	*	NS	NS	*
Interactions	NS	NS	NS	NS	NS

Means in the same column within each classification bearing different letters are significantly different at (P < 0.05)

NS: Not significant * = (P≤0.05) *** (P≤0.001).

The recorded means of BW in the present study at the different ages were within the range obtained by Youssef (2004) and Farid *et al.* (2006), which means that the improvement in growth traits of rabbits (*i.e.* BW and DG) through phenotypic selection is quiet possible. Also, El-Sheikh *et al.* (2011) found that NZW rabbits showed the heaviest (P≤0.05) initial and body weight at 60 days, while V-line and BB groups showed significantly higher daily weight gain than both Gabali and NZW growing rabbits.

Probiotics treatments increased significantly (P<0.01 or 0.001) live body weight, generally at the most of experimental periods (Table 2). The heaviest live body weight was obtained in rabbit group given a dose of *bifidobacterium bifiduim* (T_2) followed by those given a dose of *Lactobacillus acidophilus* (T_3), while the lightest one was observed in the control group (Table 2).

All probiotic treatments improved significantly (P≤0.001 or 0.001) body weight gain and relative weight gain. The highest estimates were recorded with the rabbits given a dose of *bifidobacterium bifiduim*as (T_2) as compared with the other groups (Table 3). The present results are in conformity with the findings of Eiben *et al.* (2008) who showed an increases in body weight and body weight gain in the rabbits fed with mineral mixture and probiotic as increased digestion of protein, carbohydrate and fat and their absorption through intestine which might be due to more fermentative action of microflora probiotic.

Beneficial effect of probiotic supplementation to broiler diet in terms of increased body weight through a natural physiological way and improving digestion by balancing the resident gut microflora as it can improve the integrity of the intestinal mucosal barrier, digestive and immune functions of intestine. Improvement in digestion and absorption of intestine of nutrient transportation systems leads to immune resistance and productivity (Mountzouris *et al.* 2010 and Bansal *et al.* 2011).

Tables 2 and 3 showed that the interaction between breed type and kind of probiotics treatments insignificantly affected live body weight and relative weight gain of rabbits at all the studied experimental periods. In general, the BB rabbits group, which dosage with *bifidobacterium bifiduim* recorded the heaviest live body weight and relative weight gain at 5-13 weeks of age as compared by the other groups. Similarly, El-Sagheer and Hassanein (2014) reported that concerning the interaction between Veta-zyme supplementation and strain effect showed that, using Enz2 for VL strain exceeded body weight as other groups at 72 days of age.

Feed intake and feed conversion ratio

Table 4 show that breed type insignificantly effected on feed intake, during all the experimental periods, except that only significant (P<0.01) effect found during the period of 5-7 weeks of age. The BB rabbits generally recorded the significantly (P<0.001) higher feed intake during the period of 5-7 weeks, while it was insignificantly higher at 7-9, 11-13 and 5-13 weeks of age than NZW rabbits.

The results presented in Table 5 show that the feed conversion ratio was significantly (P<0.05, 0.01 and 0.001) affected by breed type during the periods of 5-7, <9-11, <11-13 and 5-13 weeks of age, while feed conversion ratio was insignificantly affected by breed type during 7-9 weeks. Feed conversion ratio was significantly (P<0.05, 0.01 and 0.001) improved during most studied experimental periods in the BB rabbits as compared with the NZW one. Similar results were observed by El-Sagheer and Hassanein (2014) who showed that the FI for VL strain significantly (P≤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. Also, El-Sheikh *et al.* (2011) found that the NZW and V-line breeds showed significantly (P≤0.05) daily feed intake than both BB and Gabali breeds but BB rabbits showed the highest (P≤0.05) feed efficiency (0.375) estimate.

Table 5. Feed conversion ratio of rabbits ($\overline{X} \pm$ SE) at different periods as affected by breed type, probiotic treatments and their interactions

Item age period	5-7 wks	<7-9 wks	<9-11 wks	<11-13wks	<5-13 wks
New Zealand White (NZW)	2.55±0.06	2.95±0.09	3.32±0.10	5.75±0.16	3.24±0.08
Baladi Black (BB)	2.37±0.05	2.77±0.06	3.06±0.09	5.16±0.18	3.00±0.06
Breed type	*	NS	**	***	***
T_1 (Control)	$2.64±0.10^{a}$	$3.14±0.14^{a}$	$3.62±0.17^{a}$	$6.44±0.14^{a}$	$3.43±0.12^{a}$
T_2	$2.30±0.07^{b}$	$2.58±0.04^{c}$	$2.79±0.10^{c}$	$4.68±0.18^{e}$	$2.83±0.07^{d}$
T_3	$2.37±0.06^{b}$	$2.76±0.12^{cb}$	$2.93±0.08^{c}$	$4.99±0.13^{d}$	$2.98±0.06^{cd}$
T_4	$2.46±0.05^{ab}$	$2.85±0.13^{abc}$	$3.23±0.04^{b}$	$5.35±0.10^{c}$	$3.09±0.08^{bc}$
T_5	$2.53±0.10^{ab}$	$2.97±0.09^{ab}$	$3.38±0.09^{ab}$	$5.83±0.17^{b}$	$3.26±0.07^{ab}$
Probiotic treatment	*	*	***	***	***
Interactions	NS	NS	NS	NS	NS

Means in the same column within each classification bearing different letters are significantly different at (P < 0.05)

NS: Not significant * = (P≤0.05) ** = (P≤0.01) *** = (P≤0.001).

Probiotic treatments significantly (P<0.05) affected rabbits feed intake during periods of <7-9 and 5-13 weeks of age only while, during the experimental periods of 5-7, <9-11 and <11-13 weeks of age, feed intake was insignificantly affected. During the experimental period of <7-9 weeks of age the significantly (P<0.05) highest feed intake was recorded in rabbits given the bacterial mixture of *bifidobacterium bifiduim* and *Lactobacillus acidophilus* as compared with the other groups. Also, during the whole period of 5-13 weeks of age, the rabbits group which dosage with *Lactobacillus acidophilus* recorded the highest value of feed intake (71.55g) than the other probiotic treatments (Table 4).

Probiotic treatment groups were significantly (P≤0.05 or 0.001) effected on feed conversion ratio. The best feed conversion ratio was recorded with the rabbits group dosage with *bifidobacterium bifiduim* (T_2) followed by the rabbits group dosage with *Lactobacillus acidophilus* (T_3) as compared with others groups (Table 5). Kritas *et al.* (2008) found that the feed conversion ratio of the probiotic-treated rabbits was significantly (P < 0.05) improved, during all the experimental periods as compared to the control one. The same trend was observed by the findings of Matusevicius and Jeroch (2009) who reported improved feed conversion ratio in the feed additive supplemented groups. The best feed conversion ratio in the rabbits given probiotic might be attributed to better growth and higher weight gain observed during the experimental periods in present study.

The interaction between breed type and probiotics treatments was insignificantly effected on feed intake and feed conversion ratio at all the experimental periods studied. In general, the BB rabbits group, which had bacterial mixture of *bifidobacterium bifiduim* and *Lactobacillus acidophilus* (T_3) recorded the highest feed intake during 5-7 and <7-9 weeks of age as compared by the others groups. The BB rabbits group, which given *Lactobacillus acidophilus* (T_3) only recorded the highest feed intake during <11-13 and 5-13 weeks of age as compared by the other groups (Table 4).

The results presented in Table 5 showed that the best feed conversion ratio was recorded in the BB rabbits group, which given *bifidobacterium bifiduim* when compared with the other groups.

Blood Characteristics

Breed type was significantly ($P<0.001$) effected on all studied blood characteristics (within normal range). The BB breed rabbits generally recorded significantly ($P<0.001$) higher values of RBC count, WBC count, hemoglobin, hematocrit, total protein, albumin and liver enzyme (ALT and AST) than the NZW breed rabbits (Table 6).

Similar results were recorded by El-Sheikh *et al.* (2011) who showed that; genotype was significantly ($P\leq0.005$) effected on hematological and biochemical parameters. Growing native rabbits from both BB and Gabali showed significantly ($P\leq0.05$) higher values for almost hematological and biochemical traits than both imported ones (NZW and V-Line), which may be due to the high adaptation of the native rabbits to the Egyptian conditions as observed by Meshreky *et al.* (2005). They also, showed that among the native breeds, Gabali breed exhibits a significant ($P\leq0.005$) higher value of RBCs (6.61×10^6 /mm^3) as compared with 6.36×10^6 /mm^3 for the BB growing rabbits. Within exotic breeds, the V-line scored significantly ($P\leq0.005$) higher Ht % (36.47) as shown as a result of an increased in RBCs count by about 1.05×10^6 /mm^3 than NZW growing rabbits. The same trend was also observed for the globulin value, where the native Gabali recorded a significant ($P\leq0.05$) highest values and also 14% extra globulin level more than BB one. Within imported breeds, V-Line rabbits showed a significant ($P\leq0.005$) higher score for total protein level by about 0.34 mg/ 100 ml higher than NZW growing rabbits as a result of possessing ($P\leq0.005$) higher globulin level of 1.70 mg / 100 ml as compared to 1.48 mg/ 100 m globulin level for NZW rabbits.

Serum total protein level is a general indication of immune status (White *et al.,* 2002). Also, the results of Ismail *et al.* (2002) revealed that globulin can be taken as a good indicator of immunity response. The latter authors added that, the albumin level was significantly ($P\leq0.001$) higher in both Gabali and BB breeds than both V-line and NZW ones. Albumin level reflects liver function (Azoz and El-Kholy, 2005), where, the liver is the site of albumin synthesis (Selem *et al.,* 2007). The latter authors suggested that metabolic rate may be higher in native rabbits and such results may give evidence that native breeds are more able to metabolize protein.

Probiotic treatments significantly ($P<0.001$) increased all studied blood characteristics, except globulin level, which was insignificantly affected as compared by yeast and control groups. Rabbits group which fed with *Lactobacillus acidophilus* (T_3) recorded significantly ($P<0.001$) the highest values of RBC count, WBC count, hemoglobin, hematocrit, total protein, albumin and liver enzyme (ALT and AST) values as compared with the other groups (Table 6). Abdelhady and El-Abasy (2015) found that no significant changes in albumin, ALT, AST, urea and creatinine. The same authors also, showed a significant ($P < 0.05$) increase of total protein and globulin concentration only in rabbit received mixture of prebiotic and probiotic in all treated rabbit groups when compared with control group.

The interaction between breed type and probiotic treatments was significantly ($P < 0.05$ or 0.01) affected RBC count, WBC count and ALT only, while the others blood characteristics studied were insignificantly affected by the interaction between breed type and probiotic treatments. In general, the BB rabbits group which given *Lactobacillus acidophilus* (T_3) recorded the highest values of RBC count, WBC count, hemoglobin, hematocrit, total protein and liver enzyme (ALT and AST) values as compared with the other groups (Table 6).

The BB rabbits generally recorded the higher values of carcass weight, giblets, heart, liver, kidneys and lungs than the NZW rabbits (Table 7).

Similar results were recorded by El-Sheikh *et al.* (2011) who found that, dressing percentage and all internal organs weight were significantly ($P < 0.01$) affected by breed.

In general, the most of kind probiotic treatments significantly ($P<0.001$) increased carcass traits studied as compared with control group. In general, the BB rabbits group, which fed with *bifidobacterium bifiduim* (T_2) recorded the highest values of carcass weight, carcass percentage, heart, liver, kidneys, lungs and giblets as compared with the other groups (Table 7).

Table 6. Blood characteristics of rabbits ($\overline{X}$ ± SE) as affected by breed type, probiotic treatments and their interactions

Item	RBC	WBC	Hemoglobin	Hematocrit	Total protein (g/100 ml)	Albumin (g/100 ml)	Globulin (g/100 ml)	ALT (U/L)	AST (U/L)
New Zealand White (NZW)	5.13±0.08	6.11±0.07	9.13±0.10	39.50±0.95	5.52±0.10	2.92±0.08	2.60±0.10	47.70±1.34	53.30±0.99
Baladi Black (BB)	5.89±0.11	6.91±0.11	10.45±0.12	43.20±0.95	5.89±0.14	3.90±0.13	1.99±0.12	51.20±1.47	55.70±1.23
Breed type	***	***	***	***	***	***	***	***	***
T$_1$ control	5.15±0.13^{c}	6.18±0.18^{c}	9.40±0.28^{c}	36.75±1.33^{c}	5.50±0.18^{b}	3.25±0.15^{bc}	2.25±0.21	42.50±1.45^{d}	51.25±0.85^{c}
T$_2$	5.70±0.18^{b}	6.68±0.16^{b}	10.05±0.30^{ab}	41.50±1.26^{b}	5.80±0.16^{ab}	3.43±0.28^{ab}	2.38±0.22	52.25±2.28^{b}	54.75±073^{b}
T$_3$	5.95±0.18^{a}	6.90±0.23^{a}	10.25±0.32^{a}	45.00±1.77^{a}	6.03±0.13^{a}	3.73±0.24^{a}	2.30±0.12	55.50±1.15^{a}	60.00±1.46^{a}
T$_4$	5.60±0.28^{b}	6.65±0.28^{b}	9.88±0.35^{b}	43.00±0.82^{ab}	6.10±0.12^{a}	3.70±0.33^{a}	2.40±0.29	50.00±0.93^{bc}	57.00±0.86^{b}
T$_5$	5.15±0.14^{c}	6.15±0.10^{c}	9.38±0.28^{c}	40.50±1.15^{b}	5.10±0.11^{c}	2.95±0.21^{c}	2.15±0.26	47.00±1.24^{c}	49.50±0.62^{c}
Probiotic treatment	***	***	***	***	***	***	NS	***	***
T$_1$	4.90±0.06^{d}	5.80±0.12^{c}	8.80±0.12	34.50±0.87	5.20±0.12	3.00±0.12	2.20±0.23	40.00±1.15^{d}	50.00±1.15
T$_2$	5.30±0.06^{c}	6.35±0.09^{b}	9.40±0.12	39.00±0.58	5.50±0.06	2.85±0.14	2.65±0.09	47.500±1.44^{b}	53.50±0.87
T$_3$	5.55±0.03^{c}	6.40±0.12^{b}	9.55±0.03	42.00±2.31	5.80±0.12	3.25±0.09	2.55±0.03	54.00±1.15^{a}	58.00±1.15
T$_4$	5.00±0.12^{d}	6.05±0.09^{bc}	9.10±0.12	43.00±0.58	6.00±0.12	3.00±0.12	3.00±0.23	51.00±0.58^{ab}	56.00±1.15
T$_5$	4.90±0.17^{d}	5.95±0.09^{c}	8.80±0.23	39.00±1.73	5.10±0.17	2.50±0.06	2.60±0.23	46.00±1.15^{bc}	49.00±0.58
T$_1$	5.40±0.12^{c}	6.55±0.09^{b}	10.00±0.17	39.00±1.73	5.80±0.23	3.50±0.17	2.30±0.40	45.00±1.73^{c}	52.50±0.87
T$_2$	6.10±0.06^{b}	7.00±0.12^{a}	10.70±0.12	44.00±1.15	6.10±0.17	4.00±0.23	2.10±0.40	57.00±1.15^{a}	56.00±0.58
T$_3$	6.35±0.09^{a}	7.40±0.06^{a}	10.95±0.14	48.00±1.15	6.25±0.14	4.20±0.23	2.05±0.09	57.00±1.73^{a}	62.00±2.31
T$_4$	6.20±0.12^{a}	7.25±0.14^{a}	10.65±0.09	43.00±1.73	6.20±0.23	4.40±0.23	1.80±0.00	49.00±1.73^{b}	58.00±1.15
T$_5$	5.40±0.06^{c}	6.35±0.03^{b}	9.95±0.09	42.00±1.15	5.10±0.17	3.40±0.12	1.70±0.29	48.00±2.31^{b}	50.00±1.15
Interactions (Breed × Probiotic)	**	**	NS	NS	NS	NS	NS	*	NS

Means in the same column within each classification bearing different letters are significantly different at ($P < 0.05$)

NS: Not significant * = ($P \leq 0.05$) ** = ($P \leq 0.01$) *** = ($P \leq 0.001$)

Table 7. Carcass traits of rabbits ($\bar{X}$ ± SE) as affected by breed type, probiotic treatments and their interactions

Item	LBW	Carcass W	Carcass P	Heart	Liver	Kidneys	Lungs	Giblets	Dressing
New Zealand White (NZW)	1843.0±30.3	1011.6±25.5	54.8±0.6	5.8±0.2	56.6±2.8	11.9±0.5	11.8±0.7	4.0±0.13	58.8±0.6
Baladi Black (BB)	1907.0±30.0	1039.1±24.8	54.4±0.5	7.2±0.3	63.5±2.3	15.1±0.7	12.9±0.5	4.5±0.10	58.9±0.6
Breed type	***	***	NS	***	***	***	***	***	NS
T_1 control	1697.5±15.5^{e}	897.3±7.8^{e}	52.9±0.2^{c}	5.4±0.3^{d}	48.9±2.6^{c}	11.3±0.9^{d}	10.4±0.3^{d}	3.9±0.18^{c}	56.7±0.1^{d}
T_2	2005.0±11.7^{a}	1165.5±9.4^{a}	58.1±0.3^{a}	7.8±0.5^{a}	68.7±4.2^{a}	16.9±1.2^{a}	15.5±0.2^{a}	4.7±0.27^{a}	62.8±0.3^{a}
T_3	1972.5±17.4^{b}	1085.0±10.5^{b}	55.0±0.3^{b}	6.1±0.3^{c}	70.8±1.5^{a}	14.1±0.3^{b}	14.2±0.3^{b}	4.6±0.10^{a}	59.6±0.3^{b}
T_4	1890.0±20.9^{c}	1009.2±13.0^{c}	53.4±0.3^{c}	6.8±0.3^{b}	56.5±2.1^{b}	12.9±1.1^{c}	11.6±0.8^{c}	4.0±0.15^{b}	57.4±0.3^{cd}
T_5	1810.0±12.4^{d}	969.8±6.2^{d}	53.6±0.3^{c}	6.2±0.4^{c}	55.3±0.9^{b}	12.1±0.4^{cd}	10.2±0.5^{d}	4.1±0.07^{b}	57.7±0.2^{c}
Probiotic treatment	***	***	***	***	***	***	***	***	***
T_1	1665.0±2.9	885.1±4.8	53.2±0.2	4.7±0.2^{e}	43.5±1.4^{g}	9.5±0.5^{g}	9.9±0.3^{d}	3.5±0.05^{f}	56.6±0.2
T_2	1985.0±8.7	1160.3±7.4	58.4±0.1	6.8±0.1^{b}	60.0±2.9^{d}	14.3±0.4^{c}	15.5±0.3^{a}	4.1±0.16^{d}	62.5±0.3
T_3	1935.0±8.7	1067.8±16.1	55.2±0.6	5.8±0.2^{d}	73.7±1.6^{b}	14.0±0.1^{c}	14.4±0.1^{b}	4.8±0.04^{b}	60.0±0.6
T_4	1845.0±8.7	981.8±7.1	53.2±0.6	6.2±0.1^{c}	52.1±1.2^{f}	10.4±0.2^{f}	9.9±0.0^{d}	3.7±0.07^{e}	56.9±0.6
T_5	1785.0±8.7	963.1±12.2	54.0±0.4	5.3±0.1^{c}	53.5±0.8^{f}	11.2±0.5^{e}	9.4±0.6^{d}	3.9±0.06^{e}	57.9±0.5
T_1	1730.0±11.5	909.5±11.5	52.6±0.3	6.1±0.2^{c}	54.4±1.5^{f}	13.2±0.3^{d}	10.9±0.4^{c}	4.3±0.08^{c}	56.8±0.2
T_2	2025.0±14.4	1170.8±19.0	57.8±0.5	8.9±0.3^{a}	77.3±1.9^{a}	19.5±0.6^{a}	15.4±0.2^{a}	5.2±0.01^{a}	63.0±0.5
T_3	2010.0±5.8	1102.2±0.3	54.8±0.2	6.4±0.4^{c}	68.0±0.1^{c}	14.2±0.7^{c}	13.9±0.5^{b}	4.4±0.03^{c}	59.2±0.2
T_4	1935.0±8.7	1036.7±5.9	53.6±0.1	7.4±0.1^{b}	60.9±1.2^{d}	15.4±0.6^{b}	13.3±0.6^{b}	4.3±0.12^{c}	57.9±0.1
T_5	1835.0±8.7	976.6±0.8	53.2±0.2	7.1±0.4^{b}	57.1±0.7^{e}	13.0±0.0^{d}	11.0±0.4^{c}	4.2±0.04^{c}	57.4±0.2
Interactions (Breed × Probiotic)	NS	NS	NS	*	***	***	***	***	NS

Means in the same column within each classification bearing different letters are significantly different at ($P < 0.05$).

NS: Not significant * = ($P \leq 0.05$) *** = ($P \leq 0.001$).

Carcass traits

Breed type was significantly (P < 0.001) in all studied carcass traits, except carcass and dressing percentages, which were insignificantly affected. The BB rabbits generally recorded the higher values of carcass weight, giblets, heart, liver, kidneys and lungs than the NZW rabbits (Table 7).

Similar results were recorded by El-Sheikh *et al.* (2011) who found that, dressing percentage and all internal organs weight were significantly(P < 0.01) affected by breed.

In general, the most of kind probiotic treatments significantly (P<0.001) increased carcass traits studied as compared with control group. Moreover, the BB rabbits group, which fed with *bifidobacterium bifiduim* (T_2), recorded the highest values of carcass weight, carcass percentage, heart, liver, kidneys, lungs and giblets as compared with the other groups (Table 7).

The interaction between breed type and probiotics treatments was significantly (P<0.05 or 0.001) affected heart, liver, kidneys, lungs and giblets percentage.

Conclusively, it could be concluded that the breed type (BB growing rabbits) and probiotics treatment groups (*bifidobacterium bifiduim* T_2) significantly (P<0.05, 0.01 and 0.001) affected growth performance, blood profile and carcass traits generally at most experimental periods as compared with control group.

REFERENCES

Abdelhady, D.H. and M.A. El-Abasy (2015). Effect of prebiotic and probiotic on growth, immuno-hematological responses and biochemical parameters of infected rabbits with pasteurellamultocida. BENHA Vet. Med. J., 28 (2) : 40-51.

Armero, E. and A. Blasco (1992). Economic weights for rabbit selection indices. J. Appl. Rabbit Res., 15:637-642.

Azoz, A.A. and K.H. El-Kholy (2005). Blood metabolites and hormones of V-line and Bouscat female rabbits under middle Egypt conditions. Egypt. J. Rabbit Sci., 15: 131 – 142.

Bansal, G.R., V.P. Singh and N. Sachan (2011). Effect of probiotic supplementation on the performance of Broilers. Asian J. Anim. Sci., 5: 277 - 284.

Bansal, G.R., V.P. Singh and N. Sachan (2011). Effect of probiotic supplementation on the performance of Broilers. Asian J. Anim. Sci., 5: 277 - 284.

Duncan, D.B. (1955). Multiple Range and Multiple F-test. Biometrics, 11:1-42.

Eiben, C.S., T. Gippert, K. Godor-Surmann and K. Kustos (2008). Feed additives as they affect the fattening performance of rabbits. 9th World Rabbit Cong. Verona, Italy.

El-Abasy, M.A. (2002). Studies on sugar cane extract for control of chicken diseases. Ph. D. Thesis. Tokyo Univ., Tokyo, Japan.

El-Sagheer, M. and H.H.M. Hassanein (2014). Effect of enzymes and probiotic mixtures supplementation to the diet of growing female rabbits on performance and carcass criteria. Egypt. Poult. Sci., 34 (I): 259-272.

El-Sheikh, T.M., M. Ghaly, T.S.T. Mona and M.A. Selem (2011). Comparative studies on some productive capabilities among imported, endogenous and native rabbit breeds under Egyptian environmental conditions. LucrăriŞtiinţifice, 56, Seria Zootehnie.

Falcão-e-Cunha L., L. Castro-Solla, L. Maertens, M. M arounek, V. Pinheiro, J. Freire and J.L. Mour (2007). Alternatives to antibiotic growth promoters in rabbit feeding: A Rev. World Rabbit Sci., 15: 127–140.

Farid, A., G.E.Y.A. Attalah and M.G. Gharib (2006). Genetic and non- genetic factors affecting weaning and post-weaning growth traits in Bauscat and Baladi Red rabbits and their crosses. J. Agric. Sci. Mansoura Univ., 31(11): 6957-6969.

Hasanat, M.S., M.E. Hossain, M.P. Mostari and M.A. Hossain (2006). Effect of concentrate supplementation on growth and reproductive performance of rabbit under rural condition. Bangladesh J. Vet. Med., 4: 129–132.

Ismail, A.M., M.A. Abou-El-Ellaa and A.A. Sedki (2002). Blood metabolites, growth and reproductive performance and immune responsiveness in growing and doe rabbits as affected by Acitrol treatments. Egypt. J. Agric. Res., 80: 1789 – 1808.

Kritas S.K., E.I. Petridou, P. Fortomaris1, E. Tzika, G. Arsenos1 and G. Koptopoulos (2008). The effect of probiotics on microbiology, health and performance of fattening rabbits. Asian-Aust. J. Anim. Sci., 21 (9): 1312 – 1317.

Matusevicius, P. and H. Jeroch (2009). Efficacy of probiotic "ToyoCerin®" and phytobiotic "Cuxarom Spicemaster" on growing rabbits. Lohmann Infor., 44 (2): 38 - 49.

Meshreky, S.Z., S.A. Gad Alla and M.M. Arfa (2005). Growth performance, carcass traits, physiological response and economical efficiency of Baladi Red, V- line rabbits and their cross under Egyptian environmental conditions. In: Proc. 4th Int. Conf. Rabbit Prod. Hot Climates, 24-27 Feb., 2005, Sharm El-Sheik, Egypt, 197 – 210.

Mountzouris, K.C., P. Tsitrsikos, I. Palamidi, A. Arvaniti, M. Mohnl, G. Schatzmayr and K. Fegeros (2010). Effect of probiotic inclusion levels in broiler nutrition on growth performance, nutrient digestibility, plasma immunoglobulins and cecalmicroflora composition. Poult. Sci., 89: 58 - 67.

Moura, A.M.T., A.R.C. Costa and R. Polastre (2001). Variance components and response to selection for reproductive, litter and growth traits through a multi-purpose index. World Rabbit Sci., 9: 77-86.

NRC (1977). National Research Council. Nutrient Requirements of rabbits. Nat. Acad. Sci., Washington, DC.

Oso, A.O., O.M.O. Idowu, A.S. Haastrup, A.J. Ajibade, K.O. Olowonefa, A.O. Aluko and A.M. Bamgbose (2013). Growth performance, apparent nutrient digestibility, caecal fermentation, ileal morphology and caecal microflora of growing rabbits fed diets containing probiotics and prebiotics. Livestock Sci., 157 (1): 184–190. http:// doi. org/ 10.1016/j.livsci.2013,06.017

Parker, K. (2012). The rabbit handbook. Barron's Educational Series, Inc. Hauppauge, New York 11788, USA.

Rajput, I.R. and W.F. Li (2012). Potential role of probiotics in mechanism of intestinal immunity. Pak. Vet. J., 32:303–308.

Roiron A., J. Ouhayoun and D. Delmas (1992). Effect of body weight and age at slaughter on carcass and meat quality of rabbit. Anim. Breed Abst., 61: 64.

Samanta, A.K., N. Jaypal, S. Senani, A.P. Kolte, and M. Sridhar (2011). Probiotic inulin: Useful dietary adjuncts to manipulate the livestock gut microflora. The Brazilian J. Microbiol., 44 (1): 1–14.

SAS (2002). SAS Proprietary Software Version 9.00 (TS M0). SAS Institute Inc., Cary, NC, USA.

Selem, T.S.T., H. Ibrahim, A.M. Ali, A.M. Abd El-Motaal and A.E.B. Zeidan (2007). Rabbit performance as affected by Origanum Majorana in diets. The 5th Inter. Con. on Rabbit Prod. Hot. Clim., Hurghada, Egypt, 495 - 508.

Snedecor, G.W. and G.W. Cochran (1982). Statistical methods. 6th Ed. Iowa State Univ., Press Ames, USA.

White, L.A., M.C. Newman, G.L. Cromwell and M.D. Lindemann (2002). Brewers dried yeast as a source of mannan oligosaccharides for weanling pigs. J. Anim. Sci., 80 : 2619-2628.

Youssef, M.K. (2004). Heritabilities and common litter effects estimated by an animal model for post-weaning growth traits in New Zealand White and Baladi Red rabbits. Egypt. Poult. Sci., 24 (1): 205-216.

تأثيرات كلا من السلالة والكائنات الحية النافعة والتداخل بينهما على معدلات النمو وصفات الذبيحة وصفات الدم للأرانب النامية

أحمد فكرى محمد - غريب أحمد الصياد - فايز محمد رضا - علوى على عاشور

قسم الدواجن- كلية الزراعة- جامعة الزقازيق- مصر

أجريت هذه الدراسة لدراسة تأثير كل من السلالة والكائنات الحية النافعة والتداخل بينهما على الأداء الإنتاجى وصفات الذبيحة والصفات الكيميائية لمصل الدم فى الأرانب النامية، تم استخدام تصميم عاملى ٢ × ٥ اشتمل على سلالتين من الأرانب هما النيوزيلاندى الأبيض والبلدى الأسود وخمس معاملات من الكائنات الحية النافعة في الفترة من ٥ إلى ١٣ أسبوعا من العمر، كانت المعاملات الخمس هى: المجموعة الأولى لم تعامل بالبروبيوتك (المقارنة) والمجموعة الثانية جرعت بـ ١ ملى من المحلول الطازج المحتوى على بكتريا *Bifidobacterium bifiduim* بمعدل 1×10^7 خلية /١ ملى والمجموعة الثالثة جرعت بـ ١ ملى من المحلول الطازج المحتوى على بكتريا *Lactobacillus acidophilus* بمعدل 7×10^6 خلية/١ ملى والمجموعة الرابعة جرعت بـ ١ ملى من المحلول الطازج المحتوى على بكتريا (*Bifidobacterium bifiduim and Lactobacillus acidophilus*) بمعدل 3.2×10^7 خلية/١ ملى والمجموعة الخامسة جرعت بـ ١ ملى من المحلول الطازج المحتوى على بكتريا (*Saccharomyces cerevisiae*)، وأوضحت النتائج ما يلى: تأثر وزن الجسم الحى معنويا عند مستوى ($P<0.05$ or 0.001) بالسلالة خلال معظم الفترات التجريبية المدروسة، تأثرت الزيادة الوزنية للجسم الحى وكذلك الأوزان النسبية للزيادة الوزنية منسوبة لوزن الجسم الحى معنويا عند مستوى ($P<0.05$ or 0.001) بالنوع خلال معظم الفترات التجريبية المدروسة، أثر التجريع بالكائنات الحية النافعة معنويا ($P<0.01$ or 0.001) على وزن الجسم الحى للأرانب خلال معظم الفترات التجريبية، أظهرت المجموعات المعاملة بالبروبيوتك زيادة فى وزن الجسم مقارنة بمجموعة المقارنة، لم يتأثر الغذاء المأكول معنويا بالسلالة خلال كل الفترات التجريبية فيما عدا الفترة من 5-7 أسابيع من العمر التى كان فيها معنويا ($P<0.01$)، تأثر معامل التحويل الغذائي معنوياً ($P<0.05$, 0.01 and 0.001) خلال الفترات 5-7, 9-11, 11-13 and 5-13 أسابيع من العمر بينما كان التأثير غير معنوى خلال الفترة 9-7 أسبوع من العمر، تحسن معامل التحويل الغذائى معنوياً فى كل المجموعات المعاملة بالبروبيوتك ($P\leq0.05$ or 0.001)، أثرت السلالة معنويًا ($P<0.001$) على كل مكونات الدم المدروسة حيث أن أرانب البلدى الأسود أظهرت على وجه العموم أعلى القيم لكل من عدد خلايا الدم الحمراء والبيضاء، الهيماتوكريت، والهيموجلوبيولين، البروتين الكلى، الالبيومين وانزيمات الكبد مقارنة بالأرانب النيوزيلاندى، أثرت المعاملة بالبروبيوتك معنويًا ($P<0.001$) على كل مكونات الدم المدروسة فيما عدا مستوى الجلوبيولين الذى لم يتأثر معنوياً، أثرت السلالة معنويًا ($P < 0.001$) على صفات الذبيحة المدروسة فيما عدا نسبة الذبيحة والمأكول (ذبيحة + الإحشاء المأكولة) حيث لم يكن التأثر معنويًا، وبصفة عامة فقد أظهرت كل المجموعات المجرعة بالبروبيوتك زيادة معنوية فى كل صفات الذبيحة المدروسة مقارنة بمجموعة المقارنة، ونستنتج من كل ما سبق أن كل من السلالة وإضافة البروبيوتك قد أثرًا معنويًا على معدلات النمو وكلا من صفات الدم والذبيحة المدروسة مقارنة بمجموعة الكنترول.

المحكمـــون:

١- أ.د. مصطفى إبراهيم توفيـــق أستاذ رعاية الدواجن – كلية التكنولوجيا والتنمية – جامعة الزقازيق.

٢- أ.د. خالد محمد أحمد محروس أستاذ رعاية الدواجن المساعد – كلية الزراعة – جامعة الزقازيق.