International Journal of Veterinary Sciences and Animal Husbandry 2025; 10(12): 219-223

ISSN: 2456-2912
NAAS Rating (2025): 4.61
VET 2025; 10(12): 219-223
© 2025 VET
www.veterinarypaper.com
Received: 12-10-2025
Accepted: 14-11-2025

Krishna KS
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

R Narayan
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

Jaydip Rokade
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

Med Ram Verma
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

M Monika
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

Prasad M Govindaiah
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

Corresponding Author:
Krishna KS
Division of Avian Breeding and Genetics, ICAR-CARI, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly, Uttar Pradesh, India

Studies on two varieties of domesticated Japanese quails growth performance and genetic parameters

Krishna KS, R Narayan, Jaydip Rokade, Med Ram Verma, M Monika and Prasad M Govindaiah

DOI: https://www.doi.org/10.22271/veterinary.2025.v10.i12d.2816

Abstract
India faces a persistent dietary protein deficit despite being home to millions of chickens, underscoring the need to diversify poultry production systems to meet future nutritional demands. Among alternative avian species, the Japanese quail has gained prominence owing to its rapid growth, early sexual maturity, resilience to diseases, and low maintenance requirements. Given its economic importance for both meat and egg production, understanding the genetic architecture underlying growth traits is essential for designing effective breeding programmes. This study aimed to evaluate the genetic parameters associated with juvenile growth in two domesticated Japanese quail varieties CARI Brown and CARI Suneheri reared under controlled management conditions.

A total of 200 sires and 200 dams per variety were utilized in a single-pair mating system, and pedigree-based hatching produced 3400 chicks across three consecutive hatches. Body weights were recorded weekly from hatch to five weeks, and mortality and hatchability were also monitored. Data were analysed using least squares procedures, and heritability and genetic correlations were estimated using restricted maximum likelihood (REML) via the WOMBAT mixed model.

CARI Brown exhibited superior hatchability (72.02%) and lower mortality (6.8%) compared to CARI Suneheri. Significant effects (p<0.01) of variety and sex on body weight were observed, with CARI Brown and females outperforming their counterparts across all ages. Heritability estimates ranged from low to high, with hatch weight showing particularly strong heritability in both varieties (0.272-0.584). Positive and often high genetic correlations were detected between body weights at successive ages, indicating that early-age growth can reliably predict later body weight performance.

The findings demonstrate considerable potential for genetic improvement of juvenile growth traits in Japanese quails. The observed moderate to high heritabilities, particularly in CARI Suneheri, suggest that selective breeding can achieve rapid genetic gain, strengthening the foundation for sustainable quail production in India.

Keywords: CARI Brown, CARI Suneheri, Japanese quail, body weight, heritability, genetic correlation, juvenile growth, selective breeding

Introduction

India, which is swamped with millions of chickens, is a developing country that is constantly lacking in protein (Rokade *et al.* 2017) [30]. To meet the growing population's demand for protein, it is necessary to investigate and implement diversified poultry production. A large range of avian species that generate meat and eggs could provide a variety of nutrient-dense ingredients (Chepkemoi *et al*., 2016) [7]. The Japanese quail, the smallest species of bird utilized in various poultry production, is perfect for producing eggs and meat and has recently grown in popularity (Rokade *et al*., 2017) [30]. The usefulness of this bird is ascribed to a variety of elements, such as low care costs, quick production rates, and resistance to several chicken-eating diseases. The ability to grow is an essential quality for the poultry industry, and the Japanese quail may be a great lab test subject, especially for studies looking at body weight. Given the importance of this little breed of chicken, breeding programmes that can genetically increase the productivity of the birds must be initiated.

In order to conduct breeding research, it is essential to assess the genetic criteria for boosting the most important economic attributes. The majority of studies done to increase live body weight at specific ages using genetic selection, a crucial technique for breeding programmes in animal breeding programmes, are concentrated on enhancing body weight during early periods (Hassan *et al*, 2011) [15]. Phenotypic selection is widely employed to increase body weight in chickens because of the high heritability of body weight, or the positive relationship between phenotype and breeding value of the individual. Heritability estimates are influenced by population characteristics and the environment, and they might fluctuate over time as circumstances change. How much progress may be made through selection may be indicated by the size of the genetic parameter, such as heritability and correlation. In light of this, the primary goal of the study was to examine the genetic composition of two distinct farmed Japanese quail species for traits associated with juvenile growth.

Methods and Materials

Mating plan

200 sires of each variety and an equal number of dams were used for single pair mating in individual pedigree laying cages.

Collection and preservation of viable eggs

Pedigreed and viable eggs were gathered twice daily from the two kinds of eggs. Individual eggs were marked with the information about the father and dam families pedigrees in order to produce different types of pedigreed chicks. The breeder flock was aged between 8 and 11 weeks when the eggs were collected, and they were stored in the egg storage chamber for seven days at a temperature of 580.20F or 10o C. The final three days of incubation were spent in pedigree boxes after the eggs had been incubated for seventeen days (fourteen days in the setter and three days in the hatcher). On the 18th day after hatching, the chicks received wing bands, and the pedigree details were noted. Three hatches separated by seven days resulted in the hatching of 3400 numbers of chicks, including two different varieties. The day-old body weight was calculated in order to maintain the pedigree information current. The chicks were placed in a brooder house where they were grown using traditional management methods.

Hatchability

The following formula was used to determine hatchability using total egg set data:

$$\text{Hatchability \%} = \frac{\text{Number of chicks hatched out}}{\text{Total number of eggs set}} \times 100$$

Techniques for management and brooding

Chicks were hatched and raised together in battery brooders until they were five weeks old. All three categories were managed in the same way during the study period. There was no shortage of food or water. A well-balanced quail starter mash was fed up until the fifth week, and quail layer feed was given starting at the sixth week. Sexing was had during the third week of life.

Traits of juvenile growth

3400 quail chicks from three different hatches, comprising two kinds, were investigated for their genetic and phenotypic traits related to juvenile growth traits (CARI-Brown: 2000 CARI-Suneheri: 1400).

Body weight

Before feeding the chicks of each variety, an electronic balance was used to record the live weight at weekly intervals (Hatch, 1, 2, 3, 4, and 5 weeks of age), (0.1g least count).

Mortality

The daily chick bird mortality for each variety was noted. Based on these records, the mortality percentage for each genetic group was calculated using the formula below:

$$\text{Mortality \%} = \frac{\text{No. of birds died during experiment}}{\text{Total number of birds that housed on day one}} \times 100$$

Statistical analysis

The data obtained from various attributes were subjected to the following model as,

$$Y_{ijklm} = \mu + S_i + V_j + H_k + S_{el} + e_{ijklm}$$

Where,

Y_{ijklm}: the observation of k^{th} individual

μ: The overall populations mean

S_i: The effect of i^{th} sire,

V_j: The effect of j^{th} variety,

H_k: The effect of k^{th} hatch,

S_{el}: The effect of l^{th} sex,

e_{ijklm}: The random error particular to $ijkl^{th}$ individual.

The data from numerous studies were conducted to least squares analysis (JMP) using the fixed effects linear model to examine the impacts of hatches, variety, and sexes. The hatch-corrected data were used to evaluate heredity and correlations within varieties using the constrained maximum likelihood method of the Wombat Mixed Model Analysis (REML).

Results and Discussion

Hatchability and mortality percentage

Table 1 shows that of the two varieties, CARI Brown has the lowest mortality rate (6.8%) and the highest hatchability percentage (72.02%). We calculated the percentage of each variety's eggs that would hatch based on the full batch of eggs. The CARI Suneheri showed a lower hatchability rate (60.52%) and a higher death rate (7.90%) when compared to other species. The death rates for both types are within the predicted range. Farooq *et al*. (2001) [13] reported a lower percentage of hatchability (58.8% and 55.14%, respectively) based on the total number of eggs deposited than the percentages determined in this study. With a total egg setting of 61.31%, Daikwo *et al*. (2011) [9] estimated the hatchability percentage. In 8.33 and 6.67%, respectively, the death rates reported by Seker*et al*. (2009) were greater but not statistically significant (p>0.05). Different factors, including as the type of incubator being used, management techniques, brooding, the environment, stocking density, housing arrangements, infections, etc., might affect death rates.

Table 1: The hatchability and mortality percentage of domesticated Japanese qua

Variety	Total eggs collected	Good chicks	Hatchability% (TES)	Mortality% (0-5 weeks)	Total No of Birds (0-5 weeks)
Cari-Brown	3000	2142	72.02	6.8	2005
Cari-Suneheri	2581	1606	62.22	7.90	1467

Table 2: Least mean square for body weight (g) of domesticated Japanese quails among different genetic groups

Variety Num	Sex	HATCH	WK1	WK2	WK3	WK4	WK5
Cari-Brown 851	Male	7.43±0.04	32.12^{a}±0.17	56.21^{a}±0.31	88.39^{a}±0.35	126.25^{a}±0.39	156.06^{a}±0.45
1149	Female	7.49±0.04	32.52^{a}±0.17	58.82^{b}±0.31	92.44^{b}±0.35	132.79^{c}±0.39	167.14^{c}±0.45
2142	Combined Sex	7.46^{q}±0.03	32.32^{p}±0.12	57.52^{p}±0.24	90.41^{p}±0.26	129.52^{p}±0.30	161.60^{p}±0.35
Cari-Suneheri 617	Male	7.36±0.05	32.43^{a}±0.20	58.00^{b}±0.36	91.23^{b}±0.37	130.43^{b}±0.42	163.21^{b}±0.48
783	Female	7.33±0.05	32.23^{a}±0.18	58.07^{b}±0.33	92.30^{b}±0.41	131.46^{cb}±0.46	163.53^{b}±0.53
1606	Combined Sex	7.35^{p}±0.04	32.33^{p}±0.14	58.04^{p}±0.27	91.77^{q}±0.29	130.95^{q}±0.33	163.37^{q}±0.39
Overall 1468	Male	7.37±0.03	32.88±0.11	58.98^{x}±0.20	93.53^{x}±0.22	133.58^{x}±0.25	165.11^{x}±0.29
1932	Female	7.36±0.03	32.83±0.10	59.73^{y}±0.19	95.50^{y}±0.21	136.99^{y}±0.23	173.58^{y}±0.27
P-Value							
Sex		0.8519	0.7212	0.0012	0.0001	0.0001	0.0001
Variety		0.0014	0.0001	0.0001	0.0001	0.0001	0.0001
Variety*Sex		0.2826	0.0533	0.0001	0.0001	0.0001	0.0001

^{abc}Means within column bearing different superscript differ significantly (p<0.05) due to variety × sex interaction.
^{pqr}Means within column bearing different superscript differ significantly (p<0.05) due to variety.
^{xy}Means within column bearing different superscript differ significantly (p<0.05) due to sex.

Body weight

The least-squares means of the body weights of each domesticated species of Japanese quail are shown in Table 2. The Table shows that hatch had no significant impact on the body weights up to 5 weeks of age, in contrast to the findings of Vali *et al*. (2005) who found that the variation in environmental conditions over different hatches was to blame. At all ages, CARI-Brown had significantly higher (p<0.01) body weights than the other two varieties. Similar to this, female quails have significantly greater (p<0.01) body weights than male quails across their respective two categories. From hatch until the fifth week of life, variation had a substantial (p<0.01) impact on the body weight of domestic quails. Similar to the present findings, demonstrated significant body weight variation in two quail strains at 35, 42, and 49 days of age, which may be connected to the difference in the genetic make-up of the flocks. Mohammed *et al*. found that the strains significantly (p<0.01) affected the body weight of Japanese quails at different ages (2006). Japanese quails may become heavier by selection, according to Varkoohi *et al*. (2010) [29]. In either of the two kinds, there was no discernible (p>0.05) sexual dimorphism for body weight during the first two weeks of life. Significant (p<0.01) gender differences were seen in both of the two varieties after the third week. Females display substantially higher body weight than males in both species. Shokoohm and *et al*. (2007) discovered that male and female birds had similar body weights from hatch to 28 days of age, but females were heavier at 42 days. This finding raises the possibility that this difference may be caused by males reaching sexual maturity earlier than females (five weeks as opposed to six weeks) and the release of the hormone testosterone at this age, which may slow growth rate. Female quail body weights may be higher due to their higher reproductive systems. For the three different varieties of Japanese quail, an estimation of heredity was produced for the body weight at both weekly and hatch intervals in the current study. Table 3 displays the heritability estimates for the two types, which range from low to high values. In CARI Sunehheri, the estimates for the ages following that ranged from 0.178 0.052 to 0.484 0.052, with the weight at hatch being connected with the highest estimate of heredity for body weight (0.584 0.051). All two species displayed strong heritability estimates at hatch. The improved hatch weight heritability estimate in birds may be due to the common pre-ovipositional maternal variance, or egg size, according to Aggrey and Cheng (1992) [2]. Daikwo *et al*. (2011) [9] discovered moderate to high heritability values for body weight at older ages, which is consistent with our most recent findings. Environmental variables rather than additive genetic impacts may have had a higher impact on body weight at those ages, according to estimates of the heritability of body weight at earlier ages. The mass selection for growth rate in Japanese quails could lead to a rapid improvement in growth rate due to the low to high heritabilities for growth traits identified in this work. The ranges at 7, 14, and 21 days of age reported by Foomani *et al*. (2014) [14], which ranged from 0.11 to 0.14, were higher than the estimates generated in the current study. For each species of farmed Japanese quails, the estimations of the genetic and phenotypic association between body weights at various ages were identical in magnitude and direction (Table 4). The highest genetic correlation variables obtained for CARI Brown were 0.980±0.616 with WK 3 and WK 5. CARI Brown as a genetic correlation ranging from 0.010±0.546 to 0.937±0.435. Variables of CARI Brown that are poorly correlated with WK0 were WK2 (0.195±0.362) and WK 4 (0.308±0.448), with WK 1was WK 4 (0.467±0.542), with WK 2 was WK 5 (0.747±0.293). The phenotypic correlation variables of CARI Brown range from 0.010±0.546 to 0.980±0.616. Poorly correlated phenotypic variables with WK 0 was WK 1 (0.022±0.102), WK 2 (0.039±0.002), WK 3(0.046±0.022), WK 4 (0.072±0.322) and WK 5 (0.082±0.122).Whereas with WK 1 was WK 3 (0.278±0.231), WK 4 (0.286±0.121) and WK 5 (0.299±0.221). And with WK 2 was WK 3 (0.536±0.313), WK 4 (0.540±0.117) and WK 5 (0.512±0.120). The high sequence correlation factor for body weight trait obtained for CARI Suneheri was 0.849±0.162 between WK 5 and WK 3. CARI-genetic Suneheri correlation ranged from 0.022±0.183 to 0.849±0.162. Poorly correlated estimates were WK0 with WK 2 (0.022±0.072), WK 4 (0.050±0.083), WK 5 (0.078±0.077) and with WK 1 was WK5 (0.241±0.206).For CARI Suneheri the low correlated traits of body weight WK 0 was WK 1 (0.062±0.224) with WK 2 (0.071±0.123), WK 3 (0.082±0.127), WK 4

(0.068±0.235), WK 5 (0.060±0.205). CARI Suneheri phenotypic correlation variables ranged from 0.060±0.123 to 0.588±0.216. Body weight variables for CARI Brown show a strong correlation between the 5th and 1st weeks of age (0.937±0.530) and the 4th and 2nd weeks of age (0.947±0.145). As a result, the genotypic and phenotypic correlation of these traits may range widely, from practically zero to positive. The results, which have been reported by numerous other researchers, demonstrate that there are consistently more genetic relationships between body weights at various ages than between their corresponding phenotypic counterparts (Bahie-El-Deen, 1994; Farahat, 1998; Daikwo, 2010) [4, 12, 10]. Corresponding phenotypic counterparts (Bahie-El-Deen, 1994; Farahat, 1998; Daikwo, 2010) [4, 12, 10].

Table 3: Variety wise Heritability ± SE estimates of domesticated Japanese quails for various economic traits

Traits	CARI Brown	CARI Sunheri
Hatch	0.272±0.06	0.584±0.051
Wk1	0.134±0.85	0.233±0.053
Wk2	0.307±0.25	0.415±0.052
Wk3	0.196±0.05	0.178±0.052
Wk4	0.145±0.35	0.262±0.055
Wk5	0.247±0.45	0.484±0.052

Table 4: Variety wise genetic and phenotypic correlations of domesticated Japanese quails

CARI Brown	Hatch	WK1	WK2	WK3	WK4	WK5
Hatch	-	0.022±0.102	0.039±0.002	0.046±0.022	0.072±0.322	0.082±0.122
WK1	0.010±0.546	-	0.265±0.221	0.278±0.231	0.286±0.121	0.299±0.221
WK2	0.195±0.362	0.672±0.436	-	0.536±0.313	0.540±0.117	0.512±0.120
WK3	0.602±0.393	0.694±0.492	0.829±0.220	-	0.923±0.231	0.980±0.616
WK4	0.308±0.448	0.467±0.542	0.947± 0.256	0.676±0.252	-	0.692±0.311
WK5	0.296±0.542	0.937±0.435	0.747±0.293	0.530±0.343	0.399±0.274	-
CARI Suneheri	Hatch	WK1	WK2	WK3	WK4	WK5
Hatch	-	0.062±0.224	0.071±0.123	0.082±0.127	0.068±0.235	0.060±0.205
WK1	0.070±0.190	-	0.320±0.223	0.349±0.122	0.365±0.231	0.256±0.204
WK2	0.022±0.072	0.545±0.261	-	0.572±0.429	0.588±0.216	0.550±0.602
WK3	0.038±0.035	0.510±0.221	0.548±0.282	-	0.553±0.212	0.558±0.230
WK4	0.050±0.083	0.325±0.289	0.569±0.145	0.586±0.115	-	0.581±0.016
WK5	0.078±0.077	0.241±0.206	0.542±0.267	0.775±0.162	0.849±0.100	-

Conclusion

Strong and positive genetic relationships between body weights at different ages may suggest that certain genes that influence juvenile weight at one age have a significant impact on other ages due to the pleiotropic effect and that environmental factors act similarly on weight gain at various ages. Positive correlations are therefore expected when these traits are taken into consideration. CARI-Suneheri estimates have stronger heritability's than the other two versions, according to the current study's estimation. It supports both conventional and modern theories that breeding for highly heritable traits can result in rapid genetic development.

Acknowledgement

The authors would like to express their gratitude to the Indian Council of Agriculture Research, New Delhi, and the director of ICAR-CARI for providing all the resources required to conduct the current experiment.

Conflict of interest

Not available

Financial Support

Not available

Reference

1. Abolseod DI, Kadry AEH, Moubrak MM, Mohammad FA. Divergent selection for egg production in Japanese quail direct response. Agric Res. 2009;6:121-136.
2. Aggrey SE, Cheng KM. Animal model analysis of genetic (co)variances for growth traits in Japanese quail. Poult Sci. 1992;73(12):1822-1828.
3. Bagh J, Panigrahi B, Panda N, Pradhan CR, Mallik BK, Majhi B, Rout SS. Body weight, egg production, and egg quality traits of gray, brown, and white varieties of Japanese quail (*Coturnix coturnix* japonica) in coastal climatic condition of Odisha. Vet World. 2016;9(8):832-836.
4. El-Deen BM. Selection indices and crossing as a tool for improvement of meat and egg production in Japanese quail. [Ph.D. Thesis]. Alexandria, Egypt: Faculty of Agriculture, Alexandria University; 1994.
5. Bonafé CM, Torres RDA, Sarmento JLR, Silva LD, Ribeiro JC, Teixeira RB, *et al*. Modelos de regressão aleatória para descrição da curva de crescimento de codornas de corte. Rev Bras Zootec. 2011;40(4):765-771.
6. Crawford RD. Origin and history of poultry species. In: Crawford RD, editor. Poultry Breeding and Genetics. Amsterdam: Elsevier; 1990, p. 1-41.
Howes JR. Japanese quail as found in Japan. Quail Q. 1964;1:19-30.
7. Chepkemoi M, Sila D, Oyier P, Malaki P, Ndiema E, Agwanda B, *et al*. Nutritional diversity of meat and eggs of five poultry species in Kenya. In: Scientific Conference Proceedings; 2016.
8. Devi S. Genetic parameters of feed efficiency and daily weight gain in Japanese quails. Tamil Nadu J Vet Anim Sci. 2012;8(1):6-13.
9. Daikwo SI, Dim NI, Momoh MP. Hatching characteristics of Japanese quail eggs in a tropical environment. Int J Poult Sci. 2011;10(11):876-878.
10. Daikwo IS. Genetic studies of Japanese quail (*Cortunix cortunix* japonica) in a tropical environment. [PhD thesis]. Makurdi, Nigeria: University of Agriculture; 2010, p. 162.
11. Fadhi MA, Hassan KH. Divergent genetic selection for body weight at four weeks age in Japanese quail. J Glob Pharma Technol. 2018;10(11):612-616.
12. Farahat GS. Estimation of some genetic and phenotypic parameters for growth and reproductive traits of Japanese quail. [MSc thesis]. Cairo, Egypt: Faculty of Agriculture, Fayoum, Cairo University; 1998, p. 98.
13. Farooq M, Aneela K, Durrani FR, Muqarrab AK, Chand N, Khurshid A. Egg and shell weight, hatching and

production performance of Japanese broiler quail. Sarhad J Agric. 2001;17:289-293.
14. Foomani NN, Zerehdaran S, Azari MA, Lotfi E. Genetic parameters for feed traits in Japanese quail. J Fac Agric Biol Sci (Kobuchizawa, Japan). 2014;408-0041.
15. Hassan KH. Poultry Breeding. Iraq: University of Diyala Press; 2011.
16. Hrncar C, Hanusova E, Hanus A, Bujko J. Effect of genotype on egg quality characteristics of Japanese quail (Coturnix japonica). Slovak J Anim Sci. 2014;47(1):6-11.
19. Kumari BP, Gupta BR, Prakash MG, Reddy AR, Reddy KS. Genetic studies on productive and reproductive traits of Japanese quails. Indian J Anim Sci. 2009;43(4).
20. Kannaki TR, Reddy MR, Raja Ravindra KS, Chatterjee RN. Genetic diversity analysis of the major histocompatibility complex (MHC) region in Indian native chicken breeds and pureline chickens using the LEI0258 microsatellite marker. Indian J Anim Res. 2017;51:998-1000.
21. Lotfi E, Zerehdaran S, Raoufi Z. Genetic properties of egg quality traits and their correlations with performance traits in Japanese quail. Br Poult Sci. 2012;53(5):585-591.
22. Mishra SK, Srinivasu P, Jayaraman K. Maintenance of stock identification of Japanese quails in a commercial quailary using white breasted feather colour variant. Poult Guide. 2002 Oct;33-35.
25. Monika M. Genetic analysis of production and immune competence traits in three varieties of domesticated Japanese quails having different plumage; 2020.
26. Narayan R, Majumdar S, Bhanja SK. Present scenario and future prospects of turkey and quail as diversified poultry. In: Proceedings of 29th IPSACON, Hyderabad; 2012 Dec 5-7, p. 167-173.
27. Panda B, Ahuja SD, Srivastav AK, Singh RP, Agarwal SK, Thomas PC. Meat and meat products. In: Quail Production Technology. Izatnagar: Division of Transfer Technology, CARI; 1987, p. 31.
28. Bhosale SD. The study of growth and production traits and their mode of inheritance in four Japanese quail lines. [M.V.Sc Thesis]. Izatnagar (UP), India: IVRI; 2015.
29. Varkoohi S, Babak MSM, Pakdel A, Javaremi NA, Zaghari M, Kause A. Response to selection for feed conversion ratio in Japanese quail. Poult Sci. 2010;89(8):1590-1598.
30. Rokade A, Rondiya S, Sharma V, Prasad M, Pathan H, Jadkar S. Electrochemical synthesis of 1D ZnO Nano architectures and their role in efficient photo electrochemical splitting of water. Journal of Solid State Electrochemistry. 2017 Sep;21(9):2639-2648.

How to Cite This Article
Krishna KS, Narayan R, Rokade J, Verma MR, Monika M, Govindaiah PM. Studies on two varieties of domesticated Japanese quails growth performance and genetic parameters. International Journal of Veterinary Sciences and Animal Husbandry. 2025;10(12):219-223.

Creative Commons (CC) License
This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.