Research Article

Addition of Gum Arabic Powder at Different Levels to the Diet of Older Laying Hens and its Effect on Productive Performance

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Abstract | Gum arabic, a natural polysaccharide, may improve nutrient absorption and gut health, thereby positively affecting laying performance in older hens. This 140-day field study in Babylon investigated the effect of adding gum Arabic powder at different levels to the feed of 105 Lohmann Brown hybrid hens aged 65 weeks. The rearing period was divided into five 4-week intervals, from 65 to 84 weeks of age. The hens were divided into five treatments (21 hens each, with 3 replicates of 7 hens): T1 (control), T2 (15 g/kg gum Arabic), T3 (20 g/kg gum Arabic), T4 (25 g/kg gum Arabic), and T5 (30 g/kg gum Arabic). Results showed significant (P<0.05) improvements in egg production percentage, egg weight, cumulative egg number, egg mass, and feed conversion ratio in all gum-supplemented groups compared to control. In conclusion, adding gum Arabic powder improved all measured production traits. Therefore, incorporating gum arabic powder into the diets of aging laying hens can be considered an effective nutritional strategy to sustain and enhance egg production and overall productivity during the later stages of the laying cycle.

Keywords | Gum Arabic, Egg mass, Egg number, Feed conversion ratio, Laying hens, Productive performance

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INTRODUCTION

Eggs are one of the most important foods for humans due to their rich and balanced nutritional composition. They are a major source of high-quality proteins, containing all the essential nutrients necessary for growth and regeneration. Additionally, eggs provide a wide range of vitamins and minerals, making them a complete food that supports various bodily functions. The egg industry maintains strict veterinary health and safety standards to ensure eggs are free from disease and contaminants, providing a safe and high-quality product for consumption (Rahmasari *et al*., 2022; Abbas and Ali, 2023).

It is well known that aging in laying hens leads to a significant decline in egg production. This decrease is largely attributed to the accumulation of free radicals unstable molecules naturally produced during metabolism which cause cellular and tissue damage. Increased oxidative stress reduces the activity of antioxidant enzymes, impairing the health and function of ovarian cells responsible for egg production. Consequently, this results in reduced productivity and weakened immunity in older hens (Hammod *et al*., 2018; Oke *et al*., 2024).

To counteract these effects, researchers and poultry producers increasingly use natural feed additives and bio-alternatives such as herbs, medicinal plants, and bio-precursors known for their antioxidant properties. These additives contain active compounds that help reduce oxidative stress and improve growth, immunity, and overall health (Jiang *et al*., 2020). One such promising additive is Gum Arabic a

polysaccharide derived from the dried secretion of *Acacia senegal* trees native to Central and West Africa (Khan *et al*., 2022; Saad *et al*., 2022). Gum Arabic is rich in glycoproteins, carbohydrates, amino acids, and minerals like calcium (Magnini *et al*., 2022; Yasser and Ali, 2025).

Studies have demonstrated that Gum Arabic supplementation in poultry diets can significantly reduce serum cholesterol, triglycerides, and liver enzymes, while improving blood serum levels of albumin, globulin, and calcium (Ismail *et al*., 2016). Its anti-inflammatory and antioxidant effects are attributed to its ability to enhance enzyme activity, thereby preventing oxidative damage (Ahmed *et al*., 2024; Alhamdani *et al*., 2025). The antioxidant capacity of Gum Arabic is linked to its amino acid content including cysteine, tyrosine, histidine, and methionine and its role in increasing glutathione levels while reducing harmful radicals like malondialdehyde and superoxide (Shehab *et al*., 2023; El-Ratel *et al*., 2019).

Therefore, given the significant potential of Gum Arabic to improve oxidative stability and overall health in aging laying hens, this study aimed to evaluate its effects on egg production performance, egg quality, oxidative balance, and body stability, as well as to determine the optimal supplementation level.

MATERIALS AND METHODS

Experimental design and analyses

The field experiment was conducted in Babylon over 140 days, from October 26, 2024, to March 14, 2025. The study aimed to evaluate the effects of different levels of gum Arabic powder added to the feed on the productive performance of laying hens. A total of 105 Lohmann Brown hybrid hens (Figure 1), all 65 weeks old at the start, were used. The rearing period was divided into five intervals: 65–68 weeks, 69–72 weeks, 73–76 weeks, 77–80 weeks, and 81–84 weeks. The hens were assigned to five treatments, with each treatment including 21 hens divided into three replicates of 7 hens each. The treatments consisted of a control group with no gum Arabic powder added to the feed, and four experimental groups receiving gum Arabic powder at levels of 15, 20, 25, and 30 grams per kilogram of feed, respectively (Figure 2). The composition and chemical analysis of the experimental diet is presented in Table 1.

After a 2-week adaptation period with no data collection, the hens were randomly distributed into 15 replicates at 65 weeks of age. They were housed in pyramid-style pens measuring 2×2 m^2, containing six batteries per pen, each battery holding five cages (40×40 cm^2 each). Each cage was equipped with two automatic nipple drinkers, and feeding was done manually via longitudinal feeders.

Figure 1: Lohmann Brown hybrid hensn used in the experiment.

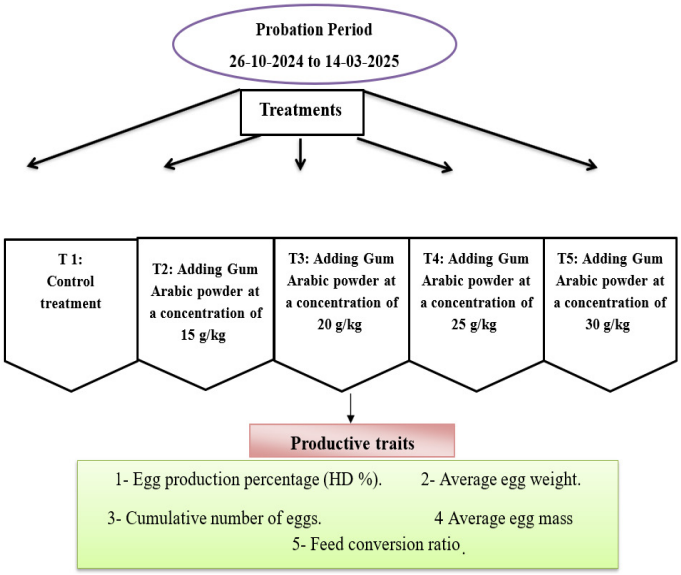

Figure 2: Schematic diagram of the experimental design used to evaluate the effects of different levels of Gum Arabic powder on the productive performance of older laying hens.

The daily feed intake was calculated at 115 g per hen. Lighting was provided for 16 hours of light and 8 hours of darkness at an intensity of 4 watts/m^2, following poultry guide recommendations. Temperature was recorded twice daily (morning and evening) using four thermometers strategically placed throughout the hall, which was heated by electric heaters to maintain optimal conditions.

Statistical Analysis

A completely randomized design (CRD) was applied to assess the effects of different treatments on the evaluated traits. Significant differences among means were determined using Duncan's Multiple Range Test (1955) at a significance level of (0.05). Statistical analysis was conducted using SAS (2012).

Table 1: Composition and chemical analysis of the experimental diet used during the study.

Dietary component	(%)
Yellow corn	55
Bran	5.5
Soybean meal (46% Protein)	24
Protein premix 2.5%	2.5
Vegetable oil	1.3
Limestone	10.85
Dicalcium phosphate (DCP)	50.
Methionine %	0.1
Lysine %	0.05
Salt	0.1
Antitoxin	0.1
Total	100
The chemical analysis **	
The representative energy (kilocalorie/kg feed)	2723
Crude protein (%)	16
Calcium (%)	4
Available phosphorus (%)	0.37
Methionine (%)	0.39
Lysine (%)	0.9
Threonine (%)	0.54
Salt (%)	0.31
Fiber (%)	3.8

Protein premix from the Dutch company Provim, each kg contains: (5.9%) crude protein, (3600) kcal metabolized energy/kg,(6.4%) calcium, (5.7%) phosphorus, (6.5%) sodium,(4000) mg/kg iron, (2800) mg/kg zinc, (600) mg/kg copper, (8.35) mg cobalt, (60) mg/kg iodine, (10) mg/kg selenium, (5.9%) methionine, (1.5%) lysine, (5.9%) methionine with cysteine, (1200) mg/kg niacin, (400,000) IU vitamin A, (140,000) IU D3, (2000) mg/kg E, (100) K, (90) mg/kg Thiamine, (160) ppb Riboflavin, (200) mg/kg Pyridoxine and (1000) meg/kg Vitamin Cobalamin. **Chemical composition calculated based on (NRC, 1994).

RESULTS

Egg production percentage (H.D%)

Table 2 shows the effect of adding Gum Arabic powder at different levels to the feed of older laying hens on egg production percentage (H.D%) over the period from 65 to 84 weeks of age. During the first production interval (65–68 weeks), treatments T3, T4, and T5 showed significant ($P < 0.05$) improvements in egg production, reaching 68.19%, 68.36%, and 71.93%, respectively, compared to the control group (T1), which had a production rate of 59.69%. Notably, T5 recorded the highest egg production rate in this period.

In the second (69–72 weeks), third (73–76 weeks), and fourth (77–80 weeks) production intervals, all gum-supplemented treatments (T2, T3, T4, and T5) outperformed the control, which had the lowest egg production rates of 60.20%, 62.24%, and 57.14%, respectively, with differences being significant ($P < 0.05$). During the fifth interval (81–84 weeks) and in the overall average for the entire study period (65–84 weeks), the T2, T3, T4, and T5 groups continued to show significantly ($P < 0.05$) higher egg production percentages compared to the control, which recorded the lowest values of 53.40% and 58.53%, respectively.

Egg weight

Table 3 presents the impact of Gum Arabic powder supplementation on egg weight (g) during the same periods. In the first (65–68 weeks) and second (69–72 weeks) production intervals, the T2, T3, T4, and T5 treatments achieved significantly ($P < 0.05$) higher average egg weights than the control (T1), which recorded the lowest weights of 66.60 g and 68.77 g, respectively.

This positive trend continued throughout the third (73–76 weeks), fourth (77–80 weeks), and fifth (81–84 weeks) intervals, where gum-treated groups consistently outperformed the control. In these later stages, T5 exhibited the highest egg weights, reaching 74.18 g, 76.88 g, and

Table 2: The effect of adding Gum Arabic powder at different levels to the feed of older laying hens on egg production percentage (H.D%) during the period from 65 to 84 weeks of age.

Treatments	First duration (65-68)	Second duration (69-72)	Third duration (73-76)	Fourth duration (77-80)	Fifth duration (81-84)	The general average (65–84)
T1	59.69 ±2.79c	60.20 ±0.51d	62.24 ±0.29d	57.14 ±0.58d	53.40 ±0.61e	58.53 ±0.17e
T2	64.45 ±1.85b c	66.15 ±0.44c	69.04 ±0.44c	64.28 ±0.37c	58.33 ±0.34d	64.45 ±0.13d
T3	68.19 ±2.46a b	69.72 ±0.34b	70.74 ±0.56b c	68.70 ±1.03b	61.73 ±0.51c	67.81 ±0.28c
T4	68.36 ±3.02a b	72.27 ±1.11a	72.10 ±1.74a b	71.93 ±0.48a	66.83 ±0.58b	70.29 ±0.39b
T5	71.93 ±2.35a	74.31 ±1.90a	74.48 ±0.28a	73.97 ±1.59a	68.53 ±0.17a	72.64 ±0.27a
Significant	*	*	*	*	*	*

*There are significant differences ($P \leq 0.05$) between the treatments. T1 (control), T2, T3, T4, and T5 treatments: Adding Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg feed, respectively.

Table 3: Effect of adding Gum Arabic powder at different levels to the feed of older laying hens on egg weight (g) during the period from 65 to 84 weeks of age.

Treatments	First duration (65-68)	Second duration (69-72)	Third duration (73-76)	Fourth duration (77-80)	Fifth duration (81-84)	The general average (65–84)
T1	66.60 ± 0.44 b	68.77± 0.14 b	69.59± 0.04 d	68.30± 0.11 d	67.77± 0.04 e	68.20 ± 0.27 e
T2	68.63 ± 0.52 a	70.50 ± 0.54 a	71.77 ± 0.05 c	71.38± 0.32 c	70.94± 0.26 d	70.64± 0.09 d
T3	68.74 ± 0.28 a	71.27 ± 0.29 a	72.63 ± 0.11b	73.60± 0.17 b	72.68 ± 0.11 c	71.78 ± 0.06 c
T4	69.26 ± 0.75 a	71.45± 0.05 a	73.23± 0.51 b	74.91 ± 0.24 b	73.82± 0.16 b	72.53± 0.12 b
T5	70.20 ± 0.61 a	71.92± 0.17 a	74.18± 0.26 a	76.88 ± 0.19 a	75.26± 0.32 a	73.68± 0.81 a
Significant	*	*	*	*	*	*

* There are significant differences (P≤0.05) between the treatments. T1 (control), T2, T3, T4, and T5 treatments: Adding Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg feed, respectively.

Table 4: Effect of adding Gum Arabic powder at different levels to the feed of older laying hens on the cumulative number of eggs during the period from 65 to 84 weeks of age.

Treatments	First duration (65-68)	Second duration (69-72)	Third duration (73-76)	Fourth duration (77-80)	Fifth duration (81-84)	The general average (65 –84)
T1	16.71 ±1.50c	16.85 ±0.14d	17.42 ±0.08c	15.99± 0.16 d	14.95± 0.17 e	16.38 ± 0.05 d
T2	18.04 ±0.40b c	18.52 ±0.12c	19.33 ±0.12b	17.99± 0.21 c	16.33± 0.09 d	18.04± 0.16 c
T3	19.09 ±0.69a b	19.52 ±0.09b	19.80 ±0.18b	19.23± 0.28 b	17.28 ± 0.14 c	18.98± 0.10 c
T4	19.14 ±0.28a b	20.23 ±0.11a	20.18 ±0.11a	20.14± 0.16 a	18.71± 0.16 b	19.68± 0.09 b
T5	20.14 ±0.36a	20.80 ±0.25a	20.85 ±0.21a	20.71 ± 0.19 a	19.18 ± 0.04 a	20.33± 0.07 a
Significant	*	*	*	*	*	*

* There are significant differences (P≤0.05) between the treatments. T1 (control), T2, T3, T4, and T5 treatments: Adding Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg feed, respectively.

Table 5: Effect of adding Gum Arabic powder at different levels to the feed of older laying hens on egg mass (g/hen/day) during the period from 65 to 84 weeks of age.

Treatments	First duration (65-68)	Second duration (69-72)	Third duration (73-76)	Fourth duration (77-80)	Fifth duration (81-84)	The general average (65 –84)
T1	39.75 ±1.58c	41.39 ±0.23e	43.31 ±0.35d	39.02± 0.31 e	36.18± 0.41 e	39.93± 0.28 e
T2	44.23± 1.13 b	46.63 ± 0.29 d	49.55 ±0.12c	45.88 ±0.72d	41.37± 0.38 d	45.53± 0.15 d
T3	46.87± 1.74 a b	49.68± 0.05 c	51.37± 0.30 b	50.56± 0.56 c	44.86± 0.32 c	48.67± 0.31 c
T4	47.34± 1.09 a b	51.63 ± 0.32 b	52.79± 0.83 b	53.88± 0.42 b	49.33± 0.49 b	50.99± 0.22 b
T5	50.49± 1.93 a	53.44± 0.47 a	55.25 ± 0.62 a	56.86± 0.35 a	51.57± 0.21 a	53.52± 0.34 a
Significant	*	*	*	*	*	*

* There are significant differences (P≤0.05) between the treatments. T1 (control), T2, T3, T4, and T5 treatments: Adding Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg feed, respectively.

75.26 g, respectively, while T1 recorded the lowest values (69.59 g, 68.30 g, and 67.77 g). All differences were significant (P < 0.05). Overall, across the entire 65–84 weeks period, all gum supplementation treatments showed significant (P < 0.05) superiority in egg weight compared to the control group.

Cumulative number of eggs

Table 4 illustrates the effect of adding Gum Arabic powder at different levels to the diet of older laying hens on the cumulative number of eggs (28 eggs/hen/day) during the period from 65 to 84 weeks of age. In the first production interval (65–68 weeks), treatments T3, T4, and T5 significantly (P < 0.05) outperformed the control (T1). Similarly, during the second (69–72 weeks), third (73–76 weeks), and fourth (77–80 weeks) production intervals, all supplemented groups showed the highest cumulative egg numbers compared to T1, which recorded the lowest values of 16.85, 15.99, and 15.99 eggs/hen/28 days, respectively. Notably, T4 and T5 recorded the highest averages, with cumulative egg numbers of 20.23, 20.18, and 20.14 eggs/hen/28 days for T4, and 20.80, 20.85, and 20.71 eggs/hen/28 days for T5, respectively. In the fifth interval (81–84 weeks) and overall average (65–84 weeks), T2, T3, T4, and T5 continued to show improved cumulative egg numbers compared to the control.

Table 6: Effect of adding Gum Arabic powder at different levels to the feed of older laying hens on feed conversion ratio (g feed/g egg) during the period from 65 to 84 weeks of age.

Treatments	First duration (65-68)	Second duration (69-72)	Third duration (73-76)	Fourth duration (77-80)	Fifth duration (81-84)	The general average (65-84)
T1	2.893 ±0.113a	2.778 ±0.020a	2.655 ±0.020a	2.947 ±0.029a	3.178 ±0.038a	2.880 ±0.017a
T2	2.600 ±0.063b	2.466 ±0.017b	2.320 ±0.026b	2.506 ±0.040b	2.779 ±0.027b	2.525 ±0.008b
T3	2.453 ±0.096b c	2.314 ±0.001c	2.238 ±0.017c	2.274 ±0.035c	2.563 ±0.020c	2.362 ±0.017c
T4	2.429 ±0.055b c	2.227 ±0.037d	2.178 ±0.026c	2.134 ±0.015d	2.331 ±0.024d	2.255 ±0.027d
T5	2.277 ±0.085c	2.151 ±0.028d	2.081 ±0.029d	2.022 ±0.023e	2.229 ±0.018e	2.148 ±0.012e
Significant	*	*	*	*	*	*

* There are significant differences (P≤0.05) between the treatments. T1 (control), T2, T3, T4, and T5 treatments: Adding Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg feed, respectively.

Average egg mass

Table 5 presents the impact of Gum Arabic powder supplementation on average egg mass (g/head/day) over the same period. In the first production interval (65–68 weeks), T3, T4, and T5 showed significant ($P < 0.05$) improvements over the control, with T1 recording the lowest egg mass of 39.75 g/head/day, while T5 achieved the highest value of 50.49 g/head/day. Throughout the subsequent intervals (69–72, 73–76, 77–80, and 81–84 weeks), T2, T3, T4, and T5 consistently outperformed T1, which had the lowest egg masses of 41.39, 43.31, 39.02, and 36.18 g/head/day, respectively. Meanwhile, T5 recorded the highest egg masses of 53.44, 55.25, 56.86, and 51.57 g/head/day in the respective intervals. Overall, for the full duration (65–84 weeks), the gum-supplemented treatments showed significant ($P < 0.05$) improvement in egg mass compared to the control, which recorded the lowest average egg mass of 39.93 g/head/day, while T5 registered the highest at 53.52 g/head/day.

Feed conversion ratio

Table 6 shows the effect of Gum Arabic powder addition on feed conversion ratio (FCR) from 65 to 84 weeks. During all production intervals (65–68, 69–72, 73–76, 77–80, and 81–84 weeks), treatments T2, T3, T4, and T5 recorded significantly ($P < 0.05$) better FCR values compared to T1 (control), which showed FCRs of 2.893, 2.778, 2.655, 2.947, and 3.178 g feed/g eggs, respectively. Treatment T5 consistently recorded the best FCRs, with values of 2.277, 2.151, 2.081, 2.022, and 2.229 g feed/g eggs in the respective intervals. The overall average FCR from 65 to 84 weeks also favored the gum-supplemented groups, which significantly ($P < 0.05$) outperformed the control value of 2.880 g feed/g eggs.

DISCUSSION

The observed improvements in production traits highlight the importance of using Gum Arabic powder, which contains active compounds such as phenols and flavonoids. These compounds enhance feed utilization by the birds, particularly due to constituents like coumarin and resorcinol, which protect and support liver function to optimize metabolic activity (Ahmed and Essien, 2023). Phenols and flavonoids have a positive effect on the productive performance of chickens, especially by enhancing egg production (Taoyan *et al*., 2023) through direct and indirect impacts on the reproductive axis. They contribute to increased estrogen secretion, a key hormone regulating reproduction (Huo *et al*., 2020), which stimulates the release of follicle-stimulating hormone (FSH). FSH, in turn, promotes the growth, differentiation, and development of ovarian follicles, leading to increased ovulation rates and thus a higher number of eggs produced (Prastiya *et al*., 2022).

Furthermore, phenols and flavonoids enhance progesterone secretion from granulosa cells before ovulation, supporting physiological changes necessary for the ovulation cycle and hormonal balance. These compounds also stimulate the proliferation and differentiation of granulosa cells, improving ovarian efficiency in hormone production and follicular development. Their antioxidant and anti-inflammatory properties reduce oxidative stress, improving overall reproductive health and positively affecting egg quality and production. Given these benefits, phenols and flavonoids are safe and natural feed additives to enhance reproductive and productive performance in laying hens, particularly during later production stages (Guo *et al*., 2020).

Quercetin, one of the bioactive compounds in Gum Arabic powder, acts as an antioxidant and supports digestive function by improving nutrient absorption, which translates into improved egg production characteristics in supplemented groups (Ali *et al*., 2020, 2021). Moreover, Gum Arabic is rich in carotenoids (Shehab *et al*., 2023), natural antioxidants that facilitate the transport of yolk precursors (vitellogenin) from the liver to ovarian follicles. This protection of hepatocyte membranes from oxidative stress supports vital cellular metabolism, resulting in

enhanced yolk deposition and increased egg mass, accelerating egg maturation and improving production performance (Puthpongsiriporn *et al*., 2001; Al-Zanqana, 2021; Ali *et al*., 2024).

Additionally, Gum Arabic contains polysaccharides such as arabinose, glucose, rhamnose, chloronic acid, and xylose, which contribute to its prebiotic properties. These sugars promote a healthy gut environment by producing short-chain fatty acids in the intestine, reducing acidity, preventing pathogen adhesion, and increasing beneficial bacteria. This improves nutrient absorption and overall health status, positively influencing production traits in chickens (Al-Fadil *et al*., 2013; Albaadani *et al*., 2021; Al-Jebory *et al*., 2024).

The improvement in feed conversion ratio may also be due to phenolic compounds enhancing the digestive tract's ability to digest proteins and amino acids (Khan *et al*., 2022; Abed and Abdul-Lateef, 2025). Antioxidants such as lycopene present in Gum Arabic protect lipids and polyunsaturated fatty acids from oxidative degradation by inhibiting lipid peroxidation and neutralizing free radicals, preserving nutritional value and energy content. This lipid protection leads to better fat utilization and energy yield, contributing to the superior feed conversion ratios observed in Gum Arabic supplemented groups (Brenes *et al*., 2008; Ali *et al*., 2015).

CONCLUSIONS AND RECOMMENDATIONS

The addition of Gum Arabic powder at concentrations of 15, 20, 25, and 30 g/kg to the diets of laying hens significantly improved several production traits, including hen-day egg production (H.D.), average egg weight, cumulative number of eggs, average egg mass, and feed conversion ratio, compared to the control group (T1). Based on these results, we recommend supplementing laying hen diets with Gum Arabic powder at 30 g/kg throughout the rearing period to enhance the productivity of older hens. Furthermore, we suggest conducting liver histological studies to assess potential physiological effects, as well as investigating the impact of Gum Arabic supplementation in the diets of both laying hens and broiler breeders. Additionally, research into the effects on offspring is warranted, especially considering the current scarcity of local studies on Gum Arabic.

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NOVELTY STATEMENT

Our study provides strong evidence that Gum Arabic powder positively influences the productive performance of laying hens. These findings offer new insights into the potential of Gum Arabic as a natural feed additive to enhance both the health and productivity of poultry. Moreover, the bioactive compounds present in Gum Arabic powder such as coumarin and astilbin hold promise for applications beyond animal nutrition. Due to their potent antioxidant and anticancer properties, these compounds could be further explored and extracted for use in the pharmaceutical and nutraceutical industries.

AUTHOR'S CONTRIBUTION

Ibrahim Hamza Yasser: conceived the presented idea, researched and supervised the results of this work, conducted the experiment, supervised the project, and contributed to the final version of the manuscript. Nihad Abdul Lateef Ali: conceived the presented idea, verified the analytical methods, conducted the experiment, and took part in drafting the final manuscript.

Generative AI and AI-assisted technology statement

The author(s) declare that no Genrative AI was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

REFERENCES

Abbas NK, Ali NA (2023). Physiological changes caused by dietary proanthocyanidin supplementation at varying doses in laying hens. IOP Conf. Ser. Earth Environ. Sci., 1262(7): 072040. https://doi.org/10.1088/1755-1315/1262/7/072040

Abed OM, Abdul-Lateef AN (2025). Effect of plantago ovata seed supplementation on laying hens' productive performance. Adv. Anim. Vet. Sci., 13(3): 523–532. https://doi.org/10.17582/journal.aavs/2025/13.3.523.532

Al-Jebory HH, Al-Saeedi MKI, Ajafar M, Ali NA (2024). Impact of melatonin on improving productive traits of broiler exposed to environmental stress. Adv. Anim. Vet. Sci., 12(4): 775–781. https://doi.org/10.17582/journal.aavs/2024/12.4.775.781

Ahmad BM, Essien EN (2023). Impact of Arabic gum powder on the growth performance and health status of Chickens. Asia-Africa J. Acad. Res. Rev., 3(2): 53-62. https://journals.iapaar.com/index.php/AAJARR/article/view/126

Ahmed AH, Tahreem R, Muhammad A, Iram G, Momina I, Umme L, Rida Z, Fethi AO, Gaweł S, Ebrahim Marcos A, Chukwuebuka E, Adonis S, Muhammad A, Pragnesh P (2024). A review on ethnobotanical, pharmacological, and conventional uses of gum Arabic. Int. Arch. Integr. Med.,

11(3): 23-30.

Al-Baadani HH, Al-Mufarrej SI , Al-Garadi MA, Alhidary IA, Al-Sagan AA, Azzam MM (2021). The use of Gum Arabic as a natural prebiotic in animals: A review. Anim. Feed Sci. Technol., 274. https://doi.org/10.1016/j.anifeedsci.2021.114894

Al-Fadil S, Mukhtar MA, Mohammed HT (2013). Response of broiler chicks to deits containing gum Arabic as natural prebiotic. J. Curr. Res. Sci., 1(4): 247-253.

Ali NE, Kaddam LA, Alkarib SY, Kaballo BG, Khalid SA, Higawee A, Saeed AM (2020). Gum Arabic (*Acacia senegal*) augmented total antioxidant capacity and reduced C- reactive protein among hemodialysis patients in phase II trial. Int. J. Nephrol., 1: 7214673. https://doi.org/10.1155/2020/7214673

Ali NA, Allaw AA, Mohammed AB (2015). Effect of adding different levels of Lycopene to the ration on liver enzymes and malondialdehyde concentration of the layer hens ISA-Brown. Sci. J. King Faisal Univ., 16(2): 13–25.

Ali DA, Ali NA, Aljubouri TRS, Al-Shuhaib MBS (2024). A novel intron variant in the prolactin gene associated with eggshell weight and thickness with putative alternative splicing patterns in chickens. J. Genet., 103(2): 30. https://doi.org/10.1007/s12041-024-01482-w

Ali NA-L, Al-Nasrawi MAM, Al-Kassie GA (2021). Investigation on the effect of adding diverse concentrations of aqueous extract of oregano leaves (*Origanum vulgare*) on physiological and immunological behaviors of broiler. Biochem. Cell. Arch., 21: 2657–2661.

Alhamdani HA, Shahooth MA, Ali NA, Mousa BH, Al-Thuwaini TM (2025). Individual and synergistic effect of adding zeolite and yeast to reduce the negative impact of aflatoxin B1 on the physiological and immune performance of laying hens. J. Anim. Health Prod., 13(1): 38–44. https://doi.org/10.17582/journal.jahp/2025/13.1.38.44

Al-Zanqana KWA (2021). Productive performance, some physiological indicators and egg quality characteristics of laying hens treated with grape seed powder, tomato powder and BHT. PhD thesis, University of Kirkuk - College of Agriculture.

Brenes A, ViverosA, Goni I, Centeno C, Sayago-Ayerdi SG, Arija I, Saura-Calixto F (2008). Effect of grape pomace concentrate and vitamin e on digestibility of polyphenols and antioxidant activity in chickens. Poult. Sci., 87: 307–316. https://doi.org/10.3382/ps.2007-00297

Duncan DB (1955). Multiple range and multiple F-tests. Biometrics, 11: 1-42. https://doi.org/10.2307/3001478

El-Ratel IT, Rehab FSA, Sara FF (2019). Productive performance, carcass traits, lipid profile, antioxidants and immunity of growing rabbits treated with gum arabic under Egyptian summer condition. Egypt. J. Nutr. Feed., 22(2): 383–394. https://doi.org/10.21608/ejnf.2019.79436

Guo Y, Li Y, Zhang S, Wu X, Jiang L, Zhao Q, Xue W, Huo S (2020). The effect of total flavonoids of Epimedium on granulosa cell development in laying hens. Poult. Sci., 99(9): 4598- 4606. https://doi.org/10.1016/j.psj.2020.05.032

Hammod AJ, Ali NA, Alkassar AM, Jameel YJ (2018). The effect of partial replacement of maize by date pits on broiler performance. J. Pure Appl. Microbiol., 12(2): 807–813. https://doi.org/10.22207/JPAM.12.2.42

Huo S, Li Y, Guo Y, Zhang S, Li P, Gao P (2020). Improving effects of Epimedium flavonoids on the selected reproductive features in layer hens after forced molting. Poult. Sci., 99(5): 2757-2765. https://doi.org/10.1016/j.psj.2019.12.053

Ismail FSA, Hassan RA, Abu El-Hassan EA (2016). Effect of arabic gum on egg production and some blood constituents of laying hens under hot summer conditions in Egypt. J. Anim. Poult. Prod., 7(3): 77-83. https://doi.org/10.21608/jappmu.2016.48515

Jiang S, Mohammed AA, Jacobs JA, Cramer TA, Cheng HW (2020). Effect of synbiotics on thyroid hormones, intestinal histomorphology, and heat shock protein 70 expression in broiler chickens reared under cyclic heat stress. Poult. Sci., 99(1): 142-150. https://doi.org/10.3382/ps/pez571

Khan S, Chand N, Hafeez A, Ahmad N (2022). Effect of gum arabic on overall growth performance, visceral and lymphoid organs along with intestinal histomorphology and selected pathogenic bacteria of broiler chickens. J. Anim. Hlth. Prod., 10: 73–80. https://doi.org/10.17582/journal.jahp/2022/10.1.73.80

Magnini RD, Hilou A, Millogo-Koné H, Compaore S, Pagès JM, Davin-Regli A (2020). A review on ethnobotanical uses,biological activities, and phytochemical aspects of *Acacia senegal* (L.) Willd. and *Acacia seyal* Delile. (Fabaceae). Int. J. Plant Sci.Hor., 2: 32–55. https://doi.org/10.36811/ijpsh.2020.110023

NRC National Research Council (1994). Nutrient requirement of poultry, (9th rev. ed.). National Research Council. National Academy Press, Washington, D.S, USA.

Oke OE, Akosile OA, Oni AI, Opowoye IO, Ishola CA, Adebiyi JO, Odeyemi AJ, Adjei-Mensah B, Uyanga VA, Abioja MO (2024). oxidative stress,oxidative stress in poultry production, in poultry production. Poult. Sci., 103 (9): 104003. https://doi.org/10.1016/j.psj.2024.104003

Prastiya RA, Madyawati SP, Sari SY, Nugroho AP (2022). Effect of follicle-stimulating hormone and luteinizing hormone levels on egg-laying frequency in hens. Vet. World, 15(12): 2890-2895. https://doi.org/10.14202/vetworld.2022.2890-2895

Puthpongsiriporn U, Scheideler SE, Sell JL, Beck MM (2001). Effects of vitamin E and C supplementation on performance, *in vitro* lymphocyte proliferation, and antioxidant status of laying hens during heat stress. Poult. Sci., 80(8): 1190- 1200. https://doi.org/10.1093/ps/80.8.1190

Rahmasari R, Hertamawati RT, Ningsih N, Imam S, Suryadi U, Nugraha BA (2022). Carica papaya seed meal in diet can reduce egg quail cholesterol without reduce egg quality. In IOP Conf. Ser. Earth Environ. Sci., 980(1): 1–4. https://doi.org/10.1088/1755-1315/980/1/012022

Saad MF, Saad MF, Abd Alla EA, Tawfeek FA, Abd Elhady D, Eshraa AA, Badawy YK (2022). Effect of feeding different levels of arabic gum (AG) on physiological and productive performance of a local breed of chicken. J. Anim. Poult. Prod., 13(9):125-130. https://doi.org/10.21608/jappmu.2022.153949.1049

Shehab N, Addai ZR, Abbas YK (2023). Effect of gum Arabic and arginine on antioxidant activity and the growth of *Lactobacillus* in rats. J. Educ. Pure Sci., 13(3). https://doi.org/10.32792/jeps.v13i3.352

Statistical Analysis System (SAS) (2012). User's guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.

Taoyan Q, Jianping W, Xuemei D, Qiufeng Z, Shiping B, Li L, Yue X, Huanwei P, Keying Z (2023). The improving effect of soybean isoflavones on ovarian function in older laying hens. Poult. Sci., 102(10): 102944. https://doi.org/10.1016/j.psj.2023.102944

Yasser DH, Ali NA (2025). Effect of adding different concentrations of aqueous and alcoholic extract of garviola (*Annona muricata*) leaves to drinking water on productive performance of laying hens. IOP Conf. Ser. Earth Environ. Sci., 1449(1): 012002. https://doi.org/10.1088/1755-1315/1449/1/012002