International Journal of Veterinary Sciences and Animal Husbandry 2024; SP-9(3): 242-246

ISSN: 2456-2912
VET 2024; SP-9(3): 242-246
© 2024 VET
www.veterinarypaper.com
Received: 20-03-2024
Accepted: 24-04-2024

Pallavi Rathi
Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Devender Singh Dalal
Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Chandrashekhar Santosh Patil
Assistant Professor, Department of AGB, LUVAS, Hisar, Haryana, India

Smriti Sharma
Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Corresponding Author:
Chandrashekhar Santosh Patil
Assistant Professor, Department of AGB, LUVAS, Hisar, Haryana, India

Estimation of genetic parameters of egg quality traits in Aseel and Kadaknath Chicken

Pallavi Rathi, Devender Singh Dalal, Chandrashekhar.Santosh Patil and Smriti Sharma

Abstract
The poultry sector, particularly backyard farming, has emerged as a crucial component of India's agricultural landscape, contributing to economic growth, women's empowerment, and food security. Indigenous chicken breeds like Aseel and Kadaknath are gaining popularity due to their resilience, disease resistance, and unique meat qualities. This study investigated and compared various egg quality parameters in Aseel and Kadaknath chickens reared under backyard systems in Haryana, India. It assessed heritability, genetic correlations, and phenotypic correlations of egg quality traits to inform breeding strategies for optimizing production.

Keywords: Poultry sector, backyard farming, indigenous chicken breeds, Aseel, Kadaknath, egg quality traits, heritability, genetic correlations, phenotypic correlations, breeding strategies

1. Introduction
Poultry sector as one of the fastest growing sector has experienced considerable development in a short span of time. Backyard poultry farming in a developing country like India plays a significant role in terms of economic development, women's empowerment, and food security (Kumar *et al.*, 2021a) [9]. However, indigenous chicken due to their low production performance are often bestowed with less attention as compared to the commercial farming (Tajane and Vasulkar, 2014) [20]. According to Mandal *et al.* (2006) [10], backyard rearing is important for producing stress-free and residue-free birds. Sale of these birds and their eggs commences a higher price than commercial eggs and broilers, thus the birds grown in backyard systems are economically advantageous (Selvam, 2004) [21].
India is home to more than 20 poultry breeds and breeds of chicken like Aseel, Kadaknath, Miri, Nicobari etc. which are still popular in their home tracts. Aseel and Kadaknath are 2 popular indigenous chicken breeds of India that are gaining popularity because of their disease resistance, heat tolerance and meat quality with desirable taste and flavor (Rajkumar *et al.*, 2017) [17]. Aseel breed has its origin in Andhra Pradesh. The fierceness, royal gait, alertness, great stamina, and persistent fighting skills of Aseel are some of the well-recognized traits (Singh, 2000) [23]. Kadaknath birds are very popular among Madhya Pradesh's tribals, owing to their unique characteristics such as adaptation to the local environment, disease resistance, meat quality and specific flavor and taste relished by all; medicinal value of egg and meat, and a variety of other breed-specific characteristics have gained attention over a period of time (Rao and Thomas, 1984) [18]. Despite its unpleasant appearance, Panda and Mahapatra (2011) [5] found Kadaknath meat to have a delicious flavor. According to Mohan *et al.* (2008a), Kadaknath chickens are unique because of black coloured flesh due to high content of melanin in their meat and eggs with high percent of protein. Aseel and Kadaknath chickens are poor layers, but the hens are good broody hens. These desi indigenous birds are famous for their hardiness and ability to survive under adverse climatic conditions (Kumar *et al.*, 2021b) [9]. Due to their toughness, adaptability, and tasty meat and eggs, farmers have recently been interested in raising indigenous chickens under backyard poultry farming. Egg quality, encompassing characteristics like shell strength, albumen quality, and yolk integrity, significantly impacts consumer preference, hatchability, and overall profitability in the egg industry (Stadelman, 1977) [26].

Recognizing this importance, the poultry breeding industry is increasingly focusing on genetic selection for improved egg quality traits. However, egg quality is also influenced by various environmental factors like temperature, season, and management practices (Sauter *et al*., 1954) [19]. Notably, internal egg quality, particularly albumen thickness and yolk integrity, plays a crucial role in both embryo development and consumer acceptance (Narushin & Romanov, 2002; Sekeroglu & Altuntas, 2009) [11, 22]. Given the importance of egg quality in backyard chicken farming as well, Sreenivas *et al*. (2013) [25] emphasized the need for regular evaluation of egg quality parameters to ensure consistent production of high-quality eggs. Motivated by these considerations, the present study aimed to assess and compare various external, internal, and biochemical egg quality parameters in Aseel and Kadaknath chickens reared under backyard systems in Haryana, India.

Importance of Genetic Parameters in Poultry Breeding:
Understanding genetic parameters, such as heritability, genetic correlations, and phenotypic correlations, is crucial for effective breeding programs in poultry. These parameters provide valuable insights into the heritable nature of traits and the relationships between them.

Optimizing Production Traits
The goal of poultry breeding is to achieve optimal production parameters during the growth and laying periods. This can involve traits related to meat production, egg production, or both. Knowledge of genetic parameters helps breeders select birds with desirable traits and create breeding strategies that maximize genetic progress over generations.

Impact on Breeding Strategies
By understanding how traits are inherited and how they interact (correlations), breeders can design targeted selection programs. These programs focus on improving primary traits of economic importance (e.g., egg production, growth rate) while considering potential impacts on correlated traits (e.g., feed efficiency, disease resistance). Effective breeding strategies consider both genetic progress in the targeted trait and potential unintended consequences in correlated traits (Rajkumar *et al*., 2017) [17]

Materials and Methods
The study followed standards guidelines approved by the Institutional Animal Ethics Committee (IAEC), LUVAS, Hisar.

Source of Data
The relevant data for the present investigation was collected from Aseel and Kadaknath population, maintained at the poultry farm of department of Animal Genetics and Breeding, LUVAS, Hisar. The chicks were brooded and reared hatch-wise. The progenies were produced in different hatches. All the chicks were pedigreed; wing banded at the time of hatching, and reared hatch wise using standard manage mental practices. The chicks were vaccinated against Marek's disease, Ranikhet, Gumboro, and Fowl.
Considering the non-orthogonality of the data due to unequal sub class frequencies, Least Squares Maximum Likelihood Computer Programme of Harvey (1937) [4] was utilized to estimate the effect of various non- genetic factors on early performance traits and to estimate genotypic and phenotypic parameters. Sire and residual variance-covariance components for various performances traits was obtained by using least squares and maximum likelihood computer programme of Harvey (1937) [4] using the following mixed model:

$$Y_{ijkl} = \mu + G_i + H_{ij} + S_{ik} + e_{ijkl}$$

Where, Yijkl, lth observation of kth sire of jth hatch of ith generation; μ, overall mean; Gi, fixed effect due to ith generation (i = 1, 2……g); Hij, fixed effect due to jth hatch in ith generation (j = 1, 2…..h); Sik, random effect due to kth sire in ith generation (k = 1, 2…….s) and eijkl, random error associated with each and every observation and assumed to be normally and independent distributed with mean zero and variance $\sigma^2 e$. Generation means were compared by using Kramer's modification of Duncan's Multiple Range Test (Kramer, 1957) [8]. Paternal half-sib correlation method was used to estimate heritability of the traits under study. The standard error of heritability was obtained from the formula given by Swiger *et al*., 1964 [27]. The genetic correlations among different traits were estimated from sire component of variance and covariance. The standard errors of genetic correlations were obtained by using the formula of Robertson, 1959. The phenotypic correlations were obtained from sire and within sire components of variances and covariance's. The standard errors of phenotypic correlations were computed by the following formula given by Panse and Sukhatme, 1967 [15].

Egg Quality Traits

I.	Egg weight at 40week (g)	VIII.	Yolk weight (g)
II.	Specific gravity	IX.	Albumen weight(g)
III.	Shape Index (%)	X.	Shell weight (g)
IV.	Yolk color	XI.	Yolk percentage (%)
V.	Haugh unit score	XII.	Albumen percentage (%)
VI.	Albumen index (%)	XIII.	Percentage of shell (%)
VII.	Yolk index (%)	XIV.	Yolk to albumen ratio

Egg quality traits were calculated using the following standard procedures (Fayeye *et al*., 2005) [3]. Egg weight was determined using an electronic scale, while egg length and width were measured with a vernier Callipers. The weights of albumen, yolk and shell were recorded and expressed as gram.

Measurement of External Parameters
A digital balance was used to weigh each egg to the nearest 0.01 g accuracy. A digital Vernier calliper was used to measure the length and width of the egg, and the shape index was calculated by multiplying the width to length ratio by 100. The inner shell membranes of the shells were removed and dried for 24 h in the open air so as to estimate the shell weight. All of the dried shells were weighed using a digital balance. Shell ratio was calculated by dividing shell weight by egg weight. The thickness of 4 portions of shells randomly were measured to the nearest 0.01 mm using screw gauze, one from each of the 2 ends (broad and narrow end) and 2 from the body of the eggs, and the average thickness was calculated.

Yolk color was measured using DSM Yolk Color
Measurement of Internal Parameters
A Vernier caliper was used to measure the length and width of the albumen and yolk in millimetres. Albumen height was measured randomly at 3 or 4 places and averaged.

Shape index: A Vernier calliper was used to measure the width and length of each egg. The shape index was calculated by ratio of maximum width and length of egg multiply by 100.

Shell thickness: after removing the shell membrane, the weight of the egg shell was measured using an electronic weighing balance. Screw Gauge was used to determine the thickness of the shell. Membrane-removed portions of shell were collected from 3 locations for this purpose, and the average shell thickness was used as the final reading.

Albumen index: with the aid of a Vernier Caliper, the maximum length and width of thick albumen were measured. Height of thick albumen was calculated between yolk and the outside border of thick albumen, avoiding chalaza. After correcting for the zero error on the plain glass plate, albumen height was measured with the assistance of a tripod spherometer with a least count of 0.001 mm. The albumen index was calculated by ratio of average height and width of albumen egg multiply by 100.

Yolk index: the yolk's height was measured using a tripod spherometer, and its width was measured using a Vernier calliper. The formula used to calculate yolk index was ratio of average height and width of yolk multiply by 100.

Haugh Unit: The Haugh unit is the product of the log of albumin height and egg weight, and it is derived using Raymond Haugh's (1937) formula:

HU = 100 log (H – 1.7w 0.37 + 7.56)

Where; H = Albumin Height (cm); W = Egg Weight (g).

Results and Discussion

The analysis of variance and least squares means along with standard errors to identify the effect of non-genetic factors on the observed performance traits were given in Table 1 and 2 &3 respectively.

Table 2: Hatch-wise least-squares means of egg quality traits along with standard errors in Aseel

Trait	µ	Hatch 1	Hatch 2
Egg weight (40wk) g	44.76±0.21	43.21±0.35	44.06±0.12
Shape Index (%)	75.61±0.32	75.29±0.38	75.93±0.56
Albumen Index (%)	0.06±0.23	0.06±0.25	0.06±0.32
Yolk Index (%)	0.43±0.01	0.44±0.01	0.45±0.01
Shell Weight (g)	3.93±0.05	3.94±0.06	3.92±0.08
Yolk Weight (g)	16.82±0.14	16.73±0.17	16.9±0.25
Albumen Weight(g)	23.99±0.32	23.91±0.38	24.07±0.54
Albumen Percentage (%)	53.51±0.36	53.49±0.43	53.54±0.63
Yolk Percentage (%)	37.74±0.31	37.7±0.37	37.79±0.54
Shell Percentage (%)	8.80±0.1	8.83±0.13	8.78±0.19
Specific Gravity	1.06±0.03	1.06±0.03	1.06±0.04
Yolk –Albumen Ratio	0.71±1.06	0.70±1.28	0.71±1.87
Haugh Unit	72.42±1.07	72.38±1.17	72.46±1.48
Yolk Color	8.01±0.03	8.05±0.02	7.8±0.02

Effect of non-genetic factors

Non-significant effect of hatch was seen on egg quality traits of both the breeds. Higher yolk index and yolk percentage in the Kadaknath were observed, whereas the Aseel breed had a higher shape index, higher albumen index and higher yolk-to-albumen ratio, egg specific gravity and higher albumen and shell percentages. The least squares mean and standard error of various egg quality traits are presented in table 2 and 3 for Aseel and Kadaknath.

Table 3: Hatch-wise least-squares means of egg quality traits along with standard errors in Kadaknath

Trait	µ	Hatch 1	Hatch 2
Egg weight (40wk)g	44.76±0.21	43.21±0.35	44.06±0.12
Shape Index (%)	75.61±0.32	75.29±0.38	75.93±0.56
Albumen Index (%)	0.06±0.23	0.06±0.25	0.06±0.32
Yolk Index (%)	0.43±0.01	0.44±0.01	0.45±0.01
Shell Weight (g)	3.93±0.05	3.94±0.06	3.92±0.08
Yolk Weight (g)	16.82±0.14	16.73±0.17	16.9±0.25
Albumen Weight (g)	23.99±0.32	23.91±0.38	24.07±0.54
Albumen Percentage (%)	53.51±0.36	53.49±0.43	53.54±0.63
Yolk Percentage (%)	37.74±0.31	37.7±0.37	37.79±0.54
Shell Percentage (%)	8.80±0.1	8.83±0.13	8.78±0.19
Specific Gravity	1.06±0.03	1.06±0.03	1.06±0.04
Yolk –Albumen Ratio	0.71±1.06	0.70±1.28	0.71±1.87
Haugh Unit	72.42±1.07	72.38±1.17	72.46±1.48
Yolk Color	8.01±0.03	8.05±0.02	7.8±0.02

Heritability estimates for egg quality traits in Aseel and Kadaknath

Heritability estimate ranged from moderate to high for most of the of egg quality traits traits in Aseel and Kadaknath. Lowest heritability estimate was observed for yolk weight, 0.14±0.15 and albumen percentage 0.14±0.15 in Aseel and Kadaknath respectively. High heritability estimates were observed for traits like albumen weight, albumen percentage, shell percentage, specific gravity, yolk albumen ratio, haugh unit and yolk colour *viz*., 0.52±0.24, 0.35±0.2, 0.43±0.21, 0.37±0.28, 0.38±0.21, 0.50±0.31, 0.5 3±0.31 in Aseel. In Kadaknath high heritability estimates were observed for shape index, yolk index, shell weight *viz*., 0.42±0.21, 0.44±0.21, 0.64±0.25 respectively.

Correlation among various egg quality traits in Aseel and Kadaknath

The genetic correlations among the egg quality traits ranged from -0.91(AW- YAR) to 0.98 (YP -YAR) in Aseel and from -0.84 (SW-YP) to 0.95 (AI-HU) in Kadaknath.

Discussion

Least-squares means of egg quality traits along with standard errors in Aseel and Kadaknath

The information on egg quality traits in Aseel chickens is scanty due to less availability of eggs and low production potential of hens. Non-significant effect of hatch was seen on egg quality traits of both the breeds. Higher yolk index and yolk percentage in the Kadaknath were observed which is accordance to the established fact that the smaller the size of eggs, the higher will be the proportion of yolk and the smaller will be the proportion of albumen whereas the Aseel breed had a higher shape index, higher albumen index and higher yolk-to-albumen ratio and higher albumen percentage. Eggs from the Aseel breed had a higher specific gravity, indicating a better shell quality, and this was reflected in a higher percentage of shell weight. Similar results were observed Singh *et al*. (2000)b [23], Ali and Anjum (2014) [2] for shape index, Pandian *et al*. (2011) [12], Premavalli *et al*. (2016) [14] for yolk index, Pandian *et al*. (2011) [12], Rajkumar *et al* (2017) [14] for albumen percentage, Sohail *et al*. (2013) [24] for haugh unit score, Rajkumar *et al.* (2017) [17] for yolk colour in Aseel. On the contrary higher estimates were observed by Pandian *et al*. (2011) [12], Haunshi *et al*. (2011) [5], Sohail *et al*. (2013) [24], Rajkumar *et al*. (2017) [17] for shape index, Pandian *et al*. (2011) [12], Premavalli *et al*. (2016) [14] for albumen index, for yolk index, Haunshi *et al*. (2011) [5] for albumen weight, yolk weight, value was not very high as reported by others which may be reduced as age of the bird advances and weight of the egg increases. Pandian *et al*. (2011) [12] observed higher specific gravity than the present study in Aseel. Higher shape index in the present study indicates more uniform egg shape and size while lower albumen weight was due to the lower egg weights observed in the present study also and Pandian *et al*. (2011) [12] for shell weight, albumen percentage, shell percentage, haugh unit score. Higher haugh unit score was also observed by Usman *et al*. (2014) [28], the haugh unit reported lower haugh unit values, 59.62 to 71.62, for the White Leghorn strain layers. Similar results were observed by Jaishankar *et al.* (2020) [6] for shape index, for yolk index, Parmar *et al*. (2006) [13] for haugh unit score. On the contrary higher values were observed by Jaishankar *et al*. (2020) [6] for albumen index, yolk index, albumen weight, yolk weight, shell weight, albumen percentage, yolk percentage, shell percentage and haugh unit score for Kadakanth.

Heritability estimate of egg quality traits in Aseel and Kadaknath

Heritability estimate ranged from moderate to high for most of the of egg quality traits in Aseel and Kadaknath. Lowest heritability estimate was observed for yolk weight, 0.14±0.15 and albumen percentage 0.14±0.15 in Aseel and Kadaknath respectively. High heritability estimate was observed for traits albumen weight, albumen percentage, shell percentage, specific gravity, yolk albumen ratio, haugh unit and yolk color *viz*.,0.52±0.24,0.35±0.2,0.43±0.21,0.37±0.28,0.38±0.21, 0.50±0.31, 0.53±0.31 in Aseel. In Kadaknath highest heritability estimates were observed for Shape Index, Yolk Index, Shell Weight *viz*., 0.42±0.21, 0.44±0.21, 0.64±0.2. Zhang *et al*. (2005) [29] observed higher estimates of heritability of albumen weight, eggshell index, egg shell thickness, eggshell weight, egg weight, haugh units, and yolk weight. Higher estimates of heritability were observed by John-Jaja *et al*. (2016) [7] for shape index in Exotic laying chicken. Alipanah *et al*. (2013) [1] also observed higher heritabilities of albumen weight yolk color, eggshell index, shell weight, egg weight, haugh units, and yolk weight which were 0.61, 0.19, 0.30, 0.54, 0.50, 0.46, and 0.32, respectively.

Correlation among various egg quality traits in Aseel and Kadaknath

The genetic correlations among the egg quality traits ranged from -0.91 (AW- YAR) to 0.98 (YP-YAR) in Aseel and from -0.84 (SW-YP) to 0.95(AI-HU) in Kadaknath. Positive relationship was observed between EW and other egg quality parameters in Aseel and Kadaknath except for SI and AP in Kadaknath where negative correlation was seen with EW. SI was seen to be highly correlated with YP, YAR and HU while AI was positively correlated with HU in Aseel. High negative correlation was observed between AP and YAR in Aseel. In Kadaknath SI was negatively correlated with SW, AW, SP, AP, SG and HU while it was positively correlated with YI, YP and YAR. Similar results were observed by Udoh *et al* (2012) who reported strong, positive and significant (p<0.01) correlations between egg weight and yolk weight (0.77) and albumen weight (0.79); yolk weight and albumen weight (0.56); yolk index and yolk height (0.715); haugh unit and albumen height (0.95) and albumen index (0.86) in normal feathered variety. Similar results were observed by Sreenivas *et al*. (2013) [25] who observed positive genetic and phenotypic correlation of haugh unit with other egg quality traits, and positive correlation between yolk weight and albumen weight. Alipanah *et al*. (2013) [1] observed higher values of the genetic correlations between egg weight and albumen weight, yolk weight and shell weight ranging from 0.78 to 0.93.

Conclusion

Data must be standardized for various performance traits to nullify the effect of monogenetic factors. Moderate to high estimates of heritability for various performance traits indicated that enough scope exists for the improvement of these traits through individual as well as family selection.

Acknowledgement

The authors are indebted to the Vice Chancellor, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana for providing the infrastructure facilities that enabled the successful completion of the project.

References

1. Alipanah M, Deljo J, Rokouie M, Mohammadnia R. Heritabilities and genetic and phenotypic correlations of egg quality traits in Khazak layers. Trakia J Sci. 2013;2:175-180.
2. Ali A, Anjum R. Evaluation of egg quality traits among different breeds/strains of chicken locally available in Pakistan. Scientific J Ani Sci. 2014;3(1):27-34.
3. Fayeye TR, Adeshiyan AB, Olugbami AA. Egg traits, hatchability and early growth performance of the Fulani ecotype chicken. Lives Res Rural Dev. 2005;17(8):1-7.
4. Harvey WR. Mixed model least squares and maximum likelihood computer program, January. Haugh RR. The Haugh unit for measuring egg quality. US Egg Poult Mag. 1937;43:522-555.
5. Haunshi S, Niranjan M, Shanmugam M, Padhi MK, Reddy MR, Sunitha R, Panda AK. Characterization of two Indian Native chicken breeds for Production, Egg and Semen quality, and Welfare Traits. Poultry Science. 2011;90(2):314-320.
6. Jaishankar S, Jyothi Priya R, Sheeba A, Ilavarasan S. Productive and Reproductive Performance of Kadaknath Chicken under Semi-intensive System. Int J Curr Microbiol App Sci. 2020;9(4):513-517.
7. John-Jaja SA, Abdullah AR, Nwokolo SC. Heritability estimates of external egg quality traits of exotic laying chickens under the influence of age variance in the tropics. J Saudi Soc Agric Sci. 2018;17(4):359-364.
8. Kramer CY. Extension of multiple range tests to group correlated means. Biometrics. 1957;13:13-18.
9. Kumar M, Dahiya SP, Ratwan P. Backyard poultry farming in India: a tool for nutritional security and women empowerment. Biol Rhythm Res. 2021;52:1476-1491.
10. Mandal MK, Khandekar N, Khandekar P. Backyard poultry farming in Bareilly district of Uttar Pradesh, India: an analysis. Lives Res Rural Dev. 2006;18:101.
11. Narushin VG, Romanov MN. Egg physical characteristics and hatchability. Worlds Poult Sci J. 2002;58:297-303.
12. Pandian C, Kumaravelu N, Sundaresan A, Rajendran R, Babu M, Thyagarajan D, Prabakaran R. Evaluation of Egg Quality Traits of Chicken Reared Under Intensive System of Management. XXVII Annual Conference and National Symposium of Indian Poultry Science Association, Poultry Products Technology, Economics And Marketing; c2011.

13. Parmar SNS, Thakur MS, Tomar SS, Pillai PVA. Evaluation of egg quality traits in indigenous Kadaknath breed of poultry. Lives Res Rural Dev, 2006, 18(132).
14. Premavalli K, Omprakash AV, Sangilimadan K, Ashok A, Rajendra R, Thyagarajan, Babu M. Egg quality traits of different Native chickens Reared under Intensive system in Tamil Nadu. Indian Vet J, 2016, 93(06).
15. Panse VG, Sukhatme PV. Statistical and Methods for Agricultural Workers. 2nd ed. ICAR, New Delhi; c1967.
16. Rajkumar U, Haunshi S, Paswan C, Raju MVLN, Rama Rao SV, Chatterjee RN. Comparative evaluation of carcass traits and meat quality in native Aseel chickens and commercial broilers. Br Poult Sci. 2016;57:339-347.
17. Rajkumar U, Haunshi S, Paswan C, Raju MVLN, Rama Rao SV, Chatterjee RN. Characterization of indigenous Aseel chicken breed for morphological, growth, production, and meat composition traits from India. Poultry Science. 2017;96(7):2120-2126.
18. Rao GV, Thomas PC. The breed characteristics of Kadaknath breed of indigenous (Desi) chicken. Avian Res. 1984;68:55-57.
19. Sauter EA, Homs JV, Stadelman WJ, Melaren BA. Seasonal variation in quality of eggs measured by physical and functional properties. Poult Sci. 1954;33:519-524.
20. Tajane SB, Vasulkar R. Development of rural backyard poultry. Poult Punch. 2014;30:30-35.
21. Selvam S. An economic analysis of free-range poultry rearing by rural women. Indian J Poult Sci. 2004;39:75-77.
22. Şekeroglu A, Altuntaş E. Effects of egg weight on egg quality characteristics. J Sci Food Agric. 2009;89:379-383.
23. Singh M, Singh U, Ourung BS. Evaluation of egg weight and its various measurements to attributes in indigenous Aseel breed of chicken. Indian J Poult Sci. 2000;35(3):312-314.
24. Sohail A, Muhammad A, Hussain J, Iqbal A, Usman M, Rehman A, Hussnain F. Comparative study on productive performance, egg quality, egg geometry, and hatching traits of three age groups of indigenous Peshawari Aseel chickens. J Vet Adv. 2013;2(2):21-25.
25. Sreenivas D, Manthani GP, Mallam M, Chatterjee R. Genetic analysis of egg quality traits in White Leghorn chicken. Vet World. 2013;6:263-266.
26. Stadelman WJ. Quality identification of shell eggs Egg Science and Technology. 2nd ed. AVI Publishing Company Inc, Westport, CT; c1977.
27. Swiger LA, Harvey WR, Everson DO, Gregory KE. The variance of interclass correlation involving groups with one observation. Biometrics. 1964;20:818-826.
28. Usman M, Bashir A, Akram M, Zahoor I, Mahmud A. Effect of age on performance, Egg geometry and Quality traits of Lakha Variety of Aseel Chicken in Pakistan. J Basis Appli Sci. 2014;10(1):384-386.
29. Zhang LC, Ning ZH, Xu GY, Hou ZC, Yang N. Heritabilities and Genetic and Phenotypic Correlations of Egg Quality Traits in Brown-Egg Dwarf Layers. Poultry Science. 2005;84:1209-1213.

How to Cite This Article
Rathi P, Dalal DS, Patil CS, Sharma S. Estimation of genetic parameters of egg quality traits in Aseel and Kadaknath Chicken. International Journal of Veterinary Sciences and Animal Husbandry. 2024; SP-9(3): xx-xx.

Creative Commons (CC) License
This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 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.