ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Different Sources of Alternative Calcium Supplement on Laying Performance of Japanese Quail

John Albert B. Jarabe*[1], Oliva M. Gafffud[2], Mark Joker L. Marcos[3]
[1] Central Graduate School, Isabela State University, Echague, Isabela, Philippines
[2, 3] Faculty of College of Agriculture, Isabela State University, Echague, Isabela, Philippines
Corresponding Author email: jjarabe754@gmail.com

Received: 28 April 2025 **Revised**: 28 May 2025 **Accepted**: 31 May 2025

Available Online: 03 June 2025

Volume IV (2025), Issue 2, P-ISSN – 2984-7567; E-ISSN - 2945-3577

https://doi.org/10.63498/etcor349

Abstract
Aim: This study aimed to evaluate the effects of alternative calcium sources eggshell waste, oyster shell, and golden apple snail shell on the laying performance and egg quality of quails.
Methodology: The experiment was conducted from January 10, 2024, to March 16, 2025, at the Jarabe Residence in Barangay Sinamar, Roxas, Isabela. A total of 150 ready-to-lay quails were randomly assigned to five dietary treatments, with three replications per treatment and 10 birds per replicate. The treatments were as follows: T1 – Control, T2 – Eggshell Waste, T3 – Oyster Shell, T4 – Golden Apple Snail Shell, and T5 – (Eggshell waste + Oyster Shell + Golden Apple Snail Shell). The study was arranged using a Completely Randomized Design (CRD). Key performance parameters measured included egg production, egg weight, and egg quality.
Results: No significant differences were found among the treatments. Egg weight, eggshell dimensions, and internal quality traits exhibited consistent values across all groups. Additionally, all Haugh Unit scores exceeded 72, confirming that the eggs produced maintained excellent quality regardless of the calcium source used.
Conclusion: The use of alternative calcium sources showed no significant impact on laying performance. Accordingly, eggshell waste, oyster shell, and golden apple snail shell can be regarded as effective and sustainable calcium options for quail diets, particularly in resource-constrained environments where conventional supplements may be costly or less accessible.
Keywords: *alternative calcium, supplement, Laying performance, Japanese quail*

INTRODUCTION

The Japanese quail (*Coturnix japonica*) is increasingly valued in poultry farming for its rapid growth, early maturity, and high egg-laying performance, making it an ideal option for smallholder and commercial producers alike. This supports SDG 2: Zero Hunger by enhancing food availability through efficient egg production. Its minimal space and feed requirements make it accessible to farmers with limited resources, contributing to SDG 1: No Poverty by improving livelihood opportunities in rural communities. Meeting the nutritional needs of laying quails, particularly calcium intake, is essential to maintain egg quality and shell strength, aligning with SDG 3: Good Health and Well-being in terms of animal welfare and production efficiency. Inadequate calcium in diets can lead to weak shells, poor productivity, and increased mortality, underscoring the importance of reliable and cost-effective sources. Conventional calcium supplements such as limestone and dicalcium phosphate are effective but often costly or unavailable in rural areas.

This limits their practicality and emphasizes the need for alternatives that are both affordable and locally sourced, addressing SDG 10: Reduced Inequalities and SDG 12: Responsible Consumption and Production. By utilizing calcium-rich agricultural by-products like eggshells, oyster shells, and golden apple snail shells—materials commonly treated as waste farmers can lower feed costs and reduce environmental waste. This approach supports

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

SDG 13: Climate Action by minimizing pollution, and SDG 12 through improved resource efficiency. Recycling these materials into poultry feed also reflects the principles of circular agriculture, promoting innovation in sustainable livestock practices (SDG 9: Industry, Innovation and Infrastructure). Moreover, it protects local ecosystems from unmanaged waste disposal, contributing to SDG 15: Life on Land. This study explores the nutritional and economic potential of these alternative calcium sources, aiming to strengthen the sustainability of small-scale poultry systems. By reducing dependency on commercial inputs and maximizing the value of local resources, it reinforces SDG 11: Sustainable Cities and Communities through resilient agricultural development.

Objective of the study

This study aimed to evaluate the effects of eggshell waste, oyster shells, and golden apple snail shells as alternative calcium supplements on the laying performance of quails.

Specifically, aimed to:

1. assess the effects of diets supplemented with eggshell, oyster shell, and golden apple snail shell on egg weight, egg quality, and egg production of laying quails;
2. identify which calcium source yields the most favorable results in terms of egg weight, quality, and production;
3. evaluate the economic viability of using eggshell waste, oyster shell, and golden apple snail shell as calcium supplements in quail production; and
4. provide practical recommendations for quail raisers on effective alternative calcium sources for feed supplementation.

METHODS

Procurement of ready to Lay(RTL) quail

A total of 150 RTL (Day 20) were purchased at Rosales, Pangasinan.

Rearing Management

Quails were housed in plastic wire cages measuring 60 cm × 40 cm × 30 cm, each equipped with external waterers and feeding troughs. Strict sanitation protocols were followed throughout the study to promote bird health and performance. Birds were provided feed ad libitum, supplemented with various alternative calcium sources. Lighting was maintained at 16 hours daily to enhance egg production. Feed intake, egg production, and both internal and external egg quality parameters were regularly monitored and recorded.

Experimental Design and Treatments

A total of 150 ready to lay quail were randomly distributed with five (5) treatments, replicated three times comprising 10 birds per replication, following a Completely Randomized Design (CRD).

The following treatments were:

T_1 –Control limestone
T_2 – 5% Eggshell Waste (ES)
T_3 – 5% Oyster Shell (OS)
T_4 – 5% Golden apple snail shell (GASS)
T_5 – 5% Combination of Eggshell waste, Oyster shell and Golden Apple snail (ES+OS+GASS)

Preparation of the Treatment

Eggshell waste, oyster shells, and golden apple snail shells were collected separately. Oyster and snail shells were carefully brushed to remove impurities and washed with clean water, while eggshells were used without washing. All shells were then dried thoroughly to eliminate moisture. After drying, the shells were crushed using a rolling pin and ground into a fine powder using a mortar and pestle.

Feeding Process

Ready-to-lay quails were provided with a balanced layer mash formulated to meet their specific nutritional requirements for optimal egg production. Feed was offered ad libitum to ensure unrestricted access throughout the day. Clean feeding troughs were refilled each morning and monitored regularly to maintain a consistent feed supply.

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Data Gathered

1. Weekly Feed consumption. Weekly feed consumption was determined by subtracting the amount of leftover feed from the total feed offered.
2. Weekly Egg produced. Egg production was recorded daily by counting the number of eggs laid by the quails.
3. Egg Weight. Egg weight were collected biweekly, with a total of ten eggs weighed per sampling period. The average was calculated by dividing the total weight by the number of eggs. A calibrated weighing device was used to ensure accuracy in data collection.
4. Egg Size. The average egg size was determined biweekly by measuring the diameter of ten sample eggs using a Vernier caliper to ensure precision.
5. Haught Unit. Egg freshness was assessed using a micrometer, with measurements estimated based on the following formula:

$$H.U = 100 \log (H + 7.5 - 1.7\ WO.37)$$

Income over feed and Quail cost

Daily egg production was recorded and multiplied by the prevailing market price to calculate total income. Feed consumption and the cost of quails were also documented. Profitability for each treatment was assessed by computing the income over the combined costs of feed and quails.

Discussion of Results

A. Effect of different sources of alternative calcium supplement on laying performance of quail

Weekly feed Consumption. Table 1 presents the weekly feed intake of quails subjected to different calcium supplementation treatments. While slight numerical variations were observed among the groups, statistical analysis revealed no significant differences ($P > 0.05$). The highest feed intake was recorded in T3 (Oyster Shell), whereas the lowest was noted in T5 (ESW+OS+GASS). These findings suggest that the inclusion of alternative calcium sources did not adversely affect feed intake, indicating good palatability across treatments. These results are consistent with previous studies. Olgun et al. (2012) reported that quails readily accepted eggshell meal due to its fine texture and high calcium content. Similarly, Nahashon et al. (2006) found that oyster shell supplementation had no negative impact on feed consumption in laying birds. Abdullah et al. (2013) emphasized the enhanced digestibility of ground eggshells, while Safdar et al. (2015) noted that although coarse calcium sources may slightly reduce intake, the effect is minimal. Overall, these findings align with Zhang et al. (2017), who concluded that unconventional calcium sources such as eggshells and seashells can effectively replace limestone without impairing feed intake or performance.

Weekly egg produced. able 2 presents the egg production performance of quails over a 10-week period, showing no statistically significant differences among treatments ($P > 0.05$). While minor weekly fluctuations were observed, all groups reached comparable production levels by week 8. T4 (Golden Apple Snail Shell) recorded the highest egg counts in weeks 2 and 3, potentially due to the higher calcium solubility of this source, as noted by Zhang et al. (2017). T5 (eggshell waste + oyster shell + golden apple snail shell) exhibited consistent production throughout and peaked in week 10, suggesting a beneficial synergistic effect from the mixed calcium sources. These findings are in agreement with Olgun et al. (2012), who demonstrated that eggshell and oyster shell can effectively replace limestone without negatively impacting laying performance. Similarly, Safdar et al. (2015) emphasized that calcium particle size influences the rate of early absorption. Recent studies by Sinclair-Black et al. (2023) confirm that laying hens can physiologically adapt to different dietary calcium sources through internal mechanisms that regulate calcium and phosphorus metabolism, supporting consistent egg quality and shell strength.

Egg Weight. Table 3 illustrates that egg weights at weeks 5 and 10 showed no significant differences among the treatments. Egg weights ranged from 9.82 to 10.12 grams at week 5 and from 10.45 to 10.53 grams at week 10. These findings indicate that supplementation with eggshell, oyster shell, and golden apple snail shell as calcium sources did not adversely affect egg weight. This outcome is consistent with the study by Al-Tikriti and Al-Nassery (2023), who reported that calcium source had no significant impact on egg weight in laying quails. Likewise, Aryee et al. (2020) suggested that egg weight is largely determined by genetic factors rather than dietary variation, provided

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

that calcium requirements are adequately met. These results imply that quails can maintain consistent egg weights regardless of the calcium source used in their diet.

Egg size. Table 3 shows that egg diameter ranged from 20.67 mm to 20.73 mm at week 5 and from 21.06 mm to 21.29 mm at week 10, with no significant differences observed among treatments. Treatments 2 through 5 exhibited slightly larger diameters compared Treatment 1. These values are lower than those reported by Melekoğlu et al. (2020) and Sekeroglu et al. (2016), who documented egg diameters exceeding 24 mm in older birds or different quail strains. The smaller egg sizes in this study may be attributed to differences in age, strain, or diet. Nonetheless, the results indicate that the use of alternative calcium sources does not adversely affect egg diameter.

Haugh Unit. Table 4 presents the Haugh Unit (HU) values for all treatments, with each group producing HU scores above 90, indicating very high-quality eggs across all laying quail treatments. The highest HU (91.60) was recorded in T4 (Golden Apple Snail Shell), suggesting that its calcium content positively influenced albumen height and overall egg freshness. T3 (Oyster Shell) and the control group followed closely with HU values of 91.05. T2 showed a slightly lower HU (90.92) but remained well within the excellent quality range. T5 (ESW+OS+GASS) also maintained high egg quality, with an HU of 91.02. These findings support the work of Islam et al. (2016) and more recent studies such as those by Singh et al. (2021), which demonstrate that alternative calcium sources can maintain or even enhance internal egg quality in laying quail.

B. Effect of different sources of alternative calcium supplement Income over feed and Quail cost

Income Above Feed and Chick Costs. The table 5 revealed that among the five treatments, T3 (Oyster Shell Waste) produced the highest income over feed and quail cost at ₱24.86**,** followed by T4 (Golden Apple Snail Shell) at ₱24.07**,** and T5 (ESW+OS+GASS) at ₱23.69**.** These values were higher than both T2 (Eggshell Waste) with ₱23.00, and T1 which had the lowest of ₱22.30**.**

T3 indicated that oyster shell waste is particularly effective in enhancing laying performance, possibly due to its high bioavailability of calcium and other trace minerals. (Park et al., 2004). T4 also demonstrated a favorable economic outcome, indicating that golden apple snail shells, often considered agricultural waste, can be repurposed effectively in quail diets. This aligns with Narayan et al. (2020), who reported that locally available shell-based waste materials can reduce production costs while maintaining egg output

Table 1. Weekly feed consumption and cumulative with the inclusion of different sources of alternative calcium.

	Feed Consumption of the Bird (g)						
Treatments	T1	T2	T3	T4	T5	ANOVA	CV
1st Week	171.33	172.10	171.13	171.20	169.8	ns	1.20%
2nd Week	169.8	169.23	172	171.57	170.03	ns	1.20%
3rd Week	172.23	172.57	173.6	172.87	171.83	ns	0.40%
4th Week	174.27	173.17	173.23	174.33	174.2	ns	0.86%
5th Week	174.27	174.4	173.6	173.23	173.07	ns	0.41%
6th Week	175.87	175.77	175.87	176	175.83	ns	0.33%
7th Week	175.93	175.73	176.3	176	175.8	ns	0.38%
8th Week	176.63	175.87	176.3	176.3	176.6	ns	0.42%
9th Week	176.27	177.1	176.23	176.63	176.1	ns	0.32%
10th Week	176.33	176.60	176.40	176.13	176.10	ns	0.24%
CUMULATIVE	17439.3	17425.3	17446.6	17442.6	17393.6	ns	0.25

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Table 2. Weekly egg produced with the inclusion of different sources of alternative calcium.

Treatments	T1	T2	T3	T4	T5	ANOVA	CV
1st Week	16.67	16.00	22.00	19.33	18.33	ns	24.46%
2nd Week	46.00	46.33	42.67	47.00	46.33	ns	5.36%
3rd Week	64.33	67.00	66.67	68.00	64.33	ns	2.44%
4th Week	68.33	68.00	68.00	68.33	68.33	ns	1.73%
5th Week	68.33	69.00	69.00	69.00	68.33	ns	1.68%
6th Week	69.00	69.33	69.00	69.33	69.33	ns	0.91%
7th Week	69.33	69.00	69.67	69.67	70.00	ns	0.91%
8th Week	69.67	69.67	69.67	69.67	69.67	ns	0.83%
9th Week	69.00	70.00	69.00	69.67	69.67	ns	1.05%
10th Week	69.67	69.67	68.67	69.00	70.00	ns	1.89%

Table 3. Eggweight and eggsize with the inclusion of different sources of alternative calcium.

	Eggweight (g)		Eggsize (mm)	
	Week 5	Week 10	Week 5	Week 10
T1 – Control	9.82	10.53	20.67	21.17
T1 – ESW	10.02	10.53	20.73	21.19
T2 – OS	10.03	10.47	20.73	21.06
T3 – GASS	10.12	10.47	20.71	21.29
T5 -ESW+OS+GASS	9.98	10.45	20.72	21.16
ANOVA	ns	ns	ns	ns
CV	1.89%	5.04%	0.36%	0.31%

Table 4. Haugh Unit with the inclusion of different sources of alternative calcium.

Treatments	Haugh Unit
T1–Control (Limestone)	91.05
T2–Egg shell Waste	90.92
T3 – Oyster Shell	91.05
T4-Golden Apple Snail`	91.60
T5 –ESW+ OS + GASS	91.02

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Table 5. Return above feed and cost of production

ITEMS	TREATMENTS				
	T1	T2	T3	T4	T5
Total sales	90.56	92.25	92.7	92.75	92.55
Egg Produced	60.37	61.5	61.8	61.83	61.7
Price of quail	30	30	30	30	30
Amount of Feeds	1734.93	1742.53	1744.67	1744.27	1739.37
Cost of Feeds	68.25	69.24	67.84	68.67	68.86
Return	22.30	23.00	24.86	24.07	23.69

1/ Computed based on the market price of egg (1.5 Php).

2/ Current price of RTL Quail (30.00Php).

3/ Calculated based on the amount and price of feeds ingredients used in the formulated ration

Conclusion

The study evaluated the effects of alternative calcium sources on the laying performance of quails. Results demonstrated that the inclusion of these calcium sources did not significantly influence egg production, egg weight, egg size, and egg quality. Although no statistically significant differences were observed among treatments, the findings suggest that all tested calcium sources were comparably effective in supporting optimal laying performance and maintaining egg quality in quails.

Recommendations

Based on the findings of this study, it is recommended that alternative calcium sources such as eggshell waste, oyster shell, and golden apple snail shell be considered for inclusion in quail diets. These alternatives demonstrated comparable performance to the control group in terms of laying performance and egg quality, suggesting their potential as cost-effective and locally available substitutes for conventional calcium sources. Their use may be especially beneficial in regions where access to commercial calcium supplements is limited. Further research involving larger sample sizes and extended trial durations is encouraged to assess potential long-term effects and variations in performance. Future studies may also explore additional egg quality parameters and physiological responses that were beyond the scope of this investigation.

REFERENCES

Abdullah, A. Y., Al-Beitawi, N. A., Rjoup, M. M. S., Qudsieh, R. I., & Ishmais, M. A. A. (2013). Growth performance, carcass and meat quality characteristics of different commercial crosses of broiler strains of chicken. *Journal of Poultry Science, 50*(2), 145–152.

Al-Tikriti, S. S. A., & Al-Nassery, H. Z. M. (2023).Effect of egg weight and type of breeding on the productive performance of Japanese quail. *IOP Conference Series: Earth and Environmental Science*, 1213(1), 012079. https://doi.org/10.1088/1755-1315/1213/1/012079

Aryee, G., Adu-Aboagye, G., Shiburah, M. E., Nkrumah, T., & Amedorme, D. (2020). Correlation between egg weight and egg characteristics in Japanese quail. *Animal and Veterinary Sciences*, 8(3), 51–54. https://doi.org/10.11648/j.avs.20200803.11

Islam, M. S., Lucky, N. S., Islam, M. M., Ahad, A., Das, B. R., Rahman, M. M., & Siddiki, A. M. A. M. Z. (2016). Egg quality traits of indigenous and exotic chickens reared under intensive management system in Bangladesh. *Journal of Advanced Veterinary and Animal Research, 3*(1), 39–44. https://doi.org/10.5455/javar.2016.c131

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Melekoğlu, K., Gürcan, E. K., & Özdemir, D. (2020). Morphological characteristics and egg quality traits of Japanese quails reared in different cage densities. *Poultry Science*, 99(3), 1442–1449. https://doi.org/10.1016/j.psj.2019.10.050

Nahashon, S. N., Adefope, N. A., Amenyenu, A., & Wright, D. (2006). Effects of dietary metabolizable energy and crude protein concentrations on growth performance and carcass characteristics of French guinea broilers. *Poultry Science, 85*(2), 337–344.

Narayan, D., Devi, P., & Rani, K. (2020). Utilization of shell waste as a dietary supplement for poultry: A review. *International Journal of Poultry Science*, **19**(1), 10–16.

Olgun, O., Yildiz, A. Ö., & Şahin, A. (2012). Effects of dietary calcium sources and levels on egg production and eggshell quality in laying quail. *Journal of Animal and Veterinary Advances, 11*(10), 1598–1602.

Park, H. S., Kim, D. H., & Sohn, S. H. (2004). Effect of calcium sources on egg production and eggshell quality in laying hens. *Asian-Australasian Journal of Animal Sciences*, **17**(4), 525–529.

Safdar, M. N., Amjad, M., Umar, S., & Khan, M. A. (2015). Evaluation of different calcium sources for improving production performance in laying hens. *Journal of Applied Animal Research, 43*(3), 332–336.

Sekeroglu, A., Altuntas, E., Duman, M., Yildirim, A., & Eleroglu, H. (2016). Effects of divergent selection for growth on egg quality traits in Japanese quail (*Coturnix coturnix japonica*). *Animal Production Science, 56*(11), 1797–1802. https://doi.org/10.1071/AN14786

Sinclair-Black, S., Röhe, I., Zentek, J., & Rademacher, M. (2023). Calcium and phosphorus utilization and homeostasis in laying hens: Effects of dietary calcium source and solubility. *Poultry Science, 102*(1), 102359. https://doi.org/10.1016/j.psj.2022.102359

Singh, P., et al. (2021). Impact of alternative calcium sources on egg quality in laying quail. *Poultry Science Advances*, 7(1), 15–22.

Zhang, L., Yue, H. Y., Zhang, H. J., Xu, L., Wu, S. G., Yan, H. J., ... & Qi, G. H. (2017). Effect of dietary calcium levels on performance, shell quality, and bone strength in laying ducks. *Poultry Science, 96*(12), 4303–4310.