

Relationship between Egg Weight and Hatching Performance in Japanese Quail (*Coturnix japonica*)

Amani Aldiyanti^{1*}, Akhmat Rizkuna², Julinda Romauli Manullang³, Roosena Yusuf⁴, Nurul Fajrih H⁵

Jurusan Peternakan Fakultas Pertanian, Universitas Mulawarman.

*Corresponding Author: amanialdiyanti@faperta.unmul.ac.id

Received 2026-09-20; Revised 2026-09-22; Accepted 2026-09-25

ABSTRACT

Egg weight is one of the important characteristics of hatching eggs and is commonly used as an initial indicator of egg quality due to its association with nutrient availability for embryonic development. However, hatchability performance is not solely determined by egg weight but is also influenced by various biological and environmental factors during the incubation process. This study aimed to analyze the association between egg weight, hatchability, and hatch weight of Japanese quail (*Coturnix japonica*). The study was conducted from April to June 2026 at the Laboratory of Animal Production and Animal Product Technology, Faculty of Agriculture, Universitas Mulawarman. A total of 36 Japanese quail eggs were randomly selected and incubated using a semi-automatic incubator maintained at a temperature of 37.5–38°C and relative humidity of 60–70% for 18 days. The observed parameters included pre-incubation egg weight, hatchability, and hatch weight. Data were analyzed using simple linear regression to determine the association between egg weight and hatch weight, and binary logistic regression to evaluate the relationship between egg weight and the probability of successful hatching. The results showed that egg weight was not significantly associated with hatch weight or the probability of successful hatching. These findings indicate that egg weight alone cannot be used as a single predictor of hatching performance in Japanese quail. Other factors, including internal egg quality, embryo characteristics, breeder-related factors, and incubation conditions, should be considered in the evaluation of hatching egg quality.

Keywords: egg weight, hatchability, hatch weight, Japanese quail, incubation

INTRODUCTION

The poultry industry is one of the important livestock sectors contributing to the provision of animal-derived protein sources due to its rapid production cycle, high efficiency, and potential for sustainable production. Improvement of poultry productivity is not only dependent on the productive performance of breeder flocks but is also strongly influenced by the success of breeding programs through the provision of high-quality hatching eggs. The quality of hatching eggs represents an initial factor determining embryonic development, hatchability percentage, and the quality of hatched chicks. Therefore, evaluating egg characteristics prior to incubation is an important aspect in improving poultry production efficiency.

Japanese quail (*Coturnix japonica*) is one of the poultry species with considerable potential for development due to its efficient production characteristics, short reproductive cycle, and relatively lower space and capital requirements compared with other poultry species. In addition to egg production for consumption, Japanese quail is widely developed as a source of breeding stock through the production of hatching eggs. Therefore, improving hatching success is an important aspect in supporting sustainable Japanese quail production. Kostaman and Sopiya (2021) stated that Japanese quail has several advantages, including high productivity, short generation interval, lower feed and space requirements, and good adaptability to various environmental conditions.

Hatching eggs serve as the primary source of nutrients for embryonic development during the incubation period. The yolk and albumen provide energy, protein, and other essential nutrients required for embryo growth until hatching. One of the parameters commonly used in the selection of hatching eggs is egg weight. Egg weight reflects the amount of biological material available for embryonic development; therefore, differences in egg weight may result in variations in embryonic development and hatch weight. Variation in egg weight is influenced by several factors, including dietary factors, environmental conditions, and changes in internal egg composition related to nutrient availability for embryo development (Aldiyanti et al., 2025).

The relationship between egg weight and hatching performance has been widely investigated in various poultry species. Kostaman and Sopiya (2021) reported that egg weight significantly affected hatch weight and hatchability of Japanese quail eggs. Their study demonstrated that classification of eggs based on weight resulted in differences in hatch weight and hatchability percentage. Heavier eggs tended to produce heavier hatchlings because initial egg weight represents one of the components contributing to chick weight after hatching.

However, egg weight is not always considered a single determinant of hatching success. Aldiyanti et al. (2025) reported that the relationship between egg weight, fertility, and hatchability in native chickens may vary depending on the egg weight range evaluated. In certain egg weight groups, egg weight did not significantly affect hatchability, whereas other groups showed significant relationships with a negative trend. These findings indicate that egg weight should be evaluated together with other factors because hatching success is the result of interactions among egg quality, embryo viability, fertility status, and incubation management.

Besides egg characteristics, environmental conditions during incubation also play an important role in determining embryonic development success. Incubation temperature and humidity regulate embryonic metabolism, egg water loss, and organ development processes. Proper hatchery management, including hatching egg selection, regulation of incubation temperature and humidity, and egg turning management, is essential to maintain embryo viability during incubation (Aldiyanti et al., 2025).

Based on these considerations, further investigation is required to evaluate the ability of egg weight as a predictive indicator of hatching success in Japanese quail, particularly using a continuous relationship approach rather than classification based only on egg weight categories. Therefore, this study aimed to analyze the association between egg weight, hatchability, and hatch weight of Japanese quail (*Coturnix japonica*) using regression analysis.

MATERIALS AND METHODS

Study area

The study was conducted from April to June 2026 at the Laboratory of Animal Production and Animal Product Technology, Faculty of Agriculture, Universitas Mulawarman, Samarinda, East Kalimantan, Indonesia. The research activities included hatching egg selection, egg weight measurement, incubation process, embryo development observation, and evaluation of hatchability and hatch weight of Japanese quail (*Coturnix japonica*).

A total of 36 Japanese quail eggs (*Coturnix japonica*) were randomly selected from a population of hatching eggs. The selected eggs exhibited normal physical characteristics, including uniform oval shape, intact and clean eggshells, and absence of cracks. The equipment used included a semi-automatic incubator, digital balance (0.01 g precision), egg trays, candling lamp, digital thermometer, and hygrometer.

Procedures

This study employed a quantitative observational approach to evaluate the association between egg weight as an independent variable and hatchability and hatch weight as dependent variables. A total of 36 Japanese quail eggs were randomly selected, and their initial weights were measured prior to incubation. Egg weight was determined using a digital balance and recorded in grams.

The eggs were then placed in a semi-automatic incubator with the blunt end positioned upward. The incubation process was carried out for 18 days under controlled environmental conditions, with a temperature of 37.5–38°C and relative humidity of 60–70%. Temperature and humidity were monitored periodically throughout the incubation period to maintain stable environmental conditions. Embryonic development was examined through candling to determine egg fertility and monitor embryo development during incubation.

Observation Parameter

Egg Weight

Egg weight was defined as the initial weight of Japanese quail eggs before being placed in the incubator. Egg weight was measured using a digital balance and recorded in grams.

Hatchability

Hatchability was determined based on the proportion of fertile eggs that successfully hatched. The hatchability percentage was calculated using the following equation:

$$\text{Hatchability \%} = \frac{\text{Number of hatched eggs}}{\text{Number of Fertile eggs}} \times 100\%$$

Hatchability percentage was calculated based on fertile eggs because infertile eggs do not reflect the ability of embryos to develop during the incubation period.

Hatch Weight

Hatch weight was determined by weighing newly hatched Japanese quail chicks immediately after hatching. Each chick was individually weighed using a digital balance, and the obtained weight was recorded in grams (g).

Data analysis

The observation data were analyzed using SPSS software.

1. Simple Linear Regression Analysis

Simple linear regression analysis was used to determine the relationship between egg weight and hatching weight.

Regression model used:

$$Y = \alpha + bX$$

Keterangan:

Y = Hatch Weight (g)

X = Egg Weight (g)

a = konstanta

b = regression coefficient

2. Binary Logistic Regression Analysis

Logistic regression analysis was used to determine the relationship between egg weight and the probability of successful hatching.

The response variable was categorized as follows:

1 = egg successfully hatched

0 = egg did not hatch

Logistic regression model:

$$P(Y) = \frac{1}{1 + e^{-(a+bX)}}$$

Keterangan:

P(Y) = probability of egg hatching

X = egg weight

a = konstanta

b = regression coefficient

The significance level used was 5% (P<0.05).

RESULTS AND DISCUSSION

Egg weight to hatchability

Based on the research that has been carried out, the effect of the weight of quail eggs on hatchability can be seen in Table 1.

Tabel 1. The Effect of Quail Egg Weight on Hatchability

Variabel	B	Sig.	Exp(B)
Hatchability	-0,292	0,462	0,747

The results of the logistic regression analysis showed that egg weight had no significant effect on the probability of hatching success (P=0.462). The negative regression coefficient (-0.292) indicated a tendency that increasing egg weight did not increase the chance of hatching. The odds ratio of 0.747 indicated that increasing egg weight was not able to increase the probability of hatching success under the conditions of this study. Hatchability is a complex biological parameter because it is influenced by the interaction between genetic factors, egg quality, embryo condition, and the environment during the incubation process. Egg weight is often used as an early indicator of hatching egg quality because it is related to the amount of nutrient reserves available for embryo development. However, egg weight does not always reflect the overall biological quality of the egg because the internal composition of the egg and the ability of the embryo to utilize nutrients also determine the success of embryo development (Fathi et al., 2022).

According to Fathi et al. (2022), the relationship between egg weight and hatchability can be influenced by the bird's genotype and embryonic mortality patterns during incubation. Higher egg weight does not always result in higher hatchability because changes in egg weight can be related to changes in the yolk ratio, albumen, and shell quality, which can affect embryo development. Therefore, variations in egg weight need to be considered along with other egg characteristics in determining hatching egg quality. According to Aldiyanti et al. (2025), the relationship between egg weight and hatchability is not always consistent. In certain egg weight groups, variations in egg weight do not have a significant effect on hatchability, while in other weight groups, it can show a significant relationship. This indicates that egg weight may only play a supporting role, while other factors such as fertility, embryo quality, and incubation conditions have a greater contribution to hatching success. In addition to egg weight, internal egg quality plays an important role in determining embryo viability. According to Fathi et al. (2022), increased egg weight can be related to changes in shell quality and the albumen-to-yolk ratio. These changes can affect gas exchange, water loss during incubation, and the embryo's ability to maintain physiological balance during development.

Other factors that contribute to hatching success are the age of the parent and the length of egg storage. Alo et al. (2024) explain that the age of the parent influences egg quality, embryo development, and hatching characteristics. Older parents generally produce larger eggs, but reproductive quality and embryo viability may decrease. Furthermore, the length of egg storage before incubation can also affect early embryonic development and hatchability. Environmental conditions during incubation are also important factors in determining hatching success. Incubator temperature and humidity play a role in regulating embryo metabolism, egg water loss, and embryonic organ development. Aldiyanti et al. (2025) state that hatching management, including egg selection, temperature and humidity control in the incubator, and egg turning, are important factors determining hatching success. Therefore, the results of this study indicate that individual egg weight cannot be used as a single parameter to predict Japanese quail hatching success. Evaluation of hatching egg quality should be carried out more comprehensively by considering other parameters such as egg index, shell quality, internal egg composition, egg weight loss during incubation, and embryo quality.

Egg Weight to Hatchling Weight (DOQ)

Based on the research that has been carried out, the effect of egg weight on hatchability can be seen in Table 2.

Table 2. Results of Regression Analysis of the Relationship Between Egg Weight and Hatchling Weight (DOQ) of Japanese Quail

Variabel	R	R ²	Adjusted R ²	F	Sig.
Hatching Weight	0,030	0,001	-0,028	0,031	0,861

The results of the study showed a coefficient of determination (R^2) of 0.001 indicating that egg weight was only able to explain 0.1% of the variation in hatching weight, while 99.9% of the variation in hatching weight was influenced by factors other than egg weight. A significance value of 0.861 indicated that an increase or decrease in egg weight did not provide a significant change in the hatching weight of Japanese quail. This indicates that under the conditions of this study, egg weight cannot be used as a single predictor in estimating the weight of quail chicks after hatching. Egg weight is one of the egg characteristics often used in hatching egg evaluation because it describes the amount of biological material available for embryo development. Eggs with a larger weight generally have a higher yolk and albumen content, thus providing greater energy and protein reserves during the embryogenesis process. However, an increase in egg weight is not always followed by an increase in hatching weight because embryo development is also influenced by the quality of egg nutrients, the embryo's ability to utilize nutrients, and environmental conditions during incubation.

In addition to egg weight, the internal composition of the egg is a crucial factor in embryonic development. Egg weight only reflects the overall size of the egg but does not indicate the distribution of its components, such as the proportions of yolk, albumen, and shell. Variations in this composition can lead to differences in the amount of nutrients available to the embryo, even though the eggs have relatively the same weight. Research on egg quality characteristics indicates that the relationship between external and internal egg characteristics is not always linear, so egg size alone is not sufficient to describe the overall biological quality of the egg (Inca et al., 2022).

Embryo development during incubation is highly dependent on the efficient use of the egg's nutrient reserves. The yolk acts as the primary source of lipids and energy, while the albumen serves as a source of protein and water to support embryonic growth. Variations in egg nutrient composition can be influenced by maternal factors, including the mother's age, nutritional status, and physiological conditions during egg formation. Research by Valcu et al. (2024) showed that variations in egg protein and lipid composition are related to maternal factors, including the mother's age and egg laying order, which can influence the biochemical environment for embryonic development. In addition to internal egg factors, incubation conditions also play a role in determining final hatching weight. During incubation, water loss, embryonic tissue growth, and metabolic changes occur, which determine the size of the chick after hatching. Therefore, two eggs with the same initial weight can produce different hatching weights if they have different patterns of water loss or embryonic development.

In this study, all eggs were incubated under uniform environmental conditions, namely a temperature of 37.5–38°C and a humidity of 60–70%, so variations in hatching weight are likely influenced more by biological factors than environmental factors. Aldiyanti et al. (2025) explained that factors such as egg quality, embryo condition, and incubation management play a role in determining the success of embryo development and hatching results. Thus, the results of this study indicate that individual egg weight is not able to significantly explain variations in Japanese quail hatching weight. Egg weight can still be used as an initial parameter for hatching egg selection, but its use needs to be combined with other parameters such as egg index, shell quality, internal egg composition, egg weight loss during incubation, and evaluation of embryo development.

CONCLUSION

Randomly obtained Japanese quail egg weights showed no significant relationship to hatchability and hatching weight. Hatching egg selection cannot be based solely on egg weight but also requires consideration of other egg quality parameters.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Laboratory of Animal Production and Animal Product Technology, Faculty of Agriculture, Universitas Mulawarman, for providing research facilities and technical support during the implementation of this study. The authors also thank all parties who contributed to the data collection and research activities.

REFERENCES

- Aldiyanti, A., Rizkuna, A., Manullang, J. R., & Fajrih, N. (2025). Optimasi Penetasan Ayam Kampung: Pengaruh Variasi Bobot Telur Terhadap Fertilitas Dan Daya Tetas. *Aves: Jurnal Ilmu Peternakan*, 19(2), 7–12.
- Alo, E. T., Daramola, J. O., Wheto, M., & Oke, O. E. (2024). Impact Of Broiler Breeder Hens' Age And Egg Storage On Egg Quality, Embryonic Development, And Hatching Traits Of Funaab-Alpha Chickens. *Poultry Science*, 103(2), 103313. <https://doi.org/10.1016/j.psj.2023.103313>
- Fathi, M., Abou-Emera, O., Al-Homidan, I., Galal, A., & Rayan, G. (2022). Effect Of Genotype And Egg Weight On Hatchability Properties And Embryonic Mortality Pattern Of Native Chicken Populations. *Poultry Science*, 101(11), 102129. <https://doi.org/10.1016/j.psj.2022.102129>
- Inca, J. S., Martinez, D. A., & Vilchez, C. (2020). Phenotypic Correlation Between External And Internal Egg Quality Characteristics In 85-Week-Old Laying Hens. *International Journal of Poultry Science*, 19 (8): 346-355. <https://doi.org/10.3923/ijps.2020.346.355>
- Kostaman, T., & Sopiyan, S. (2021). The Weight And Hatchability Of Quail Egg Viewed From The Weight, Index, And Surface Area Of The Egg. *Iop Conference Series: Earth And Environmental Science*, 788, 012128. <https://doi.org/10.1088/1755-1315/788/1/012128>
- Valcu, C. M., Scheltema, R. A., Schweiggert, R. M., Valcu, M., Teltscher, K., Walther, D. M., & Kempenaers, B. (2024). Life History Shapes Variation In Egg Composition. *Scientific Reports*, 14(2).