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Effect of using *spirulina platensis* and/or *chlorella vulgaris* algae as feed additives 0n productive performance of broiler chicks.

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ABSTRACT

The present study was designed to evaluate the productive performance of commercial broiler chicks fed *Spirulina platensis* and *chlorella vulgaris* algae containing diets. Four hundred and twenty day-old unsexed Cobb broilers chicks were used in this experiment. Birds were legs-banded, individually weighed, and randomly distributed into seven equal experimental groups; with three replicates of 20 chicks each. The average initial body weights of the treatments groups were nearly similar without significant differences. Chicks were kept in floor pens and subjected to 23 h. lighting along the experimental period which extended to 6 weeks of age. The house temperature was maintained at about 34ºC during the first 3 days, 32ºC during next 4 days and thereafter, gradually decreased by 3ºC weekly down to 24ºC. Basal control diet was formulated to contain 3100 kcal ME/kg and 23.01% crude protein during the starting period (till 21 days of age) followed by 3200 kcal ME/kg and 20.05% crude protein during the finishing period (21-42 days of age). The basal control diet was supplemented with spirulina and/or chlorella powder at levels of (1 g spirulina), (2 g spirulina), (1 g chlorella), (2 g chlorella), (0.5 g spirulina + 0.5 g chlorella), and (1 g spirulina+1 g chlorella/kg of diet, respectively). The obtained results cleared that birds fed 2 g spirulina/kg diet achieved superior means of body weight, body weight gain, and feed conversion ratio compared to the control group and the other treatments.

INTRODUCTION

Modern food industry leads to an increase of cheaper, healthier and more convenient products. The use of natural ingredients, like polyunsaturated fatty acids (PUFA's) and antioxidant pigments, exhibiting high impact on functional properties is important to reduce chronic diseases incidence. The impact of natural substances introduced in the diet via "usual" foods is proved to be efficient at long term and do not present the drawbacks of traditional therapeutic actions based on medicines of short term impact. Microalgae are an enormous biological resource, representing one of the most promising sources for new products and applications (Pulz and Gross, 2004). They can be used to enhance the nutritional value of food and animal feed, due to their well balanced chemical composition. Moreover, they are cultivated as a source of highly valuable molecules such as polyunsaturated fatty acids, pigments, antioxidants, pharmaceuticals and other biologically active compounds. The application of microalgal biomass and/or metabolites is an interesting and innovative approach for the development of healthier food and feed products.

Cyanobacteria or blue-green algae are photoautotrophic microorganisms widely distributed in nature (Parada *et al*., 1998; Molnar *et al*., 2005).They are microscopic plants more closely akin to bacteria than to seaweed. Spirulina and Chlorella are the promising microalgae for poultry feeding

Spirulina is a natural food source used for centuries which is rich in protein, chlorophyll, and essential fatty acids, and high in vitamin A, and the B-vitamins. Spirulina contains a rich supply of iron, magnesium, and phosphorus, as well as calcium, potassium, sodium, vitamin C and E, RNA and DNA nucleic acids, and phycocyanin. Spirulina is the highest plant source of beta-carotene, vitamin B12 and gammalinolenic acid (GLA). It contains more beta-carotene than carrot sources and 250% more vitamin B12 than liver.

Chlorella is also an ancient natural food, with many of the same properties as Spirulina. It differs from Spirulina in that it contains a little less protein, a fraction of the beta-carotene, and more than double the amount of nucleic acid and chlorophyll. It has been reported that spirulina and chlorella improves growth performance of poultry where, Ross and Dominy (1990) reported that hens fed Spirulina-containing diets achieved superior productive performance to their control birds. Spirulina improves absorption of minerals, protect from diarrhea, and optimize nutrient digestion processes. Kaoud (2012) found that body weights, average daily weight gain, carcass yield percentage and feed conversion ratio were improved by the dietary inclusion of the Spirulina platensis as compared the control. Chlorella algae as feed additives have been reported to improve growth, feed utilization, lipid metabolism, body composition, stress responses, liver function and disease resistance (Nakagawa *et al* 1983, Nakagawa *et al* 1984; Nematipour *et al* 1988; Nematipour *et al* 1990)

The potential health benefits of Chlorella to improve the growth and productivity of birds by increasing the intestinal microbial population (Janczyk *et al*., 2009). It is well known that increased beneficial microflora concentration in the intestine of birds may help the host with better digestion and utilization of feed components. In addition, more beneficial bacterial communities in the intestinal tract are believed to positively affect host welfare, health, and productivity (Janczyk *et al*., 2009 and Janczyk *et al*., 2006).

The aim of this study was to investigate the effects of *Spirulina platensis* and/or *chlorella vulgaris* as a natural feed additive on productive performance of broiler chicks.

MATERIALS AND METHODS

Four hundred and twenty one-day-old unsexed Cobb broilers chicks were used in this experiment. Birds were leg-banded, individually weighed to the nearest gram, and randomly distributed into seven equal experimental groups; with three replicates of 20 chicks each. The average initial body weights of the treatments groups were nearly similar with no observed significant differences. Chicks were grown in floor pens and subjected to 23hrs lighting program along the experimental period which extended to 6 weeks of age. The house temperature was kept at about 34ºC during the first 3 days, 32ºC during next 4 days and thereafter, gradually decreased to reach about 24ºC. Basal control diet was formulated to contain 3100 kcal ME/kg and 23.01% crude protein during the starting period till 21 days of age followed by 3200kcal ME/kg and 20.05% crude protein during the finishing period till 42 days of age (Table 1). The basal control diet was supplemented with different levels of spirulina and/or chlorella powder as shown in Table 2. Mash feed and water were available *ad libitum* throughout the experimental period. All experimental groups were reared under similar managerial and hygienic conditions. The response of the chicks was assessed in terms of weekly body weights, feed intake, and feed conversion. At the end of the trial, 4 chicks from each group were sacrificed scalded, de-feathered, and carcasses were eviscerated. Data on dressing yields and weights of visceral organs, lymphoid organs and abdominal fat pad were collected. The heart, gizzard, liver and thymus were excised and weighed.

Table (1): Composition and calculated analysis of the basal control diet.

Ingredients	**Experimental diets**	
	Starter	**Grower**
Yellow corn	50.48	58.64
Soybean meal (44%)	32.55	30.80
Corn gluten meal (62%)	7.10	2.52
Soybean oil	6.00	4.88
Limestone	1.45	1.30
Dicalcium phosphate	1.69	1.16
Common Salt (NaCl)	0.30	0.30
*Vit. and Min. Premix	0.30	0.30
DL-Methionine	0.10	0.10
L. Lysine	0.03	0.0
Total	100	100
Calculated analysis**		
Crude protein (%)	23.01	20.05
ME (Kcal/Kg)	3100	3200
Ether extract (%)	2.40	2.50
Crude fiber (%)	3.50	3.50
Calcium (%)	1.03	0.90
Available phosphorus (%)	0.45	0.35
Methionine (%)	0.5	0.43
Lysine (%)	1.11	1.00

***Vit.& Min. mix:. each 3kg contains: vit. A, 12000000 IU; vit. D3, 2000000 IU; vit. E, 10 g; vit. K, 2.0 g; vit. B1, 1 g; vit. B2, 5 g; vit. B6, 1.5 g; vit. B12, 10 mg; folic acid, 1 g; biotin, 50 mg; pantothenic acid, 10 g; nicotinic acid, 30 g; choline chloride, 250 g; Mn, 60g; Fe 30, g; Zn, 50 g; Cu, 10g; I, 1 g; Co 100 mg; Se, 100 mg and anti-oxidant, 10 g, and complete to 3.0 kg by calcium carbonate**

**** Calculated according to NRC (1994).**

Table (2): Experimental treatments and feed additives.

Treatment	Additives
T1	control diet
T2	1 g spirulina/kg diet
T3	2 g spirulina/kg diet
T4	1 g chlorella/kg diet
T5	2 g chlorella/kg diet
T6	0.5 g spirulina+0.5 gm chlorella/kg diet
T7	1 g spirulina+1 gm chlorella/kg diet

The head, neck, and feet were removed, and the carcass weight was then determined, and the carcass yield percentage was calculated by dividing the carcass weight by the live BW of birds multiplied by 100. Statistical analyses were conducted using analysis of variance by SAS procedure (1996). Significance of differences between groups was determined using the Duncan's multiple range test (Duncan, 1955). Differences were considered significant at $P \leq 0.05$.

RESULTS

Effect of spirulina platensis and/ or chlorella on performance traits:

Body weight:

Performance data of broiler chicks as influenced by dietary spirulina and chlorella are illustrated in Table 3.

Initial body weights were not statistically differing among treatments groups. At the end of starter period, body weights of birds fed spirulina and chlorella diets significantly increased by 5.6, 10.4, 5.3, 5.5, 5.3 and 5.97% for experimental chicks groups 2 (1 g spirulina), 3 (2 g spirulina), 4 (1 g chlorella),5 (2 g chlorella) , 6 (0.5 g spirulina + 0.5 g chlorella), and 7 (1 g spirulina + 1 g chlorella), respectively compared to the control group. The same trend was observed at the end of experimental period (42 days of age). The best body weight value was recorded with birds fed 2 g spirulina/kg diet by 13.6% and the lowest body weight value was detected with group fed 1 g chlorella by 6% compared to the control group. Generally, body weight of group 3 fed (2 g spirulina/kg diet) surpassed the other experimental groups during all investigation periods. The results indicated that all treated groups were statistically equal except group 3 which consumed 2 g spirulina/kg diet compared to the control group.

Weight gain:

Body weight gain (Table 4) of broiler chicks fed different levels of dietary algae significantly ($P \leq 0.5$) increased as compared to that of the control group during starter, finisher and the entire length of the experimental periods, where birds of T3 showed significantly the highest body weight gain, while those fed 1 g chlorella /kg diet (T4) showed the lowest gain, but all chicks had almost significantly ($P<0.05$) higher gain than the control(Table 4). Group of chicks consumed 2 g spirulina gained more during the starter period (10.9%) followed by group fed 1 g spirulina + 1 g chlorella (6.3%) and the lowest weight gain value was noticed with group fed 1 g chlorella/kg diet

(5.5%) compared to the control.The same direction was noticed at the end of finishing period, where birds of T3 group significantly recorded the highest weight gain value (15.4%) while the lowest weight gain value was detected with birds of T4 (6.4%) compared to the control group. Generally, at the end of experimental period (6 weeks of age), the present results declared that weight gain responded positively with adding spirulina and/ or chlorella to the diet. The highest weight gain value was noticed in birds of T3 (13.8%) compared to the control group. While the birds of treatments T2, T4, T5, T6 and T7 were not statistically (P<0.05) different and had nearly some variations in the percentage increases in BW, being 7.2, 6.1, 6.9, 6.7 and 8.1% respectively compared to the control group.

Table (3) : Effect of dietary supplementation with spirulina and /or chlorella on body weight of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7	Sig.
Initial body weight	40.02±0.01	40.02±0.01	40.02± 0.01	40.03± 0.01	40.03± 0.01	40.02±0.01	40.02±0.01	NS
At 21 days of age	859.8±10.8 c 100%	907.7± 6.52 ^{b} 105.6%	949.3± 6.04 ^{a} 110.4%	905.0 ± 5.89 ^{b} 105.3%	907.1 ± 7.49 ^{b} 105.5%	905.5 ± 7.11 ^{b} 105.3%	911.1 ± 5.88 ^{b} 106%	***
At 42 days of age	2360.3±28.4 ^{c} 100%	2527.1±26.4^{b} 107.1%	2680.7±15.18^{a} 113.6%	2501.3±30.1 ^{b} 106%	2520.8 ± 8.5 ^{b} 106.8%	2515.8 ±15.6 ^{b} 106.6%	2548.8 ±16.7 ^{b} 108%	***

Means of each row followed by the same letter are not significantly different at P≤ 5%.

Table (4) : Effect of dietary supplementation with spirulina and /or chlorella on body weight gain of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7	Sig.
Starting period	819.8 ±10.8 ^{c} 100%	867.7 ±6.52 ^{b} 105.8%	909.3 ±6.0 ^{a} 110.9%	865.0 ±5.9 ^{b} 105.5%	867.1 ±7.5 ^{b} 105.8%	865.5 ±7.1 ^{b} 105.6%	871.1 ±5.9 ^{b} 106.3%	***
Finishing period	1500.6±22.4 ^{c} 100%	1619.5±20.3 ^{b} 107.9%	1731.3±12.8 ^{a} 115.4%	1596.3 ±25.1 ^{b} 106.4%	1613.8 ±4.7 ^{b} 107.5%	1610.3 ±11.1 ^{b} 107.3%	1637.8 ±11.0 ^{b} 109.1%	***
Total period	2320.3±28.4 ^{c} 100%	2487.1±26.4 ^{b} 107.2%	2640.7±15.2 ^{a} 113.8%	2461.3 ±30.1 ^{b} 106.1%	2480.8 ±8.5 ^{b} 106.9%	2475.8 ±15.6 ^{b} 106.7%	2508.8 ±16.7 ^{b} 108.1%	***

Means of each row followed by the same letter are not significantly different at P≤ 5%.

Feed intake and Feed conversion ratio:

The main effect of dietary spirulina and/ or chlorella levels on feed intake are shown in Table 5. During the starter, finisher and throughout the experimental periods, it can be noticed that feed intake was not statistically (P<0.05) affected by spirulina and/ or chlorella levels supplementation.

Concerning the feed conversion ratio (Table 6), dietary treatments improved feed conversion ratio compared to the birds fed control diet during starter, finisher and the whole experimental periods. At the end of starter period, birds of T3 (2g spirulina / kg diet) recorded the best feed conversion ratio followed by those of T2, T6 and T7, respectively compared to the control group. The same trend was observed at the end of finishing period, where birds of T3 diet (2 g spirulina/kg diet) showed better feed conversion ratio by 14.8% followed by birds of groups T2, T5, and T7, respectively. Generally during the whole experimental period (0 to 6 weeks), there were no significant differences among groups fed dietary spirulina and/or chlorella levels except T3 group (2 g spirulina /kg diet).

Mortality rate:

Table 7 demonstrated the effect of spirulina and/or chlorella on mortality rate of broiler chicks at different stages. Spirulina and/or chlorella supplementation did not affect mortality rate, where some mortality reported in the current experiment were related to accidental factors.

Table (5) : Effect of dietary supplementation with spirulina and /or chlorella on feed intake of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7	Sig.
Starting period	1022.6±3.9	985±4.6	999.2±9.1	1000.4±3.4	1005.3±3.5	989.9±3.4	994.8±4.1	NS
Finishing period	3466.7±10.9	3367±7.6	3396±1.5	3353.3±1.7	3358.3±20.9	3396.3±3.4	3413.3±2.9	NS
Total period	4489.2±10.2	4352.1±5.2	4395.2±10.5	4353.7±4.9	4363.6±20.3	4386.2±1.2	4408.1±3.4	NS

Means of each row followed by the same letter are not significantly different at P≤ 5%.

Table (6) : Effect of dietary supplementation with spirulina and /or chlorella on feed conversion ratio of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7	Sig.
Starting period	1.25 ±0.01 [a]	1.14 ±0.01 [b]	1.1 ±0.01 [c]	1.16 ±0.004 [b]	1.16 ±0.001 [b]	1.14 ±0.004 [b]	1.14 ±0.001 [b]	***
Finishing period	2.3 ±0.01 [a]	2.08 ±0.01 [b]	1.96 ±0.01 [c]	2.1 ±0.01 [b]	2.08 ±0.04 [b]	2.11 ±0.002 [b]	2.08 ±0.06 [b]	***
Total period	1.94 ±0.01 [a]	1.75 ±0.01 [b]	1.66 ±0.01 [c]	1.77 ±0.01 [b]	1.76 ±0.01 [b]	1.77 ±0.001 [b]	1.76 ±0.002 [b]	***

Means of each row followed by the same letter are not significantly different at P≤ 5%.

Table (7) : Effect of dietary supplementation with spirulina and /or chlorella on mortality ratio of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7
At 21 days of age		1	1	2		1	2
At 42 days of age	4	1	1	1	2	1	1
Total mortality	4	2	2	3	2	2	3
Mortality %	6.7	3.3	3.3	5	3.3	3.3	5

Some mortality reported in this experiment was due to accidental factors and not to treatment.

Effect of spirulina and/or chlorella on carcass traits:

Results of slaughter test of birds fed spirulina and/or chlorella are summarized in Table 8. Statistical analysis revealed significant differences in carcass percentage, front parts, edible parts and abdominal fat percentages.

It can be noticed that diet containing 2 g spirulina/kg diet (T3) improved carcass percentage by (4.9%), front part (6.4%),and edible parts (4.4%) compared to the control group. The birds of T3, T7, and T2 diets had low levels of abdominal fat percentage compared with the control group. There were no significance differences among groups in hind parts, liver, gizzard, heart and giblets.

Economic efficiency:

Data for economic evaluation of using spirulina and / or chlorella in broiler diets are shown in Table 9. The best records can be noticed with birds fed spirulina levels. The highest level of spirulina 2g / kg diet (T3) surpassed the other experimental groups which increased by (16.6%) followed by T2 (1 g spirulina /kg diet) (12.5%) compared to the control group. The chlorella treatments also increased the economical evaluation record but less than spirulina treatments, where group fed 1 g chlorella increase the record by (10.6 %) and group fed 2 g chlorella (T5) by (6.5 %) .The combination between spirulina and chlorella also increase the economical evaluation record but less than spirulina groups, where group consumed (0.5 g spirulina + 0.5 g chlorella) increased by (10.3 %) and group fed (1 g spirulina + 1 g chlorella) by (6.7 %). In conclusion, it is recommended that the level of 2 g spirulina /kg diet could be added to broiler diet to obtain maximum economic efficiency.

Table (8) : Effect of dietary supplementation with spirulina and/or chlorella on carcass traits of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7	Sig.
Pre-slaughter weight (g)	2250 g	2500 g	2550 g	2475 g	2500g	2490 g	2520 g	---
Carcass %	61.3 ± 0.26 [b]	62.4 ±0.69 [ab]	64.3 ± 0.68 [a]	61.3 ± 0.41 [b]	63.2 ± 0.69 [ab]	61.3 ±0.64 [b]	63.2 ± 0.69 [ab]	**
Front part %	36.0 ±0.26 [b]	37.8 ±0.35 [a]	38.3 ± 0.23 [a]	36.97 ±0.35 [ab]	38.0 ±0.46 [a]	36.95 ±0.46 [ab]	38.1 ±0.69 [a]	**
Hind part %	28.7 ±0.26	29.4 ± 0.35	29.7 ± 0.23	28.9 ± 0.35	29.6 ±0.46	28.8 ±0.42	29.6 ±0.34	NS
Liver %	2.36 ±0.02	2.42 ± 0.02	2.27 ± 0.02	2.34 ± 0.02	2.41 ±0.02	2.36 ±0.02	2.33 ±0.02	NS
Gizzard %	2.44 ±0.02	2.45 ± 0.02	2.38 ±0.02	2.42 ±0.02	2.5 ±0.02	2.45 ±0.02	2.4 ±0.02	NS
Heart %	0.57 ±0.02	0.6 ± 0.02	0.6 ± 0.02	0.57 ±0.02	0.6 ±0.02	0.57 ±0.02	0.59 ±0.02	NS
Giblets %	5.37 ±0.08	5.47 ± 0.06	5.25 ± 0.07	5.33 ± 0.07	5.52 ±0.07	5.38 ±0.06	5.33 ±0.07	NS
Edible organs %	66.7 ±0.18 [b]	67.87 ± 0.76 [ab]	69.6 ± 0.75 [a]	66.7 ± 0.49 [b]	68.7 ±.076 [ab]	66.7 ±0.71 [b]	68.5 ±0.76 [ab]	**
Abdominal fat %	2.89 ±0.03 [a]	2.53 ±0.02 [c]	2.22 ±0.02 [d]	2.7 ± 0.023 [b]	2.68 ±0.02 [b]	2.75 ±0.02 [b]	2.45 ±0.02 [c]	***

Means of each row followed by the same letter are not significantly different at P≤ 5%.

Table (9) : Effect of dietary supplementation with spirulina and /or chlorella on Economical efficiency of broiler chicks

	T1 Control	TR2	TR3	TR4	TR5	TR6	TR7
Average feed intake	4489.2	4352.1	4395.2	4353.7	4363.6	4386.2	4408.1
Total feed cost*	15.26	15.23	15.82	15.24	15.71	15.35	15.87
Average weight gain	2320.3	2487.1	2640.7	2461.3	2480.8	2475.8	2508.8
Price of weight gain**	37.13	39.79	42.25	39.38	39.69	39.61	40.14
Net revenue***	21.87	24.56	26.43	24.14	23.98	24.26	24.27
Economical efficiency	143.3	161.3	167.1	158.4	152.6	158.04	152.9
Relative E.E.	100 %	112.5 %	116.6 %	110.6 %	106.5 %	110.3 %	106.7 %

Feed cost/bird (L.E) =feed intake× Price of kg feed, plus the cost of spirulina additives to the diets and/or antibiotic for treated in water consumed.
Total revenue/bird (L.E) = Means of live b w (g) × Price of kg at time of experiment.

DISCUSSION

As previously mentioned the objective of the present study was to examine the influence of spirulina and / or chlorella on performance parameters and carcass traits of broiler chicks.

The effect of spirulina on performance parameters and carcass traits; from the results it could be noticed that the improvements in the body weight, body weight gain, and feed conversion ratio of birds were anticipated in the presence of spirulina. These results are in line with those found by Kaoud (2012), Mariey *et al.* (2012), Mariey *et al*. (2014), and Shanmugapriya *et al*.

(2015). The significant improvement in feed conversion ratio that was achieved by birds fed spirulina diets may due to, at least in part, an improvement in live body weight gain or the improvement of viability percentage. These results are confirmed by Kaoud (2012), Mariey *et al*. (2012) and Mariey *et al*. (2014), who reported that feed conversion ratio significantly improved by dietary inclusion of Spirulina platensis as compared to the control broilers. They also reported that *Spirulina platensis* supplementation significantly decreased mortality rate of broilers. In this regard Gružauskas *et al*. (2004) reported that spirulina improved absorption of minerals, protected from diarrhea, and optimized nutrient digestion processes. Feeding Spirulina containing diets may increase the lactobacillus population and enhance the absorbability of dietary vitamins (Tsuchihashi *et al*, 1987; Mariey *et al*., 2012). Also, the present results are supported by Belay (1993), Baojiang (1994), who reported that Spirulina is beneficial for intestinal flora. They concluded that availability of free amino acids often limits the growth of *Lactobacillus* and *Bifidobacterium*. Stimulating these beneficial bacteria reduces problems with the pathogenic bacteria (*E. coli and Candida albicans*).

Also, spirulina has been shown to enhance immune function, reproduction and growth of chickens as reported by Qureshi *et al*. (1994) and Khan *et al*. (2005). Feeding spirulina containing diets may increase the Lactobacillus population and enhance the absorbability of dietary vitamins (Mariey *et al*., 2012). Growth enhancement effect of spirulina may also attributed to its role as an antioxidant.

The antioxidant capacity of spirulina is well established with its high contents of different bioactive materials including phyto-pigments (Bhat and Madyastha (2000); Wang *et al*., 2007; Bermejo *et al*., 2008). Polyphenolic compounds are principal antioxidants in plants (Moure *et al*., 2001; Balasundram *et al*., 2006), which can exert such effects through the chelation of redox-active metals as well as the acceptance of electrons from reactive oxygen species (Khokhar and Apenten, 2003).

Concerning the effect of chlorella on performance parameters and carcass traits, the current results showed that body weight, weight gain, and feed conversion ratio were improved significantly with chlorella feeding groups these results are consistent with those reported by (Kang *et al*., 2013; Xu *et al*., 2014).

Chlorella is an important unicellular green micro alge that contains more than 60% protein including most of the essential amino acids and bioactive compounds such as Chlorella growth factor for humans and animals (Borowitzka., 1988 and Schubert, 1988). It also contains several micronutrients, fibers, polyunsaturated fatty acids, and a lot of natural pigments.

The improvement of feed conversion ratio in chlorella and prebiotic treated broilers could be related to better equilibrium in the intestinal flora (Bedford., 2000). Chlorella has a specific cell wall that contains mannan oligosaccharides, these compounds are found in lots of commercial prebiotic that called MOS prebiotic. These findings are in agreement with those of many previous studies which reported that broiler chickens fed a diet supplemented with prebiotic (mannan oligosaccharide) had a significant decrease in the feed conversion value in compare to control group (Benites *et al*., 2008). The effects of feeding diet containing prebiotic on the immune response are related to enhancement the equilibrium of intestinal flora. The direct effect might be the lymphatic tissue stimulation (Bedford, 2000). The intestinal flora is in close contact with immune system cells which prevent from disease and improve performance.

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تأثير استخدام طحالب سبيرولينا و كلوريللا كإضافات غذائية على الأداء الإنتاجي لكتاكيت التسمين

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اجريت هذه الدراسه لتقييم الاداء الانتاجي لكتاكيت التسمين عند تغذيتها على عليقه مضاف اليها مستويات مختلفه من مسحوق طحلب سبيرولينا وطحلب كلوريللا وخليط منهما واستخدم في هذه الدراسه عدد ٤٢٠ كتكوت تسمين تجاري عمر يوم وزعت عشوائيا الى سبعة مجموعات تحت كل مجموعه ثلاث مكررات بكل منها ٢٠ كتكوت تم تربيتها على الارض واستخدمت عليقه تجريبيه تحتوي على ٣١٠٠ كيلو كالوري طاقه ممثله و ٢٣.٠١% بروتين خام خلال فترة البادي (من عمر يوم حتى ٢١ يوم من العمر). واستخدمت في فترة الناهي (من عمر ٢٢يوم حتى ٤٢ يوم من العمر)عليقه تحتوي على ٣٢٠٠ كيلوكالوري طاقه ممثله و٢٠.٠٥ % بروتين خام.

غذيت احدى المجموعات على العليقه التجريبيه بدون اضافه (كنترول) وغذيت باقي المجموعات على العليقه التجريبيه مضاف اليها مسحوق طحلب سبيرولينا فقط بمستويات (١ و ٢ جرام سبيرولينا / كجم علف) او مسحوق طحلب كلوريللا فقط بمستويات (١ او ٢ جرام كلوريللا / كجم علف) او خليط منهما بمستويات (٠.٥ جم سبيرولينا + ٠.٥ جم كلوريللا / كجم علف او ١ جم سبيرولينا + ١ جم كلوريللا / كجم علف).

اهم النتائج يمكن تلخيصها كالتالي :

- وزن الجسم والزيادة في الوزن وكفاءة التحويل الغذائي كانت افضل معنويا في الكتاكيت التي تم تغذيتها على علائق تحتوي على ٢جم سبيرولينا / كجم علف مقارنة بالكنترول .
- كمية العلف المأكول لم تتأثر معنويا بالطحالب المضافه
- استخدام ٢جم سبيرولينا / كجم علف ادى الى تحسن وزن الذبيحه والاجزاء الاماميه والخلفيه والحوائج وايضا ادى الى انخفاض دهن البطن.
- تحسنت الكفاءه الاقتصاديه نتيجة استخدام الطحالب المضافه .
- لذلك ينصح باستخدام طحلب سبيرولينا بمستوى ٢ جم / كجم علف بأمان كأضافه غذائيه طبيعيه في علائق كتاكيت التسمين.