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RESPONSE OF BROILER CHICKS TO LOW PROTEIN DIETS SUPPLEMENTED WITH PROBIOTICS PREPARATIONS

BY

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Abstract: *The present study was performed to evaluate the effects of feeding low protein diets fortified with probiotics preparations on the performance of broiler chicks. Two hundred and forty, unsexed one-day old Arbor Acres broiler chicks were assigned to eight equal experimental groups, each had 3 replicates of 10 birds each. Two basal diets were formulated to contain the recommended (22 and 20%) and lower (20 and 18%) crude protein for starter (7-28 days) and grower (29-42 days), periods, respectively. Both starter and grower diets were either supplemented or not with any of the tested probiotics being Bio-Top (B), Organic Green Culture (G) and Avi- Bac (A), each at level of 1.5 g/kg diets. Accordingly, a completely randomized design in 4x2 factorial arrangement of treatments was applied. The obtained results can be summarized as follow:*

Regardless of dietary crude protein level, supplementing diets with probiotics significantly ($P \leq 0.05$) increased body weight gain and improved feed conversion compared to control birds fed probiotic- free diets. Birds fed low protein diets consumed significantly more feed and exhibited inferior feed conversion efficiency compared to those fed the recommended protein levels, whereas their body weight did not significantly affected.

Regarding to the interaction between crude protein levels and probiotics no significant differences were observed for criteria of growth performance and nutrients digestibilities. However, supplementing low protein diets with any of the used probiotics tend to improve feed conversion and digestibility of crude protein and crude fiber, as well as significantly lowered the coliform and total intestinal bacterial count, while increased that of lactobacillus.

The results of this study indicated that using either Bio-Top, Organic Green Culture or Avi-Bac at level of 1.5 Kg/ton diets spared nearly 2%

crude protein of the recommended level for broilers. This result would be effective from the economical stand point of view, since protein is the most expensive feed nutrient in poultry feeding.

INTRODUCTION

Antibiotics ceasing to be used as growth stimulants for farm animals and the concern about the side-effects of their use as therapeutic agents has produced a climate in which both consumer and manufacturer are looking for alternatives. Probiotics are being considered to fill this role and already some poultry men are used them in preference to antibiotics, since they are defined as substances which contribute to intestinal microbial balance **(Fuller, 1987)**, whereas **Gram** *et al.* **(1999)** broadened such definition of probiotic as mono or mixed culture of living micro-organisms which beneficially affects the host by improving the properties of the indigenous microflora. Practically, the addition of probiotic to broiler chick diet has been found to improve growth and feed conversion efficiency **(Kaistha** *et al.,* **1996; Jin** *et al.,* 1997**;** Jin *et al.***, 2000;** and **Kalavathy** *et al .,* **2003)** and tend to decrease mortality rate **(Jin** *et al.,* **2000; Abd El-Samee** and **Abd El-Hakim**., **2002)** . In addition, **Abd El-Gawad** *et al.* (2004) showed that probiotics slightly improved nutrients digestibility and nitrogen balance of broiler low protein diets .

Dietary protein level is considered one of the major factors affecting productive performance of broiler chicks. The effects of feeding broiler chicks on diets containing different levels of crude protein on their performance had been conducted in several studies aimed to lower the protein content of poultry diets, as well as lowering feed cost. (**Deschepper** and **De Groote, 1995; Abd El-Samee, 2001** and **2002; El-Nagmy** *et al.,* **2004** and **Abd El-Gawad** *et al***., 2004).**

In this regard, **Makled** *et al.* **(2001)** showed that feed conversion efficiency was only affected during the starter period however, no significant effect due to protein level on feed consumption was observed. In addition, **Bregendahl** *et al.* **(2002)** showed that chicks fed low protein diet excreted less nitrogen than those fed the high protein diet, and so protein digestibility improved.

To keep step with these approaches and bearing in mind the high costs of high protein diets, the current study was performed to investigate the effects of feeding low protein diets, with or without supplemental probiotics preparations on the performance of broiler chicks.

Crude protein, probiotics, broiler, growth, feed utilization, digestibility.

MATERIALS AND METHODS

The present study was carried out at El- Kanater El-Khairia Poultry Research Station and Poultry Nutrition Research Department, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Dokki, Egypt.

A total number of 240 unsexed one day-old Arbor Acres broiler chicks obtained from Cairo Poultry Company were used. All chicks were fed a commercial diet containing 22% CP and 3200 Kcal ME/kg for the first week. Then, chicks were randomly distributed into 8 treatments, each treatment contained 30 birds in 3 replicates (of 10 chicks each). The initial live body weights at 7 days of age of the different groups were nearly similar with average of about 105 gram.

The experiment was carried out to study the effect of three commercial probiotics being, Bio-Top (B), Organic Green Culture (G) and Avi-Bac (A) on improving the performance of broiler chicks fed diets with slightly lower levels of crude protein. Two basal diets were formulated to contain the recommended (22 and 20 %) and lower (20 and 18%) crude protein (CP) for starter (7-28 days) and grower (29-42 days), respectively. Both starter and grower diets were either supplemented or not with each one of the tested probiotics at level of 1.5 g/kg diet (0.15%).

The Bio-Top preparation (B) is a dried product containing *Bacillas subtillus*, Zinc oxide and wheat bran as carrier. Organic Green Culture preparation (G) is a dried product of high strength live yeast culture blended with lactic acid bacteria. Whereas, Avi-Bac preparation (A) is a concentrated source of lactic acid bacteria and multi-enzyme content including amylase, beta glucanase and hemicellulase. The composition and calculated analysis of the experimental diets are shown in Table (1). In all experimental diets, various nutrients were adjusted according to the strain recommended catalogue. All diets were nearly iso–caloric of about 3200 kcal ME/kg and offered in mash form with water *ad libitum* during the experimental period which lasted for 6 weeks. Chicks in all treatments were kept under similar management conditions. Artificial lighting was provided allover 24 hours daily during the whole experimental period. Gas heaters were used to provide the chicks with needed heat for brooding. Weekly body weight and feed intake and daily mortality rate were recorded throughout the 6 weeks experimental period.

Nutrients digestion coefficient of experimental diets were carried out at 42 days after applying the tested diets to determine nutrients digestion coefficients of the experimental diets using 3 birds from each treatment.

Chicks were individually distributed in metabolism cages and fasted overnight to start the digestion trail next morning. They were fed the experimental diets up to the end of the preliminary period (3 days) to adjust feed consumption and to minimize residual feed during the collection period. The collection period lasted for 3 days during which feed intake was recorded accurately and excreta were quantitatively collected daily after cleaning from feathers and scattered feed, then sprayed with 2 % boric acid solution to prevent any loss in ammonia. The collected excreta were dried in an oven at 60ºC for 24 hours, then weighed, finely ground, well mixed for summative analysis. At the end of the digestion trails , three birds from each treatment were slaughtered and used to define and count the microbial content of the gastro-intestinal tract as affected by the tested probiotics . The microbial content was studied in their selective media as described by **Postage (1969)** for total viable count of bacteria, coliform count and *lactobacillus* count.

The proximate analysis of different experimental diets and dried excreta were done according to the official methods of analysis **(A.O.A.C., 1990)** for moisture, nitrogen, ether extract (EE), crude fiber (CF) and ash. The factor 6.25 was used for calculating crude protein (CP). The fecal nitrogen was determined according to **Jakobsen** *et al.*, **(1960**). Urinary organic matter (UOM) was calculated according to **Abou-Raya** and **Galal (1971)**

To determine the economic efficiency of the experimental treatments, the all management factors are considered as constants factors. The amounts of feed consumed during the entire experimental period were recorded. The price of experimental diets was calculated according to the price of local market at the time of the experiment. The economic efficiency (EEF) was calculated as the feed cost needed to obtain 1 kg of live body weight gain.

The data were subjected to factorial design using General Linear Model of SAS® software statistical analysis **(SAS, 1999)**. Probiotics and dietary CP levels were the two variables involved to test the significance of treatments.

The following model was used for chick performance.

$X_{ijk} = \mu + P_i + L_j + PL_{ij} + E_{ijk}$

Where:

X_{ijk}: is the dependent variable.

μ : is the overall mean.

P_i : is the effect of probiotic supplementation (i=1,2,3,4)

L_j : is the CP level (j= 1,2).
PL_{ij}: is the effect of interaction between the probiotic supplementation and CP level.
E_{ijk} : is the experimental random error.

Significant differences among treatment means were separated by Duncan's Multiple Range Test **(Duncan, 1955).**

RESULTS AND DISCUSSION

Growth Performance:

Data on growth performance of broiler chicks as affected by dietary crude protein levels, probiotic sources and their interaction are shown in Table (2). Analysis of variance of these data revealed significant ($P<0.05$) increases in live body weight during grower period as well as in body weight gain during the overall experimental period for chicks having the tested probiotics compared to those of their control counterparts. However, no significant differences were observed at starter, grower and overall period of growth among means of live body weight and body weight gain due to either crude protein levels or their interaction with probiotics (Table 2). In general, regardless of dietary protein level, the diets supplemented with probiotics were superior than the corresponding diets without probiotics supplementation. This may be due to the beneficial effect of such probiotics which improved absorption of nutrients and depressed harmful bacteria that causes growth depression. In this connection, **Hoyos and Cruz (1990)** reported the beneficial effect of probiotics since their microbial constituents produce natural lactic acid that helps in maintaining an optimum low pH which inhibit growth of undesirable bacteria leading to optimum enzyme activity. Similar findings were reported by **Siam** *et al.*, **(2004)**.

The effects of dietary crude protein level, tested probiotics and their interaction on feed intake and feed conversion ratio are illustrated in Table (3).

Significant differences among means of feed intake (FI) and feed conversion ratio (FCR) were observed either due to dietary CP level or adding probiotics, during starter, grower and overall period (Table 3). Regardless of probiotic supplementation, chicks fed low CP diets consumed significantly ($P<0.05$) higher amounts of feed and recorded inferior feed conversion values compared to those having the recommended CP level. On the other hand, irrespective of dietary CP level, all tested probiotics tend to lower feed intake and significantly improve feed conversion compared to the control diet without probiotic supplementation, either at starter, at grower or overall period of growth. Such improvements in feed conversion was about 5.1, 6.8, 7.4 %; 6.9, 6.0, 2.8%and 6.1, 6.1, 5.1% for the chicks fed diets supplemented with B, G, A probiotics during starter, grower and overall periods, respectively. It seems that Avi-Bac addition during starter period was superior, while, both Bio-Top and Organic Green Culture were better during grower period than the control. The superiority of Avi-Bac could be due to its multienzyme content that needed by chicks at lower ages.

Regarding the effect of the interaction between CP level and probiotic supplementation on FI and FCR, the obtained data showed significant differences among treatments except those of FCR at finisher period (Table 3). Birds fed diets supplemented with probiotics at recommended level of protein significantly ($P \leq 0.01$) consumed less amount of feed compared with either control groups or those fed diets supplemented with probiotics at low level of protein. No significant differences were detected on feed conversion during the overall experimental period between birds fed diets supplemented with probiotics at low level of CP and the other groups which fed unspplemented diet at recommended CP level.

This indicate the sparing effect of tested probiotics in lowering the dietary CP by 2 % than the recommended, and this result would be effective from the economical point of view, since protein is the most expensive feed nutrient in feeding all livestocks. As previously mentioned, the probiotic Avi- Bac gave better findings either with recommended or low CP during starter period. However, both Bio-Top and Orgainc Green Culture were superior either during grower or overall period. Meanwhile, Organic Green Culture was the most effective one as it recorded the best FCR during the overall period. In general, the enhanced feed conversion as a result of adding probiotics to broiler diets may be attributed to: 1) causing lethal or sub lethal damage to pathogens, resulting in a reduction of bacterial toxins; 2) reducing bacterial utilization of essential nutrients; 3) allowing increased synthesis of vitamins and growth factors; 4) improving the absorption of nutrients by reducing the thickness of intestinal epithelium; 5) reducing intestinal mucosa epithelial cell turnover and 6) reducing intestinal motility, all these effects lead to more utilization of nutrients. This explanation is inline with the findings of **Zulkifli** *et al.* **(2000), Abd El-Samee (2002)** and **Abd El- Gawad** *et al.* **(2004).** In this respect, **Kumar** *et al.* **(2003)** reported that feed intake increased by 7% and feed conversion improved by 25% for broiler chicks fed low protein diet supplied with probiotics.

It is worthy to note that all experimental chicks were healthy as the mortality rate during the overall period equal zero indicating the positive effect of dietary treatments.

Digestibility Coefficients:

The effect of dietary crude protein level , probiotics and their interactions on the digestibility coefficients of CP, EE, CF, NFE and OM at the end of experimental period are presented in Table (4).

Analysis of variance of the obtained results indicated that no significant differences were observed among dietary treatments due to dietary crude protein level. This observation may be an indication to a better utilization of feed and nutrients by the birds fed the low CP diets compared with their controls. On the other hand, probiotic supplementation, independent of dietary CP level, had no significant effect on these forementioned criteria of nutrients digestibility. However, the digestibility of CP as well as CF tend to numerically increase by adding probiotics compared to that without supplementation (Table 4). In this connection, **De Schrijver and Ollevier (2000)** reported a positive effect of probiotics on apparent protein digestion and attributed this effect to the proteolytic activity of bacteria. It is worthy to note the absence of significant differences in the obtained data as a result of the combination effect of dietary CP level and tested probiotics. Such observation confirmed the previously mentioned opinion that the tested probiotics had a sparing effect of nearly 2.0 % CP. Similarly, the better ($P>0.05$) digestibility obtained with probiotics supplementation suggests that such addition improved feed and nutrients utilization, which in turn explain the better growth and FCR values obtained with the probiotics supplemented diets. In general, the improvement ($P>0.05$) due to adding the probiotics may be attributed to improving intestinal microbial balance. In other words, probiotics help to keep the intestinal tract healthy and when the epithelial tissue is healthy, there is improved and better absorption of all nutrients **(Kaisths** *et al.,* **1996).**

Intestinal Becteria:

The effects of dietary crude protein levels, added probiotics and their interactions on the population of intestinal bacteria are summarized in Table (5).

There were no significant differences between chicks fed recommended and low levels of dietary CP regarding counts of total intestinal bacteria, coliform count and lactobacillus count of bacteria.

However, significant differences (P<0.01) were detected among dietary treatments due to added probiotics compared to the control diet without probiotic supplementation. The obtained results indicated that both total intestinal and coliform bacteria counts were significantly (P<0.01) decreased, while *lactobacillus* counts were significantly (P<0.01) increased by different sources of probiotics, when compared to chicks fed diets without probiotics supplementation.

The effect of interaction between dietary CP level and added probiotic revealed the highly significant decrease either in the total intestinal bacteria count or coliform count, even in diets with lower CP content. Oppositely, the *lactobacillus* count significantly (P<0.05) increased either with the recommended or low CP diets (Table 5). Such observation confirmed two points: 1) the effective role of added probiotics in maintaining microbial balance as well as, 2) their inhibitory effect on the harmless bacterial **(Venkat** *et al.,* **2004).** This will exert a beneficial effect on the host (chick), e.g. increased growth or resistance to disease and feed utilization as well. All these findings indicate the superiority of added probiotics to spare CP in broiler chick diets without negative effects on their growth. These results are in agreement with previous studies of **Maruta** *et al*., **(1996); Senani** *et al*.,**(1997); Jin** *et al*.,**(1998 a&b); Kumprecht** and **Zobac, (1998); Gusils** *et al*.,**(1999); Endo** and **Nokano, (1999)** and **Tolba** *et al*., **(2004 a& b)** who reported that birds fed diets supplemented with probiotics showed significant decrease in total count of pathogenic bacteria and increase in beneficial bacteria in the intestinal of chicks.

Economic Efficiency:

Economic efficiency (EEF) of different treatments at 6 weeks old are shown in Table (6). Either lowering dietary CP level or added probiotics was economically effective as the economic efficiency values increased by 3.5% as a result of lowering CP by 2.0%, while the increase reached 8.92% due to added probiotics. Regarding the combination effect of dietary CP level and added probiotics, data obtained showed that all dietary treatments surpassed the control one. However, the best economic efficiency value was for low protein diet fortified with either Organic Green Culture or Bio-Top. Meanwhile, the worst value obtained with the control diet (Table 6).

In general, there were considerable saving of cost per ton of broiler feeds due to supplementing their diets with different sources of probiotics. Economic efficiency and relative economic efficiency were improved by using probiotics in broiler diets. These results also, indicated that supplementing probiotics to broiler chick diets at low CP level is more efficient compared to high CP ones. Similar observation have been reported by **Ali** *et al.* **(2000), Osman (2003)**and **Abd El-Gawad** *et al.* **(2004)** who found that adding probiotic to broiler chick diets improved the economic efficiency of low protein diets by 20% over the control diet containing the recommended level of protein.

Conclusion:

In conclusion, either Organic Green Culture (G) or Bio-Top (B) at 1.5 kg/ton of feed produced a positive effect on growth, feed utilization and health of broiler chicks. Both spared nearly 2.0% crude protein of the recommended level of Arbor Acres broiler chicks, being economically effective.

Table (1): Composition and calculated analysis of the experimental diets during the starter (7-28 days) and grower (29-42 days) periods.

Ingredients	Starter CP		Grower CP	
	22 %	**20 %**	**20 %**	**18 %**
Yellow corn	55.50	60.15	60.16	64.12
Soyabean meal 44%	28.20	25.60	27.34	26.32
Corn gluten meal 60%	8.50	6.20	5.20	2.17
Sunflower oil	4.00	4.00	4.00	4.00
Di-calcuim phosphate	1.70	1.75	1.20	1.20
Limestone	1.32	1.32	1.40	1.41
DL- methionine	0.10	0.18	0.01	0.09
Vit. & min. premix*	0.30	0.30	0.30	0.30
NaCl	0.30	0.30	0.30	0.30
L-lysine HCL	0.08	0.20	0.09	0.09
Total	100	100	100	100
Calculated analysis**:				
CP%	22.083	20.030	19.973	18.024
ME. Kcal/kg	3194	3214	3206	3207
CF%	3.504	3.375	3.481	3.439
EE%	6.719	6.805	6.809	6.876
Ca %	0.996	1.00	0.901	0.900
Av. P %	0.453	0.455	0.357	0.353
Total P %	0.673	0.666	0.572	0.562
Lysine %	1.111	1.117	1.071	1.021
Methonine %	0.536	0.567	0.393	0.423
Meth+Cys %	0.902	0.902	0.730	0.724
Sodium %	0.133	0.133	0 .132	0.131

*Vitamin and mineral premix at 0.3% of the diet supplies the following per kg of the diet: vit A 12000IU, vit D 2000 IU, vit. E 40 mg, vit K_3 4 mg, vit B_1 3 mg, vit B_2 6 mg, vit B_6 4 mg, vit B_{12} 0.3 mg, niacin 30 mg, panthothenic acid 12 mg, folic acid 1.5 mg, biotin 0.08 mg, choline chloride 50% 700 mg, Mn 100 mg, Cu 10 mg, Fe 40 mg, Zn 70 mg, Se 0.3 mg, I 1.5 mg, Co 0.25 mg, $CaCO_3$ added at 3000 g.

** According to NRC (1994).

Table (2): Effect of dietary protein levels, sources of probiotics and their interaction on live body weight (LBW) and body weight gain (BWG) of broiler chicks.

Treatments			Starter period (7-28 d)		Grower period (29-42 d)		Overall period (7-42 d)
NO	CP	Pro.	LBW(g)	BWG(g)	LBW(g)	BWG(g)	BWG(g)
	RL		915±8.56	810±8.57	1824±9.26	909±7.64	1719±9.29
	LL		918±6.95	812±6.95	1804±19.4	886±15.34	1699±19.44
Significance level			NS	NS	NS	NS	NS
		_	891±7.12	786±7.13	1763^{b}±20.59	872±19.83	1658^{b}±20.73
		B	922±4.66	817±4.53	1832^{a}±18.79	909±17.39	1726^{a}±18.82
		G	927±435	822±4.48	1838^{a}±14.58	911±14.62	1732^{a}±14.53
		A	924±16.59	819±16.62	1823^{a}±20.4	899±17.15	1718^{a}±20.50
Significance level			NS	NS	*	NS	*
1	RL	Control	895±10	790±10.3	1799±28.53	904±25.5	1694±28.8
2	RL	B	921±4.66	816±4.36	1840±12.63	919±8.31	1735±12.30
3	RL	G	929±8.93	824±9.16	1832±15.7	903±9.71	1727±16.03
4	RL	A	915±33	810±33.03	1825±1365	910±19.73	172013.69
5	LL	-	888±11.89	783±11.6	1727±4.61	840±16.51	1623±4.91
6	LL	B	924±9.24	819±9.06	1823±39.15	900±36.7	1719±39.34
7	LL	G	925±3.36	820±3.64	1843±28.06	918±30.37	1738±12.74
8	LL	A	934±14.08	829±14.37	1822±43.51	888±31.02	1717±43.71
Significance level			NS	NS	NS	NS	NS

RL= Recommended level (22 and 20%) for St & Gr periods, respectively.
LL= Low level(20 and 18%) for St & Gr periods, respectively.
B=Bio-Top, G = Organic Green Culture and A= Avi-Bac.
NS : Not significant. *: Significant.
a,b .. Means in the same column within each factor bearing different superscripts are significantly different ($P<0.05$).

Table (3): Effect of dietary protein levels, sources of probiotics and their interaction on feed intake (FI) and feed conversion ratio (FCR) of boiler chicks.

Treatments			**Starter Period(7-28d)**		**grower period (29-42 d)**		**Overall period(7-42 d)**	
NO	**CP**	**Pro.**	**FI(g)**	**FCR**	**FI(g)**	**FCR**	**FI(g)**	**FCR**
	RL		1312^{b}±11.64	1.62^{b}±0.02	1840^{b}±13.19	2.03^{b}±.03	3151^{b}±18.62	1.83^{b}±0.02
	LL		1385^{a}±6.88	1.71^{a}±0.02	1896^{a}±9.26	2.15^{a}±.03	3281^{a}±9.91	1.93^{a}±0.02
Significance level			**	*	**	*	*	**
		_	1375^{a}±19.91	1.75^{a}±0.03	1884^{a}±7.13	2.17^{a}±.04	3259^{a}±19.45	1.97^{a}±0.03
		B	1356^{ab}±17.38	1.66^{b}±0.02	1837^{b}±15.89	2.02^{b}±.05	3193^{b}±32.09	1.85^{b}±0.03
		G	1340^{ab}±15.29	1.63^{b}±0.02	1857^{b}±26.97	2.04^{ab}±.04	3197^{b}±41.18	1.85^{b}±0.02
		A	1323^{b}±25.63	1.62^{b}±0.04	1894^{a}±18.56	2.11^{ab}±.04	3217^{ab}±41.12	1.87^{b}±0.03
Significance level			*	**	**	**	*	**
1	**RL**	**Cont.**	1342^{bcd}±29.59	1.7^{b}±0.025	1893^{ab}±2.02	2.10±0.06	3236^{a}±31.53	1.91^{bc}±0.04
2	**RL**	**B**	1321^{cde}±13.98	1.62^{bc}±0.008	1802^{c}±6.55	1.96±0.01	3123^{b}±15.72	1.80^{d}±0.003
3	**RL**	**G**	1311^{de}±16.19	1.59^{c}±0.021	1797^{c}±5.37	1.99±0.02	3108^{b}±30.36	1.79^{d}±0.008
4	**RL**	**A**	1273^{e}±19.47	1.58^{c}±0.058	1866^{b}±18.52	2.05±0.06	3139^{b}±31.46	1.83^{cd}±0.005
5	**LL**	_	1407^{a}±7.21	1.80^{a}±0.03	1874^{b}±12.6	2.23±0.03	3281^{a}±19.20	2.02^{a}±0.006
6	**LL**	**B**	1391^{ab}±8.96	1.7^{b}±0.019	1871^{b}±3.93	2.08±0.09	3263^{a}±5.04	1.90^{bc}±0.04
7	**LL**	**G**	1369^{abc}±7.31	1.67^{bc}±0.016	1917^{a}±4.91	2.09±0.06	3286^{a}±11.15	1.89^{bc}±0.026
8	**LL**	**A**	1373^{abc}±19.84	1.66^{bc}±0.034	1922^{a}±24.41	2.17±0.06	3295^{a}±36.96	1.92^{b}±0.045
Significance level			**	**	**	**NS**	**	**

RL= Recommended level (22 and 20%) for St & Gr periods, respectively.
LL= Low level(20 and 18%) for St & Gr periods, respectively.
B=Bio-Top, G = Organic Green Culture and A= Avi-Bac.
NS : Not significant.
a,b……. Means in the same column within each factor bearing different superscripts are significantly different
*: Significant (P<0.05) and **: Significant (P<0.01)

Table (4): Effect of dietary protein levels, sources of probiotics and their interaction on digestibility coefficients of nutrients of grower diets.

Treatments			digestibility coefficients				
NO	**CP**	**Probiotic**	**OM**	**CP**	**EE**	**CF**	**NFE**
	RL		85.66±0.62	95.20±0.33	80.70±0.34	32.48±0.91	86.62±0.81
	LL		85.39±0.68	95.28±0.25	80.60±0.60	29.87±1.38	85.93±0.85
Significance level			***NS***	**NS**	**NS**	**NS**	**NS**
		_	85.59±1.10	94.70±0.37	81.35±0.94	30.03±0.69	86.43±1.33
		B	85.21±0.64	95.80±0.20	79.62±0.50	31.02±1.32	85.73±0.82
		G	85.96±0.99	95.58±0.30	80.59±0.51	31.71±1.49	86.97±1.39
		A	85.33±1.04	94.88±0.56	81.05±0.60	31.93±1.34	85.98±1.27
Significance level			**NS**	**NS**	**NS**	**NS**	**NS**
1	**RL**	**Control**	85.57±0.14	94.65±0.32	81.02±0.57	28.04±1.54	86.68±0.35
2	**RL**	**(B)**	85.66±0.95	95.85±0.34	80.26±0.54	33.870.51	86.38±1.12
3	**RL**	**(G)**	86.19±1.88	95.47±0.65	80.55±0.89	34.87±0.78	87.42±2.67
4	**RL**	**(A)**	85.21±1.91	94.81±1.16	80.96±0.99	33.12±1.09	86.00±2.34
5	**LL**	**_**	85.62±2.45	94.74±0.76	81.67±2.00	32.02±5.47	86.17±2.95
6	**LL**	**(B)**	84.75±0.98	95.75±0.30	78.98±0.75	28.16±0.62	85.07±1.30
7	**LL**	**(G)**	85.73±1.13	95.70±0.15	80.62±0.72	28.56±0.71	86.52±1.51
8	**LL**	**(A)**	85.46±1.31	94.94±0.49	81.14±0.92	30.75±2.52	85.96±1.61
Significance level			**NS**	**NS**	**NS**	**NS**	**NS**

RL= Recommended level (22 and 20%) for St & Gr periods, respectively.
LL= Low level(20 and 18%) for St & Gr periods, respectively.
B=Bio-Top, G = Organic Green Culture and A= Avi-Bac.
NS : Not significant.

Table (5): Effect of dietary protein levels, sources of probiotics and their interaction on counts of total intestine bacteria, coliform bacteria and Lactobacillus bacteria of broiler chicks.

Treatments			Counts of bacteria		
NO	**CP**	**Prob.**	**Total intestinal bacteria (1X10^4)**	**Coliform bacteria (1X10^3)**	**Lactobacillus bacteria (1X10^3)**
	RL		1.98±0.77	1.00±0.41	3.07±0.58
	LL		1.49±0.65	0.79±0.31	3.16±0.64
Significance level			**NS**	**NS**	**NS**
		_	5.53^a±0.84	2.85^a±0.37	0.74^b±0.08
		B	0.59^b±0.13	0.34^b±0.08	4.07^a±0.46
		G	0.37^b±0.07	0.21^b±0.03	4.79^a±0.84
		A	0.47^b±0.08	0.18^b±0.03	2.87^a±0.69
Significance level			**	**	**
1	**RL**	**Control**	6.39^a±0.34	3.32^a±0.18	0.84^b±0.10
2	**RL**	**(B)**	0.69^b±0.23	0.38^c±0.14	3.88^a±0.40
3	**RL**	**(G)**	0.27^b±0.09	0.17^c±0.02	4.36^a±1.22
4	**RL**	**(A)**	0.58^b±0.11	0.13^c±0.03	3.22^a±1.47
5	**LL**	**_**	4.66^a±1.64	2.39^b±0.65	0.63^b±0.09
6	**LL**	**(B)**	0.49^b±0.13	0.29^c±0.11	4.26^a±0.94
7	**LL**	**(G)**	0.47^b±0.10	0.26^c±0.05	5.22^a±1.35
8	**LL**	**(A)**	0.36^b±0.08	0.23^c±0.04	2.52^a±0.32
Significance level			**	**	*

RL= Recommended level (22 and 20%) for St & Gr periods, respectively.
LL= Low level (20 and 18%) for St & Gr periods, respectively.B=Bio-Top, G = Organic Green Culture and A= Avi-Bac. NS : Not significant.
a,b .. Means in the same column within each factor bearing different superscripts are significantly different.
*: Significant ($P<0.05$) and **: Significant ($P<0.01$)

Table (6): Effect of experimental treatments on the economic efficiency (EEF) of meat production.

Treatments / Items	T1	T2	T3	T4	T5	T6	T7	T8
Fixed price/ chick (L.E)	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Average feed consumed kg/ bird starter	1.342	1.321	1.311	1.273	1.407	1.391	1.369	1.373
Price/ kg feed (L.E) starter	1.388	1.418	1.415	1.448	1.290	1.320	1.317	1.350
Average feed consumed kg/ bird grower	1.893	1.802	1.797	1.866	1.874	1.871	1.917	1.922
Price/ kg feed (L.E) grower	1.351	1.381	1.378	1.411	1.236	1.266	1.263	1.296
Price/feed (L.E) starter	1.862	1.873	1.855		1.815	1.836	1.803	1.854
Price/feed (L.E) grower	2.558	2.489	2.476	2.633	2.317	2.369	2.422	2.491
Total feed cost/ chick (L.E)[1]	4.420	4.362	4.331	4.476	4.132	4.205	4.225	4.345
Total cost (L.E) / chick	6.220	6.162	6.131	6.276	5.932	6.005	6.025	6.145
Average live body weight (kg/bird)	1.799	1.840	1.832	1.825	1.727	1.823	1.843	1.822
Price/kg live body weight (L.E)[2]	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Total revenue (L.E)/ chick	11.694	11.960	11.908	11.863	11.226	11.850	11.980	11.843
Net revenue (L.E)/ chick	5.473	5.798	5.777	5.587	5.294	5.845	5.955	5.698
Economic efficiency (EEF)[3]	0.880	0.941	0.942	0.890	0.892	0.973	0.988	0.927
Relative economic efficiency[4]	**100.00**	106.93	107.05	101.14	101.36	110.59	112.27	105.34

Main effects

	CP levels		Sources of probiotics			
	Recommended	**Low**	**Control**	**Bio-Top**	**Green cult.**	**Avi-Bac**
Economic efficiency (EEF)[3]	0.913	0.945	0.886	0.957	0.965	0.909
Relative economic efficiency[4]	**100.00**	103.50	**100.00**	108.00	108.92	102.54

1-According to the price of different ingredients available in ARE.
2-According to the price at the experimental time.
3-Net revenue per unit total costs.
4-Assuming that the relative EEF of the control group equal 100.

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الملخص العربى

استجابة كتاكيت اللحم للعلائق منخفضة البروتين والمدعمة بمستحضرات المنشطات الحيوية

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أجريت هذه التجربة بهدف دراسة تأثير إضافة بعض المنشطات الحيوية الى علائق منخفضة فى محتواها من البروتين الخام علي الأداء الأنتاجىلكتاكيت التسمين. استخدم في هذه الدراسة عدد ٢٤٠ كتكوت عمر يوم من سلالة أربور إيكرز غير مجنس تم توزيعها عشوائيا علي ٨ معاملات تجريبيةكل منها فى ثلاث مكررات. تم تكوين عليقتين أساسيتين احتوت الأولى على البروتين المصرح به(٢٢، ٢٠%) والثانية على البروتين المنخفض (٢٠، ١٨%) فى مرحلتي البادى (٧-٢٨ يوم) والنامي (٢٩-٤٢يوم) على الترتيب. أستخدمت العلائق السابقة لتغذية الكتاكيت إما بدون إضافة أو مع إضافة المنشطات الحيوية

Bio-Top,Organic Green Culture,Avi-bacكل بمعدل ١,٥ جرام / كجم عليقة وذلك فى تصميم احصائى متداخل ٢×٤ ليصبح عدد المعاملات ثمانية معاملات.

ويمكن إيجاز النتائج المتحصل عليها فيما يلي:

١- بصرف النظر عن مستوى بروتين العليقة أدى إضافة مستحضرات المنشطات الحيوية إلى زيادة معنوية في كل من الزيادة فى وزن الجسم ومعدل التحويل الغذائي مقارنة بالعليقة الكنترول الخالية من الإضافات الحيوية.

٢- زاد مقدار الغذاء المستهلك معنويا فى مجموعة الطيور المغذاة على علائق منخفضة فى محتواها من البروتين وبالتالي سجلت معدل تحويل غذائي منخفض مقارنة بالمجموعات الأخرى المغذاة على البروتين المصرح بة. ورغم ذلك لم يكن هناك فروق معنوية في وزن الجسم الحي بين المجموعتين.

٣- لم يكن للتداخل بين مستوى البروتين والمنشطات الحيوية أي تأثير معنوي سلبي على كل من مقاييس النمو، معامل هضم المركبات الغذائية المختلفة.

٤- إضافة المنشطات الحيوية للعلائق منخفضة البروتين أدى إلى تحسن معدل تحويل الغذاء وزيادة غير معنوية في معامل هضم البروتين و الألياف الخام، بينما أدى إلى اتزان محتوى الأمعاء من الكائنات الدقيقة.

٥- كان لإستخدام أي من المنشطات الحيوية المستخدمة بمعدل ١,٥ جم/كجم القدرة على توفير حوالي ٢% من البروتين الخام في علائق كتاكيت اللحم وهذا لة مردود إقتصادى جيد نظرا لارتفاع سعر وحدة البروتين في تغذية الدواجن.