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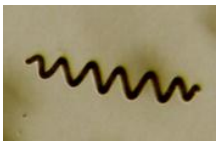
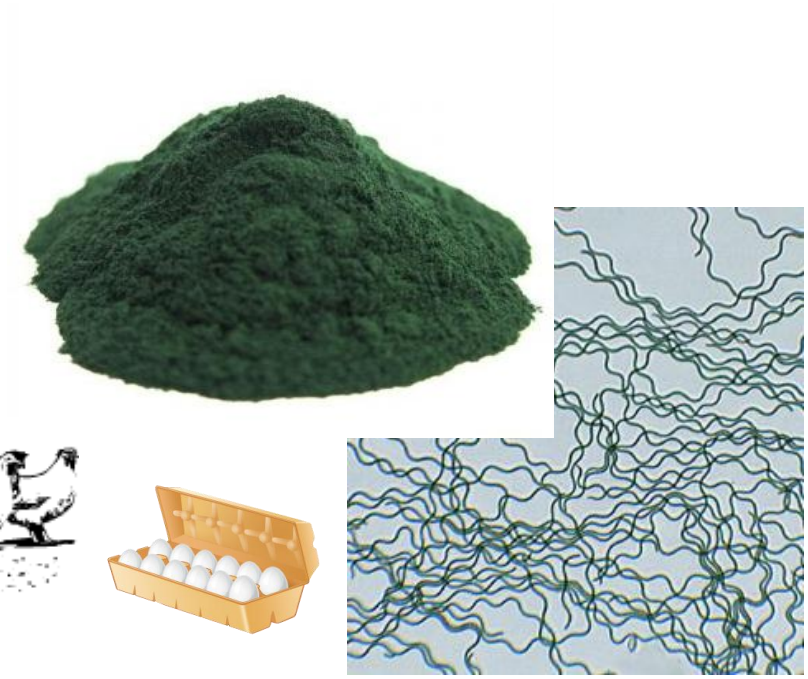
Spirulina micro-algae

The vegetarian source of protein, essential aminoacids,
GLA & omega fatty acids, pigments, vitamins and more



Profile for the poultry industry



Spirulina as a feed at short

Chicken & hens with reduced mortality,
stronger immunity system,
higher feed convertion ratio
more weight gain,
meat with more proteins
and reduced cholesterol,
coloured skin & meat.

More eggs,
higher daily egg mass,
higher fertility (hatchability),
yolk with less cholesterol
and more attractive color.

Extensible to:

- turkey
- ducks
- quail

Who is Spirulina ?

Spirulina is a micro-algae belonging to the group of the *Cyanophyta* or "blue-green algae". Those are the most "primitive" prokaryotic algae, without a nucleus and with rare (marvelous "rare" !) biochemical and nutritional characteristics.

Spirulina is a "big" micro-algae 200-1000 µm long, while most micro-algae are hardly 10-40 µm.

It grows in salty/alkaline waters and relatively high temperatures and solar radiation.

In Israel, it grows naturally in quiet stream waters, fish ponds and salty springs.

SPIRULINA - YES	SPIRULINA - NO
A vegetarian product (parve)	no GMO
60 % protein d-w	no phyto-estrogens
rich in essential aminoacids not available in other vegetables (methionine, leucine, etc.)	no cellulose ⇨ excellent digestibility
5 % crude lipids	no lignine ⇨ attractive palatability
probiotic rich in GLA, omega 3 and omega 6	no trypsin inhibitors
phosphorus : only 6-7 g/kg d-w, but all P fully absorbable	no Salmonella, no Shigella
rich in: • vitamines • betacarotene • phycocyanin, chlorophyll, zeaxanthin	no enterobacterias
• supplied as dry water-soluble powder or granules, non-perishable • can be supplied fresh wet or liquid if required • size: from 10 µm to 200 µm or pellets	no biocides

Egypt. Poult. Sci. Vol (32) (I): (201-215)

EFFECT OF USING SPIRULINA PLATENSIS ALGAE AS AFEED ADDITIVE FOR POULTRY DIETS: 1- PRODUCTIVE AND REPRODUCTIVE PERFORMANCES of LOCAL LAYING HENS.

By

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ABSTRACT: *The present study was designed to evaluate the productive and reproductive performance of two local strains of laying hens fed Spirulina platensis algae containing diets. An 2×4 factorial experiment was conducted, two local strains of laying hens [Sinai (S) and Gimmizah (G)] were fed on experimental diet containing 4 levels of Spirulina-powder (0, 0.10, 0.15 or 0.20%) from 28 to 52 weeks of age. A total number of 240 Sinai (S) and Gimmizah (G) pullets (120 of each strain) were randomly divided into four dietary treatments (3 replicates of 10 birds per treatment) and housed in floor pens were used. The basal diet was formulated to contain 2743 kcal/kg metabolizable energy and 16.4% crude protein. The obtained results can be summarizes as follows: Irrespective of hen strain, results showed that birds fed Spirulina-diets achieved superior significantly means of egg production rate, daily egg mass and feed conversion ratio to those of the control group. Analysis of variance also shows that birds fed Spirulina-diets laid significantly heavier eggs than those of control counterparts, regardless of type of hen strain. Feeding Spirulina-diets gave significant increases in egg yolk percentage and yolk color score compared with those of the control group. On the other hand, no significant differences were observed in percentages of egg shell and albumen or Haugh unit due to experimental diets. Also, there were significant ($P<0.05$) reduction in yolk cholesterol as the level of dietary Spirulina increased. The same response was observed for levels of plasma cholesterol. Data showed no significant differences among different dietary treatments in egg weight loss percentages or chicks weight at hatch, while the fertility and hatchability percentages of eggs produced by birds fed the Spirulina-containing diets were significantly superior compared to those of the control group. Panel test; using fresh or stored eggs, demonstrated that odor intensity, flavor and taste of normal egg (fresh or stored) were insignificantly affected by feeding the different dietary treatments. In the present study, regardless of the effect of dietary inclusion of Spirulina, Gimmizah hens consume significantly more feed than that of Sinai hens, while Sinai birds give significantly higher egg production performance compared with Gimmizah hens. Also, Sinai hens had significantly ($P<0.05$) a better value of feed conversion ratio than that of Gimmizah hens. In conclusion, taking the economical aspect into account, Spirulina algae could be safely used in laying hen diets with superior effects on their productive and reproductive performance*

LINK TO PAPER

A review by Belay-1996 quotes the following results on using Spirulina for poultry feeding:

Chicken	1.5-12% *Spirulina* in diet of male broiler chicks substitutes other protein source with good growth rate and feed efficiency	Ross & Dominy, 1990
	5-10% *Spirulina* in feed of growing chicken was found to be satisfactory to improve growth in chicken and laying hens	Blum & Calet, 1976, Yoshida & Hoshii, 1980; Becker & Venkataraman 1982; Brune, 1982; Nazareno et al., 1975
Quail	1.2-10% *Spirulina* in feed improved fertility, hatchability and egg production	Ross & Dominy, 1990
	0.2% *Spirulina* significantly reduced the death rate by as much as 20 times than that of control	Sakakibara & Hamada, 1994
Turkey poults	1000-10000 mg/kg-1 *Spirulina* showed significantly higher growth rate and lower mortality rate	MA Qureshi, personal communication
Poultry	Increase in yolk color due to carotenoid accumulation (from *Spirulina*) in layer and quail	Blum et al., 1976; Colas et al., 1979; Venkataram & Becker, 1982; Anderson et al., 1991; Ross & Dominy, 1990

Chicken	In vitro, treatment of macrophages with a water extract of *Spirulina* resulted in enhanced macrophage activation (phagocytosis)	Qureshi et al., 1994; 1995b
	In vivo feeding to K. strain Leghorns (up to 10000 mg kg^{-1}) showed larger thymi, higher natural killer cell (NK) activity and CBH response; Number of phagocytic macrophages increased and number of SRBC/phagocytic macrophage also greater in *Spirulina* fed group	Qureshi et al., 1994; 1995a
	Significantly higher bacterial clearing rates observed with *Spirulina* supplementation compared to control diet	Qureshi et al., 1995a
Turkey	Improved lymphoid organ development: splenic bursal and thymic weights were higher in the *Spirulina*-fed group	M.A. Qureshi, personal communication

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Another review by Habib et al. 2008, page 20 quotes two experiments on the effect of Spirulina on meat color:

In one experiment, fishmeal and groundnut cake in a commercial diet containing both protein sources was replaced on an isonitrogenous basis with dried Spirulina 140 and 170 g/kg (starter), and 120 and 128 g/kg (finisher) for broiler chicks. A vitamin and mineral supplement was not added to the algal diets because Spirulina is rich in these nutrients. A more intensely coloured meat was obtained in broilers fed on Spirulina containing diets..

In another experiment, the redness of meat of broiler chickens reaches maximum when fed 40 g Spirulina/kg diet, while the yellowness increases in a sub-linear fashion with increased Spirulina in the diet. The overall relationship between the yellowness and zeaxanthin content in the pectoralis muscle usually shows directly significant.Dietary Spirulina influences both the yellowness and redness of broiler flesh, and increments in yellowness with dietary Spirulina content may possibly be reflected in the common yellow pigment related to the accumulation of zeaxanthin within the flesh.

The Xanthophylls of Spirulina and Their Effect on Egg Yolk Pigmentation

1. DONALD W. ANDERSON3,
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1990

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Abstract

The carotenoid composition of the blue-green algae spirulina (*Spirulina platensis*) was determined using HPLC. Freeze-dried spirulina had a total xanthophyll concentration of 5,787 mg/kg.

Adult Japanese quail were fed a pigment-free basal diet for 4 wk.

Diets containing graded levels of freeze-dried spirulina between .25 and 4.0% were then fed for 21 days.

Yolk color was determined using the Roche color fan.

Spirulina at 1.0% of the diet provided optimum pigmentation in a diet otherwise free of xanthophylls.

Revista Cubana de Ciencia Agrícola, Tomo. 35, No. 2, 2001.

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Momento óptimo para la inclusión de spirulina en dietas para pollos de ceba

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Se utilizaron 1200 pollonas de engorde White Plymouth Rock x Cornish de un día de edad con el objetivo de determinar el momento apropiado de suministrar el pigmento (alga spirulina) para lograr, en el menor tiempo posible, la coloración de la piel y la grasa según las preferencias de los consumidores. Los animales se distribuyeron según diseño completamente aleatorizado con 8 tratamientos y 6 repeticiones. El tratamiento control consistió en el suministro del pienso con trigo, pero sin alga spirulina, desde que tenían un día hasta los 42 días de edad. En los 7 tratamientos restantes se utilizó el pienso con trigo y 1 % de alga spirulina en las etapas siguientes: 1 a 7, 7 a 14, 14 a 21, 21 a 28, 28 a 35, 35 a 42 y 1 a 42 días de edad. El tratamiento control sin spirulina, mostró una piel despigmentada con valor de 5 mientras que con 1 % del alga durante toda la crianza alcanzó el valor de 3. En los restantes seis tratamientos, la pigmentación alcanzó un valor de 3 después de consumir el pienso con 1 % de alga spirulina durante 7 días. La pigmentación desapareció progresivamente en 28 días después de detenerse el suministro del pienso con 1 % de spirulina. Este resultado demuestra la posibilidad de lograr al sacrificio, la pigmentación deseada en la piel y grasa abdominal con el uso del alga spirulina durante sólo 7 días en la última o penúltima semana de vida lo cual permite ahorrar entre 72 y 73 % del alga para la pigmentación que se consume durante toda la crianza.

The experiment concludes that the addition of just 1 % Spirulina to the diet of chicks during 7 days before marketing conspicously improved meat and skin color. LINK TO PAPER

International Journal of Poultry Science 8 (1): 75-79, 2009
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Effect of Spirulina on Toxic Signs, Body Weight and Hematological Parameters in Arsenic Induced Toxicities in Ducks

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Abstract: The present study, was undertaken for the effect of spirulina on toxic signs, body weight and hematological parameters in arsenic induced toxicities in ducks. One hundred and 75 ducklings were divided into 5 equal groups separately. One group (T_0) of ducklings was kept as control. One group (T_1) of ducklings were given arsenic trioxide @ 100 mg/L drinking water and rest three groups of ducklings (T_2, T_3 and T_4) were given arsenic trioxide @ 100 mg/L plus spirulina in three different doses i.e. 30, 60 and 120 mg/L in drinking water daily for 90 days starting from day 15. Five birds were sacrificed from each group in every 15 day intervals and toxic signs, body weight and hematological parameters were recorded. Ducks of T_1 group (only arsenic trioxide) showed depression, reduced feed intake, dullness and ruffled feathers which were in mild in nature in other groups i.e. arsenic plus spirulina. In arsenic treated groups (T_1) the not gained body weight was maximum (14.93%), whereas in arsenic plus spirulina treated groups (T_2, T_3 and T_4) the not gained body weight in ducks (4.08-11.26%) were better than only arsenic treated groups. Reduction of TEC, Hb and PCV values and rise of ESR values were significant ($P<0.01$) in T_1 (arsenic treated) groups. However, in arsenic plus spirulina treated rest groups reduction of TEC, Hb and PCV were less than arsenic treated groups. The present study reveals that spirulina may be helpful for reducing the body burden of arsenic in ducks.

LINK TO PAPER

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Energy values and chemical composition of spirulina (*Spirulina platensis*) evaluated with broilers[1]

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ABSTRACT - The objective of this study was to determine the chemical and energy composition of spirulina (*Spirulina platensis*), the nutrient metabolizability coefficients, and the values of apparent metabolizable energy (AME) and the apparent metabolizable energy corrected for nitrogen balance (AMEn) in broilers. A digestibility trial was carried out by using total excreta collection method, with 90 Cobb 500 lineage chicks, with initial weight of 256 ± 5 g at 11 days of age. Birds were allotted in metabolic cages for 10 days, distributed in a completely randomized design, with three treatments and six repetitions with five birds each. Diets consisted on a reference-ration based on corn and soybean meal and two test diets, one containing spirulina (30%) and the other one with soybean meal (30%). Spiruline was superior to soybean meal for contents of dry matter (DM), gross energy (9.60%), crude protein (26.56%), ether extract (54.45%), mineral matter (42.77%), calcium (100%) and total phosphorus (130.77%) and also for most amino acids, except lysine, glutamate, histidine and proline. Nevertheless, spiruline presented lower values of gross fiber (83.95%), acid detergent fiber (85.12%) and neutral detergent fiber (6.15). The AME and AMEn values (kcal/kg of DM) were, respectively, 2,906 and 2,502 for the spirulina and 2,646 and 2,340 for the soybean meal and AMEn of spirulina was 6.92% higher than soybean meal.

LINK TO PAPER

Enriquecimiento de dietas de pollos broilers (gallus domesticus) con spirulina (arthrospira platensis) para la determinación de sus propiedades

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Resumen

Se evaluó la Spirulina (Arthrospira platensis) enriqueciendo las dietas de pollos Broilers (Gallus domesticus) bajo tres tratamientos, utilizando como medio nutritivo la Spirulina (Arthrospira platensis) en diferentes porcentajes (T1=0.05%, T2=0.10%, T3=0.15%) vs un tratamiento control (T4= sin Spirulina).

A fin de determinar cual de los tratamientos brinda mejores resultados se determinó la Ganancia de peso, Valor nutritivo de la carne, y Pigmentación en el Pollo Broilers (Gallus domesticus).

Obteniéndose resultados favorables para la dieta T3 (enriquecida con Spirulina al 0.15%); como una mayor ganancia de peso, mejor conversión alimenticia, una pigmentación alta en piel como en patas, se observó también una carne con alto valor proteico y bajo contenido de grasa, por lo cual se considera un alimento altamente plástico y a la vez presentó un mayor contenido de hierro.

Estos resultados confirman que la Spirulina tiene propiedades funcionales que pueden ser utilizables en la industria aviaria.

Spirulina was added to the diet of broilers at 0.05%, 0.1 % and 0.15 %.

The control parameters were body weight gain, protein and fat content in meat, and skin pigmentation.

Addition of Spirulina at 0.15% gave the best results in all the three controlled parameters.