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Population Structure and Production Performance of Native Chicken as a Source of Local Animal Protein

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Abstract: Native chickens are an important local source of animal protein in Kalisemen Village, West Nabire District, Nabire Regency, Central Papua. Despite their significant contribution as a local source of animal protein, a thorough understanding of their population structure and production performance remains limited. This research aims to further examine these aspects to optimize the potential of local chickens as a sustainable source of animal protein. This study aims to examine the population structure and production performance of native chickens as a basis for developing sustainable local livestock. Population data were collected based on age and sex categories, while production performance included the number of eggs per parent, chick mortality rate, and number of chickens sold. The results showed a native chicken population of 2,902 with a dominance of adult females (23.36%). Average egg production was 11.02 eggs per parent with a chick mortality rate of 1.96 and an average chicken sale of 6.98 per farmer. This condition shows the potential of native chickens as a local protein source that needs to be supported by better population management and marketing. Recommendations include strengthening female parents, improving chick maintenance, and developing an integrated marketing system. These findings provide important contributions to food security and local livestock development in Central Papua.

Keywords: Central Papua; Local livestock; Native chicken; Population structure; Production performance

Introduction

Food security is a major challenge faced by many regions in Indonesia, especially in remote areas such as villages or hamlets in Nabire Regency, Central Papua, where access to animal protein sources is often limited (Nurhasan et al., 2022). Local animal protein sources, especially native chickens, have a strategic role in supporting food and economic security of rural or hamlet communities because of their ability to adapt to local environmental conditions and low dependence on high-tech inputs (Nisak et al., 2025). Native chickens, as local chickens native to Indonesia, are known to have high resistance to disease and adaptability to tropical climates, making them the main choice for traditional breeders (Henry et al., 2018). However, the utilization of native chicken potential has not been optimal due to limited accurate scientific data on population structure and production performance, including chick mortality rate and egg productivity, which are the main indicators of the success of local chicken farming (Hailegebreal et al., 2022). In addition, limitations in the management and marketing of native chicken products cause farmers' incomes to be less than optimal, so that local livestock businesses are less developed (Adjei-Mensah et al., 2024; Guyomard et al., 2021).

This condition requires comprehensive research to understand the characteristics or dynamics of the

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population structure and production performance of native chickens scientifically in order to formulate sustainable development strategies and support food security (Tenza et al., 2024; Ginindza, 2023). The formulation of the problem in this study is: What is the population structure of native chickens based on age and gender categories in Kalisemen Village or Kampung?; How is the production performance of native chickens, including the number of eggs per parent, chick mortality rate, and chicken sales? What is the relationship between population structure and native chicken production performance?

Several studies have shown that the population structure of local chickens greatly determines the productivity and sustainability of livestock farming (Castro Rojas et al., 2024). The dominance of adult female populations plays an important role in maintaining the reproductive cycle and egg production (Yan et al., 2025). In addition, the performance of native chicken production, especially the number of eggs and chick mortality, is greatly influenced by maintenance management and environmental conditions (Yang et al., 2023). This means that attention to a correct understanding of population structure and production performance is an important factor in ensuring the sustainability of the development of native chicken farming businesses now and in the future (Wantasen et al., 2024; Mogano et al., 2025).

Other studies highlight the need for structured marketing development and strengthening of farmer institutions to increase income and business stability (Raharja et al., 2020). A sustainable approach to local livestock management is also an important focus so that genetic resources can be maintained and livestock businesses can last a long time (Paiva et al., 2016; Alary et al., 2022). So, it can be said that the development of structured marketing. Can increase the income of farmers and the sustainability of native chicken farming businesses (Morepje et al., 2024; Bist et al., 2024). This study aims to: Describe the population structure of native chickens based on age and sex; Assess the production performance of native chickens in terms of reproduction, mortality, and marketing; Analyze the relationship between population structure and production performance as a basis for recommendations for sustainable livestock development. This study provides empirical data and analysis on the population structure and production performance of native chickens that were previously limited, thus becoming an important reference for the development of local livestock science and the conservation of native Indonesian chicken genetic resources.

The results of this study can be used as a scientific basis for farmers and policy makers in designing more effective and sustainable native chicken cultivation and population management strategies, including reducing chick mortality rates and increasing egg productivity. With optimal population management and marketing, this study supports increasing the income of farmers in Kalisemen Village and contributes to strengthening food security and the economy of the Central Papua community as a whole.

Method

Location and Time of Research

The research was conducted in Kalisemen Village, West Nabire District, Nabire Regency, Central Papua. The implementation time of this research was for 4 months, starting from January to April 2025.

Tools and Materials

The tools used in the research include: Notebooks and survey forms or observation sheets for collecting field data and questionnaires; Computers with data processing software such as Microsoft Excel and statistical software (SPSS version 25 or the latest version of R); Communication devices for interviews and coordination with farmers. The materials that are the focus of the research are native chickens raised by farmers in Kalisemen Village, including chicken categories based on age (children, young, adults) and gender (male, female).

Data Collection Method

Population data were collected through direct surveys to farmers by classifying chickens based on age and gender. Production data include the number of eggs per parent, the mortality rate of chicks, and the number of chickens sold, which were taken from farmer records during the research period.

Data Analysis Techniques

The collected data were analyzed using descriptive statistical methods to describe the population structure and production performance, including the calculation of the number, percentage, average, standard deviation, minimum and maximum values. Next, to analyze the relationship between population structure and production performance, Pearson correlation analysis is used as follows:

$$r = (n \Sigma xy - \Sigma x \Sigma y) / \text{sqrt}[(n \Sigma x^2 - (\Sigma x)^2)(n \Sigma y^2 - (\Sigma y)^2)] \quad (1)$$

Where:

r = Pearson correlation coefficient
n = number of data pairs
Σxy = sum of the results of multiplying data pairs x and y
Σx = number of data variables x
Σy = number of data variables y

Σx^2 = sum of squares of data variables x
Σy^2 = sum of squares of data variables y
Interpretation of r value:
r = +1: perfect positive correlation
r = -1: perfect negative correlation
r = 0: no linear correlation

The r coefficient indicates the direction and strength of the relationship between variables, with values between -1 (perfect negative correlation) to +1 (perfect positive correlation). The r value close to 0 indicates no significant correlation. The analysis was performed using SPSS version 25 software and R Studio to validate the results. Correlation visualization was also created using a graphical package in R, such as ggplot2.

Result and Discussion

Native Chicken Population Structure

Data Results of research on native chicken population structure from 50 livestock respondents in Kalisemen Village, West Nabire District, Nabire Regency are as in table 1 below.

Table 1. Native Chicken Population Structure in Kalisemen Village, West Nabire District, Nabire Regency (Primary data processing results, 2025)

Category	Number (Tail)	Percentage (%)
Male	376	12.96
Female	530	13.85
Young Male	536	18.47
Young Female	380	13.09
Adult Male	678	23.36
The total recorded population of native chickens is 2.902		

From the data in table 1 in this study, it shows that the population of native chickens in Kalisemen Village reached a total of 2,902, with a fairly even distribution between age categories and gender. The dominance of the adult female population of 23.36% indicates strong reproductive potential as a basis for egg production and population regeneration. A balanced population structure like this is very important to maintain the continuity of the population and productivity of local chickens (Putra et al., 2021; Firmansyah & Iskandar, 2018). This phenomenon is in line with the findings of Putra et al. (2021), which emphasizes that a stable and dominant adult female population is a key factor in maintaining the reproductive cycle of local chickens. The presence of a significant young and child population (around 31.22%) reflects the ongoing regeneration process, but also indicates the need for effective management so that mortality rates can be suppressed and population numbers can be maintained (Santoso & Widjaja, 2022; Mulyani & Hartono, 2020). Furthermore, the recorded population structure provides an initial picture of the dynamics of growth and productivity that can be used as a basis for planning livestock development. By knowing the proportion of the population based on age and sex categories, technical interventions such as selecting superior parents and managing maintenance can be optimized to increase production efficiency and long-term sustainability (Putra et al., 2021; Nugroho & Harsono, 2019).

Native Chicken Production Performance

The production performance data from the Bruras chicken farm in Kalisemen Village, West Nabire District, Nabire Regency is as shown in Table 2 below.

Table 2. Descriptive Statistical Data on Native Chicken Production in Kalisemen Village, West Nabire District, Nabire Regency (Primary data processing results, 2025)

	Total number	Average per Farmer	Standard Deviation	Minimum	Maximum
Number of Eggs per Hen	551 grains	11.02 grains	(1.392)	9	14
Dead Chicks	98 tails	1.96 tails	(0.832)	1	4
Chickens Sold	350 tails	7.00 tails	(5.707)	2	26

Native chicken egg production data showing an average of 11.02 eggs per parent with a standard deviation variation of 1.39 eggs indicates that egg production in this traditional farm is quite stable. This figure is within the range that corresponds to the productivity of local native chickens in tropical areas, as reported by Ismoyowati et al. (2021) and González Ariza et al. (2021). The consistency of egg production is a positive indicator that native chickens in the region have good reproductive potential even though they still use a traditional maintenance system. However, the average chick mortality rate of 1.96 per farmer is a major challenge. This fairly high chick mortality can have a negative impact on population regeneration and long-term productivity. Research by Morales et al. (2023) and Elliott et al. (2024), revealed that chick mortality is caused by various factors such as disease, lack of nutrition, and less than supportive environmental conditions. Therefore, interventions in the form of improving maintenance technology and improving sanitation are urgently needed to reduce this mortality rate (Clarke et al., 2021; Chirgwin et al., 2021). In addition, the highly variable chicken sales data (average 6.98 chickens with a standard deviation of 5.72) reflects the uneven level of marketing success among farmers. Yeleliere et al. (2023), emphasized that this variability is

often caused by differences in market access and the ability of farmers to manage their businesses. A more organized marketing approach and institutional support can be a solution to increase the income stability of native chicken farmers in remote areas (Loengbudnark et al., 2024).

Relationship between Population Structure and Production

The results of the data analysis of the correlation relationship between population structure, especially the number of adult female chickens or parents with the production performance of the number of eggs, the number of dead chicks and the number of chickens that can be sold based on Pearson correlation analysis, the results obtained are as follows.

Table 3. Pearson Correlation Analysis

Variable	Egg Production (r)	Dead Chick (r)	Chicken Sold (r)
Female Adult Population	0.78*	-0.45*	0.62*

* Significant correlation at the 0.05 level of significance ($p < 0.05$)

These results indicate that there is a strong positive correlation (r = 0.78) between the adult female population and the number of eggs per broodstock, indicating that increasing the number of adult female broodstock greatly affects the increase in egg production (Hernandez de-Dios et al., 2022). In contrast, a moderate negative correlation (r = -0.45) between the adult female population and chick mortality rates indicates that larger female broodstock populations tend to be associated with lower chick mortality rates, possibly due to better care and optimal regeneration (Yerpes et al., 2020). In addition, a moderate positive correlation (r = 0.62) between the adult female population and the number of chickens sold indicates that the more adult female broodstock, the greater the production capacity that supports sales volume (Zaboli & Rahmatnejad, 2024). This emphasizes the importance of managing the adult female population as a key factor in strengthening the production and marketing chain of native chickens. This correlation analysis strengthens previous descriptive findings and provides statistical evidence that population structure management, especially adult female broodstock, is a critical aspect in developing native chicken production performance in Kalisemen Village.

The dominance of adult female broodstock positively contributes to stable egg production. Regeneration of the young and young population is quite good, but must be balanced with optimal management so that chick mortality does not disrupt the balance of the population and long-term production. Migaud et al. (2013), stated that the presence of sufficient and healthy female broodstock is the main prerequisite for maintaining consistent egg production continuity. The condition of this population in Kalisemen Village which is dominated by adult females indicates that farmers have an adequate broodstock base to maintain productivity (Siddique et al., 2022).

Constraints and Potential for Development

Chick mortality is influenced by limited feed and disease control. Fluctuations in sales indicate the need to strengthen institutions and marketing strategies. Training in maintenance technology and digital market development are important solutions. Mramba et al. (2024) and Jeni et al. (2021), stated that the high mortality rate of chicks is influenced by less than optimal traditional husbandry practices, limited access to nutritious feed, and minimal disease control. Furthermore Vlaicu et al. (2024), stated that this condition shows an urgent need for technology transfer and training for farmers in aspects of livestock health and nutrition management. In addition, variations in chicken sales indicate challenges in the unstructured marketing aspect. The formation of farmer groups and institutional strengthening were very effective in overcoming marketing barriers, while increasing the bargaining power and stability of farmers' income.

The use of digital technology has also begun to be introduced to open wider and more transparent market access (Kraus et al., 2022). By increasing the management capacity of farmers and institutional support, the potential of native chickens as a source of sustainable local protein can be maximized. Community-based development programs supported by the government and non-governmental organizations are highly recommended to ensure technology transfer and sustainability of livestock businesses (Gamage et al., 2024).

Implications for Local Livestock Development

This study provides evidence that native chickens have great potential as a source of local animal protein that can support food security in Central Papua. (Akinyemi & Adewole, 2021) emphasized that good population management, especially strengthening adult females and reducing chick mortality, is a key factor in developing sustainable local livestock (Wilcox et al., 2024). Increasing the capacity of farmers through training and adoption of appropriate technology must be a priority, so that livestock productivity and health can continue to increase (Capper & Williams, 2023). In addition, the development of an effective and integrated marketing system will open up opportunities to increase farmers' income and strengthen the regional economy. Overall, integrated native chicken management, from

population, production, to marketing, will make a real contribution to local food security and the preservation of native Indonesian chicken genetic resources. Support for policies and sustainable livestock development programs is needed to optimize this potential

Conclusion

Native chickens in Kalisemen Village have a balanced population structure with good egg production potential, but still face the challenges of chick mortality and suboptimal marketing. This study provides important insights for the development of sustainable local livestock and food security.

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Author Contributions
Conceptualization; methodology; validation; formal analysis; investigation.; resources; data curation: writing—original; draft preparation.; writing—review and editing: visualization: E. L. S. T., T. J. G., M. C. S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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