Zagazig J. Agric. Res., Vol. 52 No. (4) 2025 877- 884

Animal, Poultry and Fish Production Research

Available online at http://zjar.journals.ekb.eg
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# IMPACT OF ADDING *Astragalus membranaceus* POWDER IN PEKIN DUCKLINGS' DIETS ON THE PERFORMANCE DURING THE FIRST TWO WEEKS OF AGE

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**Received: 24/07/2025; Accepted: 31/08/2025**

**ABSTRACT:** This study was designed to evaluate the effects of adding *Astragalus membranaceus* in Pekin ducklings' diets at two levels (0.5 and 1.0 g/kg diet) on growth performance parameters of growing ducklings during the first two weeks of age. A total of 150 healthy one- day-old Pekin ducklings were randomly distributed into 3 experimental groups. Each group contained 5 replicates with 10 birds each. The first group received the standard diet with no supplementation, while the 2nd and 3rd groups received the standard diet supplemented with 0.5 and 1.0 g *Astragalus membranaceus* per kg diet, respectively. This study found that dietary supplementation with *Astragalus membranaceus* at 0.5 and 1.0 g/kg diet had no significant impact (P> 0.05) on the growth performance of Pekin ducklings during the first two weeks of age. Live body weight (LBW) at hatch and at the end of weeks 1 and 2 showed no significant differences among groups (P = 0.325, 0.964, and 0.442, respectively). Similarly, daily body weight gain (DBWG) during 0–1 week, 1–2 weeks, and the overall 0–2-week period was not significantly affected (P=0.823, 0.368, and 0.517, respectively) by dietary supplementation of *Astragalus membranaceus*. Daily feed intake (DFI) also remained statistically unchanged across all treatments (P = 0.429, 0.708, and 0.651), despite slight numerical increases in the supplemented groups. Furthermore, feed conversion ratio (FCR) during all intervals showed no significant variation among treatments (P = 0.313, 0.819, and 0.700). Overall, the inclusion of *Astragalus membranaceus* at these levels did not significantly affect growth, DFI, or FCR in young Pekin ducklings.

**Key words:** Dietary Astragalus supplementation; Pekin ducklings' performance

## INTRODUCTION

Ducks, as a major group of waterfowls, play a significant role in the global poultry sector. Over the past decades, duck meat production has shown a notable upward trend. Between 2000 and 2013, worldwide duck meat output rose from 2.9 to approximately 4.4 million metric tons, reflecting an average annual growth of 3.2% **(Evans, 2015)**. This upward trajectory continued, reaching 7.2 million tons by 2018. The United States alone accounted for the production of nearly 31 million ducks annually (IndexBox and GlobalTrade). Asia remains the dominant hub for duck meat production, with notable contributions also from France, Myanmar, the USA, and the UK. Among the breeds raised for meat, the Pekin duck leads in popularity, followed by Muscovy and Mule ducks.

The use of antibiotics in the poultry industry has been restricted. As a result, the phytogenic feed additives have been increasingly utilized to serve this purpose, as well as for other benefits **(Ali *et al.*, 2025)**. Therefore, in recent years, there has been a growing demand for sustainable, health-promoting feed additives with added nutritional and functional value in poultry nutrition **(Salah *et al.*, 2019; Emam *et al.*, 2023; Mohamed *et al.*, 2024)**. Natural and biological supplements are increasingly being utilized in poultry diets to improve growth performance, immune status, and overall health **(El-Tarabany**

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***et al*., 2021; Rafeeq *et al*., 2022; Abd Elzaher *et al*., 2023)**. Dietary supplementation of herbs and other ingredients that contain bioactive components boost the productivity and health status of poultry **(Maznouk, 2025)**. The perennial plant *Astragalus membranaceus*, which belongs to the Leguminosae family, is also known as Radix Astragali in Latin and Huangqi in Chinese medicine **(Jia *et al.*, 2012)**. Broadly recognized in traditional Chinese medicine, *Astragalus membranaceus* has long been utilized for its immune-enhancing properties and as a remedy for ailments such as fatigue, anorexia, cardiovascular disorders, diarrhea, and respiratory infections. The dried root of *Astragalus membranaceus* is rich in various bioactive constituents, including polysaccharides, astragalosides, flavonoids, saponins, amino acids, and trace minerals, which contribute to its pharmacological properties **(Zhao *et al.*, 2012)**.

Among its many bioactive components, Astragalus polysaccharides have been extensively studied for their diverse biological activities. Astragalus polysaccharides exhibit powerful immune-modulating, antioxidant, antiviral, anti-inflammatory, anti-stress, and anti-aging effects **(Li and Zhang, 2009)**. In poultry, dietary Astragalus polysaccharides supplementation at 220 ppm yielded enhancements in both types of adaptive immune (humoral and cellular immunity), as well as offering protection against bacterial, viral, and parasitic infections **(Li *et al.*, 2009)**.

Additionally, polysaccharides of Astragalus contribute to deep immune support by regulating specific immune cell functions, making the herb particularly beneficial under conditions of environmental or physiological stress. Unlike synthetic pharmaceuticals, Astragalus is rarely used as a standalone remedy in TCM but is typically combined with other herbs to enhance its therapeutic effects. *Astragalus membranaceus* Bunge's roots, Astragali Radix, have liver protective, antioxidant, antiviral, and antihypertensive properties **(Shahrajabia *et al.*, 2019)**. This study investigates the hypothesis that dietary supplementation with *Astragalus membranaceus* improves the growth performance of Pekin ducklings during the first two weeks of age.

# MATERIALS AND METHODS

## Experimental Design, Ducklings and Managerial Conditions

The present study was carried out in a private duck farm, Sharkia governorate, Egypt. A total number of 150 one-day-old Pekin ducklings were randomly distributed to 3 equal groups in a one way completely randomized design. Each group contained 50 ducklings with 5 replications (10 birds each). The first group received the standard diet with no supplementation, while the 2$^{nd}$ and 3$^{rd}$ groups received the standard diet supplemented with 0.5 and 1.0 g *Astragalus membranaceus* per kg diet. Birds in each replicate were placed in a separate litter floor pen (150×100 cm). Birds in all treatment groups were fed on the same basal diets (Table 1) which were formulated to meet or exceed Pekin duck requirements during the starter period according to **NRC (1994)**.

All birds were reared in an open-sided duck farm. The indoor temperature was around 33°C through the first three days of age, after that the temperature was gradually reduced to 27°C at the end of the trial (14$^{th}$ day of age). The standard management and husbandry procedure was applied during the experimental period. Feed and water were introduced *ad libitum* through the experimental period.

## Data Collection

### Live body weight (LBW) and body weight gain (BWG)

Ducklings were weighed post-hatch on the first day of age (LBW 0) and were equally distributed among the replicates (10 birds each) to ensure that the average body weight was approximately equal across all replicates. Birds were weighed again at the end of the first (LBW 1) and second (LBW 2) week of age. Body weight gain (g/day) was calculated by subtracting the average live body weight of each replicate between two successive weights (DBWG 0-1 and DBWG 1-2). Also, body weight gain was calculated for the whole period (DBWG 0-2) by subtracting the average initial live body weight (LBW 0) from the average final live body weight (LBW 2) of each replicate.

**Table 1. Ingredients and calculated nutrients' content of the control diet**

| Ingredients | % |
|---|---|
| Yellow corn (8.5%) | 56.5 |
| Soybean meal (44%) | 37.0 |
| Corn gluten meal (62%) | 1.50 |
| Soybean oil | 2.00 |
| Limestone | 0.59 |
| Dicalcium phosphate | 1.41 |
| Salt | 0.20 |
| Premix[1] | 0.30 |
| Choline-chloride (50%) | 0.30 |
| Dl-Methionine | 0.03 |
| Sodium bicarbonate | 0.17 |
| **Total** | **100** |
| **[2]Calculated nutrients' content** | |
| Crude protein % | 22.03 |
| Calcium % | 0.65 |
| Available Phosphorus % | 0.40 |
| Lysine % | 1.16 |
| Methionine % | 0.41 |
| Total sulfur amino acids % | 0.75 |
| Metabolizable energy (kcal/kg diet) | 2951 |

[1] Provides per kg of diet: Vitamin A, 12,000 I.U; Vitamin D3, 5000 I.U; Vitamin E, 130.0 mg; Vitamin K3, 3.605 mg; Vitamin B1 (thiamin), 3.0 mg; Vitamin B2 (riboflavin), 8.0 mg; Vitamin B6, 4.950 mg; Vitamin B12, 17.0 mg; Niacin, 60.0 mg; D-Biotin, 200.0 mg; Calcium D-pantothenate, 18.333 mg; Folic acid, 2.083 mg; manganese, 100.0 mg; iron, 80.0 mg; zinc, 80.0 mg; copper, 8.0 mg; iodine, 2.0 mg; cobalt, 500.0 mg; and selenium, 150.0 mg.
Calculated according to **NRC (1994)**

### Feed intake (FI) and feed conversion ratio (FCR)

At the beginning of each experimental period, a certain amount of each experimental diet was weighed for each replicate within each treatment group. At the end of the certain period, the remaining diet was weighed and subtracted from that offered to obtain the total feed intake per replicate during the certain period. The previous amount was divided by number of chicks in the replicate to obtain average amount of feed intake per chick. The previous amount was divided by period length (day) to obtain the average amount of feed intake per chick per day (DFI 0-1, 1-2, and 0-2). Feed conversion ratio (FCR) was calculated as grams of feed required to produce one gram of body gain during each experimental period (FCR 0-1, 1-2, and 0-2). The calculation of FCR was achieved by determining the ratio between average daily DFI and average daily DBWG.

## Statistical Analysis

Analysis of variance for data was accomplished using the SAS General Liner Models Procedure **(SAS Institute, 2004).** The model was assessed for different traits according to **Snedecor and Cochran (1982).** The statistical fixed model used was:

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

Where:

$Y_{ij}$ = An observation.

$\mu$ = Overall mean.

$T_i$=The fixed effect of *Astragalus membranaceus* treatment (0.0, 0.5, and 1.0 g/kg diet).

$e_{ij}$ = Random error.

Duncan's new multiple range test was used to test the differences among the means according to **Duncan (1955).** Statistical significance was accepted at a probability level of 0.05 ($P < 0.05$).

# RESULTS

## Live Body Weight

The data presented in Table 2 indicate that dietary supplementation with *Astragalus membranaceus* at levels of 0.5 and 1.0 g/kg diet had no significant effect (P > 0.05) on the LBW of Pekin ducklings during the first two weeks of age. Post-hatch LBW, as well as body weights recorded at the end of the first and second weeks, showed minor numerical (P = 0.325, 0.964, and 0.442, respectively) variations among the groups; however, these differences were not statistically significant. Specifically, ducklings in all groups exhibited comparable growth performance, with LBW values at each time point remaining consistent across treatments. These findings suggest that inclusion of *Astragalus membranaceus* at the tested levels does not influence the LBW during the first and the second week of age in Pekin ducklings.

## Daily Body Weight Gain

As shown in Table 3, the inclusion of *Astragalus membranaceus* in the diets of Pekin ducklings at levels of 0.5 and 1.0 g/kg diet had no statistically significant impact (P > 0.05) on DBWG during the first two weeks of age. Across all growth intervals (0–1 week, 1–2 weeks, and the overall period) the DBWG values were numerically similar (P = 0. 823, 0. 368, and 0. 517, respectively) among the treatment groups and the control. These results indicate that dietary supplementation with *Astragalus membranaceus* at the tested levels did not significantly influence early growth rate in Pekin ducklings.

## Daily Feed Intake

Table 4 demonstrates that the dietary supplementation of *Astragalus membranaceus* at levels of 0.5 and 1.0 g/kg diet did not significantly affect (P > 0.05) the DFI of Pekin ducklings during the first two weeks of age. Throughout all measured intervals (0–1 week, 1–2 weeks, and the overall period) DFI values remained statistically comparable (P = 0. 429, 0. 708, and 0. 651, respectively) among the control and treated groups. Although minor numerical increases in DFI were observed in the supplemented groups, these differences were not statistically meaningful. Overall, the findings suggest that adding *Astragalus membranaceus* at the tested levels did not influence feed intake in young Pekin ducklings.

## Feed Conversion Ratio

Table 5 reveals that the inclusion of *Astragalus membranaceus* at 0.5 and 1.0 g/kg diet had no significant effect (P > 0.05) on the feed conversion ratio (FCR) of Pekin ducklings during the first two weeks of age. FCR values during the first week (0–1 week), second week (1–2 weeks), and the overall 0–2-week period were statistically similar (P = 0. 313, 0. 819, and 0. 700, respectively) across all treatment groups, including the control. Although slight numerical increases in FCR were observed in the supplemented groups, these differences were not statistically meaningful. These results suggest that dietary *Astragalus membranaceus* at the tested levels does not significantly impact feed efficiency in Pekin ducklings during the early growth phase.

# DISCUSSION

The current study found that dietary supplementation with *Astragalus membranaceus* at 0.5 and 1.0 g/kg had no significant effects on the growth performance, in terms of LBW, DBWG, DFI, or FCR of Pekin ducklings during the first two weeks of age. Like our results, **Zhang *et al.* (2013)** found that supplementing broiler diets with 5 g/kg of *Astragalus membranaceus* root powder in nanoparticles from had no significant effect on growth performance of broiler chicks at day 21 of age. In addition, **Alagawany *et al.* (2022)** found that *in ovo* injection of *Astragalus membranaceus* polysaccharides at 1.5–4.5 mg/egg had no significant effect on growth performance of Cobb 500 broiler chicks. Also, **Han *et al.* (2024)** found that dietary inclusion of un-fermented Astragalus powder at 1%, 2%, and 4% insignificantly affected LBW, BWG, and FCR. The same authors stated that fermented Astragalus powder at 1%, 2%, and 4% insignificantly improved LBW, BWG, and FCR. Our findings are in partial contrast to previous research, which reported beneficial outcomes depending on the dose, duration, and animal species used. In the study by **Guo *et al.* (2019)**,

**Table 2. Impact of adding *Astragalus membranaceus* in Pekin ducklings' diets on the live body weight (LBW) during the first two weeks of age**

| Items | Control | *Astragalus membranaceus* levels (g/kg diet) | | Sig. |
|---|---|---|---|---|
| | | 0.5 g | 1.0 g | |
| **Post-hatch LBW** | 46.88 ± 1.165 | 46.66 ± 0.814 | 47.58 ± 0.884 | 0.325 |
| **First week LBW** | 183.2 ± 2.596 | 183.6 ± 2.743 | 183.7 ± 3.268 | 0.964 |
| **Second week LBW** | 445.1 ± 2.270 | 446.3 ± 6.738 | 449.3 ± 5.514 | 0.442 |

LBW: Live body weight.

**Table 3. Impact of adding *Astragalus membranaceus* in Pekin ducklings' diets on the daily body weight gain (DBWG) during the first two weeks of age**

| Items | Control | *Astragalus membranaceus* levels (g/kg diet) | | P-value |
|---|---|---|---|---|
| | | 0.5 g | 1.0 g | |
| **0–1-week DBWG** | 19.46 ± 0.305 | 19.56 ± 0.305 | 19.44 ± 0.358 | 0.823 |
| **1–2-weeks DBWG** | 37.40 ± 0.224 | 37.52 ± 0.936 | 37.94 ± 0.428 | 0.368 |
| **0–2-weeks DBWG** | 28.46 ± 0.114 | 28.54 ± 0.445 | 28.70 ± 0.332 | 0.517 |

**Table 4. Impact of adding *Astragalus membranaceus* in Pekin ducklings' diets on the daily feed intake (DFI) during the first two weeks of age**

| Items | Control | *Astragalus membranaceus* levels (g/kg diet) | | P-value |
|---|---|---|---|---|
| | | 0.5 g | 1.0 g | |
| **0–1-week DFI** | 26.00 ± 0.906 | 26.92 ± 1.186 | 26.26 ± 1.218 | 0.429 |
| **1–2-weeks DFI** | 60.24 ± 1.989 | 61.62 ± 2.971 | 61.58 ± 3.647 | 0.708 |
| **0–2-weeks DFI** | 43.14 ± 1.419 | 44.28 ± 2.080 | 43.96 ± 2.302 | 0.651 |

**Table 5. Impact of adding *Astragalus membranaceus* in Pekin ducklings' diets on the feed conversion ratio (FCR) during the first two weeks of age**

| Items | Control | *Astragalus membranaceus* levels (g/kg diet) | | P-value |
|---|---|---|---|---|
| | | 0.5 g | 1.0 g | |
| **0–1-week FCR** | 1.335 ± 0.037 | 1.376 ± 0.044 | 1.350 ± 0.043 | 0.313 |
| **1–2-weeks FCR** | 1.610 ± 0.057 | 1.643 ± 0.105 | 1.622 ± 0.082 | 0.819 |
| **0–2-weeks FCR** | 1.516 ± 0.049 | 1.551 ± 0.082 | 1.530 ± 0.064 | 0.700 |

feeding quails with 3% *Astragalus membranaceus* stems and leaves significantly improved growth performance, feed intake, antioxidant status, and immunity over a 35-day period. The highest growth was observed at 3%, with reduced efficacy at 5%, suggesting a dose-dependent and species-specific response. Importantly, their trial was longer (35 days *vs.* 14 days in the current study) and their supplements' dose was higher (up to 5%), which may explain the absence of significant growth responses in ducklings over a shorter period. Furthermore, the study by **Zhao *et al.* (2025)** on juvenile *Larimichthys crocea* demonstrated that combining *Astragalus membranaceus* polysaccharides (0.1%) with *Forsythia suspensa* extract significantly enhanced growth, antioxidant capacity, and digestive enzyme activity. Interestingly, the group treated with *Astragalus membranaceus* polysaccharidesalone (0.1%) showed only numerical, not significant, improvements, consistent with the current findings in ducklings. This suggests that synergistic formulations or higher concentrations may be necessary to unlock the full potential of *Astragalus membranaceus* polysaccharidesin growth promotion.

## Conclusion

Based on the current findings, dietary supplementation with *Astragalus membranaceus* at levels of 0.5 and 1.0 g/kg diet did not produce significant improvements in growth performance, daily feed intake, or feed conversion ratio in Pekin ducklings during the first two weeks of age. These results suggest that the tested inclusion levels and short treatment duration may not be sufficient to elicit measurable physiological or growth responses. Therefore, it is recommended that future studies explore the effects of higher supplementation levels and/or extended feeding periods to better evaluate the potential benefits of *Astragalus membranaceus* in duck nutrition. Additionally, examining its impact under stress conditions or in combination with other phytogenic additives may provide further insight into its possible applications in poultry production systems.

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صُممت هذه الدراسة لتقييم تأثير إضافة نبات *Astragalus membranaceus* إلى علائق البط البكيني بمستويين (0.5 و1.0 جم/كجم علف) على معايير الأداء الإنتاجي خلال أول أسبوعين من العمر، حيث تم استخدام 150 كتكوت سليمًا من البط البكيني بعمر يوم واحد، وجرى توزيعها عشوائيًا على ثلاث مجموعات تجريبية، حيث احتوت كل مجموعة على 5 مكررات بواقع 10 طيور لكل مكرر. تلقت المجموعة الأولى العليقة القياسية دون أي إضافات، في حين تلقت المجموعتان الثانية والثالثة نفس العليقة القياسية مضافًا إليها 0.5 و1.0 جم من *Astragalus membranaceus* لكل كجم علف على التوالي. أظهرت نتائج الدراسة أن الإضافة الغذائية لـ *Astragalus membranaceus* بهذه المستويات لم يكن لها تأثير معنوي على الأداء الإنتاجي للبط البكيني خلال الأسبوعين الأولين من العمر، ولم تُسجّل أي فروق معنوية في الوزن الحي عند الفقس أو في نهايتي الأسبوعين الأول والثاني، وبالمثل، لم يتأثر معدل الزيادة اليومية في الوزن خلال الفترات 0–1 أسبوع، 1–2 أسبوع من العمر، وخلال الفترة الكلية، كما لم يُظهر معدل الاستهلاك اليومي للعلف فروقًا معنوية بين المعاملات المختلفة على الرغم من وجود زيادات طفيفة في المجموعات المعاملة، وبالإضافة إلى ذلك، لم تختلف قيم معامل التحويل الغذائي بشكل معنوي بين المعاملات خلال جميع الفترات التجريبية ، وبشكل عام، لم تؤدِ إضافة *Astragalus membranaceus* بهذه المستويات إلى تأثيرات معنوية على النمو أو استهلاك العلف أو كفاءة التحويل الغذائي في البط البكيني الصغير خلال أول أسبوعين من العمر.

**الكلمات الإسترشادية:** الإضافة الغذائية من الاستراجلس، أداء صغار البط البكيني.

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