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Characteristics of production, reproduction, and sperm quality in Kedu chickens

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ABSTRACT

Kedu chicken is an Indonesian native breed that exhibits promising potential as a layer chicken. This study aimed to evaluate the productive performance, reproductive performance, and sperm quality of Kedu chickens to determine their utilization and selection as superior breeding stocks. Ten roosters and twenty hens were used as samples, and data on body weight, egg weight, day-old chick (DOC) weight, hen day egg production (HDP), fertility, hatchability, DOC normality, and sperm quality were collected. The mean body weights of male and female Kedu chickens were 2395.7±396.8 g and 1667.5±177.86 g, respectively. The average egg weight was 43.52±5.17 g, and the DOC weight was 29.19±4.18 g. The HDP reached 68.89%, demonstrating excellent performance. Egg fertility was recorded at 77.43±4.64%, while hatchability was 79.5±4.1%. The DOC normality rate was 88.21±8.42%. Semen volume of Kedu roosters was 0.34±0.16 ml with a pH of 7.04±0.67, and sperm concentration was 3.02±0.43 billion/ml. Individual motility reached 63.06±10.3%, and sperm viability was 56.67±25.88%. However, the sperm abnormality rate was 22.22±4.81%, indicating the need for strict selection of superior males. These results suggest that Kedu chickens have good potential as a source of superior local poultry breeds; however, improved reproductive management and genetic selection programs are necessary to maximize their performance.

Introduction

Indigenous chicken breeds play an essential role in the livelihoods of rural communities and contribute significantly to food security and rural development (Desta, 2020). Among the indigeneous poultry breeds in Indonesia, the Kedu chicken is considered one of the most prominent due to its adaptability, distinctive phenotypic traits, and promising productivity. As consumer preferences shift towards local and free-range poultry products, there is increasing interest in exploring the potential of native breeds like the Kedu chicken for sustainable and profitable poultry production. However, scientific documentation on the productive and reproductive traits of Kedu chickens remains limited, hindering the optimization of their genetic potential and their integration into national breeding programs.

The Kedu chicken, a indigeneous poultry breed from Indonesia, holds significant promise as a layer chicken. Its genetic advantages include its relatively large size, excellent egg-laying capabilities, and high rates of fertility and hatchability. Investigating the traits related to productive performance, reproductive performance, and sperm quality in Kedu chickens is crucial for advancing preservation and development programs aimed at enhancing local poultry competitiveness. The productive performance of Kedu chickens can be evaluated using metrics such as body weight, egg weight, and daily egg production. Additionally, reproductive performance indicators such as fertility and hatchability are vital for assessing breeding success (Cash *et al*., 2025; Tunsisa and Reda, 2023). Evaluation of the quality of male semen also sheds light on the reproductive potential of males, which is directly linked to the efficiency of seedling production. Consequently, this study aimed to assess the characteristics of productive performance, reproductive performance, and sperm quality in Kedu chickens to inform the utilization and selection of superior breeding stock. This comprehensive evaluation of Kedu chickens will provide valuable insights into their potential as competitive local poultry breeds. By analyzing these key performance indicators, researchers can identify superior individuals for breeding programs and develop strategies to optimize production.

Materials and methods

Animal and Experimental Design

This study used adult male and female Kedu chickens intensively reared in individual and colony cages. Ten roosters and 20 hens were used as samples in the study. All the chickens received uniform rearing and feeding management during the observation period.

Data collection

The data collected consisted of three main categories: productive performance, reproductive performance, and sperm quality. Productive performance included body weight of roosters and females, egg weight, weight of day-old chicks (DOC), and hen day egg production. Body weight and egg weight were measured using digital scales, whereas HDP was calculated from the ratio of daily egg count to the number of productive hens. DOC weight was measured immediately after hatching using a precision scale. Reproductive performance was evaluated by measuring the fertility, hatchability, and DOC normality. Fertility was calculated as the percentage of fertilized eggs to total eggs hatched, whereas hatchability was obtained from the percentage of fertile eggs that successfully hatched. DOC normality was calculated from the proportion of healthy chicks to total hatched chicks. Analysis of the collected semen revealed that both its quality and quantity met established standards (Garner and Hafez, 2008). Sperm quality was evaluated using the female teaser method. Macroscopic parameters included sperm volume, pH, color, consistency, and odor. Microscopic examination included mass and individual motility, sperm concentration using a hemocytometer, sperm viability based on the duration of life after ejaculation, and percentage of sperm morphological abnormalities.

Data analysis

All data are presented as mean±standard deviation. Analyses were

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performed descriptively and comparatively by comparing the results of the study with those of previous studies to evaluate the genetic potential and reproductive efficiency of Kedu chickens.

Results

Table 1 presents an evaluation of kedu chicken production performance based on factors such as the body weight of both males and females, weight of eggs, weight of day-old chicks (DOC), and rate of production of hens. Additionally, it considers reproductive performance, which includes aspects such as fertility, hatchability, and normality of DOCs. Table 2 provides an overview of the macroscopic and microscopic qualities of the sperm of Kedu chicken. Macroscopic observations included volume, pH, color, consistency, and odor. The microscopic observations included mass motility, individual motility, sperm concentration, viability, and abnormalities. Fig. 1 presents the rooster semen observed in fresh spermatozoa from the Kedu chicken breeds.

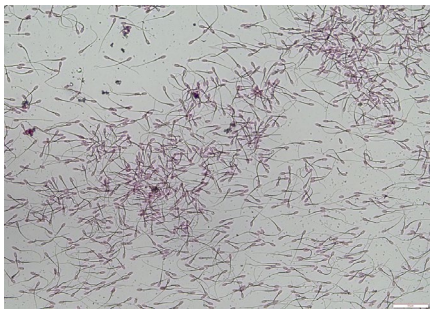

Fig. 1. Kedu rooster's semen

Fig. 2. DOC Kedu Chicken

Discussion

The average body weights of male and female Kedu chickens were 2395.7±396.8 g and 1667.5±177.86 g, respectively. This value is slightly lower than the previous report by Azizah *et al.* (2021) which showed a body weight of 2481.2±61.77 g for males and 1744.79±48.16 g for females. This difference could be caused by genetic factors, rearing environment, and feed quality. The egg weight produced was 43.52±5.17 g, which is comparable to the value reported by Sutopo *et al.* (2022) of 45.00±2.83 g. Egg weight is a critical factor for determining the initial weight of chicks at hatching. In this study, the weight of day-old chicks (DOC) was 29.19±4.18 g, which is lower than the value reported by Sutopo *et al.* (2022), which was 30.52±3.36 g. Furthermore, it was also lower compared to Merawang chickens (31.32±6.80 g), but higher than Murung Panggang and KUB chickens, which were 28.23±2.314, 28.14±2.802, respectively (Mustofa *et al.*, 2021).

The hen-day production of 68.89% showed excellent performance, which was much higher than that reported by Ismoyowati *et al.* (2024),

Table 1. Production performance of Kedu chicken.

Trait	Mean±SD	References
Productive performance		
Rooster's body weight (g)	2395.7±396.8	2481.20±61.77 (Azizah *et al*., 2021)
Hen's body weight (g)	1667.5±177.86	1744.79±48.16 (Azizah *et al*., 2021)
Egg weigth (g)	43.52±5.17	45.00±2.83 (Sutopo *et al*., 2022)
DOC weight (g)	29.19±4.18	30.52±3.36 (Sutopo *et al*., 2022)
Hen day production (%)	68.89	32.54% (Ismoyowati *et al*., 2024)
Reproductive performance		
Fertility (%)	77.43±4.64	72.22 (Telnoni *et al*., 2021)
Hatchability (%)	79.5±4.1	93.31 (Sutopo *et al*., 2022)
Normalitas DOC (%)	88.21±8.42	-

Table 2. The sperm quality of Kedu chicken

Trait	Mean±SD	References
Macroscopic		
Volume (ml)	0.34 ± 0.16	0.40 ± 0.04 (Kusumawati et al., 2020)
pH	7.04 ± 0.67	7.35 ± 0.52 (Kusumawati et al., 2020)
Colour	Milky white	Cream (Zen et al., 2020)
Consistency	Thick	Thick (Kusumawati et al., 2020)
Odor	Typical	Typical (Kusumawati et al., 2020)
Microscopic		
Mass Motility	2.36 ± 0.68	+2 (Zen et al., 2020)
Individual Motility	63.06 ± 10.3	52.27 ± 33.11 (Ulus et al., 2019)
Concentration (billion/ml)	3.02 ± 0.43	2.5 – 3.5 x 10^9 (Ervandi et al., 2020)
Viability (menit)	56.67 ± 25.88	73.40 ± 5.81 (Kusumawati et al., 2019)
Abnormality (%)	22.22 ± 4.81	5-20% (Zen et al., 2020)

which was 32.54%. However, it was higher than that of four Indonesian native chicken strains, which ranged from 43-48% (Zalizar *et al*., 2021). In comparison, Aseel chicken, a native Indian breed, exhibited a percentage of 36.23% (Haunshi *et al*., 2011). Hen-day production in chickens is subject to a range of factors, including environmental stressors, hormonal levels, genetic markers, dietary supplements, and overall health status. A significant environmental stressor impacting hen-day production is heat stress, which adversely affects performance, feed intake, and egg quality while also disrupting metabolic and endocrine functions (Kim and Lee 2023; Kim *et al*. 2024).

Kedu chicken egg fertility was recorded at 77.43±4.64%, which is higher than the 72.22% reported by Terlnoni *et al*. (2021). However, it was lower than that reported from local village chickens, which was 85.17±3.40 (Saili *et al*., 2025). Various factors influence fertility, including genetics, breeding, semen quality, environmental stress, and nutrition. Genetic factors can vary, with some breeds showing higher fertility rates. Crossbreeding can enhance traits such as egg quality and decrease embryonic mortality (Dzungwe *et al*. 2024). Semen quality is crucial for fertility, especially in artificial insemination, and it must be of high quality and stored at the correct temperature to remain viable (Mohan *et al*., 2018). External factors influenceenced fertility, such as technological and environmental stresses including high temperatures, dust, and ammonia levels in poultry houses, can adversely affect reproductive performance, leading to reduced fertility and hatchability (Surai and Fisinin, 2016). Additionally, the diet of breeder poultry must meet nutritional standards to ensure optimal fertility because the balance of nutrients directly affects reproductive performance (Hocking *et al*., 2002).

Nevertheless, the hatchability rate of 79.5±4.1% observed in this study was lower than the 93.31% reported by Sutopo *et al*. (2022). However, the hatchability of kedu chicken in this study exceeded that of Sensi chicken, ULU chicken, and Arab Silver chicken, which were recorded at 72.73±3.26%, 73.33±7.37%, and 70.21±5.64%, respectively (Jumiati *et al*., 2024). Hatchability is influenced by several factors, including egg weight, shell thickness, porosity, shape index (defined as the ratio of maximum breadth to length), and uniformity of egg content. Heat stress adversely affects both the external and internal quality of eggs and disrupts all stages of semen production in breeder roosters. Smaller eggs generally exhibit lower hatchability rates than do medium and large eggs. Fertile eggs may fail to hatch because of various factors, such as lethal genes, insufficient nutrient reserves within the egg, or exposure to unsuitable environmental conditions for embryo development. Breeder-related factors that affect hatchability include genetic strain, flock health, nutrition, age, egg size and quality, and the duration and conditions of egg storage (KingOri, 2011). The DOC normality rate, which reached 88.21±8.42%, with a DOC weight 29.19±4.18 g showed that the quality of the hatchlings was quite good (Table 1 and Fig. 2).

Table 2 showed the semen volume of Kedu rooster was 0.34±0.16 ml with a pH of 7.04±0.67, milky white colour, thick consistency, and typical spermicidal odour. These physical traits are generally associated with high semen quality. Microscopically, individual motility reached 63.06±10.3% and sperm concentration was 3.02±0.43 billion/ml. Sperm viability of 56.67±25.88% was adequate for the fertilization process, although the sperm abnormality rate still reached 22.22±4.81%, indicating the need for strict selection of superior males.

The average sperm volume of Kedu chickens aligns with the findings of previous studies (Azizah *et al*., 2023). Macroscopic evaluations indicated semen volumes ranging from 0.25 ml to 0.6 ml, consistent with established standards (Garner and Hafez, 2008). Observations revealed that the color and consistency of Kedu chicken semen adhered to standard parameters, being milky white and thick. According to Tribudi *et al*. (2024) and Almahdi *et al*. (2014), semen color and consistency are indicative of sperm concentration. Specifically, semen that is white and thick is associated with a high sperm concentration, whereas semen that is clear and thin suggests a low concentration. The pH level significantly influenced the viability of spermatozoa. A decrease in pH is correlated with a reduction in the number of viable spermatozoa. The pH values obtained in this study are nearly identical to those reported by Hambu *et al*. (2016), 6.94±0.25. The variation in semen pH among different chicken breeds can be attributed to individual differences, sperm motility, and metabolic processes, which are influenced by several underlying factors. Semen pH is a critical parameter that affects sperm motility and fertility (Ayeneshet *et al*. 2024; Madeddu *et al*. 2024). It is associated with buffering capacity and the metabolic environment within semen, which can differ among various breeds and individual chickens.

The variation in chicken spermatozoa concentration is affected by factors such as breed, age, nutrition, body weight, and frequency of semen collection (Tribudi *et al*., 2024). Sperm motility assessment is the most commonly used method for semen evaluation. Sperm motility observed in Kedu chickens falls within the range reported in previous studies on various chicken breeds (Udrayana *et al*., 2023; Azizah *et al*., 2023). Sperm viability is a crucial parameter for assessing semen quality because it indicates the fertilizing potential of semen (Tribudi *et al*., 2024). Kedu chickens exhibit good semen quality, characterized by high concentrations and motility, despite lower semen volume.

The sperm concentration in Kedu chickens was comparable to that observed in other local Indonesian chicken breeds such as Tukong, Sentul, Merawang, and Kampung chickens (Tribudi *et al*. 2024; Haryuni *et al*. 2022; Hambu *et al*., 2016). According to Garner and Hafez (2008), semen from free-range local chickens typically exhibits a sperm concentration ranging from 3 to 7×10^9 sperm/mL, indicating that the sperm concentration in Kedu chickens falls within this range and that Kedu chickens have good potential as a source of superior local poultry breeds. However, improved reproductive management and genetic selection programs must be implemented to maximize reproductive and productive performance.

Conclusion

Kedu chickens exhibit impressive production and reproductive traits, highlighting their potential as native layer chickens. They possess favorable characteristics in terms of body weight, egg production, fertility, and hatchability. Although the quality of their semen is generally adequate, the presence of sperm abnormalities indicates the importance of selecting high-quality roosters. These observations support the use of Kedu chickens as a valuable local genetic resource for improvement and conservation in the development of layer-type poultry.

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Conflict of interest

The authors have no conflict of interest to declare.

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