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RESPONSE OF BROILER CHICKS TO SOME DIETARY GROWTH PROMOTERS THROUGHOUT DIFFERENT GROWTH PERIODS

By

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Abstract: *A total number of 420 unsexed day old Arbor Acres broiler chicks were used in the present study. The birds were randomly distributed into 14 treatments of 30 chicks each. Two commercial probiotics (Avi-Bac and Zimoferment) were used at the recommended level and supplemented to chick's diets during starter (St;7-21d), starter-grower (St-Gr;7-35d) and starter-grower-finisher (St-Gr-F;7-49d) periods (Experiment 1). In the second experiment, two types of natural growth promoters (Fish soluble extract and Hot pepper) each at 1% level were also supplemented into chick's diet during the same periods as previously mentioned in the first experiment. Two control diets were used for comparison, one of them based on all plant protein and the other one contained animal protein, both were formulated without supplementation. The chicks were fed a corn-soy diet containing 22.9% CP and 3138 kcal ME/Kg for the first 7 days. All the experimental diets were formulated to be of isonutritive value (22, 20 and 18% CP) , and (3000,3000 and3100 kcal ME/kg) for starter, grower and finisher periods, respectively .The results obtained indicated that during starter-grower period (7-35d), it is preferable to use either Avi-Bac as commercial probiotic or hot pepper as natural growth promoter in broiler diet. While, during overall period (7-49d), fish soluble extract as natural growth promoter is superior. By comparison, the use of commercial probiotics particularly Zimoferment and Avi-Bac in broiler diets is better than fish soluble and hot pepper as natural growth promoters.*

INTRODUCTION

Animal protein sources such as fish meal or poultry by-product meal have beneficial effect on growth and feed utilization due to the synergetic effects among amino acids and perhaps unidentified growth factors. However, plant protein in poultry diets has drawn much attention around the world through the last years, due to the fear of mad cow disease in animal

protein sources. But plant protein doesn't completely covered the chicken's requirements especially for essential amino acids. Feed additives like probiotics or natural growth promoters may be added to broiler diets in very small quantities to obatin some special effects. The term "probiotics" is derived from the two Greek words meaning "for life" and contrasts with the more familiar term "antibiotics" which means "against life". In the broad sense, a probiotc is a product of an organism that in one way or another can enhance life performance **(Beek, 1989)**. **Jin et al.(1997)** reported that the mode of actions of probiotic are explained as following : a) maintaining normal intestinal microflora by competitive exclusion and antagonism; b) altering metabolism by increasing digestive enzyme activity and ammonia production; c) improving feed intake and digestion, and d) neutralizing enterotoxins and stimulating the immune system. **Gouse (1990)** indicated that feeding broiler chicks diets supplemented with Lacto-sacc (1g/kg feed) resulted in a significant improvement in growth performance traits from 4 to 6 weeks old. Also, **Guerrero and Hoyos (1990)** obtained heavier body weights at 7 weeks old, Similar results were obtained by **Paik *et al.* (1990), Ken (1992), Kim *et al.* (1992), Ali (1994) and Omar (1996)** in broiler chicks and the same trends were obtained by **Gippert *et al.* (1992) and Gippert and Bodrogi (1992)** for pekin ducks. An increase in feed intake and improvement in feed conversion were found in broiler chicks fed diets supplemented with Lacto-Sacc than unsupplemented ones from hatching up to marketing age **(Ken, 1992; Kim *et al.*, 1992 and Omar, 1996). While, Guerrero and Hoyos (1990), Gippert and Bodrogi (1992) and Ali (1994)** found that supplementation with Lacto-Sacc lowered feed consumption of broiler chicks. **El-Husseiny *et al.* (2001)** found that birds fed Micro-Bac-LA supplemented diets recorded the best values of weight gain and feed conversion through the experimental period, improved the nitrogen balance and digestibility of crude protein, ether extract and crude fiber, and had no significant effects on the carcass characteristics.

Abd El-Gawad *et al.* (2004) observed that the average values of total protein, albumin and creatinine were increased while, total lipids, cholesterol, AST and ALT values were decreased with probiotics supplementation compared with control group (without supplementation).

Recently, numerous studies have illustrated that natural growth promoters can be used in animal and poultry diets to improve the quantity and quality of their products. **Maigualema et al. (2002)** found that chicks fed Tilapia by-products at level of 0, 25 and 50% had significantly ($P<0.01$) higher body weights and consumed more feed throughout the 42 days experimental period. Carcass weights and yields were also significantly

(P<0.01) higher for the same treatments. Fish flavors were not detected in the breast meat or drumstick.

Hot or chili pepper (paprika) has the terpenoid compound capsaicin which has antibacterial proprieties. Hot pepper (Chili) contains high amounts of vitamin C, E, B1, B2, Niacin and also the pro vitamins alpha-, beta-, gamma-carotene and cryptoxanthin, which are transformed in the human liver into vitamin A **(Bosland, 1994). (Yoshioka *et al.*, 2000)** found that consumption of red pepper can induce a considerable change in energy balance, which was associated with an increase in sympathetic: parasympathetic nervous system activity ratio. **Azouz (2001)** cleared that hot pepper diets significantly increased body weight and body weight gain, reduced (P<0.01) feed intake, improved feed conversion and had heavier dressing % and lower abdominal fat %. **Soliman (2002)** concluded that diet containing high energy (2900 Kcal/Kg diet) and 1.5% hot pepper gave better values of egg production, egg weight, egg mass, feed conversion, nutrients digestibility and nitrogen balance, while the value of EE digestibility was decreased. **Al-Harthi (2002)** observed that 0.1 % hot pepper improved growth, FCR and economic efficiency in broiler diets. **Abdo *et al.* (2003)** noted that the organoleptic properties of cooked meat showed the best color for chicks having hot pepper at 1.5%, There were no adverse effects on blood `components due to addition of hot pepper on either kidney function (as measured by creatinine level) or liver function (as measured by alkaline phosphatase, AST and ALT).

The objective of the present study is to improve the efficiency of plant protein diets by adding either commercial (Avi-Bac and Zimoferment) or natural growth promoters (Fish soluble extract and Hot pepper) in broiler diets.

MATERIALS AND METHODS

The experimental work was carried out at Gizeret El-Sheir Poultry Research Station, Agriculture Research Center, Ministry of Agriculture, Egypt.

Preparing additives:

To prepare fish soluble extract, three kilograms of fish by-products were cooked in boiling water for 30 minutes in stainless steel container then filtered to pass through 1mm mesh sieve, and kept in the refrigerator. Chemical analysis of fish soluble extract showed the presence of moisture 48.44%, crude protein 32.02%, ether extract 7.32%, crude fiber 1.85%, ash 3.53% and NFE 6.84%. It contained 1460 Kcal ME/Kg as reported by **NRC**

(1994). The proximate analysis of hot pepper showed the presence of crude protein 14.23%, ether extract 13.97%crude fiber 18.45%, ash 3.76% and nitrogen free extract 49.59%, on DM basis.

Avi-Bac, is a concentrated source of lactic acid bacteria (*L. acidophilus, L. planterumand and L.brevis*) and enzymes (amylase, beta-glucanase and hemicellulase) for use in either the feed or drinking water of poultry.

Zimoferment, is a concentrated source of dried yeasts (dry extract *saccharomyces*, distilled solubles, fermented yeasts, natural phosphorylated yeast); protein concentrate with a high enzyme and amino acid content. It contains also vitamin B12.

Experimental birds and design.

A total number of 420 unsexed day old Arbor Acres broiler chicks were assigned into two experiments; each included 6 treatments, each treatment contained three replicates of 10 chicks per replicate. The rest of chicks (60 chicks) were divided into two groups as controls, one of them fed all plant protein control diet, while the second had been fed an animal protein control one. Four types of feed additives were used as growth promoters. These growth promoters were Zimoferment and Avi-Bac as commercial probiotics and fish soluble and hot pepper as natural growth promoters. Each one was supplemented and offered to experimental chicks diets either during starting (2-3 weeks), starting-growing (2-5weeks) or starting-growing-finishing (2-7weeks) period. Accordingly, 14 experimental treatments were used in this study (Table 1).

Experimental diets and management.

The composition and calculated analysis of starter, grower and finisher diets were tabulated in Table (2) for the first experiment and Table (3) for the second experiment based on (NRC, 1994). Experimental diets and water were offered *ad-libitum* all over the experimental periods. The proximate analysis of the different samples were carried out for moisture, ash, nitrogen, ether extract and crude fiber according to the official methods **(AOAC, 1980)**. Chicks were weighed at 21, 35 and 49 days of age, and feed intake, weight gain and FCR were calculated at the same periods. At the end of each period i.e at 21 days (starter), 35 days (starter-grower) and 49 days (starter-grower-finisher) of age, a number of 18 Arbor Acres broiler chicks were used to determine nutrients digestibility and nitrogen balance of the experimental diets. Fecal nitrogen was determined according to **Jakobsen *et al.* (1960)**. At the end of the experimental period (7 weeks), three birds of

each treatment were slaughtered, packed in airtight plastic bags and stored in a deep freezer until used for the panel test **(Molander, 1960)**. Dietary treatments were economically evaluated as described by **Bayoumi (1980)** representing the economical efficiency as the net revenue per unit of feed cost.

Statistical analysis:

The statistical analysis was computed using analysis of variance as described in the SAS programme **(SAS® institute, 1986)** and the significant mean differences among treatment means were separated by Duncan's Multiple Range Test **(Duncan, 1955).**

RESULTS AND DISCUSSION

Experiment 1: (Response of broiler chicks to commercial probiotics)

Nutrients digestibility:

Data showed that the chicks fed either plant protein diet without supplementation (control) or diets supplemented with Avi-Bac recorded significantly ($P<0.05$) higher CF digestibility coefficient than those fed either animal protein diet (control) or diets supplemented with Zimoferment during starter period (Table 4). On the other hand, the digestibility coefficient of OM, CP, CF, EE and NFE were insignificantly ($P>0.05$) affected at the end of grower period. At finisher period, data showed that either Zimoferment or Avi-Bac significantly ($P<0.05$) improved CP digestibility, This may be attributed to altering the metabolism by increasing digestive enzyme activity and decreasing ammonia production by harmful bacteria **(Patterson and Burkholder, 2003).** The amount of N retained was positive in all experimental diets. At finisher period, the N-balance values lied between 39.24% for chicks fed plant protein control diet to 52.50% for diet supplemented with Avi-Bac with significant differences between them.

Live body weight and live body weight gain

The effects of commercial probiotics and periods of supplementation on live body weight and live body weight gain of broiler chicks are presented in Table (5). Data obtained show that at (21 days), the chicks fed diet containing animal protein (T14) recorded the highest live body weight (527g), while those fed diet containing plant protein supplemented with Avi-Bac (T5) recorded the lowest value (487g) with significant difference between them. The same trend was observed at 35 days, while at 49 days, the differences between all treatments did not reach significance. The data of the live body weight gain during St period and St-Gr period, showed that

T14 recorded the best value with significant differences among all treatments. While, at the overall period, the most of live body weight gain values were not significantly affected compared to those of other treatments and to those received the plant and animal protein control diets. These results are in agreement with the findings of **Subrata and Banerjee (1996)** and **El-Ghamry *et al.* (2002)** who reported that there were no significant differences in average values of either live body weight or body weight gain between broiler chicks fed basal diet and those having probiotic at 0.1 and 0.2% in their diets.

Feed intake and feed conversion ratio

The effect of the interaction between the type of commercial probiotic and period of supplementation comparing with the control groups (Table 6) showed that birds fed animal protein diets (T14) recorded higher feed intake during starter, starter-grower period and overall period. Such treatment recorded the worst feed conversion at St-Gr and overall period, while, the best feed conversion was for T5 at 7-49d of age. These results are in agreement with those obtained by **Ken, 1992; Kim *et al.*, 1992** and **Omar, 1996** who found that the broiler chicks given diets supplemented with Lacto-Sacc had recorded better feed conversion than unsupplemented ones from hatching up to marketing age. Also, the results obtained herein are in harmony with those obtained by **Soliman *et al* (2000)** who found that the best feed conversion values were for chicks fed diets supplemented with either yeast culture, probiotic or enzymes.

Organoleptic properties of broiler meat:

The data of organoleptic properties of chicken meat (taste, color, aroma, texture and overall acceptability), Table (7) indicate that all experimental treatments including the use of probiotics exhibited better values of overall acceptability of chicken meat than those obtained with the control groups. The values obtained for overall acceptability of dietary probiotic treatments ranged between 6.8 and 8.9 while those for control groups were 7.8 and 6.2 for plant protein and animal protein diets without probiotic supplementation, respectively. This means that the use of probiotics tend to improve the physical properties of chicken meat.

Economic efficiency:

The chicks fed diets with Avi-Bac supplementation either during St or St-Gr had better economic efficiency than those fed Zimoferment supplemented diets comparing with either plant or animal protein (Table 8). These results are in harmony with those obtained by **El-Husseiny *et al.***

(2001) who found also that supplementation of Micro-Bac-LA to broiler chick diets resulted in higher relative economic efficiency value than those obtained with either animal protein diet (AP) or plant protein without supplementation.

Experiment 2: (Response of broiler chicks to natural growth promoters)

Nutrients digestibility:

Table (9) shows that at 21 day of age (starter period), the tested natural growth promoters had no significant effect on either CP, NFE, or OM digestibilities for all treatments, while CF digestibility coefficient significantly ($P<0.05$) increased in the diet supplemented with either fish soluble extract (36.46%) or hot pepper (34.44%) as well as in the plant protein control diet (38.19%) compared to the animal protein control one (27.93%). Also, EE digestibility coefficient significantly ($P<0.05$) improved in the diet containing 1% fish soluble extract (84.40%) compared to the other dietary treatments. At grower period crude fiber digestibility coefficient of chicks fed animal protein diet was significantly higher than other treatments. While, there were no significant differences on either CP, EE, NFE or OM digestibility for all treatments. At the end of the finisher period, the digestibility coefficient of CP%, EE%, NFE % or OM was not significantly affected, however, the chicks fed hot pepper supplemented diet recorded significantly ($P<0.05$) the best CF digestibility coefficient (36.56%) followed by those fed diet containing fish soluble extract (31.04%) with significant differences between them. Fish soluble gave the lowest N-balance % after 21 days (51.36%) but recorded higher % than hot pepper after 35 days of age. However, at the end of finisher period (49 days of age), hot pepper and fish soluble recorded higher N-balance % compared to the plant and animal protein control groups with no significant differences between them (Table 9). The role of hot pepper in enhancing the utilization of the nutrients had been confirmed by **Virus and Gebhart (1979)** and **Chevallier (1996)**. They revealed that capsaicin; the spicy component of hot pepper has a wide range of biological activities, affecting the nervous, cardiovascular and digestive systems. These results are in agreement with those obtained by **Harms (1972)** and **Cantor and Johnson (1983)** who reported that unidentified growth factors (UGFs) in fish soluble has a positive effect on digestion and metabolism, which in turn can improve growth rate and feed utilization of chicks.

Live body weight and live body weight gain

Compared to the control groups, data (Table 10) showed the significant effect of dietary treatments on live body weight and body weight gain at only starting and growing periods of growth. Data showed that the chicks fed animal protein diet (T14) recorded the highest live body weight during starter and grower periods (527g and 1196g, respectively). While, the lowest values were for chicks fed diet supplemented with fish soluble extract during starter period (T7) being 494g and 1092g, respectively with significant differences between the two treatments. The data of live body weight gain during starter and St-Gr periods were significantly different. The chicks fed the fish soluble extract supplemented diet during starter period (T7) recorded the lowest live body weight gain values. While the best values of live body weight gain were obtained by chicks fed animal protein control diet (T14) during the same periods with significant differences between them. On the other hand, no significant differences in live weight gain values were detected during overall period (7-49 days of age) among all treatments. In this respect, **Cantor and Johnson (1983)** showed a significant preference of chicks to the diet contained fish soluble compared to other unidentified growth factor sources, but without significant differences in weight gain. The results indicated that it was preferable to apply the use of the tested natural supplements during the period from 7 to 35 days of age. These results agreed to some extent with those reported by **Williams and Kienholz (1974)** who found that different levels of chili powder had little effect on growth of broiler chicks during the period from 27-42 day of age.

Feed intake and feed conversion ratio

The results in Table (11) showed that chicks fed the animal protein control diet (T14) recorded significantly ($P<0.05$) higher feed intake at all periods of growth. In general, chicks fed fish soluble diets consumed lower feed than those having diets supplemented with hot pepper, this means that hot pepper may enhance feed consumption of chicks compared to fish soluble extract as natural growth promoters. Data of feed conversion are presented also in Table (11) and cleared that the interaction between supplementation and period of growth did not show any significant differences between feed conversion values during starter period. However, chicks fed diets supplemented with hot pepper during starter and grower period (T11) exhibited better feed conversion during St-Gr (7-35 days) period. Such treatment showed significant differences only when compared to the animal protein control diet, which showed the worse feed conversion values. Comparing with the control groups, chicks of T3 which fed fish

soluble extract diet during St-Gr-F period and those having diet with hot pepper during St-Gr period (T11) recorded better values of total feed conversion (7-49 days of age). Regarding to the results obtained by fish soluble as natural growth promoters, data obtained herein are in agreement with **Miller and Soares (1972)** who reported that gain/feed ratio of chicken fed diets contained either fish meal, fish soluble, gelatin, casein or isolated soy protein were better than those of chicken fed basal diet of crystalline amino acids content, and concluded that the improvement in FCR in diets containing fish soluble may be due to unidentified growth factors in fish soluble. The overall data of feed conversion showed that hot pepper as natural growth promoter was superior than fish soluble extract and also better than the control diets. In this respect, **Abdo *et al.* (2003)** stated that adding either 1.5% or 3% hot pepper improved feed conversion values through the total experimental period (7-42 days of age). These effects may be due to the positive influences of capsaicin, the spicy component of hot pepper, on the terminal enzymes of digestive process, that is generally well recognized to stimulate digestion, and improved nutrients utilization.

Organoleptic properties of broiler meat:

The results showed that there was a gradually decrease in average values given for each parameter with increasing the duration of adding fish soluble extract to the broiler diet Table (12). These results agreed with **Maigualema *et al.* (2002)** who studied the effect of using tilapia by-products at different levels on performance and meat characteristics of broilers. They found that fishy flavors were clearly observed in the thigh meat and skin and accordingly the taste and overall acceptability of thigh meat decreased as judged by the consumers. On the other hand, **Abdo *et al.* (2003)** stated that the best color of cooked meat had been recorded for broilers fed hot pepper at 1.5% level, while the best values of taste, aroma, texture and overall acceptability were obtained by feeding broilers diet containing a mixture from hot pepper and marjoram.

Economic efficiency:

Economic efficiency of different treatments and net revenue PT/chick, at 7 weeks of age are shown in Table (13). The economic efficiency values ranged between the best (0.82) for chicks fed fish soluble extract diet during overall period (T9) to the worst (0.63) for chicks fed the animal protein control diet (T14). The results are in agreement with those obtained by **Al-Harthi (2002)** who observed that adding 0.1% hot pepper improved economic efficiency compared to the control diets.

Generally speaking, it is easy to postulate from the overall results obtained that Avi-Bac (commercial probiotic) which is a concentrate source of lactic acid bacteria as well as hot pepper as natural growth promoter, both could be used to promote growth of broilers during the period from 7-35 days of age. While, fish soluble extract (natural one) is being preferable to be used in broiler diet during the overall period (7-49 days of age). Such treatments recorded better findings of feed utilization and overall meat acceptability, in addition to the more successful economic efficiency values.

Table 1: Experimental Design. Fourteen experimental treatments were used in this study as follow:

Expt. No.	code	Treatment
1 Commercial Probiotics	T1	Plant protein + Zimoferment during St. period
	T2	Plant protein + Zimoferment during st.& Gr. periods
	T3	Plant protein + Zimoferment during St.,Gr. and F periods
	T4	Plant protein +Avi-bac during St. period
	T5	Plant protein +Avi-bac during St. & Gr. periods
	T6	Plant protein +Avi-bac during St., Gr and F periods
2 Natural Growth Promoters	T7	Plant protein +1% fish soluble during St. period
	T8	Plant protein +1% fish soluble during St. & Gr. periods
	T9	Plant protein +1% fish soluble during St., Gr. and F periods
	T10	Plant protein + 1% hot pepper during St. period
	T11	Plant protein + 1% hot pepper during St. & Gr. periods
	T12	Plant protein + 1% hot pepper during St., Gr. and F. periods
controls	T13	Plant protein control
	T14	Animal protein control

St = starter period (2-3 weeks), Gr = grower period (4-5 weeks), F = finisher period (6-7 weeks).

Table (2): Composition and calculated analysis of starter, grower and finisher experimental diets supplemented with commercial probiotics (Expt.1).

Ingredient	Starter			Grower			Finisher		
	Supplemented diet T1,……..,T6	Controls		Supplemented diet T2,T3,T5,T6	Controls		Supplemented diet T3,T6	Controls	
		Plant protein	Animal protein		Plant protein	Animal protein		Plant protein	Animal protein
		T13	T14		T13	T14		T13	T14
Yellow Corn	63.18	63.18	65.50	67.25	67.25	69.05	73.70	73.70	75.50
Soybean meal 44%	24.05	24.05	22.00	23.03	23.03	21.35	14.14	14.14	13.50
Fish meal 72%	-	-	6.80	-	-	4.80	-	-	4.50
Corn gluten meal 60%	9.10	9.10	2.75	6.10	6.10	1.75	8.10	8.10	3.20
Di calcium phosphate	1.70	1.70	1.40	1.70	1.70	1.40	1.70	1.70	1.40
Lime stone	1.23	1.23	1.05	1.23	1.23	1.15	1.43	1.43	1.20
Vit.&min.mix	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
L-lysine HCl	0.24	0.24	-	0.19	0.19	-	0.43	0.43	0.18
NaCl	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	-	-	-	-	-	-	-	-	0.02
Zimoferment *	2ppt	-	-	2ppt	-	-	2ppt	-	-
Avi-Bac **	5pptt	-	-	5pptt	-	-	5pptt	-	-
Total	100	100	100	100	100	100	100	100	100
Calculated analysis									
Crude protein%	22.01	22.01	22.06	20.01	20.01	20.03	18.10	18.10	18.00
ME kcal/kg	3000	3000	3004	3000	3000	3007	3101	3101	3100
C/P ratio	136.3	136.3	136.1	149.9	149.9	150.0	171	171	172
Calcium%	0.91	0.91	0.92	0.91	0.91	0.92	0.96	0.96	0.91
Available phosphorus%	0.46	0.46	0.51	0.46	0.46	0.47	0.44	0.44	0.45
Lysine %	1.13	1.13	1.22	1.04	1.04	1.08	1.01	1.01	1.01
Methionine%	0.46	0.46	0.47	0.40	0.40	0.40	0.39	0.39	0.41
TSAA%	0.82	0.82	0.79	0.73	0.73	0.71	0.69	0.69	0.69

ppt ……part per thousand, pptt……part per ten thousand, TSAA…..total sulfur amino acid

* Only for Tr 1, 2 and 3 ** only for Tr 4, 5 and 6

Table (3): Composition and calculated analysis of starter, grower and finisher experimental diets supplemented with natural growth promoters (Expt.2)

Ingredient	Starter			Grower			Finisher		
	Supplemented diet T7,……..,T12	Controls		Supplemented diet T8,T9,T11,T12	Controls		Supplemented diet T9,T12	Controls	
		Plant protein	Animal protein		Plant protein	Animal protein		Plant protein	Animal protein
		T13	T14		T13	T14		T13	T14
Yellow Corn	62.85	63.18	65.50	66.90	67.25	69.05	73.67	73.70	75.50
Soybean meal 44%	21.60	24.05	22.00	20.60	23.03	21.35	12.05	14.14	13.50
Fish meal 72%	-	-	6.80	-	-	4.80	-	-	4.50
Corn gluten meal 60%	10.85	9.10	2.75	7.85	6.10	1.75	9.30	8.10	3.20
Di calcium phosphate	1.70	1.70	1.40	1.69	1.70	1.40	1.70	1.70	1.40
Lime stone	1.23	1.23	1.05	1.25	1.23	1.15	1.30	1.43	1.20
Vit.&min.mix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
L-lysine HCl	0.27	0.24	-	0.21	0.19	-	0.48	0.43	0.18
NaCl	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	-	-	-	-	-	-	-	-	0.02
Fish soluble extract	1	-	-	1	-	-	1	-	-
Hot pepper	1	-	-	1	-	-	1	-	-
Total	100	100	100	100	100	100	100	100	100
Calculated analysis ****									
Crude protein%	22.02	22.01	22.06	20.18	20.01	20.03	18.17	18.10	18.00
ME kcal/kg	3004	3000	3004	3004	3000	3007	3103	3101	3100
C/P ratio	136.4	136.3	136.1	148.9	149.9	150.0	171	171	172
Calcium%	0.91	0.91	0.92	0.91	0.91	0.92	0.90	0.96	0.91
Available phosphorus%	0.46	0.46	0.51	0.45	0.46	0.47	0.44	0.44	0.45
Lysine %	1.10	1.13	1.22	1.01	1.04	1.08	1.00	1.01	1.01
Methionine%	0.47	0.46	0.47	0.42	0.40	0.40	0.40	0.39	0.41
TSAA%	0.84	0.82	0.79	0.75	0.73	0.71	0.70	0.69	0.69

* Only for Tr 7, 8 and 9 ** only for Tr 10, 11 and 12

*** Each 3 Kg vit.&min. premix contained :-

Vit. A 12000000 IU, Vit. D3 2200000 IU, Vit. E 10000 IU, Vit. K3 2000 mg, Vit. B1 1000 mg, Vit B2 4000 mg, Vit.B12 10 mg, Vit B6 1500 mg, Niacin 2000 mg, Pantothenic acid 1000 mg, Folic acid 1000 mg, Biotin 50 mg, Choline Chloride 500000 mg, Copper 10000 mg, Iodine 1000 mg, Iron 30000 mg, Zinc 50000 mg, Manganese 55000 mg, Selenium 100 mg and Cobalt 100mg.

**** According to NRC (1994)

Table (4): Effect of different treatments on nutrients digestibility and N-balance (%) of the experimental diets (Exp.1)

Treatment	At 21 day of age					
	CP	**CF**	**EE**	**NFE**	**OM**	**N-balance**
(Z)	93.09 ±0.45	32.58^{b} ±1.40	85.36^{a} ±2.06	79.94 ±0.24	81.60 ±0.08	61.52 ±1.53
(A)	92.15 ±0.28	38.06^{a} ±0.23	85.36^{a} ±0.75	81.10 ±0.66	82.06 ±0.22	56.16 ±1.53
Plant protein	92.50 ±0.85	38.19^{a} ±0.55	80.33^{b} ±0.24	81.32 ±0.67	81.51 ±0.85	57.06 ±2.52
Animal protein	91.51 ±0.78	27.93^{b} ±2.41	79.25^{b} ±1.40	80.81 ±0.78	80.82 ±0.78	57.14 ±0.70
	At 35 day of age					
	CP	**CF**	**EE**	**NFE**	**OM**	**N-balance**
(Z)	93.66 ±0.14	32.40 ±0.67	79.15 ±3.19	82.44 ±1.20	81.40 ±0.95	56.78 ±0.06
(A)	92.91 ±0.25	34.66 ±0.12	81.22 ±2.43	82.54 ±0.92	81.10 ±0.38	60.32 ±1.20
Plant protein	94.42 ±0.49	30.40 ±1.60	82.89 ±1.06	81.61 ±2.11	81.90 ±1.55	55.67 ±2.61
Animal protein	93.40 ±0.38	33.50 ±2.12	83.46 ±0.22	83.52 ±0.41	82.30 ±0.40	61.43 ±0.44
	At 49 day of age					
	CP	**CF**	**EE**	**NFE**	**OM**	**N-balance**
(Z)	**94.02^{a} ±0.43**	**30.33^{b} ±0.12**	82.77 ±1.20	82.19 ±1.09	83.42 ±0.86	**47.57 ^{b} ±1.18**
(A)	**94.16^{a} ±0.11**	**38.24^{a} ±0.14**	82.01 ±2.39	83.27 ±0.61	83.29 ±0.46	**52.50 ^{a} ±0.13**
Plant protein	**92.04^{b} ±0.89**	**30.83^{b} ±0.52**	81.06 ±2.80	82.27 ±2.39	80.97 ±2.41	**39.24 ^{c} ±1.05**
Animal protein	**92.43^{ab} ±0.36**	**30.77^{b} ±2.50**	79.97 ±0.50	81.32 ±1.34	80.91 ±1.12	**44.85 ^{b} ±1.05**

a, b, c……. Means of each column, within each item, bearing the same superscripts are not significantly different (P<0.05)

Table (5): Effect of type of commercial probiotics supplementation, period of growth and their interaction on live body weight and live body weight gain (Exp.1)

Main effect	Live body weight (g)				Live body weight gain (g)				
	7 day	21 day	35 day	49 day	7-21 GS	21-35 GG	35-49 GF	7-35 GT1	7-49 GT2
Sup1 (Z)	91 ±0.8	495 ±3.4	1145 ±9.0	1696 ±25.03	404 ±3.5	650 ±6.6	551 ±18.9	1054 ±8.6	1605 ±24.8
Sup2 (A)	90 ±0.1	495 ±5.6	1124 ±20.8	1784 ±55.7	405 ±5.7	629 ±17.3	660 ±42.9	1034 ±20.8	1694 ±55.7
St.	91 ±1.2	495 ±7.4	1151 ±16.2	1763 ±67.5	404 ±7.6	656 ±10.2	612 ±55.3	1060 ±15.9	1672 ±67.7
St-Gr	90 ±0.1	493 ±4.3	1112 ±19.2	1744 ±42.1	403 ±4.3	619 ±18.1	632 ±44.1	1022 ±19.1	1654 ±42.1
St-Gr-F	90 ±0.1	497 ±5.4	1141 ±22.3	1713 ±59.1	407 ±5.4	644 ±17.6	572 ±40.6	1051 ±22.3	1623 ±59.1
T1	93 ±2.4	**492^{ab} ±10.9**	**1145^{ab} ±30.2**	1696 ±69.8	**399^{b} ±2.7**	**653^{ab} ±21.2**	551 ±39.9	**1052^{ab} ±29**	1603 ±68.8
T2	90 ±0.03	**499^{ab} ±0.7**	**1148^{ab} ±5.6**	1719 ±30.1	**409^{ab} ±5.3**	**649^{ab} ±4.9**	571 ±28.3	**1058^{ab} ±5.6**	1629 ±30.1
T3	90 ±0.1	**495^{ab} ±2.6**	**1143^{ab} ±4.5**	1675 ±35.5	**405^{ab} ±3.5**	**648^{ab} ±6.6**	532 ±39.03	**1053^{ab} ±4.5**	1585 ±35.5
T4	90 0.1	**498^{ab} ±12.1**	**1158^{ab} ±19.1**	1831 ±115.4	**408^{ab} ±14.2**	**660^{ab} ±7.8**	673 ±99.6	**1068^{ab} ±9.1**	1741 ±115.5
T5	90 ±0.03	**487^{b} ±7.8**	**1076^{b} ±22.7**	1769 ±85.6	**397^{b} ±16.9**	**589^{b} ±26.6**	693 ±71.7	**986^{b} ±22.8**	1679 ±85.6
T6	90 ±0.03	**500^{ab} ±11.5**	**1140^{ab} ±49.8**	1750 ±121.5	**410^{ab} ±21.9**	**640^{ab} ±38.6**	610 ±71.8	**1050^{ab} ±49.8**	1660 ±121.6
T13	90 ±0.1	**511^{ab} ±13.8**	**1151^{ab} ±35.7**	1786 ±62.6	**421^{ab} ±13.8**	**640^{ab} ±26.4**	635 ±56.03	**1061^{ab} ±35.7**	1696 ±62.6
T14	90 ±0.1	**527^{a} ±9.6**	**1196^{a} ±7.4**	1846 ±21.9	**437^{a} ±9.5**	**669^{a} ±17.02**	650 ±17.6	**1106^{a} ±7.4**	1756 ±21.9

a, b, c…… Means of each column, bearing the same superscripts are not significantly different (P<0.05)
GS = gain during starter period
GG = gain during grower period
GF = gain during finisher period
GT1 = gain during 7-35 day
GT2 = gain during 7-49 day

Table (6): Effect of probiotic supplementation, period of growth and their interaction on feed intake (g) and feed conversion during different growth periods (Exp.1)

Main Effect	Feed Intake					Feed Conversion				
	7-21 FS	**21-35 FG**	**35-49 FF**	**7-35 FT1**	**7-49 FF1**	**7-21 FCS**	**21-35 FCG**	**35-49 FCF**	**7-35 FCT1**	**7-49 FCT2**
Sup1 (Z)	632 ± 3.6	1194 ± 14.1	1344 ± 24.8	1826 ± 13.1	3170 ± 33.9	1.56 ± 0.01	1.83 ± 0.02	2.44[a] ± 0.07	1.73 ± 0.01	1.98 ± 0.02
Sup2 (A)	646 ±10.2	1183 ±20.8	1405 ±48.9	1829 ±27.4	3234 ±72.8	1.60 ±0.01	1.88 ±0.02	2.13[b] ±0.10	1.77 ±0.01	1.91 ±0.03
St.	653 ±7.6	1197 ±20.1	1386 ±61.8	1849 ±26.3	3236 ±86.7	1.62 ±0.02	1.82 ±0.02	2.26 ±0.11	1.74 ±0.02	1.94 ±0.04
St-Gr	630 ±7.9	1156 ±19.5	1343 ±44.3	1785 ±17.3	3128 ±53.5	1.56 ±0.01	1.87 ±0.02	2.13 ±0.10	1.75 ±0.02	1.89 ±0.01
St-Gr-F	636 ±11.5	1213 ±20.1	1394 ±41.2	1848 ±26.0	3242 ±63.7	1.56 ±0.01	1.88 ±0.02	2.43 ±0.10	1.76 ±0.01	2.00 ±0.03
T1	644 ±2.7	**1164[bc] ±27.1**	1301 ±64.1	**1808[b] ±29.7**	**3109[bc] ±94.8**	1.61 ±0.04	**1.78[b] ±0.03**	**2.36[ab] ±0.10**	**1.72[ab] ±0.03**	**1.94[ab] ±0.10**
T2	631 ±5.3	**1184[bc] ±4.7**	1366 ±26.1	**1856[b] ±6.3**	**3181[bc] ±26.3**	1.54 ±0.01	**1.82[b] ±0.02**	**2.39[ab] ±0.10**	**1.75[b] ±0.01**	**1.95[ab] ±0.01**
T3	622 ±3.5	**1234[b] ±4.7**	1363 ±33.0	**1856[b] ±6.3**	**3219[bc] ±31.8**	1.54 ±0.01	**1.90[ab] ±0.02**	**2.56[a] ±0.10**	**1.76[ab] ±0.01**	**2.03[a] ±0.02**
T4	662 ±14.2	**1229[b] ±15.7**	1471 ±87.1	**1891[b] ±29.6**	**3362[bc] ±112.1**	1.62 ±0.02	**1.86[b] ±0.01**	**2.19[ab] ±0.10**	**1.77[ab] ±0.01**	**1.93[ab] ±0.10**
T5	628 ±16.9	**1127[c] ±26.9**	1320 ±92.8	**1755[b] ±11.2**	**3074[c] ±103.9**	1.58 ±0.01	**1.91[ab] ±0.04**	**1.90[b] ±0.10**	**1.78[ab] ±0.02**	**1.83[b] ±0.10**
T6	649 ±21.9	**1192[bc] ±39.6**	1425 ±80.6	**1840[b] ±57.3**	**3265[bc] ±137.1**	1.58 ±0.02	**1.86[b] ±0.04**	**2.34[ab] ±0.10**	**1.75[ab] ±0.02**	**1.97[ab] ±0.10**
T13	658 ±27.5	**1234[b] ±50.5**	1498 ±42.8	**1893[b] ±78.1**	**3390[b] ±94.8**	1.56 ±0.01	**1.93[ab] ±0.10**	**2.36[ab] ±0.10**	**1.78[ab] ±0.10**	**2.00[ab] ±0.02**
T14	677 ±39.8	**1352[a] ±5.5**	1675 ±26.01	**2029[a] ±45.3**	**3704[a] ±66.4**	1.55 ±0.10	**2.02[a] ±0.10**	**2.58[a] ±0.10**	**1.83[a] ±0.10**	**2.11[a] ±0.10**

a, b, c…… Means of each column, bearing the same superscripts are not significantly different (P<0.05)

FS= Feed intake during Starter period
FG= Feed intake during Grower period
FF= Feed intake during Finisher period
FT1= Feed intake Total (St-Gr) period
FT2= Feed intake Total (St-Gr-Fin) period

FCS= Feed Conversion during Starter period
FCG= Feed Conversion during Grower period
FCF= Feed Conversion during Finisher period
FCT1= Feed Conversion Total (St-Gr) period
FCT2= Feed Conversion Total (St-Gr-Fin) period

Table (7): Effect of the interaction between supplementation and period of growth compared with control on organoleptic properties of broilers meat (Exp.1)

Item	Taste	Color	Aroma	Texture	Overall Acceptability
T1	7.6	7.6	8.5	7.8	8.6
T2	6.5	6.8	7.8	8.6	7.8
T3	8.3	7.6	7.9	8.6	8.9
T4	8.3	7.8	7.6	8.0	7.9
T5	7.5	8.4	8.1	8.0	8.9
T6	7.8	8.0	8.4	8.9	8.6
T13	8.6	7.8	8.5	7.9	7.8
T14	7.8	7.5	7.8	6.9	6.2

Table (8): Effect of different treatments on economic efficiency (Exp.1)

Item	T1	T2	T3	T4	T5	T6	T13	T14
Fixed price/chick (PT)*	150	150	150	150	150	150	150	150
Feed consumption kg (st)	0.644	0.631	0.622	0.662	0.628	0.649	0.658	0.677
Feed consumption kg (gr)	1.164	1.184	1.234	1.229	1.127	1.192	1.234	1.352
Feed consumption kg (Fin)	1.301	1.366	1.363	1.471	1.320	1.425	1.498	1.675
Price of feed PT/kg (st)	129.98	129.98	129.98	125.48	125.48	125.48	122.98	136.56
Price of feed PT/kg (gr)	117.30	124.30	124.30	117.30	119.80	119.80	117.30	126.38
Price of feed PT/kg (Fin)	117.59	117.59	124.59	117.59	117.59	120.09	117.59	124.92
Total feed cost/chick (PT)	373.21	389.80	404.04	400.02	369.02	395.36	401.81	472.55
Total cost (PT)/chick	523.21	539.80	554.04	550.20	519.02	545.36	551.81	622.55
Average LBW(kg/bird)	1.695	1.719	1.675	1.831	1.769	1.750	1.786	1.846
Price/kg LW (PT)	550	550	550	550	550	550	550	550
Total revenue (PT)/chick	932.25	945.45	921.25	1007.05	972.95	962.50	982.30	1015.30
Net revenue (PT)/chick	409.05	405.65	367.21	456.85	453.93	417.14	430.49	392.75
Economic efficiency**	0.78	0.75	0.66	0.83	0.88	0.77	0.78	0.63
Relative E.EF% plant protein	100	96	85	106	113	99	100	80
Relative E.EF% Animal protein	124	119	105	132	140	122	123	100

*Bird price and rearing cost ** Net revenue per unit total cost

Table (9): Effect of treatments on nutrients digestibility and N-balance (%) (Exp.2)

Treatment	**At 21 day of age**					
	CP	CF	EE	NFE	OM	N-balance
Fish soluble	92.35 ±0.07	**36.46^{a} ±0.38**	**84.40^{a} ±1.14**	82.19 ±0.95	83.14 ±0.66	51.36 ±1.89
Hot pepper	92.75 ±1.32	**34.44^{a} ±2.83**	**80.70^{b} ±0.37**	82.96 ±0.71	82.64 ±0.76	57.97 ±2.54
Plant protein	92.50 ±0.85	**38.19^{a} ±0.55**	**80.33^{b} ±0.24**	81.32 ±0.67	81.51 ±0.85	57.06 ±2.52
Animal protein	91.51 ±0.78	**27.93^{b} ±2.41**	**79.25^{b} ±1.40**	80.81 ±0.78	80.82 ±0.78	57.14 ±0.70
	At 35 day of age					
	CP	CF	EE	NFE	OM	N-balance
Fish soluble	94.68 ±0.40	**30.36^{b} ±0.12**	79.48 ±1.49	83.20 ±0.77	82.92 ±0.44	59.21 ±2.13
Hot pepper	93.46 ±0.29	**28.48^{b} ±0.10**	78.91 ±2.37	81.16 ±0.09	80.78 ±0.36	55.62 ±2.62
Plant protein	94.42 ±0.49	**30.40^{b} ±1.60**	82.89 ±1.06	81.61 ±2.11	81.90 ±1.55	55.67 ±2.61
Animal protein	93.40 ±0.38	**33.50^{a} ±2.12**	83.46 ±0.22	83.52 ±0.41	82.30 ±0.40	61.43 ±0.44
	At 49 day of age					
	CP	CF	EE	NFE	OM	N-balance
Fish soluble	93.60 ±0.78	**31.04^{b} ±0.57**	80.96 ±0.07	82.66 ±1.53	82.68 ±1.65	**56.70 ^{a} ±5.23**
Hot pepper	94.95 ±0.46	**36.56^{a} ±0.13**	80.33 ±0.59	83.87 ±0.80	83.60 ±0.80	**59.33 ^{a} ±0.11**
Plant protein	92.04 ±0.89	**30.83^{b} ±0.52**	81.06 ±2.80	82.27 ±2.39	80.97 ±2.41	**39.24 ^{b} ±1.05**
Animal protein	92.43 ±0.36	**30.77^{b} ±2.50**	79.97 ±0.50	81.32 ±1.34	80.91 ±1.12	**44.85 ^{b} ±0.74**

a, b, c…… Means of each column, within each item, bearing the same superscripts are not significantly different (P<0.05)

Table (10): Effect of type of natural growth promoters supplementation, period of growth and their interaction on live body weight and live body weight gain (Exp.2)

Main effect	Live body weight				Live body weight gain				
	7 day	21 day	35 day	49 day	7-21 GS	21-35 GG	35-49 GF	7-35 GT1	7-49 GT2
Sup1 Fish soluble	90 ±0.03	495 ±6.7	1106 ±16.1	1687 ±42.8	405 ±6.6	611 ±10.9	581 ±31.2	1016 ±16.1	1597 ±42.8
Sup2 Hot pepper	90 ±0.02	502 ±6.1	1141 ±13.1	1710 ±33.8	412 ±6.1	639 ±11.1	569 ±22.7	1051 ±13.1	1620 ±33.8
St.	90 ±0.03	496 ±5.7	1125 ±20.6	1698 ±59.4	406 ±5.7	629 ±17.1	573 ±42.1	1035 ±20.6	1608 ±59.3
St-Gr	90 ±0.02	498 ±11.1	1132 ±22.2	1739 ±41.2	408 ±11.1	634 ±14.2	607 ±28.8	1042 ±22.2	1649 ±41.2
St-Gr-F	90 ±0.04	501 ±6.7	1114 ±16.6	1658 ±36.8	411 ±6.7	613 ±12.4	544 ±24.8	1024 ±16.6	1568 ±36.8
T7	90 ±0.1	**494^{b} ±10.6**	**1092^{b} ±27.6**	1639 ±109.6	**404^{b} ±10.6**	**598^{b} ±20.4**	547 ±82.6	**1002^{b} ±27.5**	1549 ±109.5
T8	90 ±0.03	**495^{ab} ±20.0**	**1112^{ab} ±39.7**	1657 ±69.1	**405^{ab} ±19.9**	**617^{ab} ±20.1**	545 ±30.6	**1022^{ab} ±39.7**	1567 ±69.1
T9	89 ±0.1	**495^{ab} ±4.9**	**1114^{ab} ±24.9**	1765 ±25.0	**406^{ab} ±4.9**	**619^{ab} ±22.1**	651 ±9.1	**1025^{ab} ±25.0**	1676 ±25.1
T10	90 ±0.03	**499^{ab} ±6.7**	**1159^{ab} ±15.7**	1758 ±46.1	**409^{ab} ±6.7**	**660^{ab} ±9.7**	599 ±37.3	**1069^{ab} ±15.6**	1668 ±46.0
T11	90 ±0.03	**502^{ab} ±14.5**	**1152^{ab} ±22.3**	1712 ±55.1	**412^{ab} ±14.6**	**650^{ab} ±18.4**	560 ±32.8	**1062^{ab} ±22.3**	1622 ±55.1
T12	90 ±0.1	**506^{ab} ±13.1**	**1114^{ab} ±27.4**	1659 ±78.5	**416^{ab} ±13.1**	**608^{ab} ±15.9**	545 ±54.7	**1024^{ab} ±27.4**	1569 ±78.5
T13	90 ±0.1	**511^{ab} ±13.8**	**1151^{ab} ±35.7**	1786 ±62.6	**421^{ab} ±13.8**	**640^{ab} ±26.4**	635 ±56.03	**1061^{ab} ±35.7**	1696 ±62.6
T14	90 ±0.1	**527^{a} ±9.6**	**1196^{a} ±7.4**	1846 ±21.9	**437^{a} ±9.5**	**669^{a} ±17.02**	650 ±17.6	**1106^{a} ±7.4**	1756 ±21.9

a, b, c…… Means of each column, bearing the same superscripts are not significantly different (P<0.05)

GS = gain during starter period

GG = gain during grower period

GF = gain during finisher period

GT1 = gain during 7-35 day

GT2 = gain during 7-49 day

Table (11): Effect of the interaction between natural growth promoters supplementation and period of growth on feed intake and feed conversion compared to controls (Exp.2)

Main Effect	Feed Intake					Feed Conversion				
	7-21 FS	21-35 FG	35-49 FF	7-35 FT1	7-49 FT2	7-21 FCS	21-35 FCG	35-49 FCF	7-35 FCT1	7-49 FCT2
Sup1 Fish soluble	637 ±6.5	1175 ±20.2	1348 ±40.1	1812 ±25.2	3161 ±57.8	1.57 ±0.01	1.92 ±0.01	2.32 ±0.1	1.78 ±0.01	1.98 ±0.03
Sup2 Hot pepper	639 ±8.5	1204 ±20.8	1393 ±29.1	1843 ±23.9	3236 ±49.3	1.55 ±0.01	1.88 ±0.02	2.45 ±0.05	1.75 ±0.02	2.00 ±0.02
St	634 ±8.9	1205 ±35.3	1402 ±56.4	1839 ±39.4	3241 ±86.7	1.56 ±0.02	1.92 ±0.02	2.45 ±0.1	1.78 ±0.02	2.02 ±0.05
St-Gr	635 ±11.4	1181 ±19.0	1381 ±25.2	1816 ±26.6	3197 ±48.1	1.56 ±0.02	1.86 ±0.1	2.28 ±0.1	1.74 ±0.02	1.94 ±0.01
St-Gr-F	646 ±7.0	1182 ±21.5	1329 ±42.2	1827 ±26.6	3157 ±64.5	1.57 ±0.01	1.93 ±0.01	2.44 ±0.1	1.78 ±0.01	2.01 ±0.01
T7	629 ±13.9	**1147 ^{c} ±44.5**	**1374^{bc} ±115.5**	**1776^{b} ±54.6**	**3150^{b} ±158.4**	1.56 ±0.01	**1.92^{ab} ±0.01**	2.51 ±0.4	**1.77^{ab} ±0.01**	**2.03^{ab} ±0.1**
T8	639 ±15.7	**1194^{bc} ±36.1**	**1289^{bc} ±38.5**	**1833^{b} ±51.8**	**3122^{b} ±84.8**	1.58 ±0.04	**1.94^{ab} ±0.02**	2.37 ±0.1	**1.79^{ab} ±0.03**	**1.99^{ab} ±0.02**
T9	643 ±4.1	**1186^{bc} ±31.7**	**1382^{c} ±42.2**	**1829^{b} ±31.1**	**3211^{b} ±73.4**	1.58 ±0.02	**1.92^{ab} ±0.02**	2.12 ±0.1	**1.78^{ab} ±0.01**	**1.92^{b} ±0.02**
T10	639 ±13.4	**1264^{ab} ±28.9**	**1430^{bc} ±42.8**	**1903^{ab} ±27.4**	**3333^{b} ±64.3**	1.56 ±0.04	**1.92^{ab} ±0.1**	2.39 ±0.1	**1.78^{ab} ±0.04**	**2.00^{ab} ±0.1**
T11	630 ±19.5	**1169^{bc} ±18.4**	**1380^{bc} ±41.3**	**1799^{b} ±25.1**	**3179^{b} ±63.6**	1.53 ±0.01	**1.80^{b} ±0.02**	2.46 ±0.1	**1.69^{b} ±0.02**	**1.96^{ab} ±0.02**
T12	649 ±15.0	**1178^{bc} ±35.8**	**1369^{bc} ±74.5**	**1827^{b} ±50.8**	**3196^{b} ±117.8**	1.56 ±0.02	**1.94^{ab} ±0.02**	2.51 ±0.1	**1.78^{ab} ±0.003**	**2.04^{ab} ±0.02**
T13	658 ±27.5	**1234^{bc} ±50.5**	**1498^{ab} ±42.3**	**1893^{ab} ±78.1**	**3390^{b} ±94.8**	1.56 ±0.01	**1.93^{ab} ±0.1**	2.36 ±0.1	**1.78^{ab} ±0.05**	**2.00^{ab} ±0.02**
T14	677 ±39.8	**1352^{a} ±5.5**	**1675^{a} ±26.01**	**2029^{a} ±45.3**	**3704^{a} ±66.4**	1.55 ±0.1	**2.02^{a} ±0.1**	2.58 ±0.1	**1.83^{a} ±0.1**	**2.11^{a} ±0.1**

a, b, c…… Means of each column, bearing the same superscripts are not significantly different ($P<0.05$)

FS= Feed intake during Starter period
FCS= Feed Conversion during Starter period
FCG= Feed Conversion during Grower period
FG= Feed intake during Grower period
FCF= Feed Conversion during Finisher period
FF= Feed intake during Finisher period
FCT1= Feed Conversion Total (St-Gr) period
FT1= Feed intake Total (St-Gr) period
FCT2= Feed Conversion Total (St-Gr-Fin) period
FT2= Feed intake Total (St-Gr-Fin) period

Table (12): Effect of supplementation and period of growth on organoleptic properties of broilers meat compared to control (Exp.2)

Treatment	Taste	Color	Aroma	Texture	Overall Acceptability
T7	8.5	8.8	8.4	8.9	8.6
T8	8.1	8.6	8.0	8.9	8.2
T9	7.3	7.8	8.0	7.8	8.1
T10	8.6	8.9	8.4	8.9	8.6
T11	8.9	9.0	8.9	9.0	8.8
T12	9.2	9.5	9.0	9.5	9.2
T13	8.6	7.8	8.5	7.9	7.8
T14	7.8	7.5	7.8	6.9	6.2

Table (13): Effect of different treatments on economic efficiency (Exp. 2)

Item	T7	T8	T9	T10	T11	T12	T13	T14
Fixed price/chick (PT)*	150	150	150	150	150	150	150	150
Feed consumption kg (st)	0.629	0.639	0.643	0.639	0.630	0.649	0.658	0.677
Feed consumption kg (gr)	1.147	1.194	1.186	1.264	1.169	1.178	1.234	1.352
Feed consumption kg (F)	1.374	1.289	1.382	1.430	1.380	1.369	1.498	1.675
Price of feed PT/kg (st)	123.7	123.7	123.7	127.2	127.2	127.2	122.98	136.56
Price of feed PT/kg (gr)	117.3	117.83	117.83	117.3	121.32	121.32	117.30	126.38
Price of feed PT/kg (Fin)	117.59	117.59	118.31	117.59	117.59	121.81	117.59	124.92
Total feed cost/chick (PT)	373.92	371.3	382.79	397.7	384.23	392.22	401.81	472.55
Total cost (PT)/chick	523.92	521.3	532.79	547.7	534.23	542.22	551.11	622.55
Average LBW(kg/bird)	1.639	1.657	1.765	1.758	1.712	1.659	1.786	1.846
Price/kg LW (PT)	550	550	550	550	550	550	550	550
Total revenue (PT)/chick	901.45	911.35	970.75	966.90	941.60	912.45	982.30	1015.30
Net revenue (PT)/chick	377.53	390.05	437.96	419.2	407.37	370.23	430.49	392.75
Economic efficiency**	0.72	0.75	0.82	0.77	0.76	0.68	0.78	0.63
Relative E.EF% plant protein	92.3	96.2	105	99	97	87	100	80
Relative E.EF% Animal protein	114	119	130	122	121	108	123	100

*Bird price and rearing cost ** Net revenue per unit total cost

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الملخص العربى

استجابة كتاكيت اللحم لبعض منشطات النمو العلفيه أثناء مراحل النمو المختلفة

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أستخدم في هذه الدراسة عدد 420 كتكوت أربور ايكرز غير مجنس عمر يوم فى تجربتين قسمت عشوائيا فى 14 معاملة بكل منها 30 طائر موزعة فى ثلاث مكررات بكل مكرر 10 كتاكيت. شملت الدراسة تجربتين: استخدم فى الاولى نوعين من المنشطات الحيوية التجارية هما أفى–باك، زيموفرمنت حيث أضيفت طبقا للمستوى المنصوص عليه الى العلائق فى مرحلة البادئ (7–21 يوم) أو مرحلتى البادئ والنامى (7–35 يوم) أو طوال فترة التجربة (7–49 يوم)، وفى التجربة الثانية استخدم نوعين من منشطات النمو الطبيعية هما مستخلص ذائبات السمك ، الفلفل الحار كل بمستوى 1 % حيث اضيفت الى العلائق خلال نفس المراحل السابقة

مع المقارنة بعليقتين احداهما تعتمد على البروتين النباتى والاخرى تحتوى على البروتين الحيوانى وكلاهما يخلو من الاضافات المستخدمة. غذيت الكتاكيت فى الاسبوع الاول على عليقة أساسية تحتوى 22.9 % بروتين خام، 3138 ك. كالورى طاقة ممثلة/كجم، ثم غذيت خلال فترة البادئ (7–21 يوم) على علائق متساوية فى محتواها من البروتين الخام (22 %) والطاقة الفسيولوجية (3000 ك.كالورى/كجم) وخلال فترة النامى (22–35 يوم) على علائق متساوية تحتوى (20% بروتين خام، 3000 ك.كالورى طاقة ممثله/كجم) وخلال فترة الناهى (36–49 يوم) على علائق تحتوى (18% بروتين خام، 3100 ك.كالورى طاقه ممثله/كجم).

أوضحت النتائج من الناحيتين الغذائية والاقتصادية أنه خلال فترتى البادئ والنامى (7–35 يوم) يمكن استخدام الفلفل الحار (منشط نمو طبيعى) أو أفى– باك (منشط حيوى تجارى) بينما طوال فترة النمو (7–49 يوم) يفضل استخدام مستخلص ذائبات السمك كمنشط طبيعى لنمو كتاكيت اللحم. وبالمقارنة يتضح تفوق منشطات النمو التجارية (أفى–باك، زيموفرمنت) عن الاخرى الطبيعية (مستخلص ذائبات السمك، الفلفل الحار).