American Journal of Biology and Natural Sciences
https://biojournals.us/index.php/AJBNS
**ISSN: 2997-7185**

# Effects Synthetic and Herbal Lysine on Nutritional Value of Local Sesame Seed Meal, Productive Performance and Quality Characteristics of Eggs in Japanese Quail

**Sameerah H. Amen, Qana H. Al-Jabari, Ahmed Ghfoor Baker**
Animal production department, college of agriculture, Kirkuk University, Kirkuk, Iraq

**Ahmed S. Shaker**
Medical Laboratory Technology, Al-Qalam University College, Kirkuk, Iraq

**Received:** 2025, 15, Jul
**Accepted:** 2025, 21, Aug
**Published:** 2025, 15, Sep



**Annotation:** Investigating synthetic and herbal lysine supplementation on local sesame seed meal is crucial for enhancing the nutritional value of quail feed, which can significantly improve the productive performance and egg quality characteristics of Japanese quail. The aimed of the experiment was to study the effect of replacing the sesame male with the soybean meal at different levels by adding synthesis and herbal lysine in the diet of Japanese quail on the egg productivity and egg quality traits such as percentage of hen day, egg mass, feed conversion ration, yolk weight, albumin weight, shell weight, percentage of yolk, percentage of albumin, and percentage of shell. Eighty-four female quail at 45 days of age were used, and divided into seven treatments were as follow included control diet (T1), replacing soybean meal (33%) with sesame seed meal by adding synthetic lysine 1.007 g (T2), replacing soybean meal (66%) with sesame seed meal by adding synthetic lysine 1.010 g (T3), replacing soybean meal (100%) with sesame seed meal by adding synthetic lysine 0.996 g (T4), replacing soybean meal (33%) with sesame seed meal by adding herbal lysine 1.007 g (T5), replacing soybean meal

(66%) with sesame seed meal by adding herbal lysine 1.010 g (T6), and replacing soybean meal (100%) with sesame seed meal by adding herbal lysine 0.996 T7, each treatment consists of three replications, and each replication has 4 quails. The productivity traits included (HD%), egg mass (EM), and feed conversion ration were improved significantly by adding the sesame meal, and synthetic lysine. Significant improving were observed between the treatments in yolk weight, albumin weight, and egg shell weight, also their percentages of the egg internal traits (yolk, albumin, and eggshell) were improved significantly. Replacing the soybean meal with sesame meal, by adding the herbal lysine was effectiveeffective on the egg internal traits (yolk, albumin, shell), and also was effectiveeffective on the percentage of (yolk, albumin, shell).

**Keywords:** Quail, Sesame, Lysine, Herbal, Egg, Trait.

## INTRODUCTION

Egg productivity, and quality traits are affected by many environmental factors such as light, diet, breeding system, etc (Gazi et al., 2015; Al-Hadeedy et. al., 2019; Zangana and Al-Neemi, 2023), genetic factors (AlSalihi et al., 2022), and the interaction between them (Shaker et al., 2023), also the traits has correlations among them (Shaker et al., 2019 a). Moreover, there are also other factors that may lead to differences and variations in these characteristics (Aziz et al., 2017; Al-Hadeedy et al., 2023). Depending on the method of extraction, 42–50% of soy meal is protein. Because of its excellent nutritional content and prolific production, it is regarded as the main source of vegetable protein in chicken feed (Stain et al., 2008). As a result, it is utilized in large amounts in feed, sometimes combined with fish or animal sources, or supplemented with synthetic amino acids to make up for the deficiencies in soybeans, such methionine (Al-Dalawi and AL-Hadeedy, 2019). It is important to remember that raw soybeans contain trypsin inhibitors, which must be eliminated by heat or another technique (Yan and Sam, 2022). For this reason, raw soybeans cannot be utilized. There are several reasons that encouraged researchers to use alternatives to soybean meal, including its high price on the international market (Alcorta et al., 2021). For this reason, many leguminous crops have been used as partial or complete substitutes for soybeans, with emphasis on the fact that these sources contain essential amino acids such as methionine and lysine (Pingxu et al., 2022). Sesame meal is considered a good source of vegetable protein and contains 47% protein, and its nutritional value increases when mixed with soybean meal. It is criticized for its low lysine content, but this problem ends when mixed with soybean

meal, as mentioned above (Souza et al., 2017). Sesame meal is used at a rate not exceeding half of the protein sources in the feed, and at a maximum of 15% of the amount of feed consumed. The aimed of the experiment was to study the effect of replacing the sesame meal with the soybean meal by adding different levels of synthesiss and herbal lysine in the diet of Japanese quail.

## MATERIAL AND METHODS

The current study was conducted in the field of the Animal Production Department – College of Agriculture – Kirkuk University, Kirkuk, Iraq from 24/8/2021 until 24/10/2021. Eighty-four female quail (*Coturnix japonica*) at 45 days of age , with average body weight (210 g) were used, and divided into seven treatments, each treatment consists of three replications, and each replication has 4 quails. The quails were raised in Batteries that contain 15 cages, and each cage contain 4 quail, and the water, and feed was *ad libitum*.quails The treatments were as follow included control diet (T1) according to (NRC, 1994), replacing soybean meal (33%) with sesame seed meal byby adding synthetic lysine 1.007 g (T2),replacing soybean meal 66%) with sesame seed meal byby adding synthetic lysine 1.010 g (T3),replacing soybean meal 100%) with sesame seed meal byby adding synthetic lysine 0.996 g (T4), replacing soybean meal 33%) with sesame seed meal byby adding herbal lysine 1.007 g (T5),replacing soybean meal 66%) with sesame seed meal byby adding herbal lysine 1.010 g (T6), and replacing soybean meal 100%) with sesame seed meal byby adding herbal lysine 0.996 g (T7) Table 1. The flock was raised in an environmentally controlled field, where the lighting period was 16 hours of light to 8 darkness using fluorescent lights, with a high light of 25 lux, while a temperature ranged between 37 to 25 according to the flock age, and a humidty ranged with 55 to 65 %.The eggs were collected daily to measure the egg weight weight was measured by using electronic balance, and the egg length, and breadth were measured by using digital virnea with (0.01) mm sensivity. After broken the egg, the yolk weight was measured by using electronic balance, and the eggshell was left in the room teamperture for 24 hours and weighted by using electronic balance. The albumin weight was found by subtract the sum of the weight of yolk and egg shell from the total weight of the egg. The Hen day (HD) percentage was calculated according to the Formula 1**.** Al-Hadeedy and Al-Nuaimy (2018):

HD (%)= [total egg number / (number of hens × breeding period)] ×100

(Formula 1)

The egg mass (g) was calculated according to the Formula 2. Al-Hadeedy and Al-Nuaimy (2018):

Egg mass = TotalT egg number × egg weight mean

(Formula 2)

The Feed conversion ration (FCR; g/g) was calculated according to the Formula 3. Al-Hadeedy and Al-Nuaimy (2018):

FCR = Feed intake / Egg mass

(Formula 3)

The albumin weight (g) was calculated according to the Formula 4. Al-Hadeedy and Al-Nuaimy, 2018

Albumin weight = egg weight – (yolk weight + eggshell weight) (Shaker et al., 2019 b):

(Formula 4)

The yolk percentage was calculated according to the Formula 5 (Shaker et al., 2019 b):

Yolk (%) = (yolk weight / egg weight) ×100

(Formula 5)

The albumin percentage was calculated according to the Formula 6 (Shaker et al., 2019 b):

Albumin (%) = (Albumin weight / egg weight) × 100

(Formula 6)

The egg shell percentage was calculated according to the Formula 7 (Shaker et al., 2019 b):

Eggshell (%) = (Eggshell weight / egg weight) × 100

(Formula 7)

**Statistical analysis**

The data were analyzed by applying one-way ANOVA using SAS v9.1 software (2003). Differences between treatments were tested using Duncan's multiple comparison test (Duncan, 1955), at a significance level of $p \leq 0.05$.

## RESULTS AND DISCUSSION

The effect of treatment on egge productivity traits were shown in Table 2. Significant improving between the treatments were observed in hen day production (HD), egg mass (EM), and FCR, but the feed intake was not affected significantly by adding the sesame meal, and the herbal and synthetic lysine ($P \leq 0.05$). The hen day production was higher in treatment 2, and lower in treatment 7 (92, and 72) respectively, compare to the control group (T1). The egg mass was also higher in treatment 2, and lower in treatment 7 (1437, and 1134) respectively, compare to the control group (T1). The best FCR was for treatment 1, 2, 3, and 6 which was (2.53, 2.25, 2.50, and 2.50) respectively compared with the treatments 4, 5, and 7 ($p \leq 0.05$). Present study disagreed with Baghban-Kanani et al. (2020), who found replacing different concentrations of sesame meal with soybean meal did not affect the HD, egg mass, and FCR in the layer chicken, but significantly affected the feed intake.

The effect of treatment on egge weight, and internal traits weightare shown in Table 3. The egg weight was not affected significantly by adding the sesame meal, and the herbal and synthetic lysine ($P \leq 0.05$), compare to the control group (T1). The yolk weight was significantly differing among the treatments ($P \leq 0.05$), it was high in T5 (3.29g), and T6 (3.17g) respectively, compare to the control group (T1). The albumin weight was also significantly differing among the treatments ($p \leq 0.05$), it was high in T3 (6.36 g), and 4 (38g) respectively, compare to the control group (T1). The shell weight was Significant differing ($P \leq 0.05$) it was high in T2 (0.74g), T5 (0.76g), and T6 (76g) respectively compare to the control group (T1). Present study was agreed with Al-Qaisi and Ameen, (2023), who found that the egg weight was affected significantly by adding the different levels of sesame meal, but the shell weight was significantly differencing among the treatments. Al-Daraji et al., (2012) foundthat replacing the soybean meal by the sesame meal significantly affected the egg weight, yolk weight, albumin weight, and shell weight.

The effect of treatment on egg external traits (length, breadth, and shell thickness)are shown in Table 4. The external egg traits did not affect significantly by adding the sesame meal, and the herbal and synthetic lysine ($p > 0.05$).Present results are agreed with study of Al-Qaisi and Ameen, (2023) that reported the egg shell thickness was not affected significantly by the adding different levels of sesame meal. Al-Daraji et al., (2012) indicated that replacing the soybean meal by the sesame meal (1%) significantly affected the shell thickness.

The effect of treatment on internal egg traits percentage are shown in Table 5. Significant improving were found among the treatments for the three traits of egg internal percentage ($p \leq 0.05$). The yolk percentage was high in T5 (38.01%), and low in T7 (24.12%), compare to the control group (T1). The Albumin percentage was high in T7 (69.51%), and low in T5 (53.25%) respectively, compare to the control group (T1). The shell percentage was high in T1 (7.96%), T2 (8.00%), T5 (8.74%), and T6 (98%) respectively, compare to the control group (T1).This finding

is agreed with Al-Qaisi and Ameen, (2023), thatthat reported the egg shell percentage was significantly affected by adding different levels of sesame meal. Al-Daraji et al., (2012) reportedreported that replacing the soybean meal by the sesame meal significantly affected the yolk weight percentage, albumin weight percentage, and shell weight percentage.

## CONCLUSION

Soybean meal with sesame meal by (66%), by adding the herbal lysine by (1.010) g was effectiveeffective on the yolk, albumin, and shell weight, and also could increase the percentage of egg components . The authors suggested to use different percentage of the herbal laysin in the future studies. contents

## REFERENCES

1. Alcorta A, Porta A, Tárrega A, Alvarez MD, and Vaquero MP (2021). Foods for plant-based diets: Challenges and innovations. Innovations Foods, 10(2): 293.
2. Al-Daraji H, Ahmed H, Al-Hayani W, and Al-Hassani A (2012). Effect of the supplementation of the laying quails ration with sesame (*Sesamum inducum*) seeds and oil on egg quality traits. International Journal of Applied Biology and Pharmaceutical Technology, 3(4): 54-63.
3. Al-Hadeedy, I. Y., Ameen, Q. A., Shaker, A. S., Mohamed, A. H., Taha, M. W., & Hussein, S. M. (2023). Using the Principal Component Analysis of Body Weight in Three Genetic Groups of Japanese Quail. In IOP Conference Series: Earth and Environmental Science (Vol. 1252, Issue 1). https://doi.org/10.1088/1755-1315/1252/1/012148
4. Al-Hadeedy, I. Y., Al-Nuaimi, M. I. A., & Ali, A. R. (2019). Effect of adding local minerals clay (meqdadia) in the female japanese quail diets upon production performance, egg quality and carcass traits. Indian Journal of Public Health Research and Development, 10(8). https://doi.org/10.5958/0976-5506.2019.02020.5
5. Al-Qaisi A and Ameen Q (2023). The effect of partial or total substitution of raw or roasted domestic sesame seeds in laying hens on the qualitative qualities of eggs. Kirkuk University Journal for Agricultural Sciences, 14(3), 113-122.
6. Alsalihi LW, Shaker AS, Ameen QA, and Torres MJO (2022). The effect of line and age on the egg external characteristics of Japanese quail. Basrah Journal of Veterinary Research, 21(S1): 27-34.
7. Aziz S, Shaker A, and Kirkuki S (2017). Changes in external egg traits of chickens during pre- and post-molting periods. Poultry Science Journal, 5(2): 91-95.
8. Baghban-Kanani P, Hosseintabar-Ghasemabad B, Azimi-Youvalari S, Seidavi A, Laudadio V, Mazzei D, and Tufarelli V (2020). Effect of dietary sesame (*Sesame indicum* L.) seed meal level supplemented with lysine and phytase on performance traits and antioxidant status of late-phase laying hens. Asian-Australasian Journal of Animal Sciences, 33(2): 277-285.
9. Duncan DB (1955). Multiple range and multiple F tests. Biometrics, 11(1): 1-42.
10. Gazi Al-Tammee N, Mohammed G, and Younis DTh (2015). Effect of methionine and lysine supplementation in productive performance and some physiological parameters of quail reared under high temperature. Kirkuk University Journal for Agricultural Sciences, 6(1): 55-61.
11. National Research Council. 1994. Nutrient Requirements of Poultry. 9th rev. ed. National Academy Press, Washington, DC.
12. Al-Dalawi, R. H. H., & Al-Hadeedy, I. Y. (2019). Influence of different levels of dietary supplementation Phytase enzyme upon growth performance, carcass traits and some biochemical parameters of local Japanese quail. Plant Archives, 19(2). https://plantarchives.org/19-2/2287-2293%20(4909).pdf

13. Pingxu Q, Taoran W, and Yangchao L (2022). A review on plant-based proteins from soybean: Health benefits and soy product development. Journal of Agriculture and Food Research, 7: 100265.

14. Shaker AS, Ameen QA, Mustafa NA, Akram SA, Kirkuki SM, and Saeed RB (2019 b). The variation between the proportions of egg external and internal traits in four species of birds. International Journal of Advances in science engineering and Technology, 7(4): 1-4.

15. Shaker AS, Mohammed AK, and Razuki WM (2023). Estimation of genetic parameters for egg production traits in Japanese quail that selected for immune responses and fed different level of dietary L-arginine. Kirkuk University Journal for Agricultural Sciences, 14(1): 73-81.

16. Shaker AS, Mustafa NA, Ameen QA, Saadullah MA, Ramadan AA, and Aziz SBR (2019 a). Effect of hen oviposition time on some egg characteristics. Journal of Animal and Poultry Production, 10(6): 171-174.

17. Souza T, Escobar K, Aguilera G, Ramírez B, and Mariscal G (2017). Sesame meal as the first protein source in piglet starter diets and advantages of a phytase: A digestive study. South African Journal of Animal Science. 47(5): 606-615.

18. Stain HJ, Kelly B, Lewin TJ, Higginbotham N. Beard JR, and Hourihan F (2008). Social networks and mental health among a farming population. Social Psychiatry and Psychiatric Epidemiology. 43: 843-849.

19. Yan Z and Sam KCCh (2022). Trypsin inhibitor activity, phenolic content and antioxidant capacity of soymilk as affected by grinding temperatures, heating methods and soybean varieties. LWT, 153: 112424.

20. Zangana N and AL-Neemi M (2023). Effect of substituting synthetic methionine and lysine with herbal, with adding thyronine by 120% in low-protein diets of laying hens on productive and some blood traits. Kirkuk University Journal for Agricultural Sciences, 14(2), 83-90.

**Table 1.** The feed staff and their chemical composition in sesame seed meal with lysine used as a substitute for soybean meal in japanese quailquail

| **The components** | **Treatments** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| Wheat | 49.9 | 43.2 | 38.50 | 34.30 | 43.2 | 38.50 | 34.30 |
| Yellow corn | 6.00 | 14.00 | 19.72 | 24.70 | 14.00 | 19.72 | 24.70 |
| Oil | 5.10 | 4.20 | 3.50 | 2.90 | 4.20 | 3.50 | 2.90 |
| Soybean meal | 31.50 | 21.10 | 10.71 | 0.00 | 21.10 | 10.71 | 0.00 |
| Sesame meal | 0.00 | 10.40 | 20.79 | 31.50 | 10.40 | 20.79 | 31.50 |
| Methionine | 0.16 | 0.10 | 0.03 | 0.01 | 0.10 | 0.03 | 0.01 |
| Lysine | 0.00 | 0.12 | 0.34 | 0.55 | 0.12 | 0.34 | 0.55 |
| Di-calcium phosphate | 0.4 | 0.50 | 0.50 | 0.65 | 0.50 | 0.50 | 0.65 |
| Limestone | 6.35 | 5.84 | 5.35 | 4.85 | 5.84 | 5.35 | 4.85 |
| Table salt | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Premix | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Colin | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Calculated chemical composition** | | | | | | | |
| Energy | 2922 | 2897 | 2876 | 2855 | 2897 | 2876 | 2855 |
| Protein (CP)% | 20.11 | 20.00 | 19.92 | 19.84 | 20.00 | 19.92 | 19.84 |
| Methionine | 0.46 | 0.46 | 0.45 | 0.49 | 0.46 | 0.45 | 0.49 |
| Lysine | 1.103 | 1.007 | 1.010 | 0.996 | 1.007 | 1.010 | 0.996 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Calcium | 2.493 | 2.511 | 2.512 | 2.551 | 2.511 | 2.512 | 2.551 |
| Phosphor | 0.439 | 0.429 | 0.402 | 0.400 | 0.429 | 0.402 | 0.400 |

control diet (T1), replacing soybean meal (33%) by sesame seed meal with adding synthetic lysine (T2), replacing soybean meal (66%) by sesame seed meal with adding synthetic lysine (T3), replacing soybean meal (100%) by sesame seed meal with adding synthetic lysine (T4), replacing soybean meal (33%) by sesame seed meal with adding herbal lysine (T5), replacing soybean meal (66%) by sesame seed meal with adding herbal lysine (T6), and replacing soybean meal (100%) by sesame seed meal with adding herbal lysine (T7)

**Table 2.** Egg productivity traits in sesame seed meal with lysine used as a substitute for soybean meal in japanese quail

| Treatment | HD % | EM (g) | FI (g) | FCR (g/g) |
|---|---|---|---|---|
| T1 | 86±2.65 $^{ab}$ | 1276±4.10 $^{ab}$ | 3221±6.34 $^{a}$ | 2.53±0.05 $^{a}$ |
| T2 | 92±1.45 $^{a}$ | 1437±6.59 $^{a}$ | 3238±7.93 $^{a}$ | 2.25±0.07 $^{a}$ |
| T3 | 74±6.35 $^{bc}$ | 1227±3.80 $^{abc}$ | 3067±1.50 $^{a}$ | 2.50±0.09 $^{a}$ |
| T4 | 75±1.15 $^{bc}$ | 1207±8.77 $^{abc}$ | 3172±4.49 $^{a}$ | 2.66±0.19 $^{ab}$ |
| T5 | 78±3.76 $^{ab}$ | 1144±8.27 $^{bc}$ | 3182±1.14 $^{a}$ | 2.81±0.33 $^{ab}$ |
| T6 | 82±2.03 $^{ab}$ | 1304±2.04 $^{ab}$ | 3266±5.03 $^{a}$ | 2.50±0.06 $^{a}$ |
| T7 | 72±7.22 $^{c}$ | 1134±3.39 $^{c}$ | 3199±2.30 $^{a}$ | 2.91±0.37 $^{b}$ |
| P-value | 0.043 | 0.049 | 0.513 | 0.050 |
| Sig. | * | * | N.S. | * |

control diet (T1), replacing soybean meal (33%) by sesame seed meal with adding synthetic lysine (T2), replacing soybean meal (66%) by sesame seed meal with adding synthetic lysine (T3), replacing soybean meal (100%) by sesame seed meal with adding synthetic lysine (T4), replacing soybean meal (33%) by sesame seed meal with adding herbal lysine (T5), replacing soybean meal (66%) by sesame seed meal with adding herbal lysine (T6), and replacing soybean meal (100%) by sesame seed meal with adding herbal lysine (T7)

HD: hen day, EM: egg mass, FI: Feed intake, FCR:: : : : Feed conversion ratio. Different letters in the same column indicate a significant difference ($p \leq 0.05$) between the means."

**Table 3.** EggE weight, and internal traits weight in sesame seed meal with lysine used as a substitute for soybean meal in japanese quail

| Treatment | EW (g) | YW (g) | AW (g) | SW (g) |
|---|---|---|---|---|
| T1 | 8.84±0.09 $^{a}$ | 2.77±0.06 $^{abc}$ | 5.36±0.16 $^{ab}$ | 0.70±0.02 $^{ab}$ |
| T2 | 9.27±0.09 $^{a}$ | 3.09±0.03 $^{ab}$ | 5.45±0.06 $^{ab}$ | 0.74±0.01 $^{a}$ |
| T3 | 10.00±0.61 $^{a}$ | 3.02±0.30 $^{ab}$ | 6.36±0.26 $^{a}$ | 0.62±0.06 $^{b}$ |
| T4 | 9.60±0.89 $^{a}$ | 2.57±0.15 $^{bc}$ | 6.38±0.71 $^{a}$ | 0.65±0.04 ab |
| T5 | 8.64±0.38 $^{a}$ | 3.29±0.27 $^{a}$ | 4.58±0.08 $^{b}$ | 0.76±0.05 $^{a}$ |
| T6 | 9.54±0.36 $^{a}$ | 3.17±0.10 $^{a}$ | 5.60±0.26 $^{ab}$ | 0.76±0.03 $^{a}$ |
| T7 | 9.35±0.71 $^{a}$ | 2.22±0.10 $^{c}$ | 6.54±0.79 $^{a}$ | 0.58±0.03 $^{b}$ |
| P-value | 0.610 | 0.008 | 0.057 | 0.025 |
| Sig. | N.S. | ** | * | * |

control diet (T1), replacing soybean meal (33%) by sesame seed meal with adding synthetic lysine (T2), replacing soybean meal (66%) by sesame seed meal with adding synthetic lysine (T3), replacing soybean meal (100%) by sesame seed meal with adding synthetic lysine (T4), replacing soybean meal (33%) by sesame seed meal with adding herbal lysine (T5), replacing soybean meal (66%) by sesame seed meal with adding herbal lysine (T6), and replacing soybean meal (100%) by sesame seed meal with adding herbal lysine (T7)

EW: Egg weight, YW: Yolk weight, AW: Albumin weight, SW: : : : Shell weight. Different letters in the same column indicate a significant difference ($p \leq 0.05$) between the means."

**Table 4.** Egg external traits in sesame seed meal with lysine used as a substitute for soybean meal in japanese quail

| Treatment | EL (mm) | EB (mm) | EST (mm) |
|---|---|---|---|
| T1 | 30.48±1.56 a | 23.87±1.12 a | 0.22±0.01 a |
| T2 | 31.59±0.27 a | 24.80±0.13 a | 0.23±0.02 a |
| T3 | 29.91±1.24 a | 23.69±1.02 a | 0.23±0.01 a |
| T4 | 32.11±0.16 a | 24.82±0.03 a | 0.23±0.01 a |
| T5 | 30.28±1.45 a | 23.88±1.10 a | 0.23±0.01 a |
| T6 | 31.93±0.27 a | 24.96±0.33 a | 0.22±0.01 a |
| T7 | 27.23±2.41 a | 21.47±1.75 a | 0.24±0.02 a |
| P-value | 0.209 | 0.240 | 0.849 |
| Sig. | N.S. | N.S. | N.S. |

control diet (T1), replacing soybean meal (33%) by sesame seed meal with adding synthetic lysine (T2), replacing soybean meal (66%) by sesame seed meal with adding synthetic lysine (T3), replacing soybean meal (100%) by sesame seed meal with adding synthetic lysine (T4), replacing soybean meal (33%) by sesame seed meal with adding herbal lysine (T5), replacing soybean meal (66%) by sesame seed meal with adding herbal lysine (T6), and replacing soybean meal (100%) by sesame seed meal with adding herbal lysine (T7)

EL: Egg length, EB: Egg breadth, EST:: : : Egg shell thickness. Different letters in the same column indicate a significant difference ($p \leq 0.05$) between the means."

**Table 5.** Internal egg traits percentage in sesame seed meal with lysine used as a substitute for soybean meal in japanese quail

| Treatment | Yolk (%) | Albumin(%)() | Egg shell (%) |
|---|---|---|---|
| T1 | 31.39±0.99 $^{b}$ | 60.66±1.24 $^{c}$ | 7.96±0.25 $^{a}$ |
| T2 | 33.28±0.15 $^{b}$ | 58.72±0.14 $^{c}$ | 8.00±0.11 $^{a}$ |
| T3 | 30.07±1.24 $^{bc}$ | 63.79±1.48 $^{bc}$ | 6.14±0.24 $^{b}$ |
| T4 | 26.96±1.17 $^{cd}$ | 66.25±1.39 $^{ab}$ | 6.79±0.23 $^{b}$ |
| T5 | 38.01±1.61 $^{a}$ | 53.25±1.89 $^{d}$ | 8.74±0.28 $^{a}$ |
| T6 | 33.31±0.64 $^{b}$ | 58.71±0.75 $^{c}$ | 7.98±0.12 $^{a}$ |
| T7 | 24.12±2.53 $^{d}$ | 69.51±3.20 $^{a}$ | 6.37±0.66 $^{b}$ |
| P-value | 0.000 | 0.000 | 0.000 |
| Sig. | *** | *** | *** |

control diet (T1), replacing soybean meal (33%) by sesame seed meal with adding synthetic lysine (T2), replacing soybean meal (66%) by sesame seed meal with adding synthetic lysine (T3), replacing soybean meal (100%) by sesame seed meal with adding synthetic lysine (T4), replacing soybean meal (33%) by sesame seed meal with adding herbal lysine (T5), replacing soybean meal (66%) by sesame seed meal with adding herbal lysine (T6), and replacing soybean meal (100%) by sesame seed meal with adding herbal lysine (T7)

Different letters in the same column indicate a significant difference ($p \leq 0.05$) between the means."