



Laying Performance and Hatchability Rate of True-To-Type Bolinao Native Chicken in Abra State Institute of Sciences and Technology Demo-Site Lagangilang, Abra, Philippines

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ABSTRACT

This study investigates the egg production, hen house egg production, egg weight, feed conversion ratio (FCR), hatchability rate, and chick weight of True-to-type Bolinao native chickens from Abra and Bolinao origins over eight months. A total of 48 heads native chickens in each group with a ratio of 5:1 (hen: rooster) was followed, and data gathered such as the mean was tabulated in Excel and analyzed using SPSS on the T-test at 0.05 alpha for the significance level. Results indicate significant differences in egg production between the two groups, with Abra-origin chickens consistently outperforming Bolinao-origin chickens. Bolinao chickens displayed higher egg weights, but lower egg production compared to Abra chickens. However, both groups exhibited satisfactory hatchability rates and similar chick weights. The FCR was higher than optimal values for both groups, potentially due to lower egg production compared to commercial layers. Overall, the study underscores the importance of genetic, environmental, and management factors in influencing egg production and quality in native chicken populations, providing valuable insights for future breeding and management strategies.

RESUMO

Este estudo investiga a produção de ovos, produção de ovos em galinheiro, peso dos ovos, taxa de conversão alimentar (FCR), taxa de eclosão e peso dos pintinhos de galinhas nativas verdadeiras ao tipo de Bolinao de origens de Abra e Bolinao ao longo de oito meses. Um total de 48 galinhas nativas em cada grupo, com uma proporção de 5:1 (galinha: galo), foi seguido, e dados como a média foram tabulados no Excel e analisados usando SPSS no teste t a 0,05 de alfa para o nível de significância. Os resultados indicam diferenças significativas na produção de ovos entre os dois grupos, com as galinhas de origem de Abra superando consistentemente as galinhas de origem de Bolinao. As galinhas de Bolinao exibiram pesos de ovos mais altos, mas menor produção de ovos em comparação com as galinhas de Abra. No entanto, ambos os grupos apresentaram taxas de eclosão satisfatórias e pesos de pintinhos semelhantes. A FCR foi mais alta do que os valores ótimos para ambos os grupos, potencialmente devido à menor produção de ovos em comparação com as camadas comerciais. No geral, o estudo destaca a importância de fatores genéticos, ambientais e de manejo na influência da produção e qualidade de ovos em populações de galinhas nativas, fornecendo insights valiosos para futuras estratégias de reprodução e manejo.

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Introduction

The native chicken is an unremarkable, purebred that originated from domesticated chickens brought to the nation by early Chinese, Spanish, and Dutch traders and settlers, crossing over with jungle fowls. Native chickens are known to have favorable traits despite their low productivity, including high hatchability, high dressing percentage, hard egg shells, good flavor in both eggs and meat, resistance to certain diseases, and thermotolerance (Aberra 2000; Moges et al., 2010). Native chicken is used in various cultural and traditional activities that are performed for both living and dead rituals because native chicken farming is an integral element of the culture that must be preserved.

Most rural homes keep their native chickens in their backyards. To produce eggs, they are often raised in small batches, up to 24 chickens. As an extra source of cash for the household, farmers breed native chickens for white meat, trade, or trade. Experts claim that the quantity of native chickens in the nation is still equal to that of commercial or hybrid stocks. Because of the industry's significant economic impact, including the ability to supplement small farmers' income, the size and scope of the local market's demand for native chicken, and the meat's health benefits, the government is putting the necessary attention and effort into enhancing native chicken farming (Santiago, 2018).

In terms of egg production, Bolinao native chickens have specific traits that set them apart. While commercial broilers can produce over 250 eggs annually, Bolinao native chickens typically yield around 100 eggs per year. Additionally, native chickens like Bolinao take almost 16 weeks to reach a similar weight gain that commercial broilers achieve in 8 weeks (Yan, 2020)

Regarding hatchability rates, indigenous chickens like Bolinao exhibit differences compared to exotic breeds. Studies have shown that the hatchability of eggs from exotic chickens is significantly lower than that of indigenous chickens, with exotic breeds reporting hatchability rates as low as 33% to 52%, while indigenous chickens can achieve hatchability rates of around 83% (Habte *et al.*, 2013). This indicates that Bolinao native chickens, being part of the indigenous breed group, may have higher hatchability rates compared to certain exotic breeds.

The laying performance and hatchability rate of true-to-type Bolinao native chickens are crucial factors that significantly impact the productivity and sustainability of poultry farming. These indigenous chickens, capacity to adjust to local conditions and resistance to diseases, play a vital role in promoting genetic diversity and preserving heritage breeds. Understanding and optimizing their laying performance and hatchability rate not only contribute to the conservation of these unique genetic resources but also enhance the economic viability of small-scale poultry operations. Efforts to improve the laying performance of Bolinao native chickens involve enhancing their reproductive efficiency, egg quality, and overall health. By focusing on factors such as nutrition, housing conditions, and breeding

practices, farmers can maximize egg production while ensuring the well-being of the birds. Similarly, enhancing hatchability rates through proper incubation techniques, egg-handling procedures, and disease management strategies can lead to increased chick survival rates and overall flock productivity.

Accordingly, Abra State Institute of Sciences and Technology helps to capacitate native chicken raisers in Abra by introducing new stocks and other S&T interventions to ensure productivity and profitability. With these, the establishment of a feasible and sustainable project-based adoption of the MMSU True-to-type Bolinao native chicken and other S&T inventions is implemented in ASIST as a demo site for production and sustainability.

In the pursuit of sustainable agriculture and preservation of indigenous poultry breeds, the study of laying performance and hatchability rate of true-to-type Bolinao native chicken holds significant importance. Indigenous chicken breeds native chickens, possess unique genetic traits honed over generations, making them resilient to local environmental conditions and diseases. However, in the face of modernization and commercialization of poultry farming, these breeds face the risk of genetic dilution and eventual extinction. By identifying individuals with superior laying performance and hatchability rates, breeders can selectively propagate desirable traits, thereby ensuring the long-term viability of this indigenous breed.

Thus, this study aims to evaluate the production performance of True-to-type Bolinao native chicken between Abra and Bolinao, Pangasinan origin under ASIST conditions as a way of contributing to native chicken conservation and commercialization.

Materials and Methods

Area. Two breeding houses, each measuring 11 x 10 meters were utilized in this study. Each house was subdivided into compartments measuring 2 x 5 meters per pen. Each pen contained 5 hens and 1 rooster in a ratio of 5:1. Three bamboo nest coops were hung to the sidewalls of each pen, alongside an automatic feeder with a capacity of 5 kilograms and a waterer with a capacity of 4 liters.

Stocks (true-to-type Bolinao native chicken).

Phenotypic characteristics were based on the description of MMSU True-to-type Native Chicken as a basis in selection that were described as follows; plain plumage pattern-roosters have red plumage while the plumage color of the hens is light to dark brown in body color, earlobe for hens is red while the rooster is either white or red, and single comb for both male and female in a small size, white skin color both hen and rooster, shank (diverse in green, yellow, black and gray), and have orange iris color both hen and rooster (Santiago et al., 2021). A total of

Breeding management.

As suggested by Santiago et al. (2021) for this breed, a 5:1 hen-to-rooster ratio was chosen. According to additional research, this optimal hen-to-cock ratio should be kept to guarantee the production of viable eggs. Depending on the production system, the typical ratios are 1:5 or 10 hens (Ogbu and Oguike, 2019).

Eggs laid were collected daily in the afternoon and stored for 7 days only, to prevent cracking of eggs, and to maintain the cleanliness of eggs. One dummy egg is left inside the nest to encourage hens to lay. Eggs were placed in an incubator at weekly intervals for hatching.

Feeding Management. Stocks were fed with breeder feeds of 100-150 grams per day which is within the range of standard recommended feed for free-range such as native chicken (Lambio, 2018). The number of feeds is patterned and adopted with the standard nutrient requirement recommendation for Layer.

According to the other recommendations, free-range chickens typically require access to healthy, high-quality feed to ensure proper nutrition and productivity. While the exact amount of feed needed can vary based on factors like breed and age, a general guideline suggests providing around 1/4 of a pound (approximately 113 grams) per fully grown chicken per day (Natures Best Organic Feeds). Moreover, restricted feeding was done twice a day at 7:00 in the morning and 4:00-5:00 in the afternoon. Breeders were also given soilage such as *Trichanthera* leaves and other green feeds as additional feeds during noon time.

Water Management. Drinking water from birds was available all the time, and was replaced as necessary, especially during hot weather conditions. Extracts and Concoctions as interventions were also given to the breeders.

Health and Sanitation. Cleanliness was regularly checked to ensure a healthy environment for the birds. Feeding troughs and waterers are regularly cleaned and feces are collected to ensure the cleanliness of the surroundings. Vaccination programs were followed, and birds were vaccinated with fowl pox and NCD as these are the common diseases that may infest the area, deworming was done also upon purchase of stocks and was regularly implemented every 2 months. Immediate isolation and medication for the sick are strictly done as needed. These practices were essential for good management practices and standard recommendations on poultry raising (Lambio 2021, Singh and Borkotoky 2018).

Data gathered:

Number of eggs (monthly). Eggs collection were done daily at 3:00 in the afternoon and recorded as a basis for computing the number of eggs produced monthly.

Hen House Egg production (HHEP). The egg and egg weight (gm) numbers were recorded daily and Hen House Egg production (HHEP) was calculated using the formula adopted from Yousif M. S. Noori Al-Barzinji (2020).

$$\text{HHEP} \quad \% \quad = \frac{\text{Total number of eggs laid during the period} \times 100}{\text{Total number of hens housed} \times \text{number of days (period)}}$$

Egg weight (g/egg) and Egg mass. All eggs collected daily were weighed and recorded.

$$\text{Average egg mass (Per hen per day in grams)} = \frac{\text{Percent HHEP} \times \text{Average egg weight in grams}}{100}$$

Feed Conversion Ratio (FCR). The mean feed intake divided by the mean egg weight yielded the feed conversion ratio (FCR), which is reported as grams of feed per gram of egg produced (g/g).

Hatchability rate. Chicks harvested upon hatching from the incubator the chicks were separated from those good from those with abnormalities and weighed. Hatchability was based on the total eggs set as reproductive as reproductive capacity. The formula used was :

$$\text{Hatchability rate} = \frac{\text{Hatched Chicks} \times 100}{\text{Total Eggs Set}}$$

Weight of chicks. All hatched chicks were weighed and recorded upon harvesting from the incubator.

Data Analysis

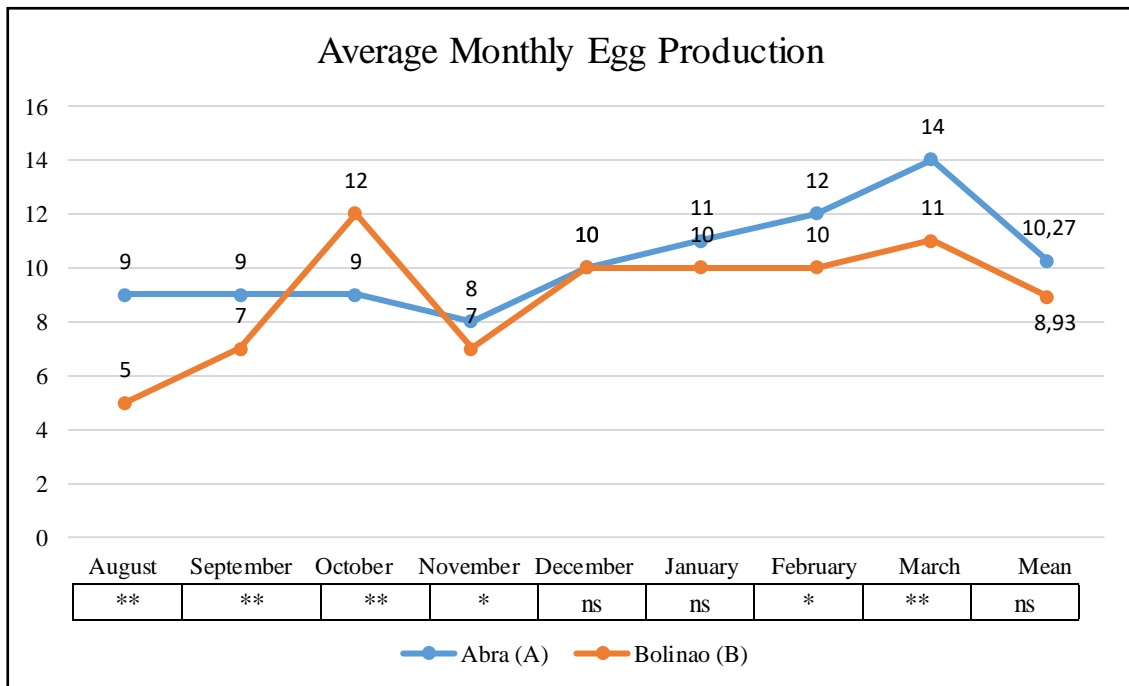
The data gathered such as the mean was tabulated in Excel and analyzed using SPSS on the T-test at 0.05 alpha for the significance level. Data gathered were the Average Number of Eggs, Hen Housed Egg production (HHEP), Weight of Eggs (g/egg) and Egg mass, Feed Conversion Ratio (FCR) ([Layer Production Indices \(tnau.ac.in\)](http://tnau.ac.in)), Hatchability rate and Weight of chicks (Nour et al.,2021).

Results and Discussion

Table 1 shows the average number of eggs produced by each group (A vs B) for eight months starting from August 2022 to March 2023.

Figure 1.

The average number of eggs produced between Abra and Bolinao origin True-to-type Bolinao native chicken.



Source. The author (2023)

The comparison reveals that Bolinao native chickens generally produced fewer eggs compared to those from Abra, especially in the earlier months of the period. Notably, egg production in Bolinao showed an increase from August to October, with a peak in October, followed by fluctuations in the subsequent months. In contrast, Abra chickens consistently showed higher egg production levels throughout the period, with a noticeable increase from January to March.

This data suggests that there are significant differences in egg production between Bolinao and Abra native chickens, with Abra chickens consistently outperforming Bolinao chickens in terms of egg production over the specified months. This could be attributed to the fact that breeders from group A were already adapted to the area compared to group B which is from a different type of environment/area. Changing weather conditions from rainy which is from June-October to dry season for the month of November-May (PAGASA) could also be another factor that affects the fluctuations of monthly production; thus the housing and environment of the experimental house are not in constant and controlled condition.

According to Santiago (2018), the average number of eggs from Philippine native chickens that include the Bolinao breed ranges from 60 to 100 eggs per year with an average of 8.33 monthly, this means that the produced eggs from the true-to-type Bolinao native chickens raised in ASIST Demo-site are within the accepted range. Thus, improvements in

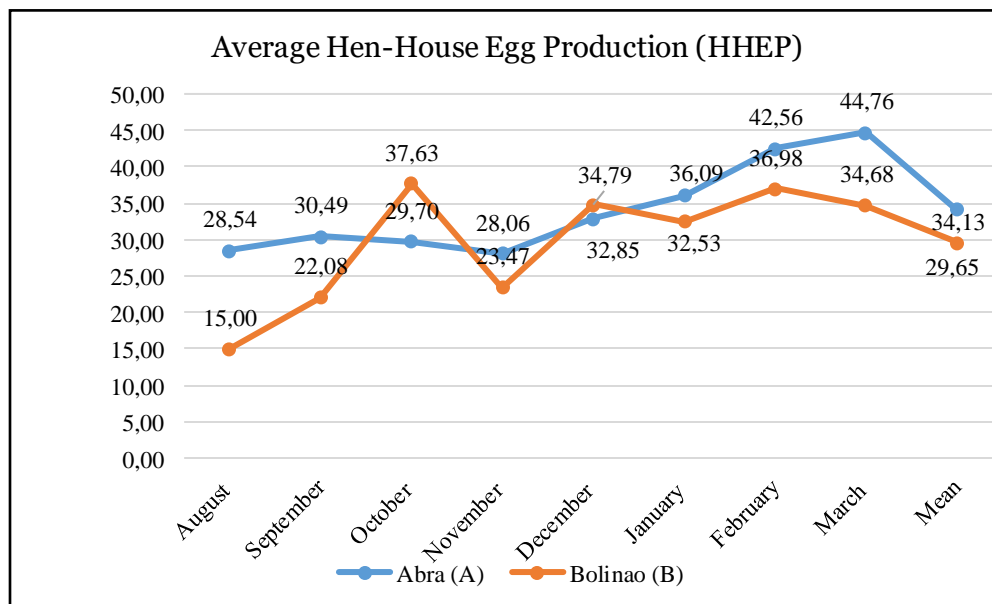
genetic breeding could be considered in future research endeavors, preserving the unique characteristics of native chickens.

Comparing on the number of eggs produced annually by native chickens in the Philippines with those from other countries reveals variations in egg production levels. Native chickens in the Philippines typically lay around 100 eggs per year such as Bolinao, Darag and Joloano breeds (Santiago, 2018). In contrast, some imported breeds like the Plymouth Rock from other countries can produce over 250 eggs yearly (Yan, 2020). The higher egg production capacity of imported breeds like the Plymouth Rock underscores the genetic selection and breeding advancements that have been made to enhance egg-laying efficiency in commercial hybrids. Native chickens, while valued for their unique characteristics and adaptability, generally exhibit lower egg production rates compared to these selectively bred breeds from other countries.

The total number of eggs produced in each group at the end of the month or every 30 days versus the total number of animals in each house (each group has a total of 48 hens and 8 roosters) to determine the hen house egg production shown in Table 2.

Figure 2.

The average monthly HHEP between Abra and Bolinao origin True-to-type Bolinao native chicken



Source. The author (2023)

The hen-house egg production (HHEP) data presented in Figure 2 reveal notable differences between groups A (Abra origin) and B (Bolinao origin) of native chickens. Group A consistently exhibited higher mean egg production throughout the entire production period, with irregular fluctuations observed in both groups. The decline in HHEP during October-

November could potentially be attributed to molting, a natural phenomenon that often disrupts laying performance, possibly triggered by changes in temperature or weather conditions during this period. Conversely, group A showed a consistent increase in HHEP from December 2022 to March 2023.

In contrast, group B demonstrated unstable HHEP, with the highest percentage recorded in October 2022 at 37.63%. These fluctuations in egg production may reflect the adaptability of Bolinao-origin chickens to varying environmental conditions, potentially impacting their reproductive performance (Jacob et al., 2018).

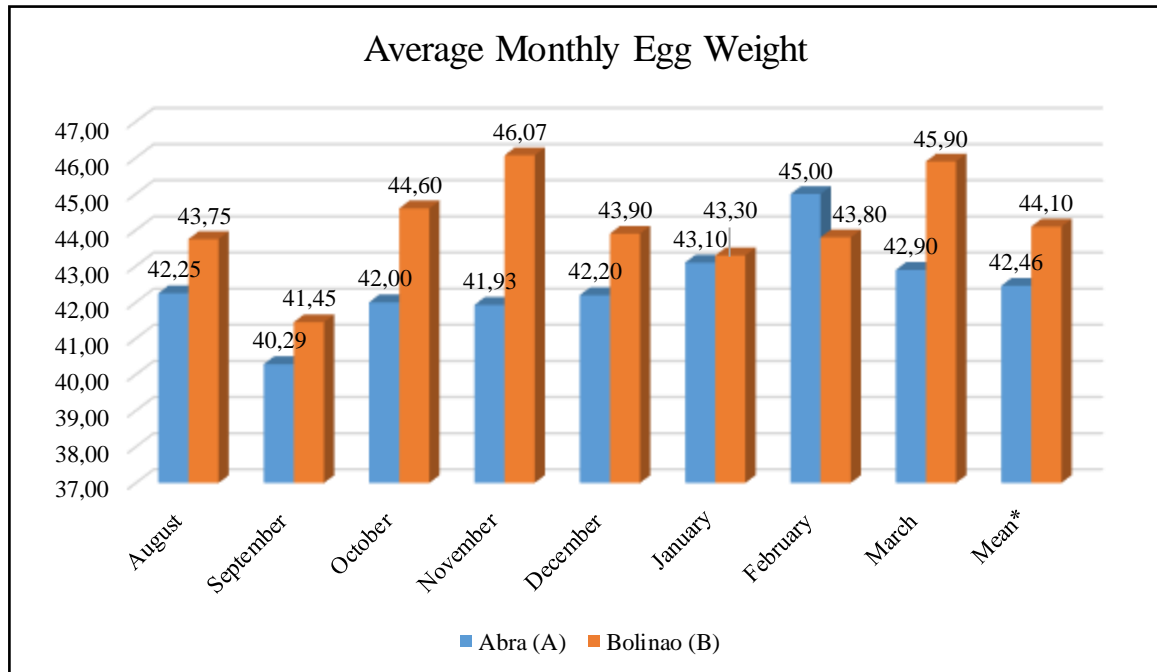
Comparing these findings, native chickens generally achieve an average hen-day egg production of approximately 24.3% by 40 weeks of age (Brosas, 2022). Remarkably, the computed HHEP results of this study generally exceeded this benchmark, indicating satisfactory performance levels. However, it's worth noting the initial lower performance of group B in the first month, possibly due to acclimatization to a new environment, as these stocks originated from different provinces.

When similar native breeds are taken into account worldwide, the findings are consistent with the general knowledge on native chicken productivity. The observed performance highlights the impact of multiple factors, such as genetic traits, environmental conditions, and management techniques, on egg production in local chicken populations, even though higher egg production values were expected (Melesse et al., 2022).

This study contributes valuable insights to the ongoing efforts to improve egg production in native chicken breeds. By revealing the factors influencing HHEP and highlighting the challenges surrounding production, such as seasonal fluctuations and environmental adaptations, the findings can inform targeted strategies for enhancing egg production efficiency. Future research endeavors could focus on optimizing management practices, implementing selective breeding programs, and leveraging technological innovations to further elevate egg production levels in native chicken populations.environment.

The average egg weight of native chicken presented in Figure 3 was taken by immediately weighing harvested eggs using a digital weighing scale (1 gram graduation) daily at around 4:00-5:00 pm.

Figure 3.
The average monthly egg weight between Abra and Bolinao origin True-to-type Bolinao native chicken.



Source: The author (2023).

The results of the t-test analysis revealed consistently insignificant differences at the 0.05 alpha level during the production months, but significant variations were observed in the mean egg weight between the two groups. Specifically, group B (Bolinao origin) exhibited a significantly higher mean egg weight of 44.10g compared to group A (Abra origin) with a mean of 42.46g. This consistent trend persisted throughout the entire eight-month production period, suggesting a potential genetic or environmental influence on egg weight differences between the two groups. This means that egg weights from the source of Bolinao native chicken of Bolinao, Pangasinan have better weight compared to the true-to-type Bolinao native chicken of other provinces.

The observed mean egg weight from both groups falls within the range reported for Philippine native chicken breeds, which typically range from 40-45 grams (Santiago et al., 2018). Interestingly, eggs from Bolinao native chickens, as noted by Brosas (2022), have been reported to weigh slightly lower, averaging around 41g. Despite this, the current study demonstrates that Bolinao native chickens in our sample exhibit egg weights comparable to other native breeds. For instance, native chickens in Western Visayas-Guimaras were reported to have an average egg weight of 42.69 grams (Cabarles, 2013), aligning closely with this finding. Moreover, specific nutrients such as methionine and lysine can significantly contribute to egg size improvement (Saenz, 2021).

The computed mean values reveal fluctuating trends between the two groups throughout the production period. Group A (Abra origin) exhibited a higher mean egg weight, particularly notable in March 2023, whereas group B (Bolinao origin) displayed a lower mean egg mass, particularly in August. These fluctuations may be influenced by factors such as egg weight variation and egg production rates within each group.

While higher egg production values might have been expected, the observed performance levels suggest that Bolinao native chickens possess desirable egg weight characteristics comparable to other native chicken breeds. However, there is potential for further improvement in egg production metrics. By exposing the factors influencing egg weight and production in Bolinao native chickens, this study contributes valuable insights towards enhancing egg production efficiency in native chicken populations. Future research endeavors could focus on implementing selective breeding programs aimed at improving egg production traits, optimizing management practices, and leveraging technological advancements to achieve higher performance standards in Bolinao native chicken farming. Thus, it's critical to take into account additional variables including heredity, diet, age, and environmental conditions that may have an impact on egg weight.

The computed mean for Egg mass in Table 1 shows that a higher mean is reflected in group A (Abra origin) with a mean of 14.54 while, group B was 13.10. The highest recorded mean was during March 2023 in group A, while the lowest mean was reported in group B (Bolinao origin) during August with a recorded mean of 6.56.

Table 1.

The computed average monthly egg mass between Abra and Bolinao origin True-to-type Bolinao native chicken.

Month	Abra (A)	Bolinao (B)
August	12.06	6.56
September	12.28	9.15
October	12.48	16.78
November	11.76	10.81
December	13.86	15.27
January	15.55	14.08
February	19.15	16.20
March	19.20	15.92
Mean	14.54	13.10

Source: The author (2023).

The trend of egg mass may be affected by egg weight and egg production. Whereas, from August to September, there was a low egg production in group B that affected the computed egg mass, this may be due to the factor that the birds in group B were still adopting since they traveled from the source of the Bolinao breed. In line with the

findings of this study, Sisay et al. (2015) observed that egg mass followed the same pattern as egg production.

The results of related studies on chicken egg mass globally have been inconsistent. According to one study, the egg mass of the hens varied between strains and months when it came to the monthly hen day egg production of three-parent strains (Udeh *et al.*, 2013). Anene *et al.* (2020) discovered that there was variance in the egg mass of individual early-laying ISA Brown hens, as part of a study that examined the relationship between hen performance and egg quality attributes. The present study's inconsistent findings may be attributed to the species of chicken used, and the fact that some variables, including age, genetics, and diet additives, can influence a chicken's egg mass.

According to research by Adetayo and Babafunso (2001), native Nigerian hens had an average egg mass of 36.8 g. According to a different study by Grobbelaar (2010), four native chicken breeds in South Africa could produce 1.5 to 3.5 eggs per hen per week, with an average egg weight of 50 g. According to this research, the native chicken's egg mass in this investigation falls within the range of egg masses generated by native chickens in other nations.

The computed monthly feed conversion ratio between the two groups is presented in Table 2. FCR is to measure how efficient layers are in converting feeds taken into a dozen eggs.

Table 2.

The computed monthly FCR between Abra and Bolinao origin True-to-type Bolinao native chicken.

Month	Abra (A)	Bolinao (B)
August	2.84	2.74
September	2.98	2.90
October	2.86	2.69
November	2.86	2.60
December	2.84	2.73
January	2.78	2.77
February	2.67	2.74
March	2.80	2.61
Mean *	2.83	2.72

Source: The author (2023).

Statistically, there was a significant result on the mean conversion ratio between group A versus group B, whereas a lesser mean of 2.72 for group B (Bolinao origin) performed better compared to group A (Abra origin) with 2.83 (Table 2). Further, both groups (A and B) did not meet the lower value of 2.2 FCR or less which is considered as advantageous to the farm (poultry production indices). Thus, this could

be due to the number of eggs produced by native chickens which is lower compared to commercial layer strains.

In a study conducted in Kenya, feed conversion ratio was strongly correlated to egg production traits than with feed intake, implying that variability in FCR was greatly influenced by production traits than by feed intake (Miyumo et al., 2023). Thus, the contradicting result of the present study on layer commercials is due to the genetic factor that commercial layers have normally higher weight compared to native chicken.

The hatchability rate of native chicken presented in Table 3 shows that better performance is observed in group A (Abra origin), compared to group B (Bolinao origin) as reflected in Table 3 for the production period of the study, thus statistical results revealed a comparison between groups.

Table 3.
The hatchability rate of True-to-type Bolinao native chicken from Abra and Bolinao origin True-to-type Bolinao native chicken.

Month	Abra (A)	Bolinao (B)
August	61.29	52.00
September	58.93	36.80
October	45.34	34.26
November	49.85	43.69
December	44.29	45.38
January	34.97	32.04
February	49.69	46.27
March	38.30	37.64
Mean	47.83	41.01

Source: The author (2023).

This present study is within a range if compared to other literature where exotic chickens have a hatchability of 39.3–76.1%, while their crossbreed has 67.9–85.8% hatchability (Yizengaw et al., 2021). However, the lower result is gathered compared to the hatchability rate of other native chicken groups in the Philippines, the hatchability percentage recorded by raisers in Palawan is approximately 79.38 ± 13.48 , whereas in Camarines Sur, Cagayan Valley, Western Visayas, 74% southern Tagalog, and 83.7% in Iloilo, it ranges from 60 to 88% (Cabarles 2012; Lopez et al., 2014). The monthly weight of hatched chicks serves as a crucial indicator of growth and development in native chicken populations, reflecting genetic, environmental, and management influences as presented in Table 4.

Table 4.

The average weight of chicks of True-to-type native chicken between Abra and Bolinao origin True-to-type Bolinao native chicken.

Month	Abra (A)	Bolinao (B)
August	25.84	25.08
September	27.35	24.31
October	27.98	28.95
November	28.53	28.48
December	28.50	28.40
January	26.23	26.57
February	27.93	27.38
March	27.55	27.58
Mean	27.49	27.09

Source: The author (2023).

Generally, table 4 shows that there was no significant difference comparing group A versus group B means in terms of the weight of chicks. Thus, the highest mean is recorded at 28.95g in group B during October, while the lowest mean is recorded in group B at 24.31 grams during September with a mean of both 27 grams.

The current study supports the findings of Brosas (2022), which found that day-old Bolinao chicks weigh roughly 26g. Males weigh approximately 862g at 12 weeks, whereas females weigh approximately 701g (Brosas, 2022). Comparing these findings to the existing literature on native chicken breeds worldwide, variability is observed in chick weight across different regions and breeds. Studies conducted in Western Visayas-Guimaras reported average chick weights ranging from 25 to 30 grams (Cabarles, 2013). In contrast, research on native chicken populations in Southeast Asia, such as Indonesia and Thailand, reported average chick weights ranging from 20 to 25 grams (Sutopo *et al.*, 2015; Charoensook *et al.*, 2018). These variations highlight the diverse genetic backgrounds and environmental conditions influencing chick growth in native chicken populations across regions.

Notably, while both groups exhibited similar egg production rates, group B consistently produced eggs with higher average weights, suggesting genetic predispositions or environmental conditions favoring larger egg sizes. This difference in egg weight is particularly relevant when considering its implications for chick development. Previous research has demonstrated a positive correlation between egg weight and chick weight, with larger eggs generally yielding heavier chicks (Tona *et al.*, 2003). Thus, the higher average egg weight observed in group B may contribute to the slightly higher mean chick weights observed in this group compared to group A, but did not have enough variance in weight to have a significant result.

Conclusions

The average monthly egg production had a mean of 10.27 from group A (Abra origin), while a mean of 8.93 in group B. In hen-house egg production (HHEP), a higher mean is observed in group A (34.13%) compared to group B with 29.65%.

The average egg mass is quietly higher also in group A (14.54%), compared to group B with 13.10%, egg weight in group B is 44.10 grams, compared to group A (42.46 grams). In feed conversion ratio (FCR), better efficiency is observed in group B (2.72) which is significant at 0.05 level, compared to group A (2.83).

In terms of hatchability rate, group A performed better with 47.83%, compared to group B with 41.01%, Lastly, the weight of chicks upon hatching had a mean of 27.49 grams in group A and 27.09 grams in group B.

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