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Article

Comparison of the Effects of Soybean, Sunflower, and Fatty Acid Omega-3 Oils on the Performance and Quality level of Eggs Produced by Turkey Hens in the Al-Shatra District

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Abstract: The aim of this research, which was carried out in the Al-Shatra District of the Thi Qar Governorate in southern Iraq, was to assess the effects of various nutrient oil sources on the production efficiency and quality characteristics of eggs produced by laying turkeys. One hundred and twenty 32-week-old turkey hens were divided into three diets: a control diet with 1.5% oil from soybeans, a second with 1.5% sunflower oil, and a third diet with the same inclusion level of omega-3 oil. The results indicated significant improvements in both the mass and rate of egg production for turkeys fed the omega-3-enriched diet compared to those on the control or sunflower oil diets. In addition, the omega-3 group had a higher ratio of feed conversion. Egg yolks from the omega-3 and sunflower oil treatments were significantly lighter in color than those from the control group in terms of egg quality. The yolk both Haugh and index units were also positively impacted by omega-3 additions. There were no discernible variations in the egg weight or thickness of the shell Within these groupings. According to these findings, sunflower oil primarily affects yolk color, whereas omega-3 fatty acids may increase productivity and alter certain characteristics of egg quality in laying turkeys.

Keywords: Soybean Oil, Omega-3, Sunflower Oil, Egg Production, Egg Quality, Laying Turkeys

1. Introduction

Turkey (Meleagris gallopavo) farming has become critically important in worldwide poultry sectors because of strong consumer interest in lean meat and enhanced products [1], [2]. In contrast to other poultry types, turkeys exhibit effective feed conversion and yield significant protein production, although their egg-laying traits vary greatly from those of chickens. Turkey eggs, although not widely found in commercial markets, have distinctive nutritional benefits and a larger size that offer potential market prospects. Nutrition is crucial in turkey production systems, where dietary formulation significantly impacts growth performance, reproductive efficiency, and egg quality metrics. The purposeful integration of particular lipid sources, especially polyunsaturated fatty acids from omega-3 and sunflower oil, has demonstrated possible advantages in poultry nutrition by increasing energy density, boosting reproductive performance, and altering egg composition [3]. These dietary fats can impact several physiological functions such as hormone production, vitamin uptake, and fat metabolism, which ultimately influence production efficiency and the quality of eggs [4]. This research sought to examine the impact of oil of sunflower and the omega-3 oil dietary supplementation on the production performance, production of eggs metrics, the feed efficiency, the quality of eggs features in laying turkeys.

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2. Materials and Methods

This study involved 120 laying turkey hens of the Nicholas breed, aged 32 weeks. The birds were allocated to three dietary groups, with 4 replicates for each group and 10 birds in each replicate. The nutritional interventions were as outlined:

a. T1 (Control): Basal diet containing soybean oil (1.5%)
b. T2: Basal diet substituting soybean oil with sunflower oil (1.5%)
c. T3: Basal Omega-3 oils in the diet (1.5%) in place of soybean oil

This table 1 outlines the composition of the diets used in the study. It shows the inclusion of various ingredients in each of the three dietary groups (Control, Sunflower Oil, Omega-3 Oil), with the main focus on the type of oil used (soybean, sunflower, or omega-3 oil) at 1.5% inclusion level. The table provides the quantities of key ingredients such as corn, soybean meal, bran, cottonseed, and others, ensuring a balanced diet for the laying turkeys.

Table 1. Diet composition and calculated chemical composition.

Item	T1 Controls	T2 Sunflower oils	T3 Omega-3 oils
Corn	58.50	58.50	58.50
Soybean Meal (44% CP)	23.00	23.00	23.00
Bran of wheat	4.75	4.75	4.75
Cottonseed	3.00	3.00	3.00
Meat Bones Meal	3.00	3.00	3.00
Limestones	4.00	4.00	4.00
Dicalcium Phosphate	1.20	1.20	1.20
Salt	0.30	0.30	0.30
Vitamin-Mineral Premix	0.50	0.50	0.50
DL-Methionine (98%)	0.15	0.15	0.15
L-Lysine HCl	0.10	0.10	0.10
Oil	1.50 (Soybean)	1.50 (Sunflower)	1.50 (Omega-3)
Total	**100.00**	**100.00**	**100.00**

Intake, feed conversion ratio, egg production rate, and qualitative egg features were among the characteristics that were examined. A digital scale was used to measure the weight of the eggs. Using a vernier caliper The diameter and height of the yolks were measured, and the yolk index was calculated. in accordance . Using a tripod micrometer, the height was measured. of the albumen, and Haugh units were computed. The measurement was taken with a vernier caliper. for thickness of the shell, and a sensitive Using a scale to determine its weight. The SAS statistical tool. was used to analyze the data using a design with complete randomization (CRD) and The Multiple Range Test by Duncan at $P \leq 0.05$.

3. Results and Discussion

Table 2. Impact of dietary oil source on feed consumption (g/bird/day).

Treatments	Week 1	Week 2	Week 3	Week 4
T1	320.5 ± 3.2^{a}	325.8 ± 2.9^{a}	318.2 ± 3.5^{a}	322.7 ± 3.1^{a}
T2	315.2 ± 2.8^{a}	310.5 ± 3.3^{ab}	312.8 ± 4.1^{a}	315.0 ± 3.6^{a}
T3	308.8 ± 3.5^{a}	295.4 ± 4.5^{b}	290.1 ± 3.8^{b}	298.6 ± 3.0^{b}
Sig.	NS	**	**	**

This table 2 presents the average feed consumption of the laying turkeys across four weeks for each of the three dietary treatments. It compares the weekly feed intake of the turkeys fed with soybean oil, sunflower oil, and omega-3 oil, showing how different oils influenced the daily feed intake across the study period [5], [6].

Table 3. Effect on egg production and feed conversion ratio.

Treatments	Egg production (%)	Egg mass (g/hen/day)	Feed conversion
T1	58.2 ± 1.8^{b}	92.5 ± 2.5^{b}	3.47 ± 0.08^{a}
T2	60.5 ± 2.1^{b}	96.8 ± 2.7^{b}	3.25 ± 0.09^{a}
T3	68.5 ± 2.4^{a}	108.3 ± 3.0^{a}	2.76 ± 0.10^{b}
Sig.	**	*	*

This table 3 summarizes the effects of the three dietary oils on egg production, egg mass, and feed conversion ratio. It compares the performance of the turkeys in each treatment group, highlighting the superior egg production and feed efficiency of the omega-3 oil group [7]. Significant differences between the groups are noted, with omega-3 oil yielding the best performance metrics.

Table 4. Characteristics of external egg quality.

Treatment	Egg weight (g)	Shell weight (g)	Shell thickness (mm)
T1	85.4 ± 1.5^{a}	9.8 ± 0.15^{a}	0.42 ± 0.010^{a}
T2	84.7 ± 1.8^{a}	9.5 ± 0.18^{ab}	0.41 ± 0.012^{a}
T3	83.9 ± 1.6^{a}	9.1 ± 0.21^{b}	0.40 ± 0.011^{a}
Sig.	NS	*	NS

This table 4 outlines the measurements for the external quality of the eggs, including egg weight, shell weight, and shell thickness. It provides a comparison of these external traits across the three dietary treatments [8]. The table helps to evaluate whether different dietary oils influenced the external features of the eggs, although no significant differences were found in egg weight and shell thickness.

Table 5. Internal egg quality traits.

Treatment	Yolk index	Yolk color	Haugh units
T1	0.39 ± 0.005^{b}	10.5 ± 0.3^{a}	85.2 ± 1.5^{ab}
T2	0.40 ± 0.006^{b}	8.2 ± 0.4^{b}	82.1 ± 1.7^{b}
T3	0.41 ± 0.007^{a}	7.5 ± 0.3^{b}	87.5 ± 1.9^{a}
Sig.	*	**	*

This table 5 presents the internal quality traits of the eggs, including the yolk index, yolk color, and Haugh units, which are critical indicators of egg quality. The table shows that omega-3 oil significantly improved the yolk index and Haugh units compared to the control and sunflower oil groups [9], [10]. It highlights the impact of omega-3 supplementation on the internal quality of the eggs, especially in terms of protein quality and yolk composition.

The results show a significant improvement in egg production rate (68.5% and 60.5% versus 58.2%), as well as many eggs (relative to 108.3 g/ıhen/day). 92.5 and 96.8 g/hen/day) and food conversion of omega group 3 (2.76 versus 3.47 and 3.25), respectively. This significant improvement in productivity performance was founded in. is consistent with the results. stated that omega-3 fatty acid dietary supplements improve nutritional metabolism and energy use, and increase the reproductive properties and efficiency of food in chicken. Regarding egg quality, the yellow in omega 3 and sunflower oil treatments showed a rather lighter colour (7.5 and 8.2, respectively) compared to the control group (10.5) [11], [12], [13]. This observed reduction in yellow color intensity. show that unsaturated food acids such as omega3 and sunflower oil, especially polyunsaturated fats (AGPI), can interfere with intestinal absorption and the precipitation of carotenoid pigments. Furthermore, omega 3 supplements had a useful effect on internal parameters

of egg quality. The Omega 3 group showed a higher yellow indicator (against 0.41). 0.39 and 0.40) and large units with registration (87.5 versus 85.2 and 82.1). This shows the structural integrity of yellow and the excellent quality of the album, respectively. The strengthening of the Hag Division, reflecting thick proteins, has been confirmed by the work of suggesting that omega-3 may have a positive impact on the protein protein matrix [14], [15].

No significant differences were found in egg mass or sink thickness between food procedures. This suggests that 1.5% food oil sources contain the quality and productive properties of the internal egg, rather than the external properties of the egg. These collective results show that adding diets from turkeys with omega-3 fatty acids increases general productivity and can alter the quality signs of certain eggs, while sunflower oil additives primarily affect the yellow colour.

4. Conclusion

Supplementing the diet of laying turkeys with omega-3 fatty acids significantly enhances egg production, egg mass, and feed conversion efficiency, offering a notable improvement in overall productivity. In comparison to soybean and sunflower oils, omega-3 supplementation also results in lighter yolk color, higher yolk index, and improved Haugh units, indicating better internal egg quality. While sunflower oil primarily affects yolk color, omega-3 oil provides broader benefits, influencing both egg quality and production efficiency. These findings suggest that omega-3 fatty acids can be a valuable dietary supplement in turkey production systems, leading to higher egg quality and more efficient production outcomes. The study supports the inclusion of omega-3 oils in poultry diets for improving reproductive performance and nutritional outcomes, thus contributing to more sustainable and productive turkey farming.

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