Assessment of Growth and Laying Performance of Local Village Chicken in Malaysia

Julie Marzlinda M.R.[1*], Azlina Azma I.A.[3], Nooraisyah S.[2], Mohd Hafizzudin A.[1], Abdul Mu'in H.B[1] Azrikin Shah A.[1], Muhammad Syafri Famin A.A. [1], Muhammad Khairul Azwan M.[1], Syahirah M. Y. [1], Nurul Akmal C.A.[1], Muhammad Nazri I.[1]

[1]Malaysian Agricultural Research and Development Institute (MARDI) Kluang, KM 15 Jalan Kluang-Kota Tinggi, 86000 Kluang, Johor.
[2]Malaysian Agricultural Research and Development Institute (MARDI) Muadzam Shah, KM 5 Jalan Rompin, 26700 Muadzam Shah, Pahang.
[3]Malaysian Agricultural Research and Development Institute (MARDI), Headquarters, Persiaran MARDI -UPM, 43400 Serdang, Selangor.

*Corresponding author: juliem@mardi.gov.my

Abstract

Local village chickens are vital for household food security in Malaysia but typically show lower egg production compared to commercial breeds. This study evaluated the growth and laying performance of three pure-line village chicken breeds (Lines A, B, and D) at MARDI Kluang. Body weight and pin bone width were measured to assess growth performance and reproductive maturity, while Hen-Day Egg Production (HDEP) was used to evaluate laying performance. Findings showed no significant differences in body weight between all lines. However, Line A tended to be heavier than Lines B and D during the grower stage (10-16 weeks) and the layering stage (24-52 weeks). Pin bone measurements taken at 20 weeks indicated that Lines B and D had pin bone spacings of 4.08 ± 0.19 cm and 4.17 ± 0.16 cm, respectively, while Line A reached a similar spacing at 22 weeks. HDEP analysis showed that Lines B and D were more productive, achieving peak production earlier at the age of 22 and 23 weeks, with values were 74.92% and 69.74% respectively, as Line A peaked at 67.37% at 28 weeks. These findings indicate that Lines B and D are more efficient for early egg production and reach sexual maturity earlier. This provides valuable insights for selective breeding strategies to enhance productivity among village chickens.

Keywords: egg production, growth performance, village chicken

Introduction

Local or indigenous chicken production can contribute to household food security through the quantity and quality of poultry products, mainly meat and eggs. Local village chickens in Malaysia have a lower egg production potential than commercial chicken breeds. However, production has improved through selective breeding and research; MARDI's Saga chicken was successfully produced in 2012 as dual-purpose local village chicken breed. At the age of 12

weeks, with commercial feeding, the weight of Saga chickens can reach around 1.3kg for hens and roosters at 1.5 kg. Saga chickens can be raised in a free-range system, semi-intensive, or intensively (Roziatul *et al*., 2021). The increasing demand for village chicken meat directly contributes to the country's chicken meat production industry. However, there is still a shortage of production of village chickens in Malaysia to meet the growing demand. Among the contributors to the shortage of supply is due to the minimal number of local suppliers to supply chicks. In addition, village chickens are known to have slower growth and lower egg production than imported layers. For example, the White Leghorns breed can produce between 300 eggs per year compared to Saga chickens, which have only an average of 120 eggs per year.

Although village chickens have a lower production rate compared to commercial breeds, their ability to thrive on natural scavenging and locally available feed makes them a sustainable and cost-effective choice for smallholder farmers. This reduces reliance on imported breeds for day-old chicks (DOC) and supports the preservation of genetic diversity, which is increasingly threatened by the widespread use of imported and commercial breeds.

Several studies have been carried out to evaluate the growth performance of local village chickens. However, there is a lack of research findings regarding the laying performance of these chickens as egg layers. Research provides a thorough understanding of the laying performance of village chickens and can inform breeding and management strategies to improve egg production. Studies can be conducted to evaluate the performance of egg-laying village chicken breeders, using methods such as pin bone measurement, assessment of egg production rates, and the quantity and weight of eggs according to the age of the chicken.

These studies give a comprehensive view of the laying performance of village chickens and can help guide breeding and management practices to enhance egg production. In addition to pin bone measurements, sexual maturity in hens can be assessed through other factors such as body weight, fleshing score, and egg production. Therefore, this study aims to assess the laying performance and egg production of selected pure lines for their potential as a breed of village chickens with higher egg production to produce more chicks.

Materials and Methods

Birds and management

A total of three pure lines of village chickens had been developed at MARDI Muadzam Shah since 2008, where group A was chickens originated from the Southern region, group B is from North region of Malaysia, and group D is the Saga chicken. One hundred of a day-old chick (DOC) from each group were transferred to the Poultry Unit, MARDI Kluang, Johor, and all DOC were reared separately in a brooder floor pen bedded with sawdust material. All chicks have been immunized against Newcastle

disease virus, infectious Bronchitis virus (Bio-Vac ND/IB), Mareks disease, infectious Bursal disease virus (IBA-Vac), fowl pox (Vaiol-Vac), infectious coryza, infectious Laryngotracheitis (Larvac) and egg drop syndrome (EDS) were given at age of 16 week prior to laying.

At the age of 8 weeks, chicks were separated according to physical assessment and were placed according to gender. At 16 weeks of age, another selection was done to select potential female birds as laying breeders and total of 30 female birds for each group. Each group had three replicates consisting of 10 birds were placed into random experimental litter floor pen of 120cm x 180cm and were fed with standard commercial breeder mash. Water was given *ad libitum.*

Animal ethics

This study was conducted in accordance with ethical guidelines and approved by the Animal Ethics Committee (AEC) of MARDI, approval number 20210827/R/MAEC00099.

Growth performance

Eight female birds from each replicate group were randomly sampled and weighed every two weeks from the age of 10 weeks until they reached 52 weeks of age.

Determination of female sexual maturity

At the age of 16 weeks, eight female birds were randomly picked from each pen and pin bone spacing were measured using measuring tape. Pin bone measurement was recorded every two weeks between 16 to 24 weeks of age to determination of female sexual maturity and when lay is about to begin.

Laying performance

Daily egg production was recorded from the first day of laying until 58 weeks of age, with eggs collected every day between 9 and 10 am and weighed using a digital balance. Hen-day egg production (HDEP) was calculated as the percentage of the total egg number (EN) during a week (7 days) divided by the total number of hens alive in the same period (adjusted for mortality). HDEP provides an accurate daily productivity estimate by accounting for changes in the hen population due to mortality throughout the recorded period.

$$\text{HDEP} = \frac{\text{Total number of eggs produced}}{\text{Total number of hen-days (alive)}} \times 100$$

Statistical analysis

This experiment used a completely randomized design (CRD) to rear each group in a litter floor pen. Body weight and egg weight data were sorted by age and group using PROC SORT of Statistical Analysis System (SAS) program version 9.4. Body weight, pin bone measurement, egg production and egg weight were analyzed using PROC GLM, and means were compared using Duncan's Multiple Range Test (DMRT) at the significance level of 0.05. R-squared values were measured using linear regression in excel.

Results and discussion

Body weight

Measurement of hens' body weight at various growth stages is important for monitoring growth trends, as body weight has been shown to influence key parameters of laying performance and egg quality in hens (Lacin *et al*., 2008). The initial weight (10 weeks) of the hens' form A, B, and D pure lines was 1.14kg, 1.10kg, and 1.12 kg, respectively. Meanwhile, the final weight was 2.36kg, 2.26 kg, and 2.34kg, respectively, at 52 weeks. As shown in Figure 1, there were no significant differences ($p>0.05$) in body weight between pure lines at different ages. However, during the grower stage (10-16 weeks), pure Line A tended to be heavier than B and D. At layer stage (24-52 weeks), pure Line A also tended to gain more weight than other pure lines.

Meanwhile, pure line B showed a trend with lower body weight throughout the different ages. Chineke (2001) reported that the recommended maintenance for optimal body weight for Olympic Black Layer chickens ranges between 1.72 and 1.80 kg, with good feeding and management practices to ensure better egg production. In contrast with this finding, this was compared to all pure Lines (A, B, and D) where body weight ranges between 1.65 to 2.10 kg were in their pre-layer phase (16-20 weeks of age). As shown in Figure 3, the optimal body weight for peak egg production across all pure lines is between 2.00 and 2.20 kg, particularly at 22-28 weeks of age. Based on the observation, while slight differences among the three pure lines, nutritional and environmental factors must be considered, as they play a critical role in achieving optimal body weight and enhancing egg production. This assessment shows the importance of improving village chicken breeds to enhance their potential as local laying hens.

Age of female sexual maturity

Measuring the width of the pin bones, helps determine the sexual maturity of female broiler breeders and it is useful for identifying non-laying females at different production stages (Satterlee and Marin, 2004). Female chicken with wider pin bone, usually associated with higher egg production potential. Example, female chicken with more than two fingers fit between the bones, is considered to have sufficiently wide pelvic bones for egg-laying.

In Figure 2, it shows no significant differences in pin bone measurement between all pure line groups at interval age of 16 to 24 weeks. However, as early as 20 weeks of age, hens in pure line B and D tend to have wider space (4.08±0.19 cm and 4.17±0.16 cm, respectively), followed by pure line A (4.2±0.13 cm) at 22 weeks. As it reached an average spacing of 4 cm wide, it is indicated that Line B and D tend to achieve sexual maturity at 20 weeks of age, earlier than Line A (22 week of age), as shown in Figure 2. Finding showed, R-squared values showed the trendline reliability in Line A had the highest value followed by Line B and D, B and D (0.93, 0.81 and 0.74 respectively). This showed the model of Line A had a strong

predictor relationship between the age and pin bone width compared to Line B and D.

Nonetheless, with hens having wider pin bones typically being more productive layers than those with narrower spacing, though this relationship can vary by breed. Therefore, by measuring pin bone enables breeders to evaluate the sexual maturity of hens and predict the pre-laying phase, and unsuitable hens for breeding can be removed from the breeder flock.

Weekly Hen-Day Egg Production (HDEP)

Egg production is a critical trait in laying hens, often considered one of the primary indicators of their productivity. Egg production rates are influenced by various factors, including genetics, environmental conditions, and the rearing system used. As reported by Anderson (2010) compares Hy-Line Brown layers in caged and free-range systems, finding a statistically significant difference in production rates: caged hens had an egg production rate of 81.9%, compared to 77.7% in free-range hens.

As shown in Figure 3, hens from Lines B and D reached the age of first egg-laying at 16 weeks, earlier than Line A, which began laying at 17 weeks. According to Ademola *et al*. (2023), breeds like Goliath and Sussex demonstrate early reproductive trait development and gain weight more rapidly, facilitating earlier egg-laying and contrasting with Yoruba ecotype chickens, which tend to lay later. However, in contrast with this study, Line A hens, despite gaining weight more quickly between 10 and 16 weeks (Figure 1), showed a later onset of egg-laying at 17 weeks compared to Lines B and D, which began laying at 16 weeks (Figure 3). Meanwhile, in HDEP (Figure 3), findings showed significant differences between the pure lines. Lines B and D had significantly higher HDEP values ($p<0.05$) at 16, 17, 18, and 21 weeks of age compared to Line A during the pre-laying phase (16–24 weeks) (Figure 3). These findings suggest that Lines B and D achieved egg-laying earlier and maintained a consistently higher production rate in the early weeks of egg-laying.

Moreover, peak production age and HDEP percentages further distinguish these lines. Line B reached peak production with an HDEP of 74.92% at 22 weeks of age, while Line D reached 69.74% at 23 weeks. In contrast, Line A reached its peak HDEP later, achieving 67.37% at 28 weeks of age. These patterns indicate that Lines B and D are more productive and reach peak production earlier, suggesting a higher efficiency in early laying performance compared to Line A. Egg production is significantly influenced by several key factors, including the age of the chickens, effective breeding selection, and comprehensive breed management systems. Research on village chickens has consistently demonstrated remarkable enhancements in egg production among current pure lines. Early findings by Engku Azahan in 1983 indicated that the egg production rate for

village chickens was 10.0% at 24 weeks and 50.7% at 34 weeks of age. More recent findings show that the average egg production among all three pure lines has reached 63% at 24 weeks and 52% at 34 weeks. This clearly demonstrates the potential for ongoing improvement and optimal management in poultry production.

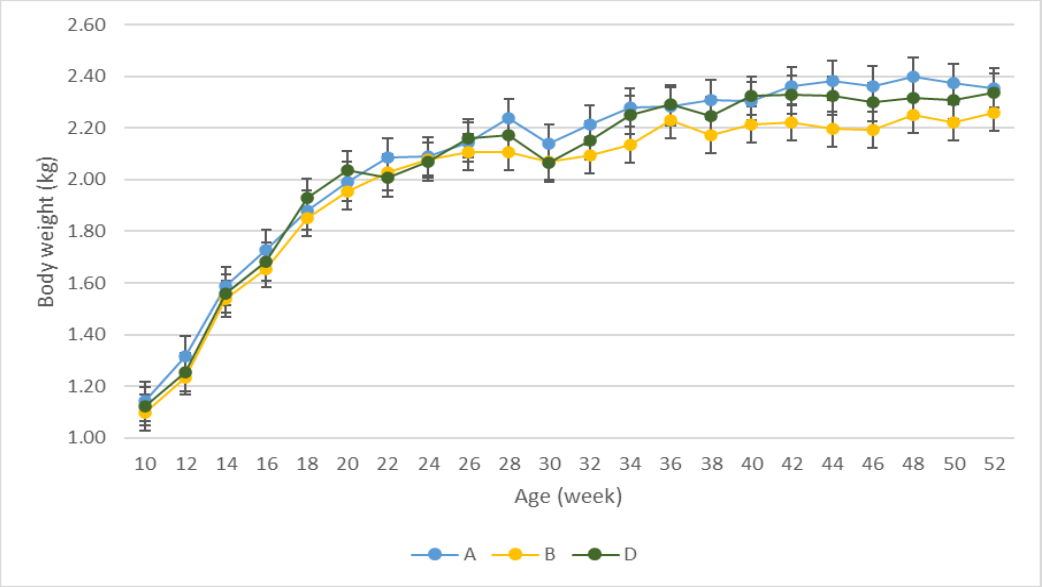

Figure 1. Body weight of female chickens between different pure line local village chickens at MARDI Kluang from age 10 until 52 weeks

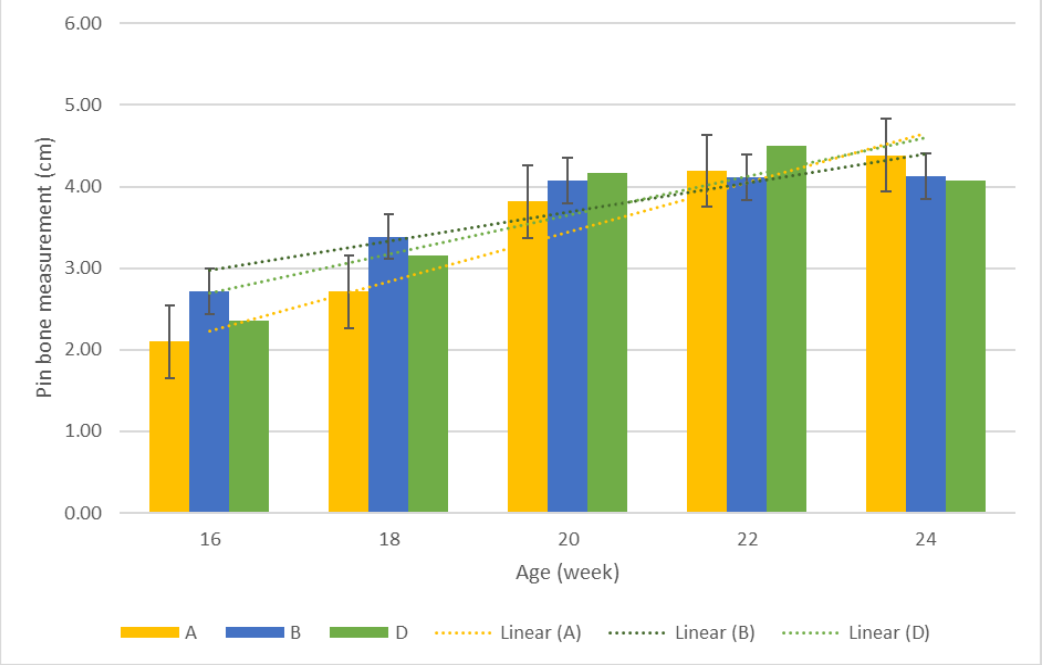

Figure 2. Pin bone measurement (cm) between different pure line local village chickens at MARDI Kluang from age 16 to 24 weeks

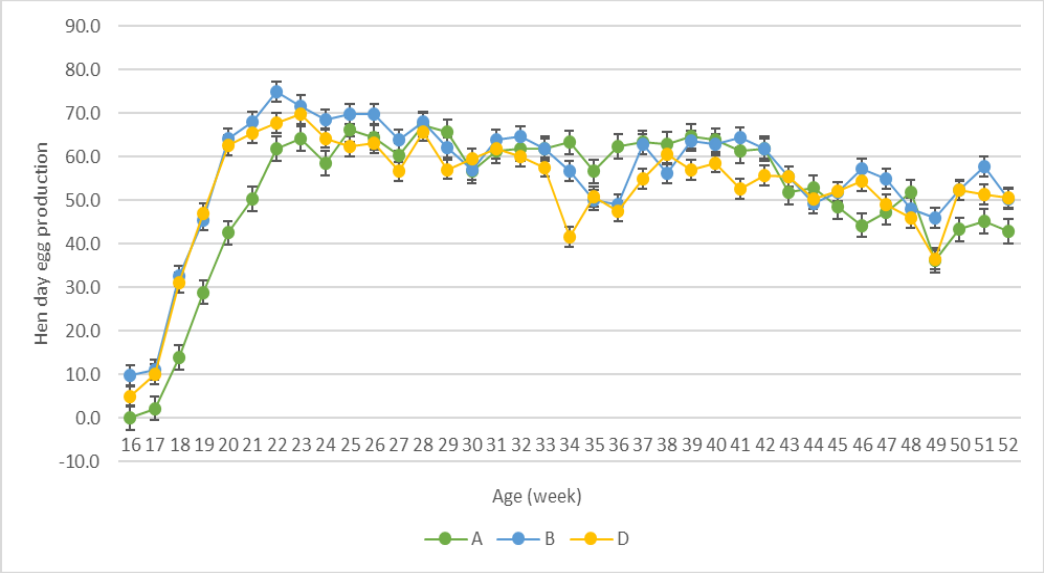

Figure 3. Hen-day egg production per week between different pure-line local village chickens at MARDI Kluang from age-onset laying until 52 weeks

Conclusion

In summary, the results reveal variations in growth and reproductive traits among the three pure lines of local village chickens (A, B, and D). Between all lines, hens in Line B and D tend to have an earlier onset of egg-laying and consistently higher production rates during the initial stages, achieving peak production sooner than Line A. Overall, the results indicate that Lines B and D attain sexual maturity earlier, highlighting their potential for early reproductive activity. This efficiency in early egg production may prove advantageous for breeding strategies to enhance early laying performance. Therefore, lines B and D offer valuable insights for breeding programs aimed at optimizing growth and productivity in village chicken populations. Future studies could further explore these influences to provide a comprehensive understanding of the interactions between genetics, management, and environmental conditions.

Acknowledgment

Sincere appreciation would like to be expressed to all officers and staff of the Poultry Unit at MARDI Muadzam Shah and MARDI Kluang for their support and assistance in carrying out this project. Furthermore, utmost appreciation to Malaysia Ministry of Agriculture (KPKM) for funding this project under 12th Malaysia Development Plan Grant (PRL-523).

Conflict of interest

The authors declare that there are no conflicts of interest.

References

Ademola, A.A. Fayeye, T.R. Akintunde, A.O. Chimezie, V. 2023. Egg production and egg quality characteristics of Yoruba, Sussex, and Goliath chickens and their crossbred progenies under humid tropical climate. *Ovozoa J. Anim. Reprod.* 12: 1-10.

Anderson, K.A. 2010. Range egg production, is it better than in cages? *MPF Convention*, March 16-18.

Engku Azahan, E.A. 1983. Laying patterns and egg production of indigenous 'kampung' chicken. *MARDI Research Bulletin* 11,3: 299-298.

Chineke, C.A. 2001. Interrelationships existing between body weight and egg production traits in Olympia Black Layers. *Niger. J. Anim. Prod.* 28: 1-8

Lacin, E. Yildiz, A. Esenbuga, N. and Macit, M. 2008. Effects of differences in the initial body weight of groups on laying performance and egg quality parameters of Lohmann laying hens. *Czech J. Anim. Sci.* 53, (11): 466–471

Roziatul, E. A. R. Nooraisyah, S. Azlina, A. I. A. dan Noraini, S. 2021. Strengthening of Saga Chicken Breeding Management through Good Agricultural and Animal Husbandry Practices (GAHPMyGAP) in grandparent (GP) breeder farm. *Buletin Teknologi MARDI* 28 (Khas Ternakan Lestari 2): 15 – 24

Satterlee, D. G. and Marin, R. H. 2004. Public Spread Development and First Egg Lay in Japanese Quail. *J. Appl. Poult. Res.* 13: 207–212