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Evaluation of Some Natural Feed Additive in Growing Chicks Diets

I.M. Abaza, M.A. Shehata, M.S. Shoieb and I.I. Hassan
Department of Poultry Nutrition, Animal Production Research Institute, ARC., Dokki, Giza, Egypt

Abstract: This study was conducted to evaluate the effect adding of *Saccharomyces cerevisiae, Bacillus* s*ubtilis* and *Bacillus licheniform*, black seed oil versus, virginamycin and zinc bacitracin to growing chick's diets at level of 0.1%, for each. Growth performance, digestibility, carcass treats, meat composition, serum blood constituents and economical efficiency of growing chicks were studied. A total of 180 unsexed one-day old chicks, were divided into 6 treatments of 30 chicks each in three replicates. The experiment was terminated when chicks were 12 weeks of age. The results showed that, addition of black seed oil, *Saccharomyces cerevisiae* and *Bacillus subtilis* and *Bacillus licheniform* in the experimental diets increased body weight, body weight gain. Chicks fed diets supplemented with black seed oil and virginamycin were significantly lower in their feed consumption. While, Chicks fed diet supplemented with *saccharomyces cerevisiae* consumed the highest amount of feed. The best feed conversion ratio was recorded with chicks fed diets contained black seed oil or virginamycin. All the treatments insignificantly affected dressing, giblets percentages, composition of breast Meats and blood serum constituents as compared with those of the control. Chicks fed diets supplemented with either black seed oil, virginamycin or *Bacillus subtilis* and *Bacillus licheniform* had significantly decreased abdominal fat percentages. The Addition of *Saccharomyces cerevisiae*, black seed oil and *Bacillus subtilis* and *Bacillus licheniform* significantly improved digestibility coefficient of dray matter and crude protein. The best relative economical efficiency was recorded by black seed oil flowed by virginamycin addition. It was concluded that black seed oil, *Bacillus subtilis* and *Bacillus licheniform* and *Saccharomyces cerevisiae,* could serve in growing chicks diets. However, further research is required to better understand the role of natural feed additives in poultry nutrition and their implications in human health.

Key words: Probiotic, black seed, antibiotic, feed additives, poultry

Introduction

Probiotic and medicinal plants as natural feed additives are recently used in poultry diet to enhance the performance and the immune response of birds. The most common recent definition for probiotics is organisms (fungi or bacteria) which contribute to the intestinal microbial balance. Probiotics are microorganisms that are fed to animals to colonize the intestinal environment and promote a better flora balance (Fuller, 1989). Besides, these microorganisms are responsible for production of vitamin B complex and digestive enzymes and for stimulation of intestinal mucosal immunity, increasing protection against toxins produced by pathogenic microorganisms. Probiotics are bacteria or yeast in origin, could be fed either alone or in combination. Probiotics regulate microbial environment of the intestine, decrease the digestive disturbances, inhibit pathogenic intestinal microorganisms and improve feed conversion ratio (Dhingra, 1993). The addition of probiotic preparations in quail diets improved the feed conversion (Sellars, 1991). Many attempts have been undertaken to improve the growth rate and feed conversion ratio to reduce the cost of diets by addition of dietary supplementation such as probiotic (Sherif, 2000), and antibiotics (Abdel Azeem, 2002). Some investigators demonstrated that growth performance and nutrient digestibility of birds had improved by feeding diets containing active dried yeast (Bintvihok, 2001; Abd El Wahed *et al.,* 2003; Soliman *et al.,* 2003). The use of natural feed additives as substitute for antibiotics in poultry production has become an area of great interest (Kumar *et al*., 2003).

There is a general agreement that black seed contain 30-35% of oil that is rich in oleic and linoleic acids that are very essential to poultry (Ustun *et al*., 1990). Recently, the volatile oil of black seed is considered as antibacterial and anti-aflatoxigenic (Abou-Ayta *et al.*, 1993). Using black seed as a feed additive improves the performance, health and immunity without problems (Mohan *et al*., 1996). Moreover, (Ghazalah and Ibrahim, 1996) showed that the black seed oil is preferable as flavoring agents to the consumer and is the best from the economical stand point of view. There is currently a world trend to reduce the use of antibiotics in animal food due to the contamination of meat products with antibiotic residues (Menten, 2001), as well as the concern that some therapeutic treatments for human diseases might be jeopardized due to the appearance of resistant bacteria (Dale, 1992). Therefore, many scientists are searching alternatives to antibiotics for commercial use in animal nutrition (El Husseiny *et al*., 2002). The present study aimed to define the effect of adding probiotic as yeast (*Saccharomyces cerevisiae*), beneficial bacteria as *Bacillus subtilis* and *Bacillus licheniform* (*Bacillus S. & L*) and medicinal plants black seed oil versus, two antibiotics as virginamycin and zinc bacitracin in growing diets on performance, digestibility, carcass traits, breast meat composition, serum blood constituents and economical efficiency of growing chicks.

Materials and Methods

This study was conducted at the Poultry Research Center, Faculty of Agriculture, Damanhour, Alexandria University, Egypt. A total number of 180 unsexed one-day old local strain "El-Salam" chicks of nearly similar live body weight were wing-banded, weighed and randomly distributed into six treatments with three replicates (10 chicks of each) in wire batteries under similar managemental and hygienic conditions. The environmental temperature was about 32°C during the first week using gas heater and gradually decreased to about 24°C in the fourth week of age. Artificial lighting was maintained continuously during night without interruption. The basal and experimental diets were formulated to be isonitrogenous (19.56% CP) and iso-caloric (2860 kcal/kg diet). The experimental diets were supplied to meet the requirements of the Ministry of Agriculture Decree (1996). Corn-Soy experimental diets were used as a basal diet through the experimental periods (One day-12 weeks of age). The ingredients and chemical composition are shown in Table 1. Feed in a dry mash form and water were provided *ad-libitum* throughout the experimental period.

The dietary treatments were as follow:

Diet 1) Basal diet (Control).

Diet 2) Basal diet+0.1% *Saccharomyces cerevisiae*.

Diet 3) Basal diet+0.1% *Bacillus subtilis* and *Licheniform.*

Diet 4) Basal diet+0.1% black seed oil.

Diet 5) Basal diet+0.1% Virginamycin.

Diet 6) Basal diet+0.1% Zinc bacitracin.

The first group was used as control (fed without any additives), while the other five groups were fed the same control diet supplemented with probiotic as active yeast *Saccharomyces cerevisiae* {1000 million, Colony Forming Units (CFU)} presented in "Dinaferm"[a], beneficial bacteria as *Bacillus subtilis* and *licheniform* (*Bacillus S.* and *L*.) {4×10^{10} CFU } presented in "Biotop"[b] and medicinal plants as black seed oil versus, some antibiotics as Virginamycin[c] (each 100 g. product contain 20 g. V virginamycin) and Zinc bacitracin[c] (each 100 g. product contain 10 g. Zinc bacitracin) were obtained from local commercial supplier. For each group of chicks, individual body weight (BW) and feed consumption were recorded biweekly throughout the experimental periods.

Table 1: Composition and calculated analysis of the basal diet during the experimental period

Ingredients %	Basal diet
Yellow corn	64.00
Soybean meal (44% CP)	32.10
Calcium diphosphate	1.80
Limestone	1.40
Methionine	0.10
Salt (NaCl)	0.30
Vit. and mineral (premix)[1]	0.30
Total	100
Calculated analysis[2]	
Crude protein (%)	19.56
ME (Kcal/kg diet)	2860
C/P ratio	146.2
Crude fat (%)	2.69
Crude fiber (%)	3.65
Calcium (%)	1.03
Phosphorus available (%)	0.47
Methionine (%)	0.41
Methionine + Cysteine (%)	0.74
Lysine (%)	1.03
Arginine (%)	1.25

[1]Three kg of vitamin- mineral premix per ton of feed supplied each kg of diet with Vit. A 12000 IU; Vit. D_3 2000 IU; Vit. E. 10mg; Vit. k_3 2mg; Vit.B_1 1mg; Vit. $B_2$4mg; Vit. B_6 1.5 mg; Pantothenic acid 10mg; Vit.B_{12} 0.01mg; Folic acid 1mg; Niacin 20mg; Biotin 0.05mg; Choline chloride (50% choline) 500 mg; Zn 55mg; Fe 30mg; I 1mg; Se 0.1mg; Mn 55mg; ethoxyqain 3000 mg. [2]Calculated values were according to NRC (1994) text book values for feedstuffs. Total sulphur containing amino acids.

Then, gain of body weight (BWG) and feed conversion ratio (g feed/g gain), were calculated for the same periods. Performance index (Body weight gain (kg)/feed conversion) x 100 was also calculated according to North (1981). The digestibility values of nutrients of the experimental diets were determined at 12 weeks of age using three birds randomly from each treatment. Samples of diets and excreta were analyzed for their contents of nitrogen, ash, fiber and fat. Fecal nitrogen was determined according to the method of Jakobson *et al.* (1960). The proximate analyses of feed and dried excreta were carried out according to Official Methods (A.O.A.C., 1990). At the end of the experimental period (12 week's of age), three birds from each treatment were randomly chosen, weighed, slaughtered by slitting the jugular vein, then scaled and feather were removed. Weights of dressed carcass, giblets (liver, heart and gizzard) and abdominal fat were separately recorded for each bird and expressed as percentage of live body weight. The chemical composition of chicks meat breast was carried out according to Official Methods (A.O.A.C., 1990). Blood samples were collected from slaughtered birds. Serum was separated for determination of total protein, albumin and cholesterol which were calorimetrically determined using commercial kits, following the same steps as described by the manufacture. Economic evaluation for all the experimental diets was made. Economical efficiency is defined as the net revenue per unit feed cost calculated from input output analysis as described by Hassan *et al.* (1996).

Data were subjected to one-way analysis of variance applying SAS program (SAS, 1996) using general linear model GLM. Significant differences among treatment means were separated using Duncan's multiple range procedure (Duncan, 1955).

Results and Discussion

Live body weight and body weight gain: Data of body weight and body weight gain are shown in Tables 2 and 3. The initial live body weight of chicks at one-day old showed nearly similar values with no significant differences among treatment groups. Significant differences among treatments were found for body weight (BW) and body weight gain (BWG) through the experimental periods. This creates a suitable condition to appraise the effect of dietary treatments during the subsequent periods. With the progress of age to 4, 8 and 12 weeks of age, it was clear that using either black seed oil, *Saccharomyces cerevisiae* and *Bacillus S.* and *L.* in the experimental diets increased (BW) as compared with that of the control group at 12 weeks by about 3.02, 2.70 and 2.10%, respectively.

Similar trend was observed for (BWG) by feeding either black seed oil, *Saccharomyces cerevisiae* and *Bacillus S. & L* by about 3.01, 2.69 and 2.09% during the experimental period from one day to 12 weeks of age. However, BW and BWG of chicks fed the other supplementation antibiotics as virginamycin or zinc bacitracin were significantly decreased compared to the chicks fed natural additives as black seed oil, *Saccharomyces cerevisiae* and *Bacillus S.* and *L*., respectively. Moreover, the lowest value of (BW or BWG) was recorded with chicks in the control group. In connection, the positive effect of the black seed oil, *Saccharomyces cerevisiae* and *Bacillus S.* and *L.* compared with that of the virginamycin and zinc bacitracin groups and control group may be attributed to the biological function of medical plant components that have been essential for growth (Boulos, 1983; Bradley, 1992; Leung and Foster, 1996). Such improvement in both body weight and body weight gain may be due to the presence of a mixture of essential fatty acid including linoleic and linolenic acids presented in black seed oil, which are essential for growth (Murray *et al.,* 1991). These results are in harmony with the conclusion reported by Ghazalah and Ibrahim, 1996; Abd El-Latif *et al.*, 2002, who assumed that the improvement in (BW and BWG) may be due to improving protein utilization, absorption of nutrients and suppression of gram negative bacteria and Clostridium that cause growth depression. Osman and Mona (2002) indicated that using black seed oil as a biological feed additive enhanced the performance of broiler chicks. We agree with an earlier observation by Hooge *et al*. (2004), who mentioned that *Bacillus subtilis* spores as a direct feed significantly increased the broiler (BW). Ibrahim *et al*., 1998, reported that adding natural additives in broiler diets caused a significant increase in broiler performance. Santin *et al*. (2001) found that supplemented *Saccharomyces cerevisiae* cell walls to broiler chicken diets improved (BWG). Also, Khodary *et al*. (1996) proved the efficiency of herbal edible plants and some plant seeds as natural tonic, restoratives, anti-bacterial and anti-parasitic drugs in improving the productive performance in poultry. Onifade *et al*. (1999) reported that yeast *Saccharomyces cerevisiae* and antibiotics increased BW, BWG, above the control.

Feed consumption and feed conversion ratio: Results presented in Table 4, indicated that there were significant differences among treatments in feed consumption during the experimental periods. Chicks fed diets supplemented with black seed oil or virginamycin were significantly lower in their feed consumption as compared to the control group and the other treatments through all growing period. While, chicks fed diet supplemented with *Saccharomyces cerevisiae* consumed significantly the highest amount of feed without significant the control group as compared to the other treatments. No significant difference between groups fed diet supplemented with *Bacillus S.* and *L.*, zinc bacitracin and the control group during the experimental periods. Concerning feed conversion ratio in Table 5, it was clear that significant differences between treatments in feed conversion ratio during the experimental periods was seen. The best feed conversion ratio was recorded with chicks fed diets contained black seed oil or virginamycin compared with control group and other treatments through all growing period. There was no significant difference between groups fed diet supplemented with zinc bacitracin, *Bacillus S.* and *L*. and *Saccharomyces cerevisiae* during all the experimental periods. Regarding all feed additives used in the experiment significantly improved feed conversion ratio as compared to the control group. These results agreed with those of Onifade *et al.* (1999) who found that *Saccharomyces cerevisiae* and antibiotics increased feed intake and improved feed conversion above the control. El-Gendi *et al.*, 1994 revealed that the improvement in feed conversion with feeding herbal as feed additive could be attributed to improving the digestibility of dietary protein in the small gut. Ustun *et al.,* (1990) reported that black seed oil contains high amount of unsaturated fatty acids that is capable of inhibiting mold growth and aflatoxin production. Thus changes in the efficiency of feed utilization are mainly depending on the difference in feed intake followed by the differences in BWG caused by oil administration.

Table 2: Means and standard error (SE) for body weight (g) of growing chicks fed the experimental diets

	Body weight (g.)			
Treatments	One-day	4 wks	8 wks	12 wks
Control	35.71±0.84	401.84[c]±2.28	875.99[d]±4.63	1180.29[d]±2.78
Saccharomycs c.	36.82±0.80	412.82[a]±2.43	903.93[a]±3.06	1212.19[ab]±2.62
Bacillus S.&L.	36.57±0.77	411.89[ab]±2.42	897.62[ab]±3.06	1205.02[b]±2.68
Black seed oil	36.93±0.81	414.66[a]±0.81	906.33[a]±2.41	1215.98[a]±2.66
Virginimicyin	36.11±0.81	408.13[abc]±2.41	887.12[c]±2.99	1191.76[c]±2.69
Zinc bacitracin	36.21±0.80	405.06[bc]±3.08	888.49[bc]±2.99	1191.68[c]±2.69

[a,b,c,d]Means in the same column in each classification bearing different letters; differ significantly ($p < 0.05$).

Table 3: Means and standard error (SE) for body weight gain (g) of growing chicks fed the experimental diets

	Body weight gain (g)			
Treatments	0-4 wks	4-8 wks	8-12 wks	0-12 wks
Control	366.13[c]±2.01	474.15[c]±4.21	304.30±4.84	1144.58[d]±2.90
Saccharomycs c.	375.99[ab]±2.44	491.11[a]±3.14	308.26±3.95	1175.36[ab]±2.74
Bacillus S. & L.	375.33[ab]±2.25	485.73[ab]±3.56	307.39±4.48	1168.45[b]±2.77
Black seed oil	377.72[a]±2.12	491.68[a]±3.39	309.64±4.34	1179.05[a]±2.87
Virginimicyin	372.02[abc]±2.31	478.99[bc]±2.31	304.64±4.71	1155.65[c]±2.59
Zinc bacitracin	368.86[bc]±3.29	483.42[abc]±3.77	303.19±4.63	1155.47[c]±2.90

[a,b,c,d]Means in the same column in each classification bearing different letters; differ significantly ($p < 0.05$).

Table 4: Means and standard error (SE) for feed consumption of growing chicks fed the experimental diets

	Feed consumption (g/chick/period)			
Treatments	0-4 wks	4-8 wks	8-12 wks	0-12 wks
Control	906.08[a]±12.54	1323.37[a]±3.51	1746.09[b]±0.41	3975.55[ab]±9.47
Saccharomycs c.	903.32[a]±09.06	1325.16[a]±1.75	1750.61[a]±0.89	3979.09[a]±11.22
Bacillus S. and *L.*	891.05[a]±09.08	1309.19[b]±0.25	1733.21[c]±0.65	3933.45[ab]±8.78
Black seed oil	837.85[ab]±7.06	1258.69[d]±0.25	1674.79[f]±2.32	3771.33[c]±8.32
Virginimicyin	771.87[b]±65.48	1259.35[d]±2.29	1681.69[e]±0.25	3712.91[c]±63.46
Zinc bacitracin	884.89[a]±22.71	1289.49[c]±0.76	1709.60[d]±0.28	3883.99[b]±21.69

[a,b,c,d,e,f]Means in the same column in each classification bearing different letters; differ significantly ($p < 0.05$).

Such improvement may be attributed to the properties of these materials that could act not only as antibacterial, anti-protozoa and anti-fungal but also as antioxidants (Bradley, 1992; Leung and Foster, 1996). Abaza *et al*., (2003) reported that using black seeds at level of 0.25% in broiler diet improved feed conversion. Fritts *et al*. (2000) reported that inclusion of certain *Bacillus spp*. in poultry diets may improve live performance of broilers in the absence of antibiotics and may contribute to on-farm pathogen reduction. Hooge *et al*. (2004) reported that *Bacillus subtilis* spores as a direct-fed microbial improved broiler feed conversion ratio.

Performance index (PI): Results presented in Table 6, indicated that there were significant differences among treatments in PI during the different experimental periods. PI of chicks fed diet supplemented with black seed oil followed by virginamycin or *Bacillus S.* and *L*. were higher than those received the control diet and the other treatments. It may be attributed to the higher body weight gain and/or lower feed consumption. Similar results were found by Osman and Mona, 2002 who cleared that the addition of black seed oil into broiler chicks diet significantly improved the PI parameter also, El-Gendi *et al.*, (2000) indicated that feeding chicks on diet containing 0.5 kg/ton of Bio-tonic (included of black seed oil) as a feed additive improved the performance index value.

Digestibility coefficient of nutrients: Digestibility coefficient of nutrients of the experimental diets is presented in Table 7. Results indicated that supplementation of *Saccharomyces cerevisiae*, black seed oil and *Bacillus S.* and *L.* to growing diets significantly improved the digestibility coefficient of dry matter (DM) and crude protein (CP) as compared to verginamycin and zinc bacitrcin. The digestibility values of crude fiber (CF) and ether extract (EE) were numerically increased due to the supplementation of *Saccharomyces cerevisiae*, black seed oil and *Bacillus S.* and *L*. to the growing diets as compared to virginamycin, zinc bacitrcin. These results are in agreement with Abaza (2001) who found that mixture of two or three of medicinal plants improved the digestibility of nutrients compared to the control group, while, zinc bacitracin or virginamycin had no effect on the digestibility of nutrients compared to the control group. Abaza *et al*. (2006) reported that addition of feed additives as probiotic and black seed oil in layer diets insignificantly affected most digestibility coefficient parameters while, zinc bacitracin and amoxicillin

Table 5: Means and standard error (SE) for feed conversion of growing chicks fed the experimental diets

	Feed Conversion[1]			
Treatments	0-4 wks	4-8 wks	8-12 wks	0-12 wks
Control	2.48^{a}±0.05	2.79^{a}±0.02	5.74^{a}±0.04	3.47^{a}±0.01
Saccharomycs c.	2.40^{a}±0.02	2.70^{b}±0.01	5.68^{b}±0.02	3.39^{b}±0.01
Bacillus S.& L.	2.37^{a}±0.02	2.70^{b}±0.01	5.64^{b}±0.01	3.37^{b}±0.01
Black seed oil	2.22^{ab}±0.02	2.56^{d}±0.01	5.41^{d}±0.01	3.20^{c}±0.01
Virginimicyin	2.08^{b}±0.18	2.63^{c}±0.01	5.52^{c}±0.01	3.21^{c}±0.05
Zinc bacitracin	2.40^{a}±0.06	2.67^{bc}±0.02	5.64^{b}±0.02	3.36^{b}±0.02

[a,b,c,d]Means in the same column in each classification bearing different letter; differ significantly ($p < 0.05$). [1]Grams of feed per grams of body weight gain.

Table 6: Means and standard error (SE) for performance index (PI) of growing chicks fed the experimental diets

	Performance Index (PI)			
Treatments	0-4 wks	4-8 wks	8-12 wks	0-12 wks
Control	14.81^{b}±0.33	16.99^{d}± 0.22	4.73^{d}± 0.03	31.36^{e}±0.09
Saccharomycs c.	14.88^{b}±0.11	17.49^{c}±0.08	4.77^{d}± 0.03	31.97^{de}± 0.06
Bacillus S. & L.	15.82^{ab}±0.16	18.03^{b}±0.03	4.89^{bc}±0.01	33.04^{c}±0.09
Black seed oil	16.48^{ab}±0.67	19.21^{a}± 0.01	5.11^{a}± 0.03	34.99^{a}±0.06
Virginimicyin	18.24^{a}±1.74	18.21^{b}± 0.12	4.93^{b}± 0.01	34.14^{b}±0.55
Zinc bacitracin	15.39^{b}±0.48	18.13^{b}±0.27	4.82^{cd}±0.04	32.70^{cd}±0.19

[a,b,c,d,e]Means within columns having different superscripts are significantly different at ($P \leq 0.05$)

Table 7: Digestibility coefficient of nutrients of growing chicks fed the experimental diets

Treatments	Dry matter (DM)	Crude protein (CP)	Crude fiber (CF)	Ether extract (EE)
Control	80.86^{ab}±0.86	89.89^{b}±0.86	22.98^{ab}±0.86	75.51^{ab}±3.54
Saccharomycs c.	82.74^{a}±0.87	92.76^{a}±0.87	23.25^{a}±0.86	78.03^{a}±0.87
Bacillus S.& L.	82.03^{a}±0.86	90.83^{ab}±0.87	22.39^{ab}±0.86	74.02^{ab}±0.85
Black seed oil	82.39^{a}±0.87	91.79^{ab}±0.86	22.84^{ab}±0.85	76.17^{ab}±0.86
Virginimicyin	78.68^{bc}±0.86	88.96^{bc}±0.87	20.12^{b}±0.87	73.87^{ab}±0.86
Zinc bacitracin	76.66^{c}±0.50	86.47^{c}±0.86	21.55^{ab}±0.86	72.14^{b}±0.87

[a,b,c]Means in the same column in each classification bearing different letters; differ significantly ($p < 0.05$).

decreased significantly the digestion coefficients of (DM) and (CP) as compared to the control group.

Slaughter data and breast meat analysis: Results shown in Table 8 indicated that the all treatments had no affect on dressing and giblets percentages as compared with those of the control. Chicks fed diets supplemented with either black seed oil, viriginamycin and *Bacillus S.* and *L.* had significantly decreased abdominal fat percentages as compared to the control group and the other treatments. This result agreed with that found by Osman and Mona (2002) who indicated that using black seed oil as a biological feed additive had no adverse effect on carcass of broiler chicks.

Results of breast meat analysis as shown in Table 9 indicated that moisture, protein, fat and ash percentages were not significantly influenced by feed additives supplementation in all the experimental diets. This result agree with that found by Santoso *et al*. (1995) who cleared that body composition of moisture, fat, protein and ash contents of broiler chicks were not influenced by the *Bacillus* subtilis culture supplemented commercial diets at 10 or 20 g/kg diet.

Table 8: Means and standard error (SE) for carcass traits of growing chicks fed the experimental diets

	Carcass traits		
Treatments	Dressing%	Giblets%	Abdominal fat%
Control	66.56±3.66	5.62±0.31	0.10^{a}±0.01
Saccharomycs c.	68.85±7.73	5.80±0.32	0.09^{ab}±0.01
Bacillus S.& L.	68.38±5.71	5.78±0.31	0.09^{bc} ±0.01
Black seed oil	69.87±7.84	5.88±0.29	0.07^{c}±0.01
Virginimicyin	67.20±2.92	5.68±0.31	0.07^{c}±0.01
Zinc bacitracin	67.89±3.90	5.67±0.31	0.09^{ab}±0.01

[a,b,c]Means within column having different superscripts are significantly different at ($P \leq 0.05$).

Blood serum constituents: Results of blood serum constituents as shown in Table 10 indicated that feed additives supplementation in all the experimental diets had no significant on serum total protein, albumin,globulin and cholesterol. This result agreed with that found by Osman and Mona (2002) who founded that using black seed oil had no adverse effect on blood constituents of broiler chicks. Abaza *et al*. (2006) found that addition of probiotic and black seed oil to laying hen diets had no significantly effect on total protein, albumin, globulin and cholesterol as compared to the control group. We disagree with those of Zeweil *et al*., (1993); Abdel Azeem *et al*., (2001) used Japanese quail and Tollba *et al*. (2004) used broiler chicks, who reported a

Table 9: Average chemical composition of breast Meats of growing chicks fed the experimental diets

Treatments	Moisture %	Protein %	Fat %	Ash %
Control	70.12±3.43	20.88±0.87	2.49±0.12	1.27±0.06
Saccharomycs c.	70.56±3.45	21.56±0.87	2.55±0.86	1.23±0.05
Bacillus S. and L.	71.04±3.48	21.09±0.87	2.42±0.11	1.31±0.06
Black seed oil	70.63±3.05	21.33±0.86	2.49±0.12	1.24±0.10
Virginimicyin	69.79±3.42	20.67±0.87	2.53±0.15	1.29±0.06
Zinc bacitracin	69.54±3.43	20.10±0.87	2.36±0.11	1.21±0.06

Table 10: Some blood constituents of growing chicks fed the experimental diets

Treatments	Total protein (mg/100 ml)	Albumin (mg/100 ml)	Globulin (mg/100 ml)	Cholesterol (mg/100ml)
Control	4.30±0.65	2.31±0.10	1.99±0.55	87.58±4.79
Saccharomycs c.	5.39±0.28	2.83 ±0.12	2.57±0.40	84.50±3.65
Bacillus S. and L.	4.46±0.75	2.32±0.10	2.14±0.65	85.60±7.14
Black seed oil	4.69±0.24	2.39±0.20	2.30 ±0.45	84.58±4.63
Virginimicyin	4.52±0.38	2.56±0.14	1.96±0.52	83.50±3.63
Zinc bacitracin	4.13±0.14	2.44±0.27	1.69±0.41	85.39±4.67

Table 11: Input/output analysis and Economical efficiency of growing chicks fed the Experimental diets

	Diets					
Item	Control	*Saccharomyces C.*	*Bacillus S.* and *L.*	Black seed oil	Virginimycyin	Zinc bacitracin
Feed cost (L.E)[1]	6.32	6.33	6.25	6.00	5.90	6.18
Selling revenue (L.E)[2]	13.73	14.10	14.02	14.15	13.87	13.87
Net revenue (L.E)[3]	7.41	7.77	7.77	8.15	7.97	7.69
E.E[4]	1.17	1.23	1.24	1.36	1.35	1.24
R.E.E %[5]	100	104.91	106.26	116.10	115.46	106.35

1 Feed cost = number of kg feed per bird X price of kg feed (1.59 L.E).
2 Selling revenue = body weight gain per bird X price of kg for live body weight chick (12 L.E).
3 Net revenue = difference between selling revenue and feed cost.
4 E.E (Economic efficiency) = net revenue/feed cost.
5 R.E.E (Relative economic efficiency), assuming control treatment = 100%

significant increases in the values of total protein and albumin as a result of feeding microbial probiotics.

Economical evaluation: Results of economic efficiency (E.E) for chicks fed experimental diets during the growth period (one day-2 weeks) are summarized in Table 11. There are considerable cost saving with using the inclusion of black seed oil, *Bacillus S.* and *L.*, *Saccharomyces cerevisiae*, virginamycin and zinc bacitracin as compared to the control group. Differences in relative economic efficiency showed that diet contained black seed oil and viriginiamycin had the best values (116.10 and 115.46%), respectively compared to the control diet. Also, zinc bacitracin followed by *Bacillus S.* and *L.* and *Saccharomyces cerevisiae* gave the better relative economic efficiency (106.35, 106.26 and 104.91%), respectively compared to the control diet. It could be recommended either to use natural feed additives as black seed oil, *Bacillus S.* and *L.* and *Saccharomyces cerevisiae* in growing chicks diets. This improvement could be due to improving the feed conversion or reducing the amount of feed required to produce body weight gain.

Conclusion: The results of this study indicated that feeding growing chicks on diets containing natural feed additives as black seed oil, *Bacillus S.* and *L.* and *Saccharomyces cerevisiae* improved chicks performance, digestibility and relative economic efficiency values and decreased abdominal fat compared to the control group. Further researches are needed to get better understanding of the effect of natural feed additives in poultry production and their beneficial impact on human health.

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[a]Dinafirm a product of Dinatec Inc. Co. P.O. Box 226 U.S.A.
[b]Biotop a product of Shin – IL. Chemical & Livestock Co. Korea
[c]Virginamycin and Zinc bacitracin a products of Amon Co., Adwia Co., Egypt.