



Original Article

Comparative Study on the Production, Performance and Various Eggs Characteristic of Rhode Island Red and Plymouth Rock Poultry Breeds

Rameez Raja Kaleri^{1*}, Hubdar Ali Kaleri², Muhammad Altaf Hussain³, Naimat Ullah⁴, Raz Hussain¹, Abdul Ghafar Ghotia⁵, Muhammad Hayat⁶, Ahsan Zulfiqar Kaimkhani⁷, Imran Ahmed⁸ and Mudasar Ahmed Khosa²

¹Department of Livestock and Fisheries, Government of Sindh, Karachi, Pakistan

²Department of Animal Breeding and Genetics, Sindh Agriculture University, Tandojam, Pakistan

³Department of Veterinary Microbiology, Lasbela University of Agriculture Water and Marine Sciences, Uthal, Pakistan

⁴Department of Livestock and Dairy Development, Quetta, Pakistan

⁵Department of Livestock Management, Lasbela University of Agriculture Water and Marine Sciences, Uthal, Pakistan

⁶Department of Veterinary Pathology, Lasbela University of Agriculture Water and Marine Sciences, Uthal, Pakistan

⁷Department of Food Sciences, University of Karachi, Pakistan

⁸Department of Livestock and Poultry Production, University of Poonch, Rawalakot, Pakistan

ARTICLE INFO

Keywords:

Chicken, Feed Consumption, Egg Quality, Poultry Breeds

How to cite:

Kaleri, R. R., Kaleri, H. A., Hussain, M. A., Ullah, N., Hussain, R., Ghotia, A. G., Hayat, M., Kaimkhani, A. Z., Ahmed, I., & Khosa, M. A. (2024). Comparative Study on the Production, Performance and Various Eggs Characteristic of Rhode Island Red and Plymouth Rock Poultry Breeds: Comparative Study on Eggs of Poultry Breeds. *MARKHOR (The Journal of Zoology)*, 5(02). <https://doi.org/10.54393/mjz.v5i02.100>

*Corresponding Author:

Rameez Raja Kaleri
Department of Livestock and Fisheries,
Government of Sindh, Karachi, Pakistan
rameezkaleri@gmail.com

Received Date: 5th April, 2024

Acceptance Date: 23rd May, 2024

Published Date: 30th June, 2024

ABSTRACT

A comparative study was conducted at Arain Farm in Nasarpur, Sindh during to January 2024 to March 2024. **Objective:** To assess the production performance and egg quality of Plymouth Rock and Rhode Island Red chickens. **Methods:** A total of 105 birds (50 females and 5 males per breed) were selected for the study. The birds were divided into 10 groups, with 5 groups per breed. The chickens were fed layer feed L5, and various parameters including feed conversion ratio, egg weight, egg production, and egg quality characteristics were measured. **Results:** The results revealed that Rhode Island Red chickens showed higher egg weight and production, as well as more efficient feed utilization per kilogram of egg weight and per dozen eggs compared to Plymouth Rock chickens. Rhode Island Red chickens also exhibited higher values for yolk weight, shell weight, albumin weight, breaking strength, yolk index, and shell thickness. Haugh unit values did not differ significantly between the two breeds. **Conclusions:** Rhode Island Red chickens demonstrated superior production performance and egg quality characteristics in the Nasarpur region of Sindh.

INTRODUCTION

Many poultry strains have been developed in order to achieve the highest egg and meat production from poultry birds. In Pakistan, due to the lower production potential of desi chicken in terms of egg farming, it has been replaced with various imported layer breeds in rural areas such as Plymouth Rock and Rhode Island Red. The purpose of developing these breeds is to provide better performance and enable them to survive under harsh climatic conditions

in both urban and rural areas. The Plymouth Rock was developed from Dominique, Java, Cochin, and Brahma in America, while the Rhode Island Red was developed from Cochin, Java, Malay, and Shanghai breeds with Brown Leghorn birds in Italy [1]. Both the Plymouth Rock and Rhode Island Red chicken breeds are dual-purpose breeds from the American class and are becoming increasingly popular in rural and urban areas of Pakistan due to their

superior taste of meat and egg production [2-4]. These breeds are being kept on a large scale in rural areas of Sindh to increase egg and meat production. There is a lack of information regarding the Plymouth Rock and Rhode Island Red breeds in Pakistan, and they are being kept indiscriminately due to insufficient information about their body characteristics, production potential, and survivability in severe climatic conditions of Sindh, Pakistan [5, 6].

Recognizing the importance of these exotic breeds, the present study aimed to compare the production performance of Plymouth Rock and Rhode Island Red chicken breeds in Nasarpur, Sindh.

METHODS

In this experiment, a total of one hundred ten birds, with 5 males and 50 females from each Plymouth Rock and Rhode Island Red breed at 32 weeks of age, were placed under study. The birds were distributed into 10 replicates, each composed of 1 cock and 10 hens, with 5 replicates each. All the groups were reared in separate portions with 5.8 square feet of floor space and kept under similar management conditions for an 8-week period from January to March 2024. The relative humidity and temperature inside the shed were maintained and observed to vary from 26°C to 28°C and 55% to 65%. The birds were provided with 16 hours of light daily. The experimental birds were fed commercial L5 layer feed throughout the experiment. Weekly residual feed was removed and weighed on a digital weighing balance machine. Egg collection was done routinely at 12:00 pm daily without delay. The feed consumption ratio was recorded after deducting the residue feed. Eggs were weighed daily, and the average weight of eggs at the end of each week was recorded. The feed consumption ratio was recorded based on the kilogram mass of eggs and one dozen eggs (Table 1).

Table 1: Poultry Feed Ingredient of Layer Ration

Ingredients	Percentage %
Soybean Meal	6.65
Rice	20.5
Fish Meal	5
Corn	41
Cotton Seed Meal	1.40
Rice Polishing	7.60
Limestone	7
Molasses	2.30
Di Calcium Phosphate	2.80
Mineral/Vitamin	0.40
Corn Gluten (60%)	6
Total	100

The chemical composition of the layer ration feed provided to the experimental birds is summarized in table 2.

Table 2: Poultry Feed Chemical Composition % of Layer Ration

Ingredients	Composition (%)
Methionin	0.40
Crude Protein	16.1
Crude Fiber	3.70
Lysine	0.71
Phosphorus	0.70
Calcium	3.54
Metabolized Energy Kcal/kg	2808
Vitamin A	3000

The egg quality characteristics were recorded over a two-week period. To observe various egg quality traits, 3 eggs from each group were randomly selected for analysis, including albumin height, yolk height, egg breaking strength, shell thickness, and yolk diameter, as suggested by [1]. The data for egg Haugh unit was calculated as a percentage of albumin height and egg weight. The recorded parameters were then analyzed using the RCBD model. Variation among the average values was compared using Duncan's Multiple Range Test [7].

RESULTS

Production Potential

The average results for FCR eggs per dozen, egg weight, egg production, FCR per bird per week in kilograms, and FCR per egg mass per kilogram of both chicken breeds are presented in table 3. The feed consumption ratio per bird per week in Plymouth Rock chickens was significantly higher ($P < 0.05$) compared to Rhode Island Red birds. The minimum feed consumption was observed in Rhode Island Red birds per week per bird. In this study, Rhode Island Red birds produced a greater number of eggs compared to Plymouth Rock chickens. It was also noted that Rhode Island Red birds produced heavier eggs with better FCR per dozen compared to Plymouth Rock chickens (Table 3).

Table 3: Average Values for Different Parameters of Rhode Island Red and Plymouth Rock Layer

Parameters	Groups	
	RIR (Mean \pm S.D)	Plymouth Rock (Mean \pm S.D)
FCR Eggs Dozen	2.453 \pm 0.310	2.387 \pm 0.137
Egg Weight	52.43 \pm 3.401	50.55 \pm 3.511
Production of Egg	3.65 \pm 0.417	4.47 \pm 0.259
FCR/Bird/Week kilo gram	0.739 \pm 0.041	0.786 \pm 0.055
FCR/ Egg mass/kg	4.215 \pm 0.355	3.399 \pm 0.251

Egg Quality Traits

The average results for yolk weight, shell weight, albumin weight, breaking strength, Haugh unit, yolk index, and shell thickness are displayed in table 4. The findings of the present study revealed that egg yolk weight and albumin weight were significantly higher ($P < 0.05$) in Rhode Island Red chickens compared to Plymouth Rock chickens, and the influence of the week on the egg yolk weight was also

significantly higher. The results for the egg yolk index were non-significant among both breeds. The results for the Haugh unit were non-significant and at the desired level in both breeds. The results for shell strength were significantly higher ($P < 0.05$) in Rhode Island Red chickens compared to Plymouth Rock chickens, and the highest breaking strength was observed during the 1st week of the experiment, while the interaction of breed on the week was recorded non-significantly (Table 4).

Table 4: Average Values for Different Egg Quality Characteristics of Plymouth Rock and Rhode Island Red Layer

Parameters	Groups	
	RIR (Mean \pm S.D)	Plymouth Rock (Mean \pm S.D)
Yolk Weight (grams)	16.87 \pm 1.055	16.25 \pm 1.91
Shell Weight (grams)	7.57 \pm 0.645	6.55 \pm 0.611
Albumin Weight (grams)	26.45 \pm 3.317	26.27 \pm 0.195
Breaking Strength	2.90 \pm 0.141	1.95 \pm 0.075
Haugh Unit	76.5 \pm 8.243	74.3 \pm 6.876
Yolk Index	0.467 \pm 0.031	0.437 \pm 0.021
Shell Thickness	0.39 \pm 0.013	0.34 \pm 0.011

DISCUSSION

The results for feed consumption ratio per bird per week in Plymouth Rock chickens were observed to be significantly higher ($P < 0.05$) compared to Rhode Island Red birds. The minimum feed consumption was observed in Rhode Island Red birds per week per bird. Previous studies have reported that feed consumption ratio during the 8th week of study was significantly higher ($P < 0.05$) in Fayoumi as compared with Rhode Island Red birds [8]. It was observed that Rhode Island Red birds showed minimum feed consumption ratio results compared to Fayoumi. Our findings are concordant to previously reported studies that certain layer strains had a significant influence on feed intake compared to other diets [3-8]. It is widely considered that Feed Conversion Ratio (FCR) is a heritable feature, and the maximum feed intake in Fayoumi and Plymouth Rock birds might be due to their different physical activities on the farm, where the maximum amount of consumed feed can be effectively utilized by their bodies for multiple functions. In our study, significantly higher ($P < 0.05$) and heavier egg production was recorded in Rhode Island Red birds compared to Plymouth Rock birds. The results of various literature reports are relative to our findings, as they reported maximum egg weight and egg production in Rhode Island Red compared to Lyallpur Silver Black birds [10-13]. Another study reported lower egg weight and production in Lyallpur Silver Black birds compared to Rhode Island Red chickens [6]. The variation in egg weight and production might be due to genetic potential and better management

conditions with proper feeding, vaccination, and medication during the laying process. The results of some previous studies are contrary to our findings, as they reported that Lyallpur Silver Black birds produced heavier and higher egg production compared to Fayoumi and Rhode Island Red chickens [8, 15, 16]. According to some other studies, the significant difference in egg production between breeds might be due to feed composition, body weight, and genetic makeup of individual breeds [17-19]. The results for egg yolk weight and egg index were observed to be significantly higher ($P < 0.05$) in Rhode Island Red compared to Plymouth Rock. Similarly, higher egg yolk index in Rhode Island Red hens compared to White Leghorn hens have been reported previously [18-22]. The egg yolk index was recorded as non-significant between Lyallpur Silver Black and Fayoumi breeds. On the contrary, some studies have revealed no significant difference among breeds at any stage for egg yolk index [23-26]. In our study, Rhode Island Red produced heavier egg yolk weight. It has been suggested that the maximum egg yolk and albumin weight was non-significant among three different poultry breeds during the 8th week experiment [22]. The highest results for eggshell breaking strength were recorded during the initial week of the experiment. The results of higher eggshell strength were observed in White Leghorns compared to Rhode Island Red, which had less shell breaking strength [28].

CONCLUSIONS

It is concluded that Rhode Island Red chickens produced higher egg production with better feed utilization in Nasurpur compared to Plymouth Rock chickens. It is suggested that Rhode Island chickens can be reared in rural areas of Sindh to improve egg production and the economy of rural people.

Authors Contribution

Conceptualization: RRK

Methodology: MAK

Formal analysis: MAH, NU, IA, HA, RH

Writing, review and editing: AZ, AGG

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

This research has been partially funded by ORIC KMU as Master Thesis approved by ASRB

REFERENCES

- [1] Akhtar N, Mahmood S, Hassan M, Yasmeen F. Comparative study of production potential and egg characteristics of Lypallpur Silver Black, Fayoumi and Rhode Island Red breeds of poultry. *Pakistan Veterinary Journal*. 2007; 27(4): 184-8.
- [2] Hess CW, Byerly TC, Jull MA. The efficiency of feed utilization by Barred Plymouth Rock and crossbred broilers. *Poultry Science*. 1941 May; 20(3): 210-6. doi: 10.3382/ps.0200210.
- [3] Kaleri R, Kaleri HA, Moryani AA, Mangrio ZA, Bhuptani DK, Janyaro H et al. Influence of Different Housing Systems on the Quality Characteristics of Table Egg Produced by Plymouth Rock Chicken. *Pakistan Journal of Biotechnology*. 2024 Feb; 21(1): 57-60. doi: 10.34016/pjbt.2024.21.01.881.
- [4] Kumar M, Dahiya SP, Ratwan P, Sheoran N, Kumar S, Kumar N et al. Assessment of egg quality and biochemical parameters of Aseel and Kadaknath indigenous chicken breeds of India under backyard poultry farming. *Poultry Science*. 2022 Feb; 101(2): 101589. doi: 10.1016/j.psj.2021.101589.
- [5] Rajput N. Effect of Flock Size on Fayoumi Layer Production Nasir Rajput, Muhammad Ismail Rind and Rahmatullah Rind" Department of Poultry Husbandry, Faculty of Animal Husbandry and Veterinary Sciences. *Journal of Animal and Veterinary Advances*. 2005; 4(10): 842-4.
- [6] Ashraf MU, Mahmood SU, Khan MS, Ahmad FA. Productive behaviour of Lypallpur Silver Black and Rhode Island Red breeds of poultry. *International Journal of Agriculture and Biology*. 2003; 5(3): 384-7.
- [7] Steel, R.G.D., Torrie, J.H. and Dicky, D.A. *Principles and Procedures of Statistics, A Biometrical Approach*. 3rd Edition. New York: McGraw Hill, Inc. Book Co; 1997.
- [8] Khan WA and Mian A. Population biology of black francolin (*Francolinus francolinus*) with reference to Lal Suhanra National Park, Pakistan. *Pakistan Journal of Zoology*. 2013 Feb; 45(1): 183-191.
- [9] Jones DR and Musgrove MT. Effects of extended storage on egg quality factors. *Poultry science*. 2005 Nov; 84(11): 1774-7. doi: 10.1093/ps/84.11.1774.
- [10] Mohammed MD, Abdalsalam YI, Kheir AM, Jin-yu W, Hussein MH. Comparison of the egg characteristics of different Sudanese indigenous chicken types. *International Journal of Poultry Science*. 2005 Jun; 4(7): 455-7. doi: 10.3923/ijps.2005.455.457.
- [11] Monira KN, Salahuddin M, Miah GJ. Effect of breed and holding period on egg quality characteristics of chicken. *International Journal of Poultry Science*. 2003 Jun; 2(4): 261-3. doi: 10.3923/ijps.2003.261.263.
- [12] Lalhlimpua C, Singh NS, Mayengbam P, Chaudhary JK, Tolenkhomba TC. Phenotypic characterization of native chicken 'Zoar' of Mizoram, India in its home tract. *Journal of Entomology and Zoology Studies*. 2021; 9(1): 1756-9. doi: 10.5455/ijlr.20200221092632.
- [13] Tufail M, Sajjad M, Zulfiqar M, Sohail SM, Ahmad I. Economic of backyard poultry in tehsil Matta, district Swat. *Sarhad Journal of Agriculture*. 2012 Sep; 28(3): 485-92.
- [14] Ullah M, Marri GM, Jogi Q, Rasheed M, Rizawana HR, Kaleri RR et al. 23. Dietary effect of autolysed yeast on broilers (Levabon®, Biomin Austria) on broiler growth. *Pure and Applied Biology*. 2019 Jun; 8(2): 1223-7. doi: 10.19045/bspab.2019.80064.
- [15] Hocking PM, Bain M, Channing CE, Fleming R, Wilson S. Genetic variation for egg production, egg quality and bone strength in selected and traditional breeds of laying fowl. *British Poultry Science*. 2003 Jul; 44(3): 365-73. doi: 10.1080/00071660301988.
- [16] Sangilimadan K, Vasanthi B, Valavan SE, Meenakshi S. Egg quality traits of different native chickens under organized farm conditions. *International Journal of Veterinary Sciences and Animal Husbandry* 2024 Feb; 9(2): 97-103.
- [17] Qureshi M, Qadri AH, Gachal GS. Morphological study of various varieties of Aseel chicken breed inhabiting district Hyderabad. *Journal of Entomology and Zoological Studies*. 2018; 6(2): 2043-5.
- [18] Hussein SM, Harms RH, Janky DM. Effect of age on the yolk to albumen ratio in chicken eggs. *Poultry Science*. 1993 Mar; 72(3): 594-7. doi: 10.3382/ps.0720594.
- [19] Silversides FG, Korver DR, Budgell KL. Effect of strain of layer and age at photostimulation on egg production, egg quality, and bone strength. *Poultry Science*. 2006 Jul; 85(7): 1136-44. doi: 10.1093/ps/85.7.1136.
- [20] Marghazani IB. Proceedings and Abstract Book of the Sixth International Conference and Industrial Exhibition on. In Proceedings 6th International Conference and Industrial Exhibition on Dairy Science Park. Mar 2023: 20-21.
- [21] He T, Mahfuz S, Piao X, Wu D, Wang W, Yan H et al. Effects of live yeast (*Saccharomyces cerevisiae*) as a substitute to antibiotic on growth performance, immune function, serum biochemical parameters and intestinal morphology of broilers. *Journal of Applied Animal Research*. 2021 Jan; 49(1): 15-22. doi: 10.1080/09712119.2021.1876705.
- [22] Jahejo AR, Rajput N, Rajput NM, Leghari IH, Kaleri RR, Mangi RA et al. Effects of heat stress on the performance of Hubbard broiler chicken. *Cells, Animal and Therapeutics*. 2016; 2(1): 1-5.

- [23] Akber I, Rajput N, Ali S, Naeem M, Mumtaz M, Rajput L *et al.* Comparative study on the efficiency of various feed additives on growth performance of broiler. *Pure and Applied Biology*. 2020 Feb; 9(1): 240-8. doi: 10.19045/bspab.2020.90028.
- [24] Khalid S. Comparative study of egg quality characteristics of Rhode Island Red, Lyallpur Silver Black and White Leghorn breeds [Doctoral Dissertation]. Pakistan; Government College University Faisalabad: 2001.
- [25] Usman M, Bashir A, Akram M, Zahoor I, Mahmud A. Effect of age on production performance, egg geometry and quality traits of lakha variety of aseel chicken in Pakistan. *Journal of Basic & Applied Sciences*. 2014 Jan; 10: 384. doi: 10.6000/1927-5129.2014.10.50.
- [26] Ahmed I, Rajput N, Laghari IH, Kaleri RR, Shamas S, Ahmed Z *et al.* Exploring the Confluence of In-Ovo Mineral Supplementation and Hatching Attributes in Broiler Chick Progeny: A Symphony of Nutritional Enrichment and Broiler Chicks Development: In-Ovo Mineral Supplementation and Hatching. *Futuristic Biotechnology*. 2023 Sep; 3(2): 33-40. doi: 10.54393/fbt.v3i02.64.
- [27] Banerjee S. Morphological characterization of indigenous chickens of Sikkim and West Bengal, India. *Animal Genetic Resources/Resources génétiques animales/Recursos genéticos animales*. 2012 Dec; 51: 57-71. doi: 10.1017/S2078633612000343.