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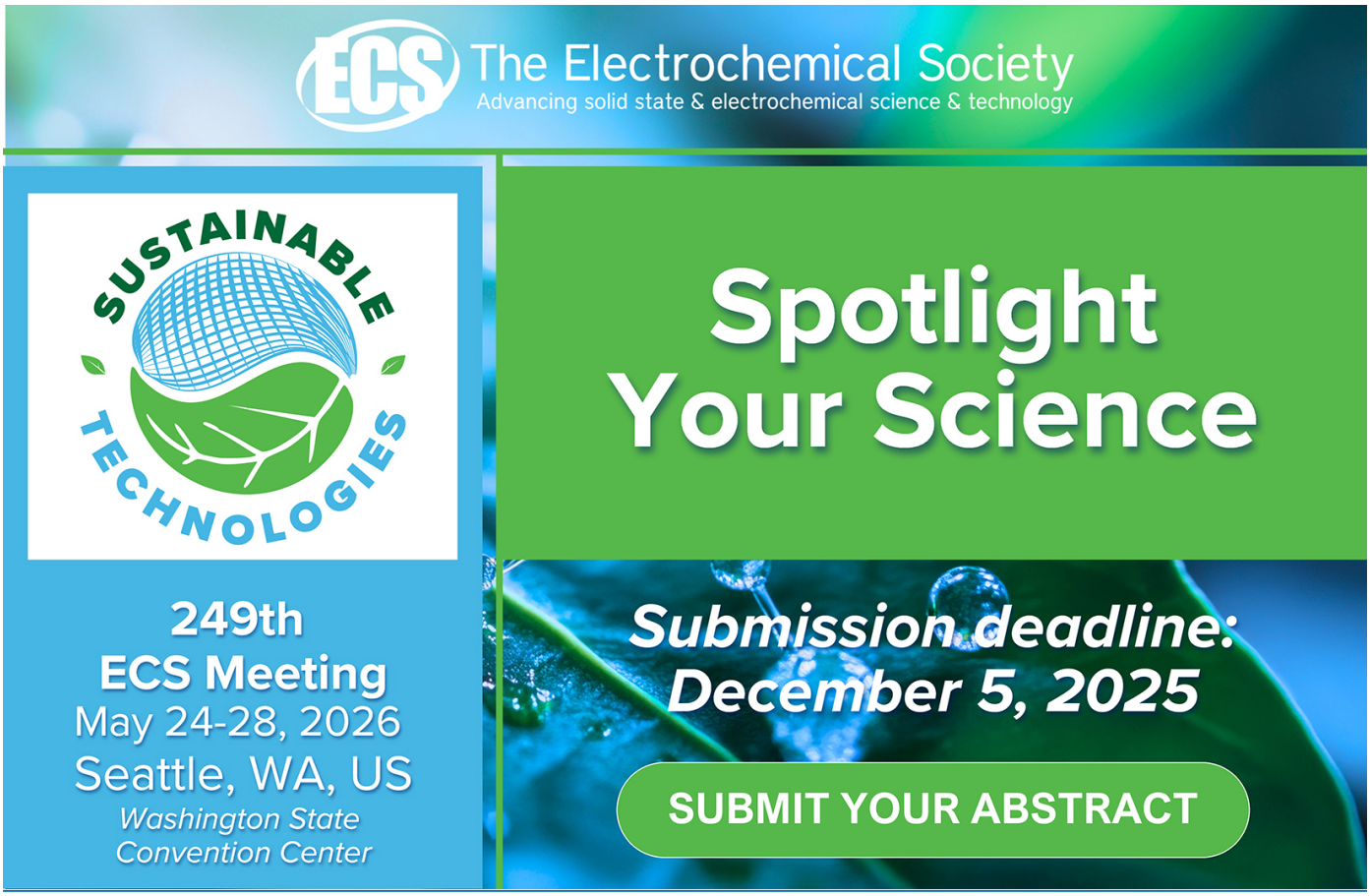

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Influence of Adding Fresh Azolla on the Productive and Physiological Traits of Iraqi Local Ducks

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Abstract. The aim of this research was to evaluation the effects of feeding fresh azolla on the physiological and productive characteristics of Iraqi local ducks. A total of 72 local ducks, one week old, weighed an average of 108 g. We randomly divided the chicks into four treatments, each consisting of three replicates and containing 6 birds per replicate. The following were the treatments: T2, T3 and T4 Add 5, 10 and 15% fresh Azolla of basal diet, respectively. The results indicated that Azolla at 5, 10, and 15% inclusion levels in local duck indicated a significant increase (P≤0.05) in body weights, weight gain, and feed conversion among the treatments compared to the control treatment. There was not a significant (P≤0.05) effect on feed intake. However, fresh Azolla supplementation did not affect total protein, total cholesterol, triglyceride, ALT, and AST levels in blood serum. Therefore, adding fresh Azolla to the diet of local ducks may be quite beneficial. It can be added up to 15% of the ducks' diet to improve their growth performance.

Keywords. Azolla, Local Ducks, performance.

1. Introduction:

Rural farmers in South Iraq grow ducks in their backyards for both domestic protein and additional revenue. However, feed costs, particularly those associated with commercial diets, account for over 70% of the total cost of raising chicken and can limit local output. In light of these difficulties, Rich in necessary amino acids and crude protein, the aquatic fern Azolla (Azolla pinnata) seems to be a feasible, plentiful, and easily accessible alternative feed source for chicken. [1] Azolla is a type of fern that floats on water's surface. The velvety leaf surfaces, vivid green hue, numerous spores, and small, overlapping leaves are the characteristics of this plant [2]. Additionally, according to the results of a chemical study of the nutrients in Azolla, the protein content is 31.25%, the fat content is 7.5%, the soluble sugar content is 3.5%, and the crude fiber content is 6% [2]. The advantage of utilizing azolla as an ingredient in poultry feed is that it has a high protein content (20–35%). Vitamins A and B12 are included along with amino acids [3]. Additionally abundant in minerals like iron, calcium, magnesium, potassium, and manganese, as well as bioactive substances with built-in antioxidant properties like phenols, tannins, and glycosides, is azolla [4]. Additionally, Azolla's low fiber level makes it extremely digestible, giving it a competitive edge over other feed substitutes that need to undergo a lot of processing before they can be used as farm animal feed [5]. Owing to its abundance and low cost, azolla is regarded as a non-traditional source of plant protein. Without having any negative effects, it enhances economic performance, energy efficiency, and feed conversion efficiency [6]. It has been proposed by a number

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of researchers that feeding broiler chickens 5% azolla lowered mortality rates, increased weight gain, and improved feed conversion efficiency [7]. [8] indicated that 30% fresh azolla and 70% commercial feed partial substitution enhance body weight and body weight gain in the Itik Pinas breed of ducks. (9) found that adding azolla to broiler diets at 5%, 10%, and 15% significantly improved the animals' body weight, weight increase, and feed conversion ratio. (10) reported a significant improvement in average body weight, average weight gain, and feed conversion ratio upon adding 7.5% azolla to broiler diets. According to research, adding azolla at a rate of 5% to laying hens' diets resulted in the best productive performance [11]. This study was aimed at investigating the effects of adding fresh Azolla pinnata on the physiological and productive characteristics of local ducks in Iraq.

2. Materials and Methods:

2.1. The Production and Harvesting of Azolla

In order to prepare experimental diets, azolla was planted following this methodology: A cultivation pit measuring 2.5 m × 1.5 m with 25 cm depth was prepared and lined with polyethylene sheeting for water retention. Ten centimetres of water filled the pit, followed by the application of 10–15 kg of fine soil as a base layer. A nutrient solution was prepared by mixing 2 kg of cattle manure with 20-30 g of single superphosphate in 10 liters of water. Azolla was inoculated at a 0.5-1 kg rate. The biomass required 10-15 days for full growth, during which maintenance doses of 10 g of superphosphate and 500 g of cattle manure were applied every four days. Harvested Azolla was washed 3-4 times with fresh water to remove clay, sand, and small roots, then drained on perforated trays for 2 hours before poultry feeding.

2.2. Design and diet of experiments

The current study was conducted at the University of Basrah's Agriculture College in the field of water fowl from November 25 to December 30, 2024, during which 72 local ducklings that were raised at one week of age and weighed 108 g were split equally into four treatments, each consisting of three replicates, each with 6 chicks per replicate. The following were the treatments: T1: basal diet (control), T2: 5% Fresh azolla, T3: 10% Fresh azolla, and T4: 15% Fresh azolla. The birds were raised and housed in rearing cages (1 × 2 meters per cage) inside the rearing hall under standard management conditions. Water and feed were given freely during the study period. A 24-hour continuous lighting system was implemented. Throughout the growth period, ducklings in each treatment group were kept in comparable environmental, health, and managerial circumstances. During the experimental period (days 14–42), With a metabolizable energy content of 2840.2 kcal/kg and 19.42% crude protein, the ducklings were fed a meal.

2.3. Study parameters

The birds were reared for 4 weeks (days 14–42), during which various broiler performance parameters were assessed weekly; the body weight (g), weight gain (g), feed intake (g), and feed conversion ratio. Following the experiment, three birds were chosen at random from each replicate to provide a blood sample. Blood samples were centrifuged at 3,000 rpm for 15 minutes in tubes devoid of EDTA to extract serum. The serum samples were then stored at refrigerated temperatures for subsequent biochemical analyses, including total protein, total cholesterol, and triglyceride levels. To estimate these values, commercial kits from the French company Biolabo SAS were used. The aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activity were recorded using the procedure outlined by [12].

2.4. Statistical analysis

SPSS [13] was used to analyse all of the data., and Tukey's HSD Test ($p \leq 0.05$) were used to compare them.

3. Results and Discussion:

A statistically significant increase ($p \leq 0.05$) is shown in Tables 1 and 2 in the second, third, and fourth treatment groups' body weight and weight gain at 35 and 42 days of age in comparison to the control group. Our results are consistent with the findings of [14], who reported that incorporating 5% Azolla

into White Pekin duck diets significantly enhanced body weight at 56 days of age. These findings further align with [15], who observed that supplementing Pekin duck diets with 5% and 10% fresh Azolla significantly improved body weight relative to the control group at 5 weeks of age, while there was no effect of the addition on body weight gain. Additionally, our results corroborate those of [11], They found that broiler diets with 10% Azolla meal saw increases in body weight and weight gain. It is possible that the increased protein and essential amino acid content in azolla, together with vitamins and mineral elements like iron, calcium, potassium, magnesium, phosphorus, manganese, and others, is what caused the significant increase ($p \leq 0.05$) in body weight and weight gain [16]. Furthermore, its content of carotenoids and biopolymers, which act as immune stimulants and antioxidants, has a major positive impact on productivity and health [15].

Table 1. Influence of Adding Fresh *Azolla* on the body wight (gm) of Iraqi Local Ducks (Mean± SE).

Treatment	**Age (days)**				
	14	21	28	35	42
T1	212.94±1.20	563.91±6.06	997.25±12.13	1308.11^{c}±6.60	1608.66^{d}±8.19
T2	214.94±1.74	563.66±12.34	988.77±14.78	1351.77^{b}±8.51	1682.78^{c}±8.78
T3	214.72±0.27	568.66±11.25	1001.08±14.73	1397.22^{a}±11.15	1725.66^{b}±7.17
T4	212.94±2.16	569.33±11.56	1019.94±7.16	1407.77^{a}±7.77	1775.44^{a}±12.62

There are significant variances between means in a column with various superscripts.

Table 2. Influence of Adding Fresh *Azolla* on the weight gain (gm) of Iraqi Local Ducks (Mean± SE).

Treatment	**Age (days)**				
	14	21	28	35	42
T1	104.94±1.20	350.97±7.09	433.33±8.56	310.85^{c}±6.11	300.55^{c}±5.29
T2	106.94±1.74	348.723±11.26	425.11±12.73	363.00^{b}±7.57	331.00^{b}±2.83
T3	106.72±0.27	353.94±11.09	432.41±9.39	396.14^{a}±6.20	328.44^{b}±8.88
T4	104.94±2.16	356.38±13.61	450.61±5.03	387.83^{a}±3.53	367.67^{a}±4.93

There are significant variances between means in a column with various superscripts.

Tables 3 and 4 illustrate how feed intake and feed conversion ratio (FCR) are affected when Azolla is added to the diets of domestic ducks. According to the findings, supplementing had no significant effect on the amount of feed intake. However, as compared to the control group, the second, third, and fourth treatment groups showed a significant improvement in FCR. These findings are consistent with [15], They found that Pekin duck diets supplemented with fresh Azolla at 5% and 10% increased FCR but had no discernible impact on intake of feed. [16] indicated that adding Azolla at 100 and 200 g/duck/day while reducing the basal diet of white Pekin ducks by 10% and 20% respectively, led to improved FCR. [17] reported that 20% Azolla supplementation in duck diets did not significantly affect feed consumption. [18] found that adding Azolla at 3 g/kg to broiler diets resulted in significant improvements in FCR.

Table 3. Influence of Adding Fresh *Azolla* on the feed intake (gm) of Iraqi Local Ducks (Mean± SE).

Treatment	Age (days)				
	14	21	28	35	42
T1	143.00±4.35	587.66±9.73	944.00±13.11	1151.66±9.27	1328.66±13.69
T2	137.00±6.50	577.66±9.13	946.00±10.53	1166.33±13.71	1301.00±15.50
T3	137.00±5.03	566.33±9.70	930.66±10.66	1152.66±12.70	1322.00±11.54
T4	134.66±4.80	578.00±10.78	912.33±12.97	1142.16±10.86	1307.58±18.28

There are significant variances between means in a column with various superscripts.

Table 4. Influence of Adding Fresh *Azolla* on the feed conversion ratio of Iraqi Local Ducks (Mean± SE).

Treatment	Age (days)				
	14	21	28	35	42
T1	1.36±0.02	1.67±0.008	2.180±0.060	3.706 ^{c} ±0.078	4.423 ^{c}±0.082
T2	1.28±0.07	1.66±0.03	2.226±0.042	3.220 ^{b} ±0.098	3.930 ^{b} ±0.061
T3	1.28±0.04	1.60±0.07	2.153±0.033	2.913 ^{a} ±0.059	4.030 ^{b} ±0.075
T4	1.28±0.06	1.62±0.04	2.026±0.042	2.946 ^{a} ±0.0233	3.560 ^{a} ±0.085

There are significant variances between means in a column with various superscripts.

The results presented in Table 5 revealed the effect of adding fresh Azolla pinnata on serum biochemical parameters of local ducks. Total protein, total cholesterol, triglycerides, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels did not differ significantly ($p \leq 0.05$). Several investigations have found no discernible effects of Azolla supplementation on total protein, total cholesterol, or triglyceride levels, which is consistent with our findings. [19] observed no significant variation in total protein and total cholesterol in blood serum of broilers between different Azolla-fed groups. Also, these results were similar to those obtained by [20], who reported that adding azolla at levels of 5%, 10%, and 15% to broiler diets did not significantly affect the concentrations of total protein and total cholesterol in blood serum. [21] discovered that the blood serum levels of triglycerides and total cholesterol in the Azolla-fed groups did not differ substantially.

Table 5. Influence of Adding Fresh *Azolla* on serum biochemical parameters of Iraqi Local Ducks (Mean± SE).

Treatment	Parameters				
	Total Protein (g/dL)	Alanine aminotransferase (U/L)	aspartate aminotransferase (U/L)	Total Cholesterol (mg/dl)	Triglyceride (mg/dl)
T1	4.44±0.09	35.96±2.61	63.35±2.86	127.23±2.90	75.39±2.51
T2	4.51±0.08	36.33±1.83	66.37±1.51	124.11±3.13	72.35±3.99
T3	4.57±0.08	37.46±2.86	66.81±1.69	121.70±3.12	72.09±3.31
T4	4.58±0.12	37.77±1.97	68.16±1.39	121.30±3.81	70.44±3.87

There are significant variances between means in a column with various superscripts.

Conclusions.

We conclude from our current study that when adding 5, 10 and15% Fresh Azolla to basal diet of local ducks, BW, BWG, and FCR are significantly impacted in comparison to the control treatment. The addition of fresh azolla had no significant impact on several blood biochemical measures, such as total protein, the activity of enzymes (AST and ALT), and the concentration of cholesterol and triglycerides.

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