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Effect of Parental Age on Growth Performance and Feed Conversion Ratio of Progeny in Three Naked Neck Chicken Varieties

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Abstract

The present study was conducted to evaluate the effect of parental age on growth performance and feed conversion ratio of progeny in three varieties of Naked Neck chickens. A total of 126 day-old chicks produced from parent stocks of two age groups (45 and 55 weeks) belonging to light brown, black, and dark brown varieties were reared for a period of 20 weeks. Growth performance parameters, including body weight gain, feed intake, and feed conversion ratio (FCR), were recorded weekly. Results showed that progeny from 55-week-old parents exhibited significantly higher body weight gain and improved FCR compared to progeny from 45-week-old parents ($P \leq 0.05$). Feed intake was also higher in progeny of older parents; however, improved feed efficiency indicated better nutrient utilization. Among varieties, light brown males and black females demonstrated superior growth performance. A significant interaction between parental age and variety was observed for body weight gain and FCR, with progeny from 55-week-old black parents showing the best overall growth performance. It was concluded that parental age is a critical factor influencing the growth performance of Naked Neck chicken progeny, and optimizing breeder age can enhance the productivity of indigenous poultry under local management conditions.

Keywords: Parental age, Growth performance, Feed intake, Feed conversion ratio, Naked Neck chicken

1. Introduction

The poultry industry plays a crucial role in meeting the growing global demand for affordable animal protein, particularly in developing countries where indigenous and improved chicken varieties contribute significantly to food security and rural livelihoods [1]. Among these, Naked Neck chickens (Na gene carriers) have attracted considerable attention due to their superior adaptability to hot and humid climates, enhanced heat tolerance, and relatively efficient feed utilization compared with fully feathered birds [2]. These advantages make Naked Neck chicken varieties promising genetic resources for sustainable poultry production under tropical and subtropical conditions [3].

Growth performance and feed conversion ratio (FCR) are key economic traits in poultry production, as they directly influence production efficiency, profitability, and resource use [4]. While nutrition, management, and genotype are well-recognized determinants of these traits, parental factors, particularly parental age, have been shown to exert significant effects on progeny performance. Parental age can influence egg weight, egg composition, hatchability, chick quality, and early growth, all of which may have lasting impacts on post-hatch growth and feed efficiency of the offspring [5].

Indigenous poultry production plays a crucial role in enhancing rural livelihoods, improving food security, and generating income in developing countries. Local chicken breeds are valued for their adaptability to harsh environmental conditions, resistance to diseases, and ability to perform under low-input management systems [6]. In Pakistan, indigenous poultry constitutes a major proportion of the national poultry population, particularly in rural areas where it contributes substantially to household nutrition through meat and egg production [7].

Among indigenous chicken breeds, Naked Neck chickens are of special importance due to the presence of the *Na* gene, which reduces feather coverage and enhances heat dissipation. This genetic trait enables Naked Neck chickens[2] to tolerate high ambient temperatures, leading to improved feed intake, growth rate, and survivability under tropical and subtropical conditions. Owing to these advantages, Naked Neck chickens are widely preferred by rural farmers as a dual-purpose breed for meat and egg production [8].

Growth performance is a key economic trait in poultry production and is influenced by genetic makeup, nutrition, management practices, and parental factors. Among parental factors, age of the breeder stock has been recognized as a major determinant affecting chick quality and subsequent growth performance [9]. Several studies conducted on commercial broiler strains have reported that chicks derived from older breeders generally exhibit higher body weight gain and better feed efficiency compared to those from younger breeders. This improvement has been attributed to increased egg size, better nutrient deposition in the egg, and enhanced embryonic development associated with advancing breeder age [10].

Despite extensive research on breeder age effects in commercial poultry, information regarding indigenous chicken breeds remains limited. Indigenous birds differ substantially from commercial strains in terms of growth rate [11], adaptability, and genetic potential; therefore, results obtained from exotic breeds cannot be directly extrapolated to local poultry populations. In particular, limited scientific data are available on the influence of parental age on growth performance and feed efficiency of Naked Neck chicken progeny [12].

In Pakistan, Naked Neck chickens exist in several phenotypic varieties, including light brown, black, and dark brown. These varieties may differ in growth potential and feed utilization efficiency due to genetic variation [13, 14]. Understanding the interaction between parental age and varietal differences is essential for optimizing breeding strategies and improving productivity of indigenous poultry under local conditions. Therefore, the present study was designed to investigate the effect of parental age on growth performance, feed intake, and feed conversion ratio

of progeny in three varieties of Naked Neck chickens. The findings of this study are expected to provide valuable information for optimizing breeder age in indigenous poultry production systems and contribute to the sustainable utilization and improvement of Naked Neck chicken genetic resources.

2. Materials and Methods

2.1.Experimental Site

The experiment was conducted at the Indigenous Chicken Genetic Resource Center (ICGRC), Department of Poultry Production, University of Veterinary and Animal Sciences (UVAS), Pakistan. The study was carried out for a period of 20 weeks under standard management and environmental conditions.

2.2. Experimental Birds and Design

A total of 126-day-old Naked Neck chicken chicks were used in this study. Chicks were obtained from parent stocks of two age groups, 45 and 55 weeks, belonging to three Naked Neck chicken varieties: light brown, black, and dark brown. The experiment was arranged in a 3 × 2 factorial arrangement under a randomized complete block design (RCBD).

Each treatment group was replicated seven times, with three birds per replicate (one male and two females). Birds were individually weighed and wing-tagged at the start of the experiment for identification purposes.

Light Brown **Black** **Dark Brown**

Figure 2.1. Naked Neck phenotypes maintained at ICGRC

2.3. Housing and Management

After an initial brooding and adaptation period, birds were reared in a well-ventilated poultry house under semi-controlled environmental conditions. Birds were maintained in battery cages equipped with trough feeders and nipple drinking systems. Feed and fresh drinking water were provided ad libitum throughout the experimental period. Standard vaccination and biosecurity protocols were followed according to local recommendations. housing, management, and experimental conditions for Naked Neck chicken progeny are summarized in Table 2.1.

2.1. Comprehensive housing, management, and experimental conditions for Naked Neck chicken progeny

Category	Parameter	Description
Housing	Housing facility	Well-ventilated poultry house
	Environmental control	Semi-controlled environmental conditions
	Housing system	Battery cage system
	Cage allocation	Birds allocated according to experimental layout described in the thesis
Brooding & Rearing	Brooding period	Initial brooding and adaptation period prior to experimental phase
	Rearing duration	Birds reared up to 20 weeks of age
Feeding Management	Feeding system	Trough feeders
	Feeding regime	Feed provided *ad libitum* throughout the experimental period
	Diet uniformity	Same diet provided to all treatment groups
Water Management	Drinking system	Nipple drinking system
	Water provision	Fresh drinking water provided *ad libitum*
Health Management	Vaccination program	Standard vaccination schedule followed
	Disease prevention	Routine health monitoring

2.4. Feeding Regimen

Birds were fed commercial starter (0–6 weeks), grower (7–16 weeks), and developer (17–20 weeks) diets formulated according to NRC (1994) recommendations. Diets were iso-caloric and iso-nitrogenous for all treatment groups to ensure that any observed differences in growth performance were attributable to parental age and varietal effects rather than nutritional variation.

2.5. Growth Performance Parameters

Growth performance was evaluated by recording body weight gain, feed intake, and feed conversion ratio (FCR).

- **Feed Intake**

Feed intake was recorded on a weekly basis by subtracting feed residue from feed offered. Weekly feed intake trends of male and female progeny were evaluated among different varieties as well as between the two parental age groups to assess the effect of variety and parental age on feed consumption.

- **Body Weight Gain**

Birds were weighed individually on a weekly basis using an electronic weighing balance. Weekly body weight gain trends were analyzed for male progeny among different varieties and between parental age groups. Corresponding trends for female progeny were also evaluated to determine the influence of variety and parental age on growth patterns.

- **Feed Conversion Ratio (FCR)**

Feed conversion ratio was calculated as the ratio of feed intake to body weight gain. Weekly FCR trends were evaluated for male progeny among varieties and between parental age groups. Similar trends were also assessed for female progeny to examine differences in feed utilization efficiency associated with variety and parental age.

Cumulative growth performance values at 20 weeks of age, including body weight gain, feed intake, and FCR, are presented in Table 3.1**.**

2.6. Statistical Analysis

Data collected on growth performance parameters were analyzed using two-way analysis of variance (ANOVA) through PROC GLM in SAS software (version 9.1). The statistical model included the effects of variety, parental age, and their interaction. Treatment means were compared using Tukey's Honestly Significant Difference (HSD) test at a probability level of $P \leq 0.05$. Each replicate cage was considered the experimental unit. Each cage was considered the experimental unit.

3. Results

3.1. Feed Intake

Parental age had a significant effect on feed intake of Naked Neck chicken progeny during the 20-week experimental period ($P \leq 0.05$). Progeny derived from 55-week-old parents consumed significantly more feed compared to those obtained from 45-week-old parents. This trend was observed in both male and female progeny. Among the three varieties, feed intake did not differ significantly ($P > 0.05$), indicating a comparable voluntary feed consumption pattern across light brown, black, and dark brown Naked Neck chickens. Furthermore, the interaction between parental age and variety showed no significant effect on total feed intake, suggesting that the influence of parental age on feed intake was consistent across all varieties.

Weekly feeding intake trends illustrated a gradual increase with advancing age in both sexes. Progeny from older parents consistently maintained higher feed intake throughout the rearing period compared to progeny from younger parents. Feed intake among the three varieties did not differ significantly ($P > 0.05$), indicating comparable feed consumption across light brown, black, and dark brown Naked Neck chickens **(Figures 3.1 and 3.2).**

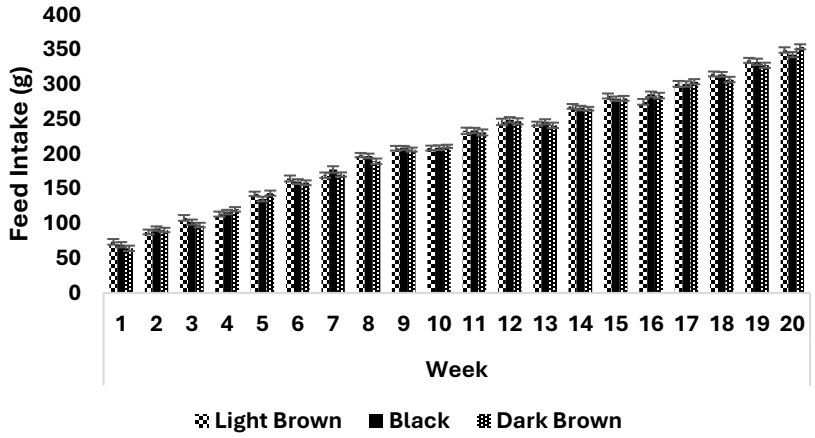

Figure 3.1. Trend of weekly feed intake among the male progeny of three Naked Neck chicken varieties

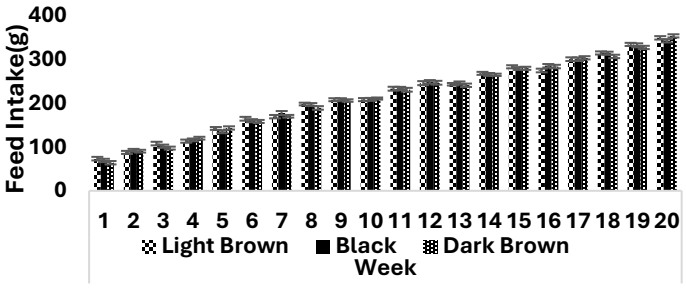

Figure 3.2. Trend of weekly feed intake among the female progeny of three Naked Neck chicken varieties; *Significant at $P \leq 0.05$

3.2. Body Weight Gain

Body weight gain was significantly influenced by parental age, variety, and their interaction ($P \leq 0.05$). Progeny from 55-week-old parents exhibited significantly higher body weight gain compared to progeny from 45-week-old parents over the 20-week rearing period. Among male progeny, the light brown variety showed the highest body weight gain, followed by black and dark brown varieties. In female progeny, the black variety exhibited superior body weight gain compared to light brown and dark brown varieties. These results indicate varietal differences in growth potential within Naked Neck chickens. A significant interaction between parental age and variety was observed for body weight gain. Male progeny from 55-week-old parents of the black variety attained the highest body weight gain, whereas the lowest gain was recorded in progeny from 45-week-old parents. Similar trends were observed in female progeny, where chicks from older black parents showed superior growth performance.

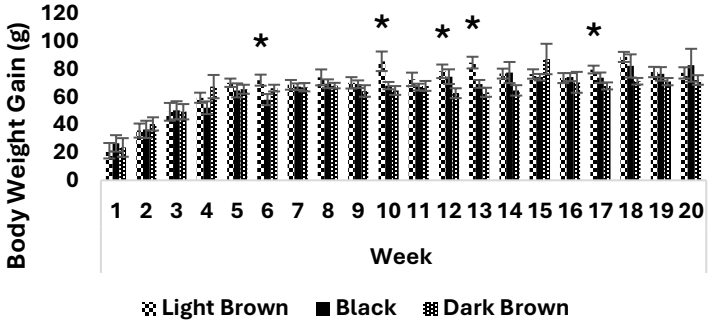

Figure 3.3. Trend of weekly body weight gain among the male progeny of three Naked Neck chicken varieties; *Significant at $P \leq 0.05$

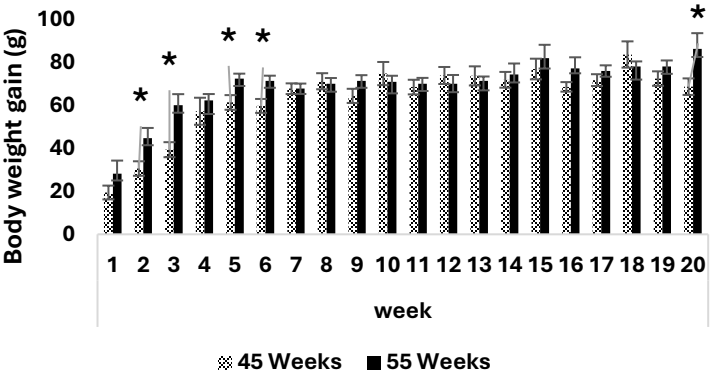

Figure 3.4. Weekly trend of body weight gain in male progeny of Naked Neck chicken between two parental ages; *Significant at $P \leq 0.05$

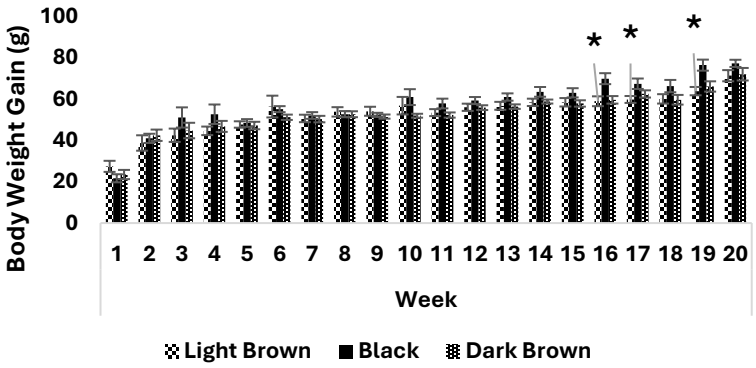

Figure 3.5. Trend of weekly body weight gain among the female progeny of three Naked Neck Chicken Varieties; *Significant at $P \leq 0.05$

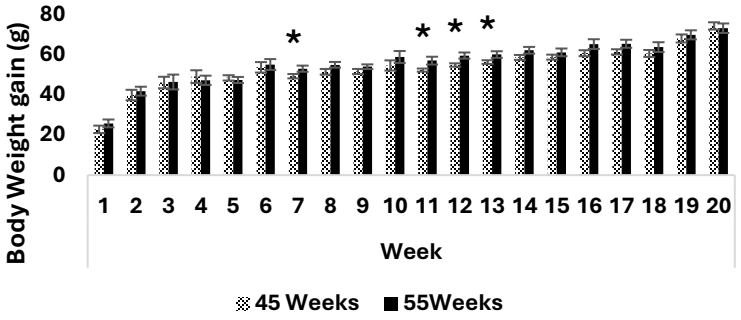

Figure 3.6. Weekly trend of body weight gains in female progeny of Naked Neck chicken between two parental ages; *Significant at $P \leq 0.05$.

Table 3.1. Effect of Two Parental Ages on Progeny Growth (20 weeks) among three varieties of Naked Neck chickens

[a-c]Superscripts on different means within column show significant difference ($P \leq 0.05$)

3.3. **Feed Conversion Ratio (FCR)**

Feed conversion ratio was significantly affected by parental age and variety ($P \leq 0.05$). Progeny from 55-week-old parents demonstrated significantly improved FCR compared to those from 45-week-old parents, indicating more efficient feed utilization with increasing parental age.

Variety		Weight gain (g)		Feed Intake (g)		FCR (feed/gain)	
		Male	Female	Male	Female	Male	Female
Light Brown		1393.00[a]±27.60	1070.07[b] ±19.84	4324.65±16.69	4324.65±16.69	3.11[b] ±0.06	4.08[a] ±0.08
Black		1315.21[ab]±50.76	1150.14[a] ±20.77	4319.08 ±14.64	4319.08±14.64	3.37[a] ±0.14	3.79[b] ±0.07
Dark Brown		1275.86[b]±24.92	1063.68[b] ±13.25	4293.26±14.48	4293.26±14.48	3.39[a] ±0.06	4.06[a] ±0.06
Parental age group							
45 weeks		1274.57[b]±25.54	1070.20[b]±12.49	4290.46[b]±10.49	4290.46[b]±10.49	3.42[a] ±0.08	4.03±0.05
55 weeks		1381.48[a]±31.86	1119.05[a]±18.16	4334.20[a]±13.57	4334.20[a]±13.57	3.15[b] ±0.07	3.92±0.07
Variety × Parental age group							
Light Brown	45 weeks	1327.86[ab] ±28.86	1033.29[b]±22.35	4306.54±14.73	4306.54 ±14.73	3.25[bc] ±0.08	4.20[a]± 0.10
	55 weeks	1458.14[a]±32.48	1106.86[ab] ±30.46	4342.75±29.82	4342.75±29.82	2.97[c] ±0.07	3.96[ab]±0.12
Black	45 weeks	1167.86[c]±37.14	1096.50[b]± 25.27	4299.34±18.48	4299.34 ±18.48	3.76[a] ±0.14	3.95[ab]±0.09
	55 weeks	1462.57[a]±50.49	1203.79[a]±26.66	4338.81±22.12	4338.81±22.12	2.98[c] ±0.09	3.63[b]±0.09
Dark Brown	45 weeks	1328.00[ab] ±38.24	1080.86[b]±13.08	4265.50±20.22	4265.50 ±20.22	3.27[bc] ±0.10	3.95[ab]± 0.05
	55 weeks	1223.71[bc] ±17.97	1046.50[b]±22.65	4321.02 ±18.54	4321.02±18.54	3.50[ab] ±0.05	4.16[a]±0.10
***P*-value**							
Variety		0.0076	0.0007	0.2919	0.2919	0.0086	0.0042
Parental age		0.0008	0.0149	0.0134	0.0134	0.0010	0.1364
Variety × Parental age		<.0001	0.0114	0.8878	0.8878	<.0001	0.0155

Among varieties, light brown males exhibited better FCR compared to black and dark brown males. In contrast, female progeny of the black variety showed superior feed efficiency relative to

the other varieties. These results highlight sex-specific varietal differences in feed utilization efficiency.

The interaction between parental age and variety significantly influenced FCR. Progeny from 55-week-old parents, particularly of the black variety, showed the most favorable FCR, whereas poorer feed efficiency was observed in progeny from 45-week-old parents. Weekly FCR trends further demonstrated improved feed efficiency in progeny from older parents throughout the growth period.

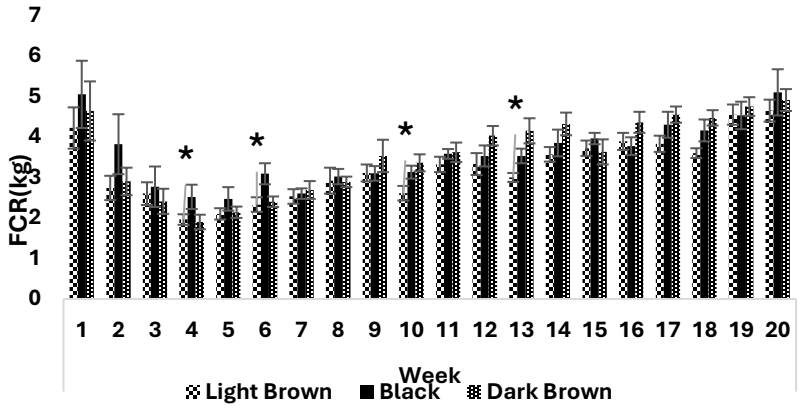

Figure 3.7. Trend of weekly FCR among the male progeny of three Naked Neck chicken varieties; *Significant at $P \leq 0.05$

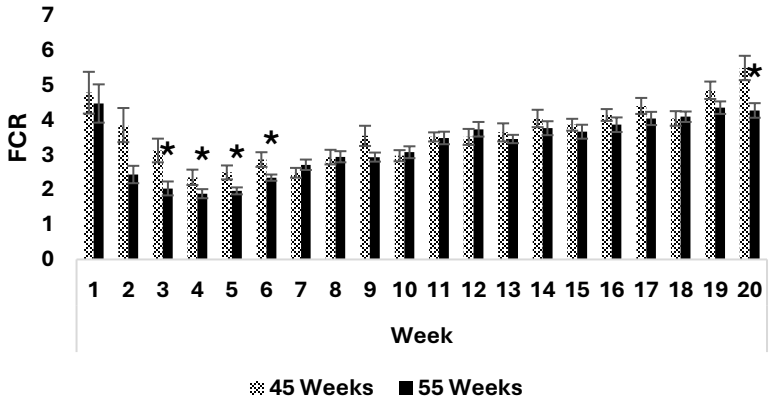

Figure 3.8. Weekly trend of FCR in male progeny of Naked Neck chicken between two parental ages; *Significant at $P \leq 0.05$

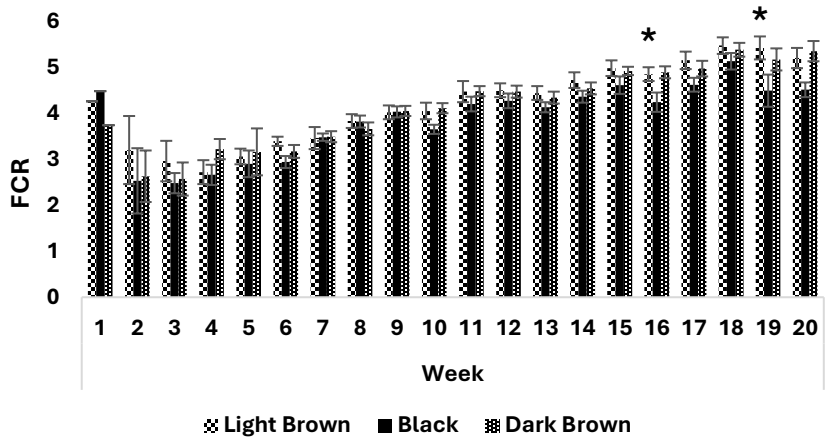

Figure 3.9. Trend of weekly FCR among the female progeny of three Naked Neck chicken varieties; *Significant at $P \leq 0.05$

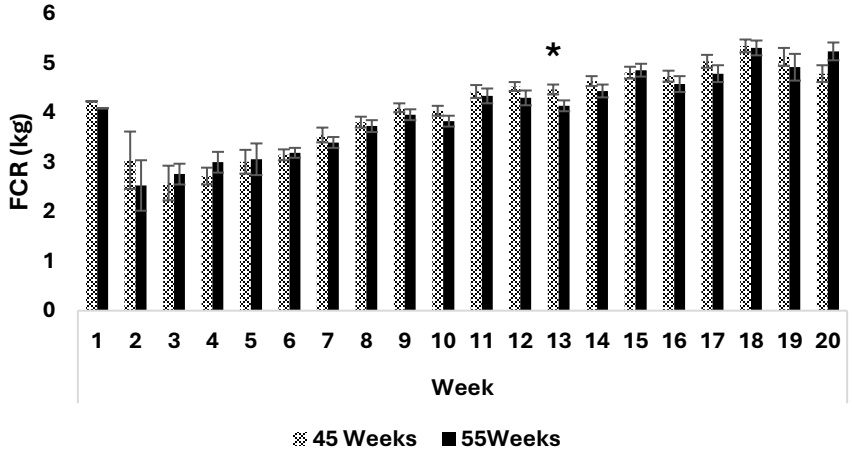

Figure 3.10. Weekly trend of FCR in female progeny of Naked Neck chicken between two parental ages; *Significant at $P \leq 0.05$

3.4. Summary of Growth Performance

Overall, progeny from older parents (55 weeks) consistently outperformed progeny from younger parents (45 weeks) in terms of body weight gain and feed conversion efficiency. Although feed intake was higher in progeny of older parents, improved FCR indicated more efficient conversion of feed into body mass. Varietal differences further influenced growth performance, with significant interaction effects between parental age and variety.

4. Discussion

In Pakistan, the Naked Neck chicken is famous for its meat and egg production. Different breeding and selection programs have been employed previously, but information regarding parental age and variety effects on subsequent progeny performance still lacks, which seems to be a major hurdle in propagation of this novel indigenous poultry genetic resource [15]. The present study demonstrated that parental age significantly influences growth performance and feed efficiency of Naked Neck chicken progeny. Progeny derived from 55-week-old parents exhibited superior body weight gain and improved feed conversion ratio compared to progeny from 45-week-old parents.

These findings indicate that advancing breeder age positively affects post-hatch growth performance in indigenous Naked Neck chickens.

Improved growth performance in progeny from older parents may be attributed to enhanced egg characteristics associated with increased breeder age. Older breeders are known to produce larger eggs with greater nutrient reserves, which support better embryonic development and early post-hatch growth. Enhanced nutrient availability during embryogenesis may result in improved physiological development, allowing chicks from older parents to utilize feed more efficiently and achieve higher body weight gain during the growing period [16].

Feed intake was higher in progeny from 55-week-old parents; however, an improved feed conversion ratio suggests more efficient utilization of consumed feed. This indicates that increased feed intake alone does not explain the superior growth performance of progeny from older parents, but rather improved metabolic efficiency and growth potential. Similar trends have been reported in previous studies conducted on commercial poultry strains, where progeny from older breeders showed enhanced feed efficiency and growth performance.

Varietal differences observed in the present study suggest genetic variation in growth potential among Naked Neck chicken varieties. Superior growth performance of light brown males and black females indicates that these varieties possess favorable genetic attributes related to growth and feed utilization. Such differences may be attributed to inherent genetic variability affecting appetite regulation, nutrient assimilation, and growth rate.

The significant interaction between parental age and variety further emphasizes that the response to parental age is not uniform across all genetic backgrounds. Progeny from 55-week-old parents of the black variety exhibited the best growth performance and feed efficiency, suggesting a synergistic effect between advanced parental age and genetic potential. These findings highlight the importance of considering both parental age and varietal characteristics when developing breeding and management strategies for indigenous poultry. Overall, the results of this study provide valuable insights into the role of parental age in determining the growth performance of Naked Neck chicken progeny. The findings contribute to the limited body of knowledge on indigenous poultry breeds and underscore the need to optimize breeder age for improved productivity under local production systems.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Contribution

All authors contributed equally.

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None.

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