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Productive, Physiological and Economic Evaluation of Supplementing Fattening Rabbit Diets with *Spirulina platensis*

M.A. El-Sawy[1]; M.A. Ahmed[1]; A.M. Emam[1]; M.G. Gharib[1]; F.A. Noha[1]; A.M.H. Ahmed[2] and A.M.Tammam[2]

[1] Animal Production Research Institute, Agric. Res. Cent., Ministry of Agric., Giza, Egypt

[2] Poult. Prod. Dept. Fac. of Agric. Ain Shams Univ. Egypt

corresponding author: elsawy1966@gmail.com

ABSTRACT

This study examined the effectiveness of Spirulina platensis powder (SPP) levels during the fattening of weaned rabbits regarding growth, blood, and economic evaluation. Two hundred eight commercial V-line male rabbits, aged 7 weeks (with an average weight of 795.92±12.1 g), were randomly divided into four tested groups. Each group tested a specific additive level of SPP in feedstuff. The 1st group was served as a control group with zero level (G_0); the 2nd, 3rd and 4th groups were received 1, 2 and 4 g of SPP/kg of feedstuff (G_1, G_2 and G_3), respectively.

Results indicated that the SPP additive had positive impact compared to the control group. Both G_2 and G_3 significantly ($P \leq 0.05$) enhanced final body weight (2221.5 and 2208 g, respectively), feed conversion ratio (4.58 and 4.64, respectively), and performance index (48.50 and 47.60, respectively). Furthermore, G_2 excelled in body weight gain (BWG) and growth rate (GR) (41.20 and 184.99, respectively). Treatments with SPP improved biochemical and hematological parameters. Similarly, lipid profiles and kidney function were directly enhanced by SPP additives. Economically, the level of G_2 significantly increased ($P \leq 0.05$) net revenue (82.49) compared to the other groups.

Conclusively, it could be concluded that using 2 g SPP/kg diet as feed additive in fattening rabbits feedstuff can improve the growth performance and enhance feed utilization with highly net revenue.

Keywords: Additives, blood, economic, fattening, rabbits, *Spirulina platensis*.

INTRODUCTION

Algae play a crucial role as a nutritional supplement, improving feed efficiency and increasing benefits for farm animals. The biological characteristics and nutritional value of Spirulina, a form of filamentous cyanobacterium, give it a variety of special qualities and uses (Wu *et al.* 2016). The cells that make up a spiral are unbranched filaments that are 200–500 µm long and 5–10 µm wide. Spirulina contributes to carbon neutrality by capturing carbon dioxide, fixing atmospheric nitrogen, and improving environmental quality. Additionally, it can adsorb metal ions, thereby offering potential for environmental protection (Suwono and Suryoprabowo, 2025).

According to Frag *et al.* (2024), spirulina has a complex composition with a simple structure and high polynutrient value and phytopigments. It has essential components like protein (50–70% on DM basis) that contains all of the essential amino acids (Farag *et al.* 2016 and Dimopoulou *et al.* 2025), essential fatty acids, alpha-, gamma-, and linolenic amino acids (Mendes *et al.* 2003), photosynthetic pigments (Čmiková *et al.* 2025), vitamins like thiamine, nicotinamide, riboflavin, folic acid, pyridoxine, vitamins A, D, and E (Hoseini *et al.* 2013), and minerals like calcium, potassium, chromium, copper, manganese, iron, phosphorus, magnesium, sodium, zinc, and selenium (Babadzhanov *et al.* 2004). As a result, spirulina is in high demand worldwide and is regarded as a safe and healthful food as well as animal feed for medical purposes (Suwono and Suryoprabowo, 2025).

The antioxidant defense system of spirulina includes both non-enzymatic (carotenoids, tocopherols, ascorbic acid, glutathione, and chlorophyll derivatives) and enzymatic (superoxide dismutase, catalase, and glutathione peroxidase, peroxiredoxin, and ascorbate peroxidase) components that eliminate oxidants to shield cells from the damaging effects of stressors (Abd El-Baky *et al.* 2007). Additionally, it was observed that spirulina enhanced digestibility and palatability while lowering toxicity (Spínola *et al.* 2022). According to previous literatures, adding spirulina to the diet improved the animals' and poultry's economic efficiency, health, and reproductive and productive performance when compared to other chemical products (El-Shall *et al.* 2023).

Spirulina platensis powder (SPP) is a suitable dietary supplement. The most attention has been paid to the potential pharmacological properties of these microalgae, which may reduce blood cholesterol, scavenge free radicals, strengthen the immune system, lessen nephrotoxicity caused by toxic metals, and provide protection from harmful radiation (El-Far *et al.* 2022 and Sabat *et al.* 2025). Spirulina, recognized for its high protein content, contains β-carotene, vitamin B_{12}, and minerals, which are becoming increasingly important for vegetarians concerned about their diets (Russell *et al.* 2022 and Podgórska-Kryszczuk, 2024). It is known that spirulina serves as a significant source of vitamins, especially vitamin B_{12}, which is primarily found in animal-based diets (Altmann and Rosenau, 2022). According to Holman and Malau-Aduli, (2013), spirulina is an organic source of calcium and phosphorus (1200 and 13000 mg/kg, respectively) that can be incorporated into chicken and rabbit feed to promote healthy bone formation throughout life and enhance bone strength, thereby reducing carcass deterioration. Phytochemical screening of the ethanoic extract of *Spirulina platensis* identifies alkaloids, flavonoids, glycosides, tannins, phenolic compounds, steroids, and saponins (Ilieva *et al.* 2024).

In rabbits, adding *Spirulina platensis* to rabbit feedstuff enhances the hepatoprotective, immunostimulatory, antioxidative, and anti-inflammatory properties (Bashar *et al.* 2024). SPP may be used to prevent and treat a number of illnesses (Abd El-Hack *et al.* 2019), as well as to lower heat stress in rabbits by reducing inflammation and oxidative stress (Abdelnour *et al.* 2020). Additionally, it has been demonstrated that SPP enhances immunity and health, while lowering oxidative stress and inflammation brought on by heat stress (Abdel-Moneim *et al.* 2022).

Therefore, the purpose of current study was to assess the evaluation of *Spirulina platensis* affected the economic assessment of fattening rabbits, specific .blood parameters, and productive performance.

MATERIALS AND METHODS

Statement of Ethics:

The experimental design were acceptance (No. 5-2025-31) by the experimental care and research ethics committee of Ain Shams University, Agriculture sector committee, Egypt.

Housing and management:

The current study was conducted at a private rabbit farm in the Qalyubia Governorate, Egypt from December 2023 to February 2024. At 7 weeks of age, with an average weight of 795.92±12.1 g, 208 male developing V-line rabbits were randomly assigned to four equal treatments, each involving 52 rabbits, lasting for five weeks. The rabbits were housed in naturally ventilated facilities in galvanized wire batteries 60×55×40 cm. Water and feed were freely available in each cage, which was equipped with a stainless steel drinking nipple and feeders that allowed for the independent measurement of individual rabbit feed intake. During the experimental period, room temperatures ranged from 22 to 25°C, with relative humidity levels between 45 and 60%. Rabbits were housed under the same conditions. The rabbits were clinically free of internal and external parasites and healthy. Table 1 illustrates how the nutritional needs of the rabbits in this experiment were satisfied by the pellets produced according to NRC (1977).

***Spirulina platensis* dosages:**

Rabbits of G_0 (control), G_1, G_2, and G_3 were fed a diet containing 0, 1, 2, and 4 g of spirulina powder/kg diet, respectively for 35 days.

Fatting indicators:

Initial body weight (IBW), final body weight (FBW), and feed consumption (FC) were recorded. In the same concept, daily body weight gain (BWG), growth rate (GR), feed conversion ratio (FCR), and performance index (PI) were calculated.

Physiological responses:

At the end of the fattening period (12 weeks), samples of blood were collected from the ear vein into heparinized tubs, and then centrifuged at 3000 rpm for 10 minutes to examine the biochemical blood and hematological parameters. After centrifuging, the plasma was stored at ⁻20°C. Hematological parameters were evaluated immediately following whole blood collection, and biochemical analyses of albumin (Alb), total protein (TP), aspartate aminotransferase (AST) activity, and alanine aminotransferase (ALT) were conducted. The globulin (Glo) was calculated by using the differences between total protein (TP) and albumin (Alb). Also, total cholesterol (TC) and triglycerides (TG) and the renal functions of creatinine (Crea) and urea were assessed.

Table 1. The composition and calculated of the basal experimental diet

Ingredients	%
Whole barley grains	15.00
Yellow maize	6.22
Harsh wheat bran	23.33
Alfalfa hay	30.12
Soybean meal 44%	22.33
Premix[1]	0.30
Sodium chloride	0.50
Di-Calcium-phosphate	1.20
Limestone	1.00
Total	**100**
Calculated chemical analysis of basal diet	
Crude protein,%	17.4
Digestive energy, kcal/kg	2580
Ether extract %	2.59
Crude fiber %	13.20

The premix provided the following (per kg of diet): Vitamin A, 6000 IU; Vitamin D_3 , 900 IU; Vitamin E, 40 mg; Vitamin K_3, 2 mg; Vitamin B_1 , 2 mg; Vitamin B_2 , 4 mg; Vitamin B_6 , 2 mg; Pantothenic acid, 10 mg; Vitamin B_{12}, 0.01 mg; Niacin, 50 mg; Folic acid, 3 mg; Biotin, 0.05 mg; Choline, 250 mg; Fe, 50 mg; Mn, 85 mg; Cu, 5 mg; Co, 0.1 mg; Se, 0.1 mg; I, 0.2 mg and Zn, 50 mg.

Economic assessment:

In this study, the equations of economic assessment were used according to El-Speiy *et al.* (2015).

Statistical analysis:

Data were statistically analyzed using analysis of variance according to Snedecor and Cochran (1982) using the SAS software's general linear model approach was applied to analyze the rabbit data (SAS, 2001) as the following model

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where: Y_{ij} = The observation, μ = Overall mean, T_i = Treatments (1,….4) and e_{ij} = Experimental error, associated with i and j observations assumed to be randomly distributed.

Significant difference among means of treatment groups was detected by Duncan’s multiple range test procedures (Duncan, 1955). The differences were considered significant at ($P \leq 0.05$).

RESULTS AND DISCUSSION

Fattening records:

Using natural ingredients as growth-promoting and preventative feed supplements is a trend spreading in livestock production. Fatting indicators (FBW, BWG, FC, FCR, PI, and GR) were estimated under different levels of SPP (0, 1, 2, and 4 g/kg diet) are presented in Table 2. The *Spirulina platensis* as a nutrient additive enhanced the fattening indicators generally (*P≤0.05*) vs. the control group (0 level of SPP). The current results agreed with the previous results (Hanan *et al.* 2014, Khalifa *et al.* 2016, Martins *et al.* 2021, Alghonaim *et al.* 2022 and Lestingi *et al.* 2024) in different farm animal species. In this decade, several studies focused on evaluating *Spirulina platensis* as a feed additive in growing rabbits and found basically enhancement in the growing rabbit traits (Al-Azab *et al.* 2020; Bashar *et al.* 2022 and Farag *et al.* 2024).

Adding SPP at 2 and 4g SPP/kg diet to growing rabbits enhanced (*P≤0.05*) significantly (P≤0.05) FBW. In the same context, growing rabbits received 2 and 4g SPP/kg diet significantly (*P≤0.05*) improved BWG (41.20 and 39.88 g) as compared with the other groups. The synergistic effect of *Spirulina platensis's* chemical constituents may be the reason for the improvement in growth performance (FBW and BWG) when added to a diet. *Spirulina platensis* supplements have a high protein content that includes the entire essential amino acids, high carotenoids, and a high mineral and vitamin content (Begum *et al.* 2024 and Spínola *et al.* 2024). Supplementing with dietary SPP at levels of 2 and 4 g/kg feed showed a positive impact on the average FCR (13 and 12%, respectively) and PI (21.5 and 19.3 %), respectively. Additionally, other beneficial bacterial populations are likely to be disrupted. El-Sawy *et al.* (2024) concluded that 200 mg/kg body weight of *Spirulina platensis extract (*SPE) can improve productive performance and feed utilization of growing rabbits.

Table 2. Effects of supplentation of SPP to diets of fattening male rabbits on growth performance

Items	Experimental groups				MSE	Sig.
	G_0	G_1	G_2	G_3		
IBW (g)	787.33	803.83	779.50	813.00	12.10	NS
FBW (g)	2104.0^{b}	2126.0^{ab}	2221.5^{a}	2208.7^{a}	128.48	*
FC (kg)	6.94^{a}	6.51^{b}	6.60^{b}	6.48^{b}	0.59	*
BWG (g)	37.62^{c}	37.78^{c}	41.20^{a}	39.88^{b}	3.40	*
FCR	5.27^{a}	4.92^{b}	4.58^{c}	4.64^{c}	0.98	*
PI	39.92^{c}	43.21^{b}	48.50^{a}	47.60^{a}	3.14	*
GR	167.23^{c}	164.48^{c}	184.99^{a}	171.67^{b}	15.16	*

[a,b,c] Means in the same row with different superscripts are significantly different (*P≤0.05*),

- (P≤0.05), MSE: standard error of the mean. Sig: Significant, G_0: Control (un-supplemented), NS: Not significant; G_1: Supplemented with 1 g SPP/kg diet, G_2: Supplemented with 2 g SPP/kg diet, G_3: Supplemented with 4 g SPP/kg diet; IBW: Initial body weight; FBW: Final live body weight; BWG: Daily body weight gain; FC: Feed consumption; FCR: Feed conversion ratio, PI: Performance index and GR: Growth rate.

Physiological profile:

Blood biochemistry parameters:

According to the results, in Table 3, rabbits that fed feedstuff in different levels of SPP (G_1, G_2, and G_3) had significantly (*P≤0.05*) lower plasma of TP, Alb, Glo, AST, and ALT levels than the control group (G_0). Results are in agreement with those reported by El-Hawy *et al.* (2022), El-Sawy *et al.* (2024) and Elhady *et al.* (2025).

Table 3. Effects of supplementation SPP to diets of fattening male rabbits on biochemical blood parameters

Items	Experimental groups				MSE	Sig.
	G_0	G_1	G_2	G_3		
TP, g/dl	6.00^{a}	5.97^{a}	5.70^{ab}	5.32^{b}	0.65	*
Alb, g/dl	4.73^{a}	4.77^{a}	4.47^{ab}	4.21^{b}	0.54	*
Glo, g/dl	1.27^{a}	1.20^{ab}	1.23^{a}	1.11^{b}	0.22	*
AST, U/l	77.00^{a}	43.00^{b}	20.67^{c}	40.00^{b}	4.49	*
ALT, U/l	101.33^{a}	73.33^{c}	52.00^{d}	78.00^{b}	10.31	*

^{a,b,c} Means in the same row with different superscripts are significantly different (P≤0.05).

*(P≤0.05), MSE: Standard error of the mean. Sig: Significant G_0: control (un-supplemented), G_1: Supplemented with 1 g spirulina/kg diet, G_2: Supplemented with 2 g spirulina/kg diet, G_3: Supplemented with 4 g spirulina/kg diet; TP: Total protein; Alb: Albumin; Glo: |Globulin; AST: Aspartate aminotransferase and ALT: Alanine aminotransferase.

The reasons for liver problems include increased levels of the liver enzymes AST and ALT, as well as lower levels of TP and Alb. An overdose of the toxic substances mentioned seems to have resulted in the production of reactive oxygen species, which caused oxidative stress and indicated hepatotoxicity (Thakur *et al.* 2024). Plasma AST and ALT serve as markers for diagnosing hepatic injury since they are released into circulation following cellular injury (Skat-Rørdam *et al.* 2025). Unlike the production of Albumin (van de Wouw and Joles 2022), the liver was also damaged by hepatotoxins.
Total blood protein levels decreased in rabbits given any hazardous chemical, likely due to liver tissue damage affecting protein synthesis (El-Gindy, 2025). When comparing the SPP- supplemented group to the control group, the current study showed a decrease in the levels of liver enzymes AST and ALT, alongside a slight increase in TP, Alb, and Glo. This suggests that exposure to antioxidant phytochemical compounds like flavonoids and chromogenic acid helps suppress lipid peroxidation caused by free radicals and prevents toxicity (Ravindran and Mohamed, 2019). However, Khalifa *et al.* (2016) discovered that goats fed a diet supplemented with spirulina powder had significantly (*P≤0.05*) more total protein than the control group. In contrast, the untreated goats had higher AST and ALT concentrations compared to the treated group (*P≤0.05*). Reports indicate that spirulina can increase total protein levels in lambs without compromising renal function (Assar *et al.* 2023 and El-Sawy *et al.* 2024).

Every value fell within the typical range of physiological values. According to references, the AST and ALT values were within the normal range of liver enzymes (Momo *et al.* 2021). This finding is consistent with that of Aladaileh *et al.* (2020), who suggested that *Spirulina platensis* might be protective against liver dysfunction. However, Mazokopakis *et al.* (2014) found that adding *Spirulina platensis* to diet has a number of positive metabolic effects and that mean levels of triglycerides, total cholesterol, AST, and ALT were dramatically reduced 38.5%, 37.5%, 24.8%, and 9.1%, respectively. According to Nedeva *et al.* (2014), piglets' liver function was unaffected by *Spirulina platensis*. The levels of the liver enzymes AST and ALT in the control and experimental groups did not differ significantly. Both experimental groups' absolute levels of these enzymes fell within acceptable physiological ranges. The data reported above suggested that the addition had an anabolic impact (Nedeva *et al.* 2014). Attiya *et al.* (2019) reported that, while the liver function enzyme AST was significantly impacted by high *Spirulina platensis*, where they were recorded at the lowest ($P \leq 0.05$) in comparison to the control, the liver function enzyme ALT was not significantly affected by spirulina levels.

b. Hematological parameters:

The results indicated that rabbits receiving SPP had significantly ($P \leq 0.05$) higher levels of WBCs, hemoglobin, and all other parameters compared to the control group (Table 4). According to Zeweil *et al.* (2016), varying dosages of supplements such as Spirulina (0.5 and 1 g/kg diet) reduced the negative effects of heat stress on chickens' WBCs, RBCs, and immunity. In addition, current results are nearly similar to those of Bashar *et al.* (2022 and 2024) at the mean RBCs, WBCs, Hb, and MCV. In contrast, it does not agree with Bléyéré *et al.*

Table 4. Effects of supplementation of SPP to diets of fattening male rabbits on hematological parameters

Item	Experimental groups				MSE	Sig.
	G_0	G_1	G_2	G_3		
Hb g/dl	11.33^b	12.13^a	11.10^b	12.00^a	0.28	*
RBCs, $\times 10^6$	5.80^a	5.97^a	5.17^b	5.95^a	0.19	*
WBCs, $\times 10^3$	8.20^b	10.00^a	9.93^a	9.90^a	0.22	*
Eosinophils %	7.00^c	10.67^a	8.33^b	8.50^b	0.24	*
Monocytes %	15.30^c	17.07^b	18.50^a	17.00^b	0.43	*
Lymphocytes %	50.10^a	40.30^c	44.77^b	43.21^b	2.14	*
Neutrophils %	27.60^c	31.96^a	28.70^b	31.29^a	1.99	*
Hematocrite %	37.39^b	40.03^a	36.63^c	39.60^a	2.01	*
MCH pg	19.53^c	20.32^b	21.47^a	20.17^b	0.90	*
MCV μm^3 (fl)	64.47^c	67.05^b	70.85^a	66.55^b	4.30	*
Platelets $\times 10^{-3}$/l	349.7^b	267.3^c	370.7^a	348.7^b	20.12	*

^{a,b,c} Means in the same row with different superscripts are significantly different, *: ($P \leq 0.05$), MSE: Standard error of the mean o. Sig: Significant, G_0: Control (un-supplemented), G_1: Supplemented with 1 g SPP/kg diet, G_2: Supplemented with 2 g SPP/kg diet, G_3: Supplemented with 4 g SPP /kg diet.

(2013) and Al-Azab *et al.* (2020) when they didn't differ significantly among values. Red blood cell, hemoglobin, hematocrit, MCV, and MCH mean values were comparable to those found by Ouedraogo *et al.* (1998) and Bléyéré *et al.* (2013). However, Aboh *et al.* (2012) found that the RBC count was 7.30×10^6 /mm^3, which was statistically different from our results. These findings demonstrated that, while maintaining the reference values, blood cell counts might differ within a rabbit population or between locations. Follet, (2003) states that the range of RBC counts is 3.8×10^6/mm^3 to 7.9×10^6/mm^3. The ratios of the hematocrit value to erythrocyte and the rate of total hemoglobin to red blood cell count in a liter are represented by MCV and MCH, respectively, and they fluctuated in the same proportions.

c. Lipid profile and kidney function:

Table 5 shows that the reduction of plasma Creatinine for the SPP groups (0.69, 0.35, and 0.52 for G_1, G_2, and G_3, respectively) is greater significantly ($P \leqslant 0.05$) than that of the control group (1.43). The same indicators were observed in TC and TG, while the increase in urea levels is significantly higher in G_3 (38.33) compared to the others, which aligns with the findings of Abdelnour *et al.* (2020). The decrease in TC and TG in rabbits was consistent with Nedeva *et al.* (2014) and Abdelnour *et al.* (2020). The inclusion of phytochemicals, particularly flavonoids and other phenolic compounds (Jha *et al.* 2010), known for their free radical scavenging properties, may contribute to SPP's hypocholesterolemic effect. Our findings demonstrate that the use of SPP increases renal enzyme levels associated with urea. These results are consistent with Dalle Zotte *et al.* (2003) and El-Sawy *et al.* (2024).

Table 5. Effects of supplementation of SPP to diets of fattening male rabbits on lipid profile and kidney function

Items	Experimental groups				MSE	Sig.
	G_0	G_1	G_2	G_3		
TC, mg/dl	62.40 [a]	58.57 [b]	42.57 [c]	32.40 [d]	7.7	*
TG, mg/dl	113.33 [a]	96.17 [b]	75.08 [c]	62.33 [d]	8.9	*
Urea, mg/dl	35.33 [b]	32.27 [c]	32.93 [c]	38.33 [a]	4.24	*
Crea, mg/dl	1.43 [a]	0.69 [b]	0.35 [d]	0.52 [c]	0.21	*

[a,b,c] Means in the same row with different superscripts are significantly different (*P≤0.05*), *: (*P≤0.05*), MSE: Standard error of the mean. Sig: Significant, G_0: Control (un-supplemented), G_1: Supplemented with 1 g spirulina/kg diet, G_2: Supplemented with 2 g spirulina/kg diet, G_3: Supplemented with 4 g spirulina/kg diet; TC: Total cholesterol; TG: Triglyceride; and Crea: creatinine.

Total cholesterol, total lipids, LDL cholesterol, and VLDL cholesterol all significantly decreased due to the mechanisms by which SP plays a substantial role in lipid metabolism (Bondar *et al.* 2023 and Spinola *et al.* 2024). This reduction in serum cholesterol has been attributed to the influence of SPP on lipoprotein metabolism and the elevation of lipoprotein enzyme activity levels (Karkos *et al.* 2008). It is believed that one of SPP's primary metabolic functions is enhancing several biochemical parameters, potentially leading to a reduction in liver histological changes. The active ingredients in SPP, which suggest antioxidant activity, may account for its hepatoprotective properties. The presence of compounds that activate lipoprotein lipase, responsible for hydrolyzing triglycerides into fatty acids and glycerol in the liver, may explain the observed decrease in triglyceride levels in hypercholesterolemic rabbits treated with SPP. The active ingredients in SPP that indicate antioxidant activity may be the cause of its hepatoprotective properties (El Nabtity *et al.* 2023).

Economic analysis:

According to Table 6, adding SPP at different levels to fattening rabbit feedstuff improved the net profit (180.71, 188.83, and 187.93 for G_1, G_2, and G_3, respectively) significantly (*P resp*) vs. the control group (178.84). In the same context, the cost of feed intake was significantly (*P vs.*) reduced in SPP groups compared to other. The G_2 level improved the net revenue/rabbit (82.94), while G3 expressed the lowest value (73.94), as is shown in Figure 1.

According to Hanan *et al.* (2014), rabbits given meals supplemented with both spirulina levels outperformed the other treatments in terms of economic performance. Additionally, Mariey *et al.* (2012) discovered that the most cost-effective feeds for laying hens were those that contained 0.1, 1.5, and 2.0 percent spirulina.

Table 6. Effects of supplementation of SPP to diets of fattening male rabbits on economic evaluation

Items	Experimental groups				MSE	Sig.
	G_0	G_1	G_2	G_3		
Final body weight, kg (A)	2.104^{d}	2.126^{c}	2.222^{a}	2.209^{b}	0.37	*
Body weight price, L.E. /kg (B)	85.00	85.00	85.00	85.00		
Net profit, L.E./rabbit (C)**	178.84^{b}	180.71^{ab}	188.83^{a}	187.93^{a}	24.3	*
Total feed intake, kg (D)/5 weeks	6.94^{a}	6.51^{b}	6.60^{b}	6.48^{b}	0.92	*
Price of kg feed, L.E. (E)	15.0	15.0	15.0	15.0		
Feed intake cost, L.E. (F)**	31.93^{a}	29.94^{c}	30.36^{b}	29.81^{c}	2.6	*
Cost weaned rabbits, L.E. (J)	60.00	60.00	60.00	60.00		
Mangemental cost rabbits, L.E. (L)	7.0	7.0	7.0	7.0		
Spirulina cost/rabbit/35 days, L.E.	0.00	4.43	8.98	17.63		

[a,b,c] Means in the same row with the same letters are not significantly different. MSE: Standard error of the mean. Sig: Significant, * (*P≤0.05*). G_0: Control (un-supplemented), G_1: Supplemented with 1 g SPP/kg diet, G_2: Supplemented with 2 g SPP/kg diet, G_3: Supplemented with 4 g SPP/kg diet.

*Calculations included period from 49 to 84 day-old, fixed cost = price of weaning live rabbit + care + electricity + vaccination ….ect, according to price in February 2024.

** C= A×B, F= D×E.

Price of 1 one kg of Spirulina powder = 680.0 L.E., one gram= 0.68 L.E.

[a,b,c] Means in the same row with the same letters are not significantly different. MSE: Mean standard error NS: Non-significant, *: (*PMeans*). G_0: control (un-supplemented), G_1: supplemented with 1 g SPP/kg diet, G_2: supplemented with 2 g SPP/kg diet, G_3: supplemented with 4 g SPP/kg diet

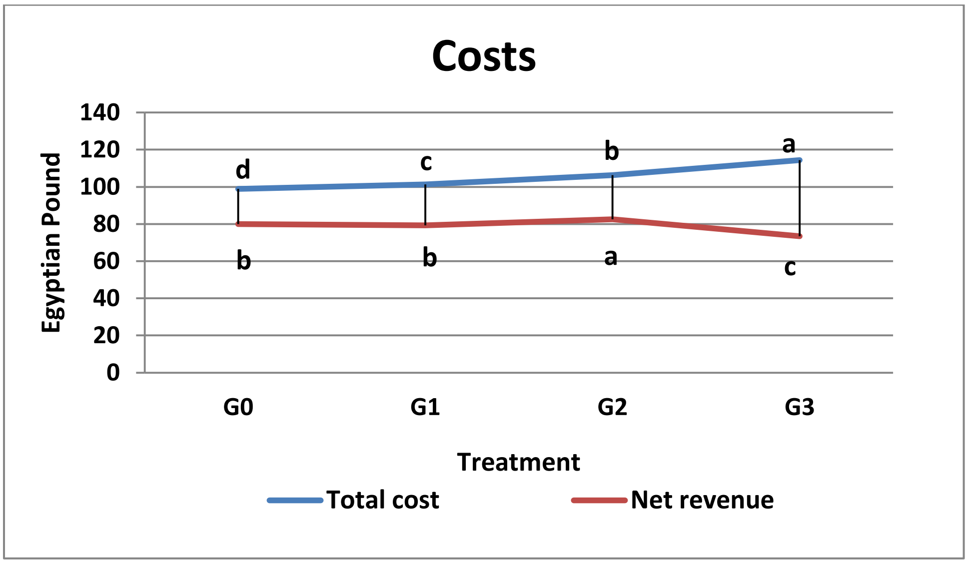

Figure.1. The treatment summery of total cost and net revenue.

[a,b,c] Means in the same row with the same letters are not significantly different. MSE: Mean standard error NS: Non-significant, *: (*PMeans*). G_0: control (un-supplemented), G_1: supplemented with 1 g SPP/kg diet, G_2: supplemented with 2 g SPP/kg diet, G_3: supplemented with 4 g SPP/kg diet

Conclusively, it could be concluded that using 2 g SPP/kg diet as feed additive in fattening rabbits feedstuff can improve the growth performance and enhance feed utilization with highly net revenue.

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تقييم الأداء الإنتاجى والفسيولوجى والإقتصادى لإضافة الأسبيرولينا بلاتينسس إلي علائق أرانب التسمين

محمد عبد العزيز الصاوى[1]- محمود عاطف أحمد[١] ـ أحمد مصطفى إمام[١] ـ محمود غريب غريب[١] ـ نهى فتحى أحمد[١] ـ أيمن حسن أحمد[٢] ـ أحمد محمد تمام[٢]

١ معهد بحوث الأنتاج الحيوانى ـ مركز البحوث الزراعية ـ وزارة الزراعة ـ مصر

٢ قسم إنتاج الدواجن ـ كلية الزراعة ـ جامعة عين شمس ـ مصر.

يهدف هذا البحث لدراسة تأثير إضافة الأسبيرولينا بلاتينسيس لتقييم أداء النمو، والدم، والتقييم الاقتصادي لأرانب التسمين. إستخدم عدد ٢٠٨ أرنبٌ ذكرٌ من أرانب الـ " فى لاين" عمر ٧ أسابيع ووزنٍ متوسطٍ ٧٩٥.٩٢±١٢.١ جرام، حيث تم تفسيمها عشوائيًا إلى ٤ مجاميع تجريبية متساوية. أُضيف الأسبيرولينا بلاتينسيس (SPP) بتركيزات مختلفة حيث إستخدمت المجموعة الأولى كمجموعةٍ مقارنة (G_0) بدون أي أضافات، تلقَّت المجموعات G_1 وG_2 وG_3 ١، ٢، و٤ جم أسبيرولينا/كجم عليقة على التوالي.

وقد أشارت النتائج لوجود مردود إيجابى لإضافة الإسبيرولينا مقارنة بمجموعة المقارنة. أظهرت كل من المجموعتين G_2 وG_3 تحسنا معنويا ($P \leq 0.05$) في كل من وزن الجسم النهائي(٢٢٢١.٥ و ٢٢٠٨ جم) معدل التحويل الغذائى (٤.٥٨ و ٤.٦٤) وكذلك دليل الأداء (٤٨.٥٠ و ٤٧.٦٠) على التوالى.

تفوقت مجموعة G_2 فى الزيادة الوزنية اليومية (BWG)، معدل النمو (GR) (٤١.٢٠ و ١٨٤.٩٩) على التوالى.

تحسنت الصفات الطبيعية والبيوكيميائية للدم مباشرة بإضافة الأسبيرولينا للعليقة. كما ان كل من وظائف الكلى ودهون الدم أظهرت تحسنا مع إضافة الأسبيرولينا مقارنة بمجموعة المقارنة.

من المنظور الاقتصادي، قدمت المعاملة G_2 أفضل عائد صافى معنويا ($P \leq 0.05$) (٨٢.٤٩ جنيه) عند المقارنة بباقى المجاميع.

التوصية: يمكن الاستنتاج أن ٢ جم إسبيرولينا/كجم علف أدى إلى تحسين الأداء الإنتاجي والفسيولوجى مع تحقيق كفاءة اقتصادية جيدة.