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EFFECTS OF PROBIOTIC AND PREBIOTIC SUPPLEMENTATION ON GROWTH PERFORMANCE AND BLOOD METABOLITES IN BROILER CHICKS REARED IN BATTERIES.

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SUMMARY

Two hundred and forty unsexed one day-old Hubbard broiler chicks were used up to 6 weeks of age to study effects of probiotic, prebiotic, and their combination (symbiotic) on growth performance and some blood metabolities. Chicks were divided into 6 treatments, each with 5 replicates of 8 chicks each. Starter (1-14 days) and grower (15-42 days of age) diets were ad lib fed. Treatments were the control (T1); probiotic (Bio-plus2B®, 400g/ton diet, T2); prebiotic (Techno Mos®, 500g/ton diet, T3); and three symbiotic treatments (200 and 250g/ton (T4), 400 and 500g/ton (T5), and 800 and 500g/ton diet (T6), for Bio-plus2B® and Techno Mos®, respectively). Effect of treatments on body weight and gain was only significant at grower period. Symbiotic treatments at recommended (T5) or high level (T6) significantly ($P < 0.05$) increased body weight and gain at 6 weeks of age, while the effect of symbiotic at low level (T4) was not significant. Similar trend was observed with the full period (0-6 weeks). The solely addition of either probiotic (T2) or prebiotic (T3) had a significant ($P < 0.05$) reduction in body weight and gain in comparison with the recommended symbiotic (T5). However, symbiotic treatments significantly ($P < 0.05$) increased feed intake at starter and grower periods, while only prebiotic (T3) resulted in a significant reduction in feed intake ($P < 0.05$) and numerically improved feed conversion ratio during grower period. Plasma total protein was significantly ($P < 0.05$) increased by only prebiotic (T3). Similar trend was shown with plasma albumin, although the effect was non-significant ($P > 0.05$). Plasma globulin was significantly ($P < 0.01$) increased by only prebiotic (T3) which indicate same trend as plasma total protein. Symbiotic at low level (T4) ~~had~~ recorded the lowest values of plasma globulin and total protein. Plasma triglycerides was significantly ($P < 0.05$) reduced by adding only prebiotic (T3) in comparison with the control (T1) and probiotic (T2) treatments. In addition, chicks fed on symbiotic treatments showed a significant ($P < 0.05$) reduction in plasma triglycerides and cholesterol. However, neither the addition of only probiotic (T2) nor only prebiotic (T3) had a significant effect on plasma cholesterol. Results revealed that the use of broiler diets supplemented with symbiotic as growth promoter appeared to have better performance than using probiotic or prebiotic solely. Also, symbiotic addition resulted in reduction of cholesterol and triglycerides and produced healthy broiler meat products for human consumption.

Keywords: *broiler; probiotic; prebiotic; symbiotic; performance; blood metabolities.*

INTRODUCTION

Antibiotics have been used for decades as feed additives in poultry due to their properties to prevent poultry pathogens and to improve feed efficiency and poultry performance. Because of the resistant of microbes to antibiotics used in human therapies, the Europe Union Commission (2005) decided to ban the inclusion of antibiotics as growth promoter. Moreover, there is an interest to find alternatives to antibiotics, so the use of probiotic and prebiotic as feed additive in avian species is considered (Biggs *et al.*, 2007 and Xu *et al.*, 2006). Probiotic is a substance that contains microorganisms or bacteria that have a positive influence on improving the intestinal microbial balance (Fuller, 1989) and prevent establishment of pathogenic bacteria (Czerwinski *et al.*, 2010). Prebiotic is a substance (usually an oligosaccharide) that can not be digested but does promote the growth of beneficial bacteria or probiotic. Also, it can be known as a non-digestible food ingredient that affects the host by selectively stimulating the growth and/or activity of beneficial bacteria in the intestinal tract (Gibson and Roberfroid, 1995). The interest in using probiotic is for pathogenic control to inhibit the growth of harmful bacteria (Rahimi *et al.*, 2007, Biggs and Parsons, 2008, and Willis and Reid, 2008), increase resistance to infection (Eeckhaut et al., 2008, Biggs and Parsons, 2008, and Awad et al., 2009), and to promote a balance of intestinal flora (Patterson and Burkholder, 2003 and Jung et al., 2008) that produce organic compounds such as lactic acid and acetic acid. These products increase the acidity of the intestine, which inhibits the reproduction of harmful bacteria (Willis and Reid, 2008). Moreover, probiotic bacteria produce bacteriocins that are natural antibiotics that kill undesirable microorganisms (Nava et al., 2005). On the other hand, probiotic is using to improve health and enhancement production performance. Probiotic helps overcome stress (Patterson and Burkholder, 2003), and improves ability of immune system response, general health (Rahimi et al., 2007 and 2009), growth (Lan et al., 2003 and Awad et al., 2009), and feed conversion ratio (Midilli et al., 2008). The objective of the study is to evaluate effects of probiotic (Bio-plus 2B®), prebiotic (Techno Mos®), and their symbiotic on broiler performance and blood metabolism.

MATERIALS AND METHODS

The current study was carried out in the experimental laboratories of faculty of Agriculture of Ain Shams University and the Desert Research Center, Egypt, to study the effects of adding probiotic, prebiotic, and their combination (symbiotic) on broiler chicks performance and metabolism. The selected probiotic is "Bio plus 2B® contains *Bacillus Licheniformis* CH 200/DSM 5749 1.6x109 CFU/gm and *Bacillus Subtilis* CH 201/DSM 5750 1.6x109 CFU/gm", while the prebiotic is "Techno Mos® contains Mannanoligosaccharides (Mos) and 1.3 β-glucan that is derived from the cell wall of the yeast *saccharomyces cerevisiae*.

Birds and management:

Two hundreds and forty unsexed one day-old Hubbard broiler chicks, purchased from a commercial hatchery, were randomly distributed into 30 pens, each with 8 chicks, and assigned to 6 treatments with 5 replicates per treatment. All chicks were vaccinated against the IB and New-castle by using Hitchner B1 in the eyes at 7 days of age, Gumboro (13 days), and Lasota (18 and 28 days of age) diseases, and no mortality was recorded during the full experimental period.

Electric heaters were used at first two weeks of the experiment to keep the required temperature (30°C) for the brooding period, while light was constant for 24 hours daily throughout the experimental period (6 weeks). Feed and water were offered ad libitum, while chick's body weight and feed intake were weekly recorded and feed conversion ratio (feed/gain) was calculated per each pen.

Experimental diets:

Six experimental diets were used and formulated based on the NRC (1994) for starter (0-2 weeks) and grower (3-6 weeks). The un-supplemented, control diet (T1); probiotic (Bio-plus2B®, 400g/ton, T2); prebiotic (Techno Mos®, 500g/ton, T3); and three symbiotic treatments, 200 and 250g/ton (T4), 400 and 500g/ton (T5), and 800 and 500g/ton diet (T6) for Bio-plus2B® and Techno Mos®, respectively. Diets were formulated based on corn and soybean meal. Protein and energy were kept equal in all diets and vitamins and minerals mixture were added enough to cover chicks according to daily requirements by NRC (1994). The composition of experimental diets is shown in Table (1).

Slaughter parameters:

At the end of 6-week of age, four chicks were taken at random from four replicated per treatment and sacrificed by cervical dislocation, while blood samples were immediately taken, centrifuged, and then plasma stored at -20°C for later analysis.

Biochemical analysis:

Total protein, albumin, and globulin, and cholesterol and triglycerides were estimated by using the Biodiagnostic kits. Samples were assessed by using Spectrophotometer.

Statistical analysis:

Data were analyzed by one way analysis of variance (Completely Randomized Design) according to the General Linear Models (GLM) procedures of SAS (2002). The difference among means was determined by least significant difference (LSD).

Table (1): Ingredients and composition of the experimental diets.

Ingredients (%)	Starter diet	Grower diet
Yellow corn	56.0	59.9
Soybean meal 44%	28.8	26.4
Corn gluten meal 60%	8.97	6.94
Vegetable oil	1.50	2.50
Calcium carbonate	1.60	1.46
Monocalcium phosphate	1.85	1.64
Salt	0.30	0.30
Vit.& min. premix*	0.30	0.30
DL-Methionine	0.25	0.25
Lysine	0.39	0.32
Total	100	100
Calculated composition		
Crude protein%	23.0	21.0
ME kcal/kg	3000	3100
Calcium%	1.00	0.90
Available P%	0.50	0.45

**Vitamins and minerals premix, each kg contains: Vit A 12000 IU, Vit D3 3000 IU, Vit E 12 mg, Vit K 1 mg, Vit B12 0.02 mg, Vit B1 1 mg, Vit B2 4 mg, Vit B6 1.5 mg, Nicotinic acid 20 mg, Folic acid 1 mg, Biotin 0.05 mg, Choline chloride 160 mg, Copper 3 mg, Iron 30 mg, Manganese 40 mg, Zinc 45 mg and Selenium 3 mg.*

RESULTS AND DISCUSSION

The effects of probiotic and/or prebiotic levels on broiler chick performance:

The effect of treatments on body weight changes, feed intake, and feed conversion ratio (feed/gain) is illustrated in Table 2. The effect of experimental treatments on body weight and gain during the first two weeks (starter period, 0 – 2 weeks) was not significant, while this effect was significant during the last 4 weeks (growing period, 3 - 6 weeks). Similar findings were observed by Alkhalf *et al.* (2010) who found that the positive effect of probiotic started after two weeks of age with a significant increase in body weight and gain from 3 weeks and persisted until 6 weeks of age. Addition of probiotic and prebiotic together (symbiotic) at the recommended or higher levels (symbiotic, T5 and T6) to broiler diets had a significant ($P < 0.05$) effect on body weight at 6 weeks of age in comparison with the control (T1), while adding probiotic and prebiotic together at low levels (T4, 200 pro and 250 pre g/Ton respectively, T4) did not have effect on body weight (Table 2 and Fig. 1). The same trend was observed with body gain (Table 2 and Fig. 2). Body gain was significantly ($P < 0.05$) increased during growing period in both T5 and T6 in comparison with the control, while the effect was not significant with T4. Moreover, same result was observed with the full period (from 0 to 6 wks). Neither the addition of probiotic (T2) nor prebiotic (T3) had an effect on body weight or gain compared to the control (T1). In addition, both (T2 and T3) had a significant ($P < 0.05$) reduction in body weight and gain in comparison with the recommended symbiotic treatment (T5). On the other hand, feed intake (Table 2 and Fig. 3) is going on same trend with body weight gain. Symbiotic treatments significantly ($P < 0.05$) increased feed intake during starter and growing periods, while prebiotic treatment (T3) recorded the lowest feed intake ($P < 0.05$). At the starter period, probiotic (T2) and recommended symbiotic (T5) had a slight improvement on feed conversion ratio, while, at the growing, the significant reduction in feed intake by prebiotic (T3) was improved numerically feed conversion ratio (Fig. 4). Same trend was found during the whole period (0 - 6 weeks, fig. 5).

The inclusion of probiotic or prebiotic in broiler diets improved body weight and gain, feed intake, and feed conversion (Khaksefidi and Ghoorchi., 2006, Liu *et al.*, 2007, Mountzouris *et al.*, 2007, Timmerman *et al.*, 2006, Torres-Rodriguez *et al.*, 2007, Ashayerizadeh *et al.*, 2009, Alkhalf *et al.*, 2010, Kim *et al.*, 2011, and Houshmand *et al.*, 2011). On the contrary, in the current experiment, results reported that no significant effect of either only probiotic or prebiotic treatment on body weight gain, feed intake, and feed conversion in comparison with the control diet. Results are in agreement with those findings of Biggs et al. (2007), Midilli et al. (2008), Taherpour *et al.* (2009), Cox *et al.* (2010), and Rodrigues *et al.* (2012). This discrepancy may be due, in part, to the type of probiotic and prebiotic supplementation and the level of their addition, and in other part to the experimental condition and type of diets, On the other hand, the limited level of only Bio-plus 2B® (T2) or Techno Mos (T3) may be not sufficient to make a significant response with chicks performance, although Ozpinar *et al.* (2010) showed that addition of Bio Mos® at higher level (1.5g / kg diet) did not have a significant effect on broiler performance, body weight gain, feed intake, or feed conversion.

Table (2): Effect of the addition of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) to broiler diets on body weight, body weight gain, feed intake, and feed conversion ratio at the starter (week 0-2) and grower (week 3-6) periods.

	Treatment*							
	Control	Pro	Pre	Pro / Pre				
	T1	T2	T3	T4	T5	T6	SE	Significant
Body weight (Bird/g)								
Initial	39.5	39.7	39.5	40.2	39.8	39.8	0.38	ns
Week-2	287.9	292.6	285.3	291.2	294.2	295.3	5.66	ns
Week-6	2035^{c}	2049^{bc}	2042^{c}	2115^{abc}	2130^{a}	2126^{ab}	25.7	*
Body weight gain (Bird/g/period)								
0 - 2 weeks	248.1	252.8	245.5	251.5	254.4	255.6	5.65	ns
3 - 6 weeks	1747^{c}	1757^{bc}	1757^{bc}	1824^{abc}	1836^{a}	1830^{ab}	25.1	*
0 – 6 weeks	1995^{c}	2010^{bc}	2003^{bc}	2075^{abc}	2091^{a}	2085^{ab}	25.7	*
Feed intake (Bird/g/period)								
0 - 2 weeks	340.7	340.1	342.8	349.4	343.5	351.0	7.22	ns
3 - 6 weeks	3094^{abc}	3073^{bc}	3038^{c}	3220^{a}	3220^{a}	3172^{ab}	42.6	*
0 – 6 weeks	3434^{abc}	3413^{bc}	3381^{c}	3569^{a}	3563^{a}	3523^{ab}	43.2	*
Feed conversion (Feed/Gain)								
0 - 2 weeks	1.37	1.35	1.40	1.39	1.35	1.37	0.024	ns
3 - 6 weeks	1.77	1.75	1.73	1.76	1.76	1.73	0.015	ns
0 – 6 weeks	1.72	1.70	1.69	1.72	1.70	1.69	0.015	ns

**T1: Control T2: Pro = 400g/Ton T3: Pre (500g/Ton) T4: Pro (200g/Ton) + Pre (250g/Ton)*
T5: Pro (400g/Ton) + Pre (500g/Ton) T6: Pro (800g/Ton) + Pre (500g/Ton)
[a,b] Means with no common superscript differ significantly (P<0.05).

On the other hand, the synergism between probiotic and prebiotic, when both were added together, may make better nutrients utilization, metabolism, and absorption as significant indicator by symbiotic treatments. Results concluded that symbiotic treatment would maintain a better environment in digestive tract (Khaksefidi and Ghoorchi., 2006 and Chicholowski *et al.*, 2007). In agreement with our results, Falaki *et al.* (2010) and Taherpour et al. (2009) found that symbiotic treatment has improved body weight gain and recorded highest feed intake in broiler chicks in comparison with only probiotic or prebiotic treatments. Chicholowski et al. (2007) and Mountzouris et al. (2007) reported that addition of only prebiotic to broiler diet had no significant effect on feed intake and feed conversion. Similar results were reported with only probiotic treatment (Ergun *et al.*, 2000 and Kumprechtova *et al.*, 2000).

Effects of probiotic and/or prebiotic on some blood parameters:

Plasma total protein, albumin, and globulin:

Table (3) show the effect of probiotic and/or prebiotic on plasma total protein, albumin, and globulin in broiler chicks at 6 weeks old. It has noticed that experimental treatments had significantly affected plasma total protein and its fraction.

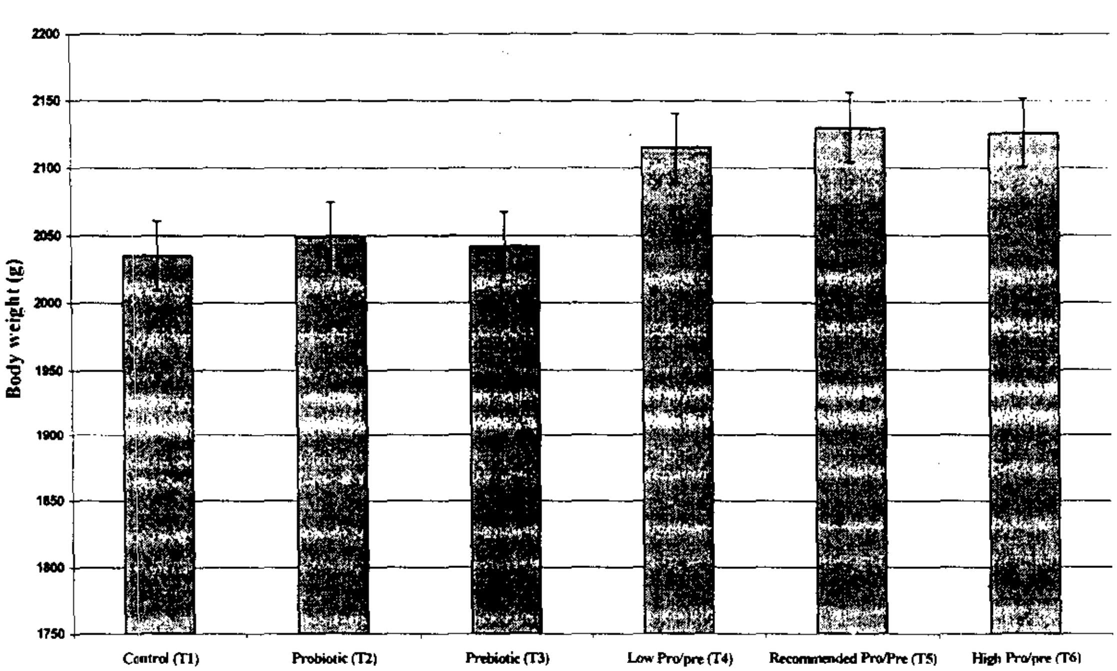

Fig. (1): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on body weight at 6 weeks of age.

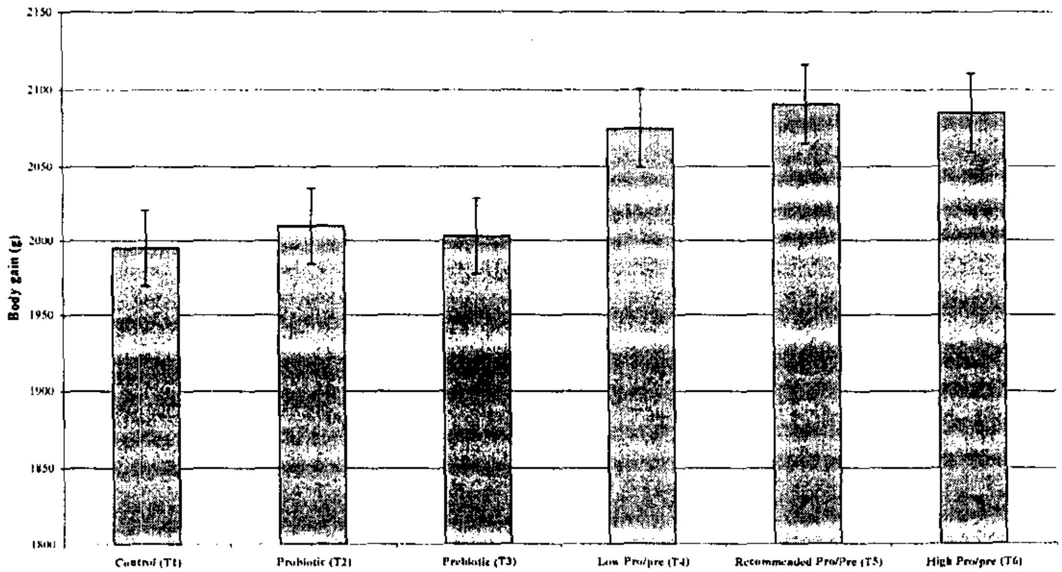

Fig. (2): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on body weight gain (0-6 weeks of age)

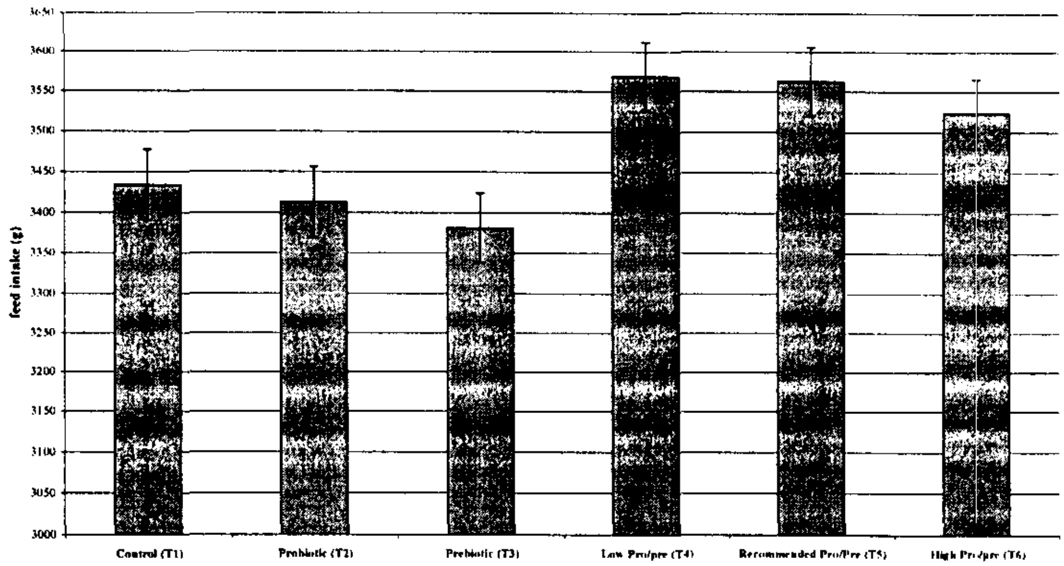

Fig. (3): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on feed intake (0-6 weeks of age)

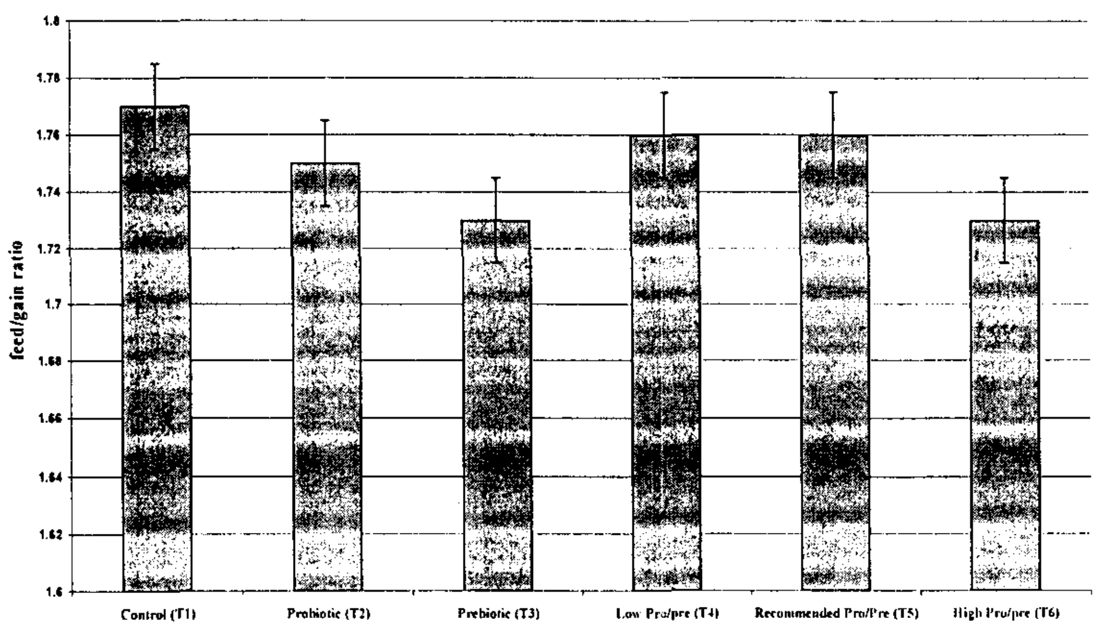

Fig. (4): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on feed conversion ratio, feed/gain (3-6 weeks age).

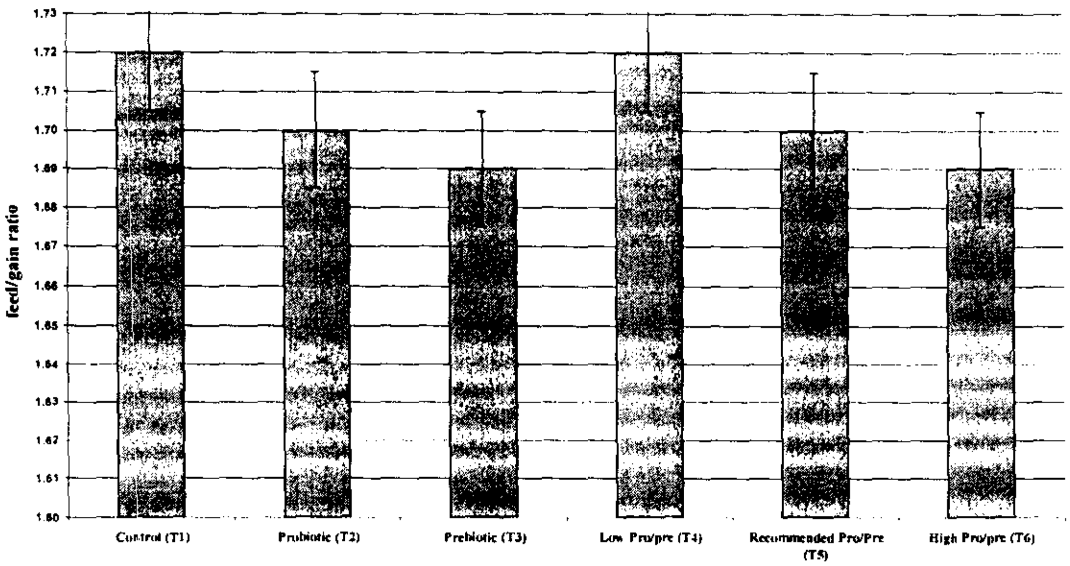

Fig. (5): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on feed conversion ratio, feed/gain (0-6 weeks age).

Plasma total protein was significantly ($P<0.05$) increased by adding prebiotic (T3) in comparison with the control (T1) and the low level symbiotic treatment (T4) (Fig. 6). Prebiotic (T3) recorded the highest plasma total protein value, followed by recommended symbiotic (T5), and probiotic (T2). Same trend was shown with plasma albumin (Fig. 7), although the effect was not significant ($P >0.05$) but chicks fed on control diet recorded the lowest plasma albumin value. However, it is known that plasma albumin is very strong predictor of health, so low albumin is a sign of poor health.

On the other hand, plasma globulin is an indicator of the immunity response and source of gamma globulins (antibodies). Plasma globulin was significantly increased ($P<0.01$, fig. 8) by adding only prebiotic (T3) following same trend with increasing plasma total protein. When probiotic and prebiotic were added at low level (symbiotic, T4), the lowest values of plasma globulin and total protein were recorded.

In agreement with our results, mannanoligosaccarids (prebiotic) has been reported to increase blood globulin (Savage *et al.*, 1996 and Cetin *et al.*, 2005). This increment in plasma globulin has a significant contribution in increasing plasma total protein (Table 3). Cotter *et al.* (2000) reported that mannanoligosacarids has improved the antibody response in broilers and can modulate the immune response in chickens (Savage *et al.*. 1996, Cotter *et al.*, 2002, and Shashidhara and Devegowda, 2003). In addition, the prebiotic (Techno Mos) used in the current study is containing both mannanoligosacarids and β-glucans. Both of them may bind to pattern-recognition receptors on a variety of defense cells of the gut associated lymphoid, tissue, and in turn activate immune defenses such as phagocytes, the alternative complement pathway, and the lectin pathway (Shashidhara and Devegowda, 2003). Dietary β-glucans has been shown to increase the size of the primary and secondary lymphoid organs, providing further evidence of their immunomodulating capabilities (Guo *et al.*, 2003 and Zhang *et al.*, 2008). β-glucans has beneficial effects on both the inate and adaptive immune systems and can magnify plasma IgG and IgA levels, indicating an up-regulation of the humoral immune response (Zhang *et al.*, 2008). In contrast, Ozpinar *et al.* (2010) showed that supplementation of Bio-Mos (prebiotic), at week 6, would significantly lower plasma globulin. On the other hand, in harmony with the current results, many studies found that blood total protein, albumin (Dimcho *et al.*, 2005 and Alkhalf *et al.*, 2010), and globulin (Ashayerizadeh *et al.*, 2009) concentrations were not affected by probiotic supplementation, although others (Havenaar and Spanhaak, 1994) reported that probiotic is stimulating Poultry immune system.

Table (3): Effect of adding different levels of probiotic, prebiotics and/or their mixtures (symbiotic) in broiler diets on some blood metabolites (g/dl), total protein, albumin, and globulin at 6 weeks of age.

Blood metabolites	Treatment*						SE	Significant
	Control	Pro	Pre	Pro / Pre				
	T1	T2	T3	T4	T5	T6		
T. Protein	3.04^{bc}	3.29^{ab}	3.47^{a}	3.00^{bc}	3.32^{ab}	3.22^{abc}	0.137	*
Albumin (A)	1.23^{b}	1.48^{a}	1.50^{a}	1.31^{ab}	1.50^{a}	1.39^{ab}	0.106	ns
Globulin (G)	1.81^{bc}	1.81^{bc}	1.98^{a}	1.69^{c}	1.82^{b}	1.83^{b}	0.058	**

**T1: Control T2: Pro = 400g/Ton T3: Pre (500g/Ton) T4: Pro (200g/Ton) + Pre (250g/Ton)*
T5: Pro (400g/Ton) + Pre (500g/Ton) T6: Pro (800g/Ton) + Pre (500g/Ton)
^{a,b} Means with no common superscript differ significantly (P<0.05).

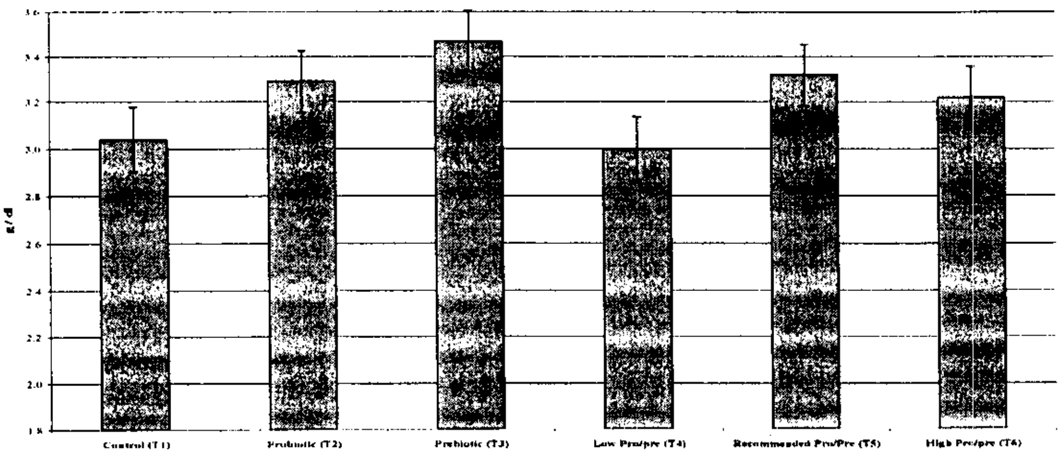

Fig. (6): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on plasma total protein at 6 weeks of age.

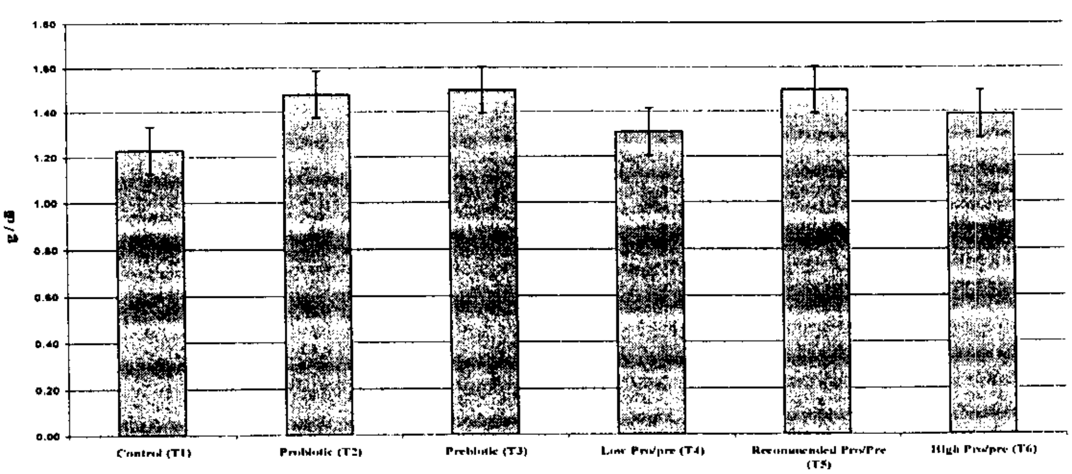

Fig. (7): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on plasma albumin at 6 weeks of age.

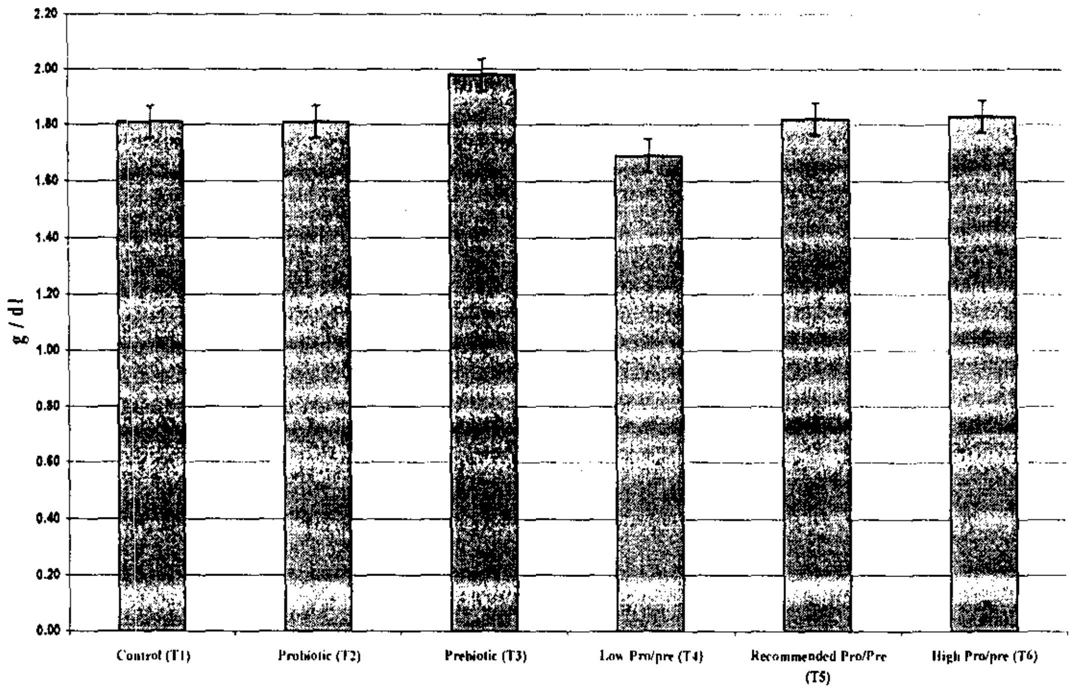

Fig. (8): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on plasma globulin at 6 weeks of age.

Plasma cholesterol and triglycerides:

Cholesterol is a fat-like substance produced in the liver. Human body makes all needed cholesterol. Triglycerides are the chemical form of most stored fats. Both cholesterol and triglyceride are also found in the food, like broiler chicks. However, having high cholesterol and triglycerides level in human blood can be a threat to their health as they linked to heart disease. In this concern, reducing plasma cholesterol and triglycerides levels in broiler chicks is an important target for safety food product.

The effect of adding probiotic and/or prebiotic on cholesterol and triglycerides in broiler chicks are shown in table (4) and fig. (9 and 10). Plasma triglycerides was significantly ($P<0.05$, fig, 9) reduced by adding only prebiotic (T3) to broiler diet, in comparison with the control (T1) and only probiotic (T2) treatments. In addition, chicks fed on symbiotic treatments (T4, T5, and T6) had shown a significant reduce in plasma triglycerides compared to those fed the control diet (T1). In a similar trend, chicks fed on symbiotic treatments had lower ($P<0.05$) plasma cholesterol in comparison with control diet (Fig. 10). However, neither solely addition of probiotic (T2) nor prebiotic (T3) had any effect on plasma cholesterol in comparison with the control.

Many studies showed lower level of cholesterol and/or triglycerides resulted from the addition of probiotic and/or prebiotic to poultry diets (Arun *et al.*, 2006, Taherpour *et al.*, 2009, Ashayerizadeh *et al.*, 2009, Alkhalf *et al.*, 2010, Karimi Torshizi *et al.*, 2010, and Capcarova *et al.*, 2010). In the current study, the synergism between probiotic and prebiotic in symbiotic treatments (T4, T5, and T6) showed a great effect lowering plasma triglycerides and cholesterol, although adding solely probiotic or prebiotic does not have significant effect on cholesterol. In harmony with the current results, Kannan *et al.* (2005) reported that the use of 0.5 g/kg mannanoligosaccharide (as the current prebiotic treatment, T3) in broiler diet is significantly reduced blood cholesterol level in compared with the control. Furthermore, Taherpour et al. (2009) reported that adding prebiotic (Primalac) and/or probiotic (Fermacto) to broiler diets have significantly reduced blood cholesterol, and those fed symbioytic treatments showed the lowest cholesterol level. Ashayerizadeh et al. (2009) found that blood triglycerides (61.6 g/dL) and cholesterol (144.8 g/dL) were lower when probiotic (Primalac) and/or prebiotic (Biolex-MB) were added to broiler diets in comparison with the control and antibiotic diets (83.8 and 164.1 g/dL). They also reported that symbiotic treatments recorded the lowest cholesterol level.

Although previous studies reported a significant lowering effect of probiotic on triglycerides (Santose *et al.*, 1995, Arun *et al.*, 2006, Karimi Torshizi *et al.*, 2010, and Capcarova *et al.*, 2010) and cholersterol (Arun *et al.*, 2006, Alkhalf *et al.*, 2010, and Karimi orshizi *et al.*, 2010), the current findings did not show any significant effect of probiotic addition alone (T2) on lipid profile parameters. This may be attributed to the different type and level of probiotic, in addition to the different experimental condition and ration.

Table (4): Effect of adding different levels of probiotic, prebiotics and/or their mixtures (symbiotic) in broiler diets on some blood metabolites (mg / dL), triglyceride and cholesterol, at 6 weeks of age.

	Treatment*							
	Control	Pro	Pre		Pro / Pre		SE	Significant
Blood metabolites	T1	T2	T3	T4	T5	T6		
Triglyceride	69.2^{a}	65.0^{ab}	34.1^{c}	37.8^{c}	45.9^{bc}	44.4^{bc}	9.96	*
Cholesterol	144^{a}	142^{ab}	132^{abc}	123^{c}	126^{c}	127^{bc}	6.87	*

**T1: Control T2: Pro = 400g/Ton T3: Pre (500g/Ton) T4: Pro (200g/Ton) + Pre (250g/Ton)*
T5: Pro (400g/Ton) + Pre (500g/Ton) T6: Pro (800g/Ton) + Pre (500g/Ton)
^{a,b} Means with no common superscript differ significantly ($P<0.05$).

Microorganisms such as *Bacillus Subtilis* and *Bacillus Licheniformis* are able to synthesize esterase enzymes alongside with lipase enzymes, which the former converts free fatty acids to esterified form, different from triglycerides, in intestinal content and finally less chance for triglyceride absorption into plasma (Mahdavi *et al.*, 2005) because triglycerides are the chemical form of most stored fats in the body.

Also, Santose *et al.*, (1995) have been reported that supplementation of *Bacillus Subtilis* to the ration of broiler chickens in addition to reducing the carcass fat, reduces the triglyceride concentration in blood, liver, and carcass. Therefore, *Bacillus Subtilis* can be effective in reducing the activity of acetyl coenzymes A carboxylase (the enzyme limiting the synthesis rate of fatty acids).

On the other hand, results of reducing cholesterol, resulted from symbiotic treatments in the current study, may be due to synthesis of bile acids from cholesterol in the liver that is considered the most important way of cholesterol excretion (Wilson *et al.*, 1998). Also, some of the microorganisms present in the probiotic preparation could utilize the cholesterol present in the gastrointestinal tract for their own metabolism, thus reducing the amount of cholesterol absorption (Nelson and Gilland., 1994 and Mohan *et al.*, 1995).

Lactobacillus (lactic acid bacteria), which has a high bile salt hydrolytic activity by produce of enzymes disintegrating bile salts is responsible for deconjugation of bile salts (Sarono., 2003). Deconjugated bile acids reduce the pH in the intestinal tract and are less soluble at low pH, less absorb in the intestine and are more likely to be excreted in feces (Klaver and Van der meer., 1993). In addition, probiotic microorganisms inhibit hydroxymthyl-glutaryl coenzyme A (an enzyme involved in the cholesterol synthesis (Fukashima and Nakon., 1995).

The most important mechanism by which prebiotic eliminates cholesterol would likely be through reducing lipid absorption in intestine by binding bile acids, which results in increased cholesterol elimination and hepatic synthesis of new bile acid (Zhang *et al.*, 2003). Salma *et al.* (2007) have shown that cholesterol concentration in thigh and breast muscle of the broilers had a positive correlation with the change of the cholesterol contents in serum. Ros (2000) mentioned that hepatic cycle of bile acids in the liver converts more cholesterol concentration into the tissue so that their concentrations in the blood are reduced. It is expected that with decreasing of serum cholesterol, the amount of meat cholesterol is tending to decrease too, so that food which contains these supplementations can help in reducing the occurrence of cardiovascular heart diseases in consumers.

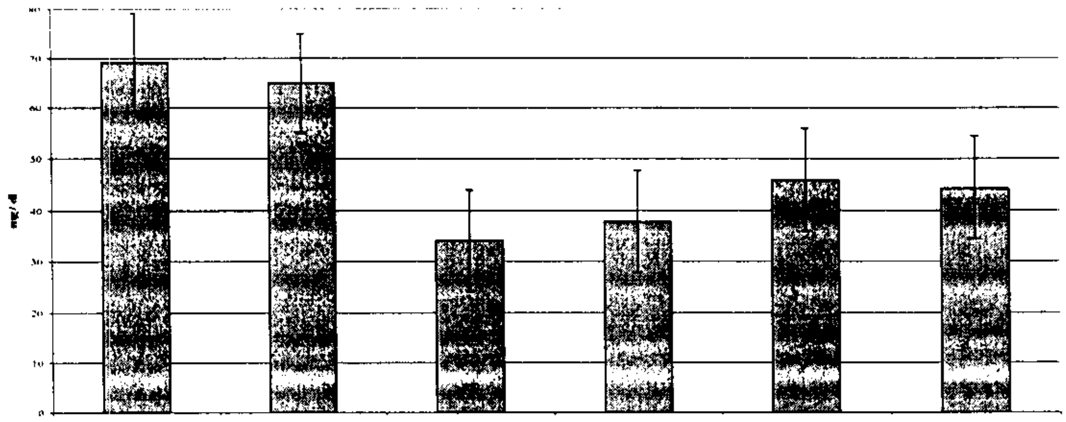

Fig. (9): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on plasma triglycerides at 6 weeks of age.

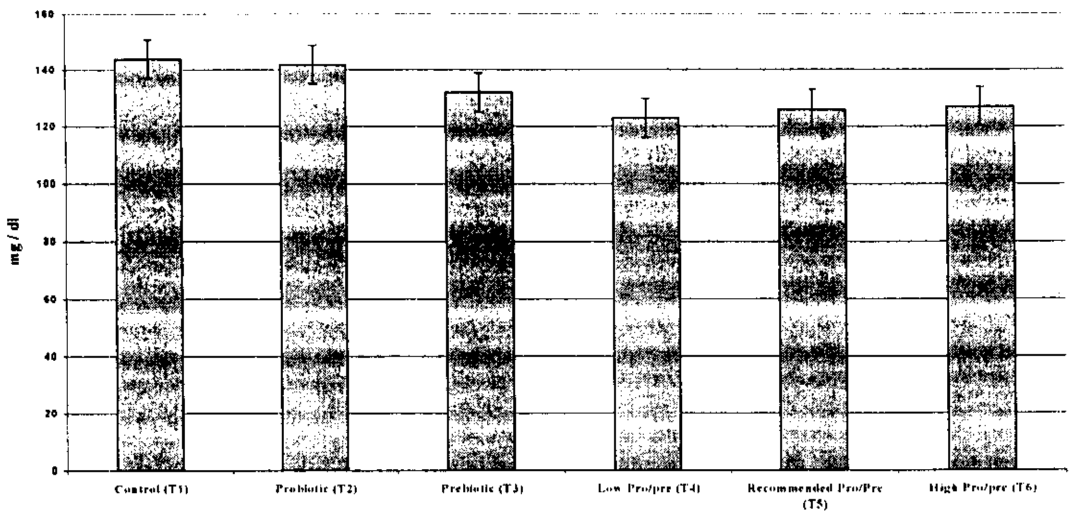

Fig. (10): Effect of different levels of probiotic, prebiotics and/or their mixtures (symbiotic) on plasma cholesterol at 6 weeks of age.

CONCLUSION

The current study revealed that addition of both probiotic and prebiotic together (symbiotic) at recommended level (400 and 500g/ton, for Bio-plus2B® and Techno Mos®, respectively) has a significantly stimulation effect on body weight gain and feed intake, although feed conversion ratio was not significantly improved. In addition, symbiotic addition has a lowering cholesterol and triglycerides effect and is necessary to produce a safety broiler meat product for human consumption with free harmful side effects.

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تاثير إضافة المدعمات الحيوية و منشطاتها على اداء النمو و مكونات الدم لكتاكيت التسمين المربى فى اقفاص.

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تم استخدام 240 كتكوت تسمين غير مجنس عمر يوم فى التجربة من سلالة الهابرد لمدة 6 اسابيع لدراسة تاثير اضافة المدعمات الحيوية و منشطاتها (البروبيوتك و البريبيوتك و خليط منهما) على اداء النمو وبعض مكونات الدم لكتاكيت التسمين. وزعت الكتاكيت على 6 معاملات كل معاملة تحتوى على 5 مكررات و كل مكررة بها 8 كتاكيت و تمت التغذية على فترتين, فترة البادئ (1- 14) و فترة الناهى (15- 42 يوم من المعمر). كانت المعاملات التجريبية كالتالى: عليقة الكنترول (T1) و عليقة تحتوى على البروبيوك Bio-plus2B® (400جم/طن علف, T2) و عليقة تحتوى على البريبيوتك Techno Mos® (500 جم/طن علف, T3) و ثلاث معاملات تحتوى على البروبيوتك وبريبيوتك معا بالمستويات التالية, 200+250جم/طن (T4) و 400+500جم/طن (T5) و 800+500جم/طن (T6) على التوالى. لم يتأثر وزن الجسم ولا الزيادة الوزنية للكتاكيت بالمعاملات التجريبية فى فترة البادئ ولكن كان هناك تاثير معنوى (P<0.05) للمعاملات فى فترة الناهى. أعطت المعاملات التى تحتوى على خليط من البروبيوتك والبريبيوتك بمستوى عالى (T5 و T6) زيادة معنوية فى وزن الجسم و الزيادة الوزنية (P<0.05) عند 6 اسابيع من العمر. بينما تأثير المعاملة (T4) لم تصل الى المعنوية. نفس الاتجاة لوحظ بالنسبة للفترة من صفر-6 اسابيع. أضافة البروبيوتك فقط (T2) أو البريبيوتك بمفردة (T3) أدى لانخفاض معنوى (P<0.05) فى وزن الجسم و الزيادة الوزنية بالمقارنة بالمعاملة (T5). يوجد زيادة معنوية (P<0.05) فى الماكول خلال فترتى البادئ و الناهى بالنسبة للمعاملات الخليط (T4, T5 and T6) بينما اضافة البروبيوتك بمفردة (T3) نتج عنة انخفاض معنوى فى الماكول (P<0.05) وتحسن طفيف لم يصل للمعنوية فى معامل التحويل الغذائى فى فترة الناهى.

لوحظ وجود زيادة معنوية (P<0.05) فى البروتين الكلى ببلازما الدم عند أضافة البريبيوتك فقط (T3) وكذلك بالنسبة للالبيومين ولكن التاثير لم يصل للمعنوية. كذلك زاد مستوى جلوبيولين البلازما معنويا (P<0.01) باضافة البريبيوتك فقط (T3). بالنسبة للمعاملة (T4) أعطت اقل قيمة للبروتين الكلى والجلوبيولين فى البلازما. انخفض مستوى التراى جليسيريد فى البلازما معنويا (P<0.05) باضافة البريبيوتك بمفردة (T3) مقارنة بالكنترول (T1) والمعاملة المحتوية على البروبيوتك فقط (T2). الكتاكيت المغذاة على المعاملات المحتوية على خليط من البروبيوتك و البريبيوتك اوضحت انخفاض معنوى (P<0.05) فى مستوى التراى جليسريد و الكوليستيرول فى البلازما. أضافة البروبيوتك والبريبيوتك كلا بمفردة لم يكن له اى تاثير معنوى على مستوى كوليسترول البلازما.

أوضحت النتائج ان اضافة Bio-plus2B® و Techno Mos معا فى العلائق كمنشط للنمو يعمل على خفض مستوى التراى جليسريد والكوليستيرول فى البلازما وبالتالى أنتاج ذبائح من دجاج التسمين أمنة للاستهلاك الأدمى وليس لها تاثيرات جانبية ضارة.