

PERFORMANCE ASSESSMENT OF NATIVE CHICKEN STRAINS AS BROILERS

SONAM LHENDUP^{1*} AND JIGME TENZIN²

¹National Sheep Farm, Dechenpelrithang, Bumthang.

²College of Natural Resources, Royal University of Bhutan, Lobesa, Punakha, Bhutan.

*Author for correspondence: somlhendu88@gmail.com

Copyright© 2024 Sonam Lhendup. The original work must be properly cited to permit unrestricted use, distribution, and reproduction of this article in any medium.

ABSTRACT: This study assessed the performance of native chicken strains; Naked Neck, Frizzle, and Seim as broilers under the same management conditions at Pantang Phangkhar under Zhemgang Dzongkhag. The experiment was arranged in a completely randomized experimental design. Throughout the experiment period of 42 days, birds were weighed in groups every 7 days to calculate Average Daily Gain (ADG). Daily feed offered and refusals were recorded to compute Average Daily Feed Intake (ADFI) as the difference between the two measures. Data on ADG, ADFI, and Feed Conversion Ratio (FCR) were analyzed. Data were collected from 90 unsexed chicks comprising 30 each of Naked Neck, Frizzle, and Seim. The slight difference in body weight between the three native chicken strains (Seim; 330.08 ± 64.01 g, Naked Neck: 373.42 ± 92.07 g, and Frizzle; 314.95 ± 75.46 g) was found in this study. On 42-day, there was a modest difference in weight between Naked Neck and Frizzle. Similarly, ADG was also recorded little higher in Naked Neck (2.15 ± 0.50 g) followed by Seim (1.92 ± 0.51 g), and Frizzle (0.72 ± 0.61 g) with no significant difference ($p = 0.98$) among three native strains. At the conclusion of the experiment, five randomly chosen birds from each strain were slaughtered and dressed to assess carcass characteristics. The Pearson correlation test indicated perfect positive correlation ($r=1.00$) between live weight and hot carcass weight, live weight and dressing percentage, live weight and shank or leg weight, hot carcass weight and shank weight, head weight and shank weight. Naked Neck showed comparatively better broiler characteristic than the Frizzle and Seim in terms of FCR, ADG, eviscerated weight and dressing percentage. The results of this study indicated that Naked Neck can be promoted as a native broiler strain. However, an in-depth study is recommended to gain a scientific understanding of native broilers, which should continue until a substantial market size is achieved and an extended study duration is covered.

Keywords: Broiler; growth; native chicken; performance; strain.

1. INTRODUCTION

The poultry farming has been practiced in Bhutan from the time of our forefathers. It is an important component of Bhutanese farming system (Nidup and Tshering 2007). Poultry plays an essential economic, nutritional and socio-cultural role in the rural household's livelihood (Kumar 2016).

The planned poultry development program formally began during the first Five Year Plan (FYP) in 1961, with an objective to enhance rural nutrition and eliminate poverty (Nidup et al. 2005). Since then, layer farming for egg production remained dominant. Broiler farming is a popular and profitable agro-business due to its competitive

advantage of short gestation period of 42-days (Jamtsho and Rai 2018). There is a significant demand for chicken in Bhutan, with a particular preference for locally produced chicken, which holds a higher market value (Norbu and Wangdi 2009). In this regard, exotic broiler farming in Bhutan was initially introduced in 2004 in Samtse followed in 2006 in Tsirang (Tashi 2009). This initiative was an initial step to meet domestic broiler demand, but native broiler farming has not yet begun.

Chicken from local or native birds is preferred over the commercial breed because of their distinct meat quality, and it has a high economic value (Moharrery and Mirzaei 2014). The hardiness nature and high-quality meat remains the distinctive characteristics of native birds (Kumar 2016), which provides opportunities for the sustainable production of high value chicken, while it has potential to withstand the climate impacts. There are 13 different native poultry strains (Nidup et al. 2005) and its potential for broiler purpose is not explored although it is being slaughtered and consumed occasionally at household level. Further, farmer's instinct to rear native chicken despite the government's effort to promote exotic poultry breeds demands Research and Development (R&D) to explore opportunities to identify and establish native broiler strain in the country. Therefore, this study was undertaken to derive the scientific understanding on the comparative performance of native chickens reared as a broiler considering the similar broiler management level of exotic broiler.

2. MATERIALS AND METHODS

2.1 Study area and characteristics

The study was conducted at Pantang RNR-EC; Phangkhar Gewog under Zhemgang Dzongkhag. It is located at 26.97205° N, 90.85565° E, and at an altitude of 238m above sea level. The annual average temperature of 20°C and 35°C was recorded in winter and summer, respectively (Phangkhar Gewog Report, 2020). It experiences an average annual rainfall ranging from 1200-2800mm. The site covers a total area of 542.7

sq. Km (LUPP- 1995) with 78% under forest cover. The study area has 169 households with a total population of 2416 (1197 men and 1219 women) (Phangkhar Gewog report, 2020).

2.2 Sample size

A total of 90 Day old Chicks (DoCs) with 30 numbers each of Seim, Naked Neck and Frizzle were used for the study. DoCs for Seim were sourced from the Native Poultry Breeding Centre, Sertsham, Lhuntse, and DoCs for Naked Neck and Frizzle were hatched at the experiment site. The eggs for hatching native DoCs were sourced from Barpong, Phangkhar Gewog, and Tingtibi under Trong Gewog, Zhemgang. Additional eggs required for the study were sourced from Surey, Jigmecholing Gewog under Sarpang Dzongkhag too.

2.3. Experimental Design

A completely randomized design (CRD) was used with a total of 90 unsexed chicks divided into three groups of the same feeding regime and management condition. The three native chicken strains (n=30) were compared amongst and assessed for the suitability to be raised as a native broiler. Three native poultry strains were selected because they are commonly raised by rural farmers and have higher populations compared to other native birds in the country. The initial mean live weight for Seim, Naked Neck, and Frizzle was 33.17 g, 32.57 g, and 29.48 g, respectively.

2.4 Management of experimental birds

All chicks were reared up to 42 days of age in an open-sided house (6.5 m x 3.5 m x 5.8m) of a deep litter system (4" deep). The chicks in all treatments were provided uniform stocking density, feed, and water. They were reared under standard and uniform management conditions throughout the experimental period.

Brooding preparation was performed before the arrival of chicks. At day zero, feed and water were provided *ad libitum*. The uniform brooding facilities of 100 and 65-watt

Compact Inflorescent Lamps (CFL) were provided in all the treatments. For the first three days, 24 hours lighting was provided followed by 23 hours lighting till chicks attended the age of seven days. Fresh, clean, and sun-dried saw dust was used as bedding materials. Chicks were vaccinated against Marek disease in the hatchery and as well as in the brooding unit as per the vaccination schedule.

2.5 Feeding management

The experimental birds were provided with chick starters from day one to 23 according to Ross-308 management standards. To acclimate to the change of feed, broiler starter (crumble) and broiler finisher (mash) were mixed and fed at 70% and 30% respectively, on the 24th day. On the following day, birds were provided starter and finisher at 50% each. However, on 26th day, birds were fed starter and finisher at 30% and 70% respectively. From 27th day, the birds were provided broiler finisher till 42 days of age.

2.6. Data collection and analysis.

The growth performances of experimental birds were evaluated based on body weight gain, Average Daily Gain (ADG), and Feed Conversion Ratio (FCR). The parameters were recorded on daily and weekly basis. The body weight of all experimental birds was electronically weighed and recorded. ADG, FCR, and mortality were calculated using the following formulae:

$$ADG = \frac{\text{Final weight} - \text{Initial weight (g)}}{\text{Age of birds (days)}}$$

$$FCR = \frac{\text{Total feed intake (g)}}{\text{Final weight gain (g)}}$$

$$\text{Mortality} = \frac{\text{No. of death birds}}{\text{No. of initial birds}} \times 100$$

randomly selected and processed using locally adopted method to determine the dressing percentage. The birds were scalded in boiling water (60°C for 45 second) and then the feathers were removed and weighed (Choo et al. 2014) to determine feather

weight, shank weight, head weight, and hot carcass weight.

Feed consumption was recorded daily and each bird was measured weekly basis for its growth performance and carcass weight was measured upon the terminal stage of 42 days study period. Analysis of Variance (ANOVA) was administered using Statistical Package for Social Sciences (SPSS) version 26.0 to determine the significant difference of different variables of experimental birds.

3. RESULTS AND DISCUSSION

3.1. Average live weights of experimental birds

The average live weights of Seim, Naked Neck and Frizzle recorded were 330.08 ± 64.01 g, 373.42 ± 92.07 g, and 314.95 ± 75.46 g respectively which differs significantly ($p < 0.05$). These findings showed that Naked Neck has the highest growth performance followed by Seim, and Frizzle. When comparing treatments, the Naked Neck demonstrates superior growth performance under these feeding and management conditions (Figure 1). This result reflects that Naked Neck is the fast-growing poultry strain that will reach market weight sooner than others reducing the time and cost involved in raising them. Thus, choosing Necked Neck among three strains will be profitable venture concerning native broiler strains. Such finding also indicates effectiveness of feeding and management practices implemented in this study. The current finding resembles the findings of Fathi et al. (2013) who found that Naked Neck had larger body weight and significantly superior performance during both summer and winter seasons. The same authors observed above findings in their study on Naked Neck and Frizzle genes for improving chickens raised under high ambient temperature: Growth performance and egg production. This observation is consistent with the findings of

Ali et al. (2012) who found no significant ($p > 0.05$) differences in the body weight gain of native chicken as a result of varied densities, flock sizes, and their interactions.

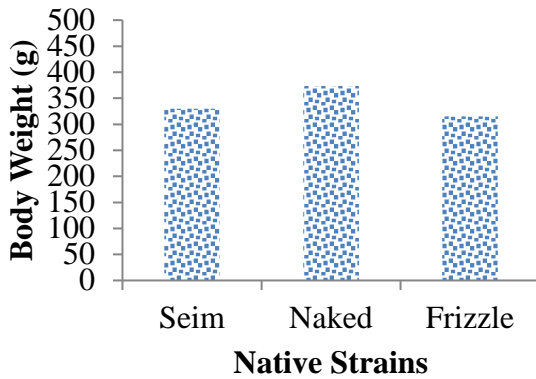


Figure 1: Final body weight of native strains on 42 days.

In general, the overall growth output of native chicken had a growth pattern that the cumulative body weight gain increases linearly with age (Figure 2), which agrees with the findings of Ali et al. (2012).

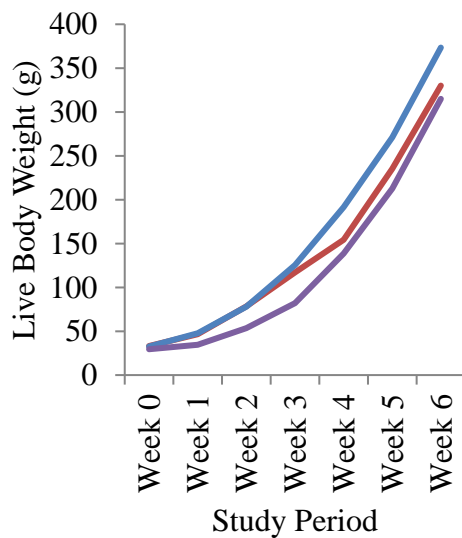


Figure 2: Overall week-wise growth performance of different native birds.

The current findings agree with the findings of Patra et al. (2002) who reported a similar range of growth indices for native poultry birds in India. Figure 2 represents the time-series growth pattern of native birds. Table 1

represents the weekly mean body weight of the experimental birds.

Table 1: Weekly average body live weight of experimental birds (g/bird)

Age	Naked Neck	Seim	Frizzle
Week 0	32.56 ± 0.60 ^b	33.16 ± 0.66 ^b	29.48 ± 0.67 ^c
Week 1	47.58 ± 1.96 ^b	46.61 ± 1.45 ^b	34.55 ± 1.01 ^c
Week 2	78.08 ± 3.16 ^b	78.28 ± 2.68 ^b	53.53 ± 2.12 ^c
Week 3	125.48 ± 4.92 ^b	117.1 ± 4.67 ^b	81.91 ± 4.58 ^c
Week 4	191.66 ± 9.13 ^b	154.28 ± 6.95 ^b	138.46 ± 6.78 ^b
Week 5	271.11 ± 11.85 ^b	235.23 ± 9.17 ^b	212.68 ± 10.39 ^b
Week 6	373.41 ± 16.80 ^b	330.08 ± 11.68 ^b	314.95 ± 13.77 ^b

***Means with different superscripts within row are significant at $p < 0.05$

3.3. Average Daily Gains of poultry birds

Naked Neck showed highest overall mean ADG of 25.89 g with minimum and maximum ADG of 6.80 g and 53.35 g respectively (Figure 3). During the first week, ADG was 2.15 ± 0.50 g for Naked Neck, 1.92 ± 0.51 g for Seim and 0.72 ± 0.61 g for Frizzle revealing no significant difference ($p > 0.05$) among the experiment birds in terms of ADG in the study area (Figure 3). However towards the subsequent weeks of the study period, Naked Neck exhibited much higher ADG amongst the experimental birds that often correlates with better feed efficiency, which can reduce feeding costs. Moreover, high ADG is an indicator of good health and well-being of poultry birds. Similar findings were also reported by Moharrery and Mirzaei (2014) in their study on growth characteristics of commercial broiler and native chickens as predicted by different growth functions.

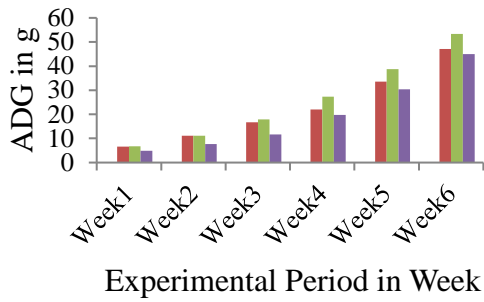


Figure 3: Week-wise ADG of different native strains

3.4. Average Body Weight Gain (ABWG) of birds

The ABWG recorded during 42-day study period for Seim, Naked Neck, and Frizzle was 296.92 g, 340.85 g, and 285.47 g (Figure 4). It is an important metric in poultry management, providing insights into the growth performance and efficiency of animals under particular feeding and management conditions. Thus, ABWG results evident that Naked Neck is the most potential poultry strain to be reared as a native broiler bird to generate higher ABWG on exotic broiler feed.

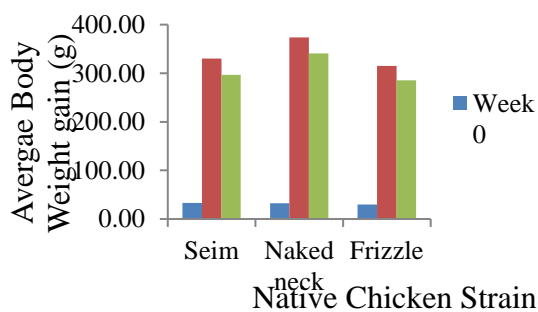


Figure 4: Average Body Weight Gains of different Native strains

3.5. Average Daily Feed Intake (ADFI) of birds

Overall, Seim and Naked Neck showed intermittent ADFI across the entire trial period, however, towards the terminal stage of its culture period Naked Neck has exhibited higher ADFI. On the other hand, Frizzle had the least ADFI. ADFI is another

critical metric in poultry production, helping to evaluate the efficiency of feed utilization, monitor health and growth, and manage feeding costs. Thus, Naked Neck is the best feed utilizers native bird to derive inferences on how to manage costs of the feeds and its feeding. The ADFI results were consistent with Patra et al. (2002), who found that Naked Neck broilers typically exhibit a faster growth rate and higher feed intake. This is primarily due to their reduced feather coverage, which prevents excessive body temperature increases during feeding, and their more exposed skin, which helps them dissipate heat more effectively. ADFI of the three poultry strains is presented in Figure 5.

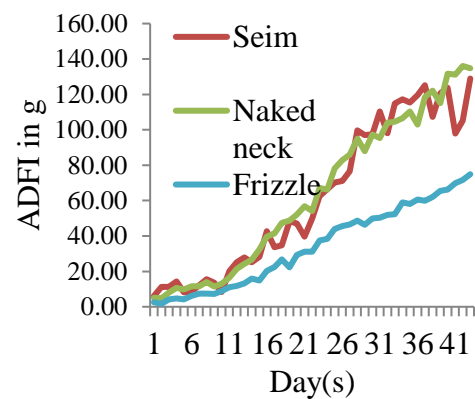


Figure 5: Average Daily Feed Intake of different native strains

3.6. Feed Conversion Ratio of birds

Overall FCR for Seim, Naked Neck, and Frizzle were 8.28 (n=30), 7.34 (n=30), and 9.33 (n=30) respectively, indicating that the Naked Neck strain is the most efficient in feed utilization with an FCR value of 7.34 (Figure 6). However, there was no significant difference ($p > 0.05$) in FCR among groups which is in agreement with the findings of Ali et al. (2012) as cited in Taboada et al. (1986). The FCR of native chickens is almost in line with the findings of most of the researchers (Ali et al. 2012 as cited in (Sazzadet al. 1990; Khandoker1993, and Yeasmin2000).

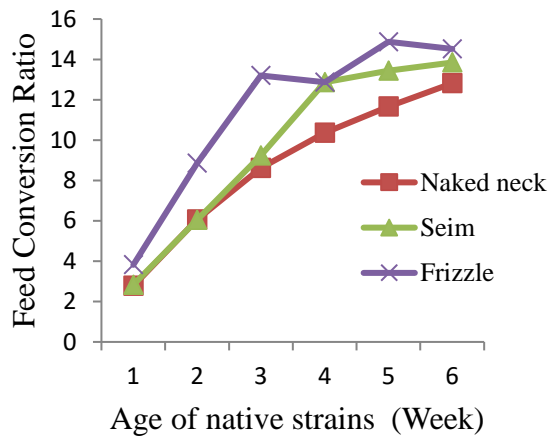


Figure 6: Week-wise FCR for different poultry birds.

3.7. Dressing percentage of birds.

Among the three-native poultry, Naked Neck (71.51%) had a better dressing than Seim and Frizzle (Table 2). Fathi et al. (2013) had reported that dressing percentage was significantly found higher in two Naked Neck genotypes than their normal siblings.

Table 2: Determining dressing percentage of different experimental birds.

Descriptions	Naked Neck	Seim	Frizzle
Ave. Live weight (g)	399.1	382.6	301.3
Ave. Hot carcass weight (g)	285.4	270.6	215
Dressing (%)	71.51	70.73	71.36

The Pearson correlation test was conducted to understand the relationship and degree of association between each harvested yield for different strains of birds. The test resulted perfect positive correlation ($r = 1.00$) between LW and HCW, LW and DP LW and S/LW, HCW and S/LW, HW and S/LW as shown in the Table 3.

Table 3: Pearson correlation matrix of different variables.

	LW	HCW	DP	FW	HW	S/LW
LW	1	1.00**	1.00**	0.96*	0.99**	1.00**
HCW		1	0.99**	0.96*	0.99**	1.00**
DP			1	0.95*	0.98*	0.99**
FW				1	0.99**	1.00**
HW					1	1.00**
S/LW						1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

LW= Live weight, HCW= Hot Carcass Weight, DP= Dressing Percentage, FW= Feather Weight, HW= Head Weight, S/LW= Shank or Leg Weight

4. CONCLUSIONS

In this study, the better weight gain of birds is directly related to efficient feed conversion and therefore it is an indicative of a potential to raise as a native broiler. However, the study also indicates that the greater weight gain does not necessarily lead to better feasibility of birds to be raised as broiler, due to high investment and higher FCR mainly in feed. On the other hand, the low weight gains of birds are often compensated by low investment. The overall final growth indices indicate that Naked Neck has overrun the performance of Seim and Frizzle significantly. Naked Neck strain showed comparatively better broiler characteristic than the Frizzle and Seim strain considering the performance in terms of FCR, Average Daily Gains, higher eviscerated weight and dressing percentage. However, the study duration was short for native birds unlike the commercial broiler to attain a market size or economic weight within 42 days. Therefore, Naked Neck can be promoted as a native broiler over Seim and Frizzle. However, this

study suggests conducting further research to gain additional insights into the parameters determining when the birds reach marketable size, along with a cost-benefit analysis.

Acknowledgements

The authors acknowledge Regional Livestock Development Centre and Dzongkhag Livestock sector, Zhemgang for the financial supports. The authors equally acknowledge, National Poultry and Research Development Centre, Sarpang and Native Poultry and Heifer Breeding Centre, Sertsham, Lhuentse for supplying DOCs for free of cost. All the stakeholders involved in this research were sincerely acknowledged.

REFERENCES

- Ali M, Azmal S, and Faruque M. (2012). Effect of density and flock size on growth performance of native chicken. *Journal of Bangladesh Agricultural University.*, 10 (1), 55-59.
- Choo YK, Oh ST, Lee KW, Kang CW, Kim HW, Kim CJ, (2014). The Growth Performance, Carcass Characteristics, and Meat Quality of Egg-Type Male Growing Chicken and White-Mini Broiler in Comparison with Commercial Broiler (Ross 308). *Korean Journal of Food Science and Animal*, 34 (5), 622-629.
- Fathi M, Galal A, El-Safty S, and Mahrous M. (2013). Naked neck and frizzle genes for improving chickens raised under high ambient temperature: I. Growth performance and egg production. *World's Poultry Science Journal*, 69, 813-832.
- Jamtsho T, and Rai SB. (2018). Effects of poultry feed and stocking density on broiler performance. *Bhutan Journal of Animal Science (BJAS)*, 2(1), 53-56.
- Kokoszyriski D, Bernacki Z, Saleh M, Stczny K, and Binkowska M. (2017). Body Conformation and Internal Organs Characteristics of Different Commercial Broiler Lines. *Brazilian Journal of Poultry Science*, 19(1), 047-052.
- Moharrery A, and Mirzaei M. (2014). Growth characteristics of commercial broiler and native chickens as predicted by different growth functions. *Journal of Animal and Feed Sciences*, 23, 82-89.
- NidupK, and Tshering P. (2007). Status of Family Poultry Production and HPAI in Bhutan. *Proceedings of the 8th Asian Pacific Poultry Conference of the World's Poultry Science Association.*, (pp. 78-83). Bangkok, Thailand.
- Nidup K, Dorji P, and Penjor. (2005). A Review of Poultry Development in Bhutan. (E. Gueye, Ed.) *Family Poultry; INFPD Newsletter*, 15(1), 8-15.
- Nidup K, Penjor and Dorji P. (2005). A review of poultry development in Bhutan. *Family 15(1)*: Rome: FAO.
- Nidup K, Penjor and Dorji P. (n.d). Chapter V: Poultry.
- Nidup K, Penjor, Dorji P, Gurung R, Arasta, P, and Moran C. (2005). Genetic structure of the indigenous chicken of Bhutan. *SAAR Journal of Agriculture*, 3, 69-89.
- Padhi MK. (2016). Importance of Indigenous Breeds of Chicken for Rural Economy and Their Improvements for Higher Production Performance. *Scientifica*, 2016, 1-9.
- Patra BN, Bais RK, and Singh RB. (2002). Performance of Naked Neck versus Normally Feathered Coloured Broilers for Growth, Carcass Traits and Blood Biochemical Parameters in Tropical Climate. *Asian-Aust. Journal of Animal science Science*, 15(12), 1776-1783.
- RNRC. (2019). *Renewable Natural Resources Census, 2019*. Thimphu, Bhutan.: Renewable Natural Resources Statistics Division, Directorate Services, Royal Government of Bhutan. Ministry of Agriculture and Forests.

- Singh B, Singh B, Chaudhuri D, and Malik C. (1998). Naked Neck: A Noble Gene for Broiler Production in Tropical Climate. *Journal of Applied Animal Research*, 13, 37-48.
- Tashi. (2009). Commercial chicken production in Bhutan: Will social and religious sentiment allow the development? Van Hall Larenstein University of Applied sciences., Agriculture Production and Chain Management. Part of Wageningen UR, Forum building 102 Droevendaalse steeg 2 ,6708 PB Wageningen The Netherlands: Wageningen, The Netherlands.
- Norbu T, and Wangdi S. (2009). Demand Analysis of High-End Hotels in Thimphu, Bhutan.
- Tougan PU, DahoudaM, Salifou CF, Ahounou GS, Kpodekon MT, Mensah GA. (2013). Relationships between carcass traits and offal components in local poultry populations (*Gallus gallus*) of Benin. *Journal of Applied Biosciences*, 69, 5510 – 5522.