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Effect of wheat grass supplementation on the performance and economics of guinea fowls

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Abstract

This investigation evaluated the effects of dietary wheat grass supplementation on the production performance and economic viability of guinea fowls reared at an organized poultry farm. A 12-week feeding trial was conducted using 144 guinea fowls randomly assigned to four dietary treatment groups: T₁: Control (Basal diet only), T₂: Basal diet + 2.5 g wheat grass, T₃: Basal diet + 5.0 g wheat grass, and T₄: Basal diet + 7.5 g wheat grass during the first fortnight. To accommodate avian growth, successive fortnightly wheat grass levels were adjusted upward by adding 50% of the initial baseline quantity to the preceding levels. Growth performance metrics were evaluated across three developmental phases: Starter (Weeks 1-4), Grower (Weeks 5-8), and Finisher (Weeks 9-12) at bi-weekly intervals. Parameters measured included body weight gain, feed intake, feed conversion ratio (FCR), performance index (PI), and net economic returns. The results demonstrated that wheat grass supplementation significantly ($P < 0.05$) decreased feed intake while concurrently maximizing body weight gain across all production phases compared to the control. The T₄ group achieved the highest cumulative body weight gain (1285.32 ± 0.11 g). FCR and PI were also significantly improved by dietary supplementation ($P < 0.05$), with the T₄ group exhibiting the most efficient FCR (3.14 ± 0.01) and superior PI (409.33 ± 0.05) over the 12-week period. Economic analysis revealed that although wheat grass reduced basal feed costs, the cumulative cost of forage production led to the highest net profit margin in the control group (T₁), followed by T₃, T₂, and T₄. In conclusion, dietary supplementation of wheat grass up to 7.5 g significantly enhances the growth performance, FCR, and biological efficiency of guinea fowls, presenting a viable natural feeding strategy in poultry production.

Keywords: Guinea fowl, Wheat grass, Growth performance, Feed conversion ratio, Economics

Introduction

The poultry sector is currently the fastest-growing segment within India's livestock industry. Having transitioned from a traditional backyard venture in the 1960s, contemporary poultry farming has evolved into a highly organized, scientifically driven, and vibrant commercial enterprise. It serves as a vital tool for rural employment generation, poverty alleviation, and the mitigation of nutritional insecurity. Over the past few decades, substantial infrastructure developments largely driven by the private sector have rendered India self-sufficient in high-quality breeding stock, automated poultry equipment, therapeutics, biosecurity vaccines, and technically skilled manpower.

Concurrently, alternative poultry species such as guinea fowl, quail, and turkey have gained commercial traction due to rising consumer demand for alternative meat sources (Anonymous, 2010) [2]. The guinea fowl (*Numida meleagris*) is increasingly favored as an alternative to commercial broiler chickens due to its attractive plumage, unique game-type flavor, and high meat-to-bone ratio (Embury, 2001) [4]. Because guinea fowl meat commands a premium market price, it is often featured during special culinary occasions.

From an agronomic perspective, guinea fowls are resilient, highly adaptable, and exhibit low nutritional maintenance requirements. They perform well under extensive scavenging or intensive systems, utilizing cheap grains and forages during lean seasons. Standard diet adjustments and optimized protein bounds remain crucial during their intensive rearing to achieve target market weights (Oluwafemi *et al.*, 2023) [9]. Incorporating green forages like berseem, lucerne, and wheat grass as dietary supplements offers a safe, eco-friendly, and cost-efficient feeding alternative devoid of synthetic side effects. Recent husbandry trends

demonstrate that fresh forage inclusion optimizes intestinal health and can effectively enhance structural growth parameters in alternative poultry (Hassan *et al.*, 2025) [6]. Wheat grass refers to the young cotyledons of common wheat (*Triticum aestivum*). In human and animal nutrition, it is widely consumed as a functional juice, extract, or dehydrated powder owing to its powerful bioactive profile (Al-Khalaifah *et al.*, 2021) [1]. Typically harvested 8 to 10 days post-germination, wheat grass is exceptionally rich in essential vitamins (A, C, B-complex, E, and K) and bioavailable minerals, containing 82 of the 92 trace elements found in soil, including calcium, magnesium, iron, zinc, potassium, phosphorus, and cobalt (Kulkarni *et al.*, 2006) [7]. Furthermore, wheat grass provides highly digestible proteins and functional amino acids, minimizing the metabolic energy expenditure required by the animal for protein catabolism. Given these nutritional benefits, this study investigated the effect of incremental dietary wheat grass supplementation on the growth parameters, feed efficiency, and economic returns of guinea fowls.

2. Material and Methods

The feeding trial was executed at the university poultry farm utilizing a Completely Randomized Design (CRD). A total

of 144 day-old pearl variety guinea fowls were randomly allocated into four distinct dietary treatments, with each treatment group containing three replicates. The treatment cohorts were structured as follows: T₁: Basal control diet without wheat grass supplementation; T₂: Basal diet + fresh wheat grass at a baseline rate of 2.5 g per bird; T₃: Basal diet + fresh wheat grass at a baseline rate of 5.0 g per bird; T₄: Basal diet + fresh wheat grass at a baseline rate of 7.5 g per bird. The baseline forage allowances were allocated during the first fortnight. For each subsequent fortnight, the wheat grass dosage was scaled upward by adding 50% of the initial baseline quantity to the preceding volume to match animal maturity. Fresh wheat grass was harvested 8 to 10 days post-germination, chopped, and mixed manually with the daily basal feed over a total experimental duration of 12 weeks. The experimental birds were managed under a fully intensive deep-litter housing system utilizing paddy husk as the bedding material. Environmental conditions, ventilation, and husbandry protocols were uniform across all treatment groups. Diets formulated for the Starter (Weeks 1-4), Grower (Weeks 5-8), and Finisher (Weeks 9-12) production phases were offered *ad libitum*, alongside clean drinking water. The chemical and nutrient composition of the experimental basal rations is detailed in Table 1.

Table 1: Nutrient Composition of the Experimental Basal Rations

Nutrients (%)	Starter Feed (1-4 Weeks)	Grower Feed (5-8 Weeks)	Finisher Feed (9-12 Weeks)
Moisture	9.45	9.78	9.67
Crude Protein	22.97	20.38	18.87
Crude Fibre	4.84	4.72	4.35
Ether Extract	3.90	4.05	4.15
Total Ash	7.16	7.23	6.84

Performance parameters

Growth performance was evaluated at bi-weekly intervals. Live body weight and feed consumption were recorded systematically to compute periodic weight gain, feed conversion ratio (FCR), and performance index (PI). FCR was determined using the standard equation:

$$FCR = \frac{\text{Total Feed Consumed (g)}}{\text{Total Live Weight Gain (g)}}$$
 The Performance Index (PI) across the respective production phases was calculated using the standardized formula established by Bird (1955) [3].

Economic parameters

The economics of production were calculated based on local prevailing market rates. Total feed cost per bird was derived from cumulative individual feed intake. The cost of producing and provisioning fresh wheat grass was determined factoring in seeds and management inputs. Gross revenue was calculated based on the final live market weight of the birds, allowing for the determination of net profit margins over feed and forage expenses.

Statistical analysis

All experimental data were subjected to a one-way Analysis of Variance (ANOVA) using the methods described by Snedecor and Cochran (1994) [11]. Differences between treatment means were separated using the Critical

Difference (CD) test, with statistical significance established at a threshold of $P < 0.05$.

Results and Discussion

The empirical data demonstrating the effects of wheat grass supplementation on the performance metrics, biological efficiency, and economic parameters of guinea fowls are compiled in Tables 2 through 5.

Feed consumption

The cumulative feed consumption values over the 12-week experimental period were 3747.70 ± 0.29 g, 3652.35 ± 0.30 g, 3557.25 ± 0.15 g, and 3461.54 ± 0.29 g for groups T₁, T₂, T₃, and T₄, respectively (Table 2). Statistical analysis revealed that feed intake was significantly lower ($P < 0.05$) in all wheat grass-supplemented cohorts (T₂, T₃, and T₄) relative to the control group (T₁).

The lowest overall feed intake was recorded in the maximum-supplementation group (T₄). This reduction in dry matter intake from the basal ration highlights a significant, dose-dependent relationship driven by the high nutrient density and metabolic efficiency of the green forage. This finding aligns with Morgan (1992) [8], who observed substantial reductions in basal feed consumption when animals were fed diets supplemented with green wheat grass and related fresh forages.

Table 2: Effect of Wheat Grass Supplementation on Feed Intake (mean $\pm$ SE) of Guinea Fowls

Treatments	Starter Phase (g)			Grower Phase (g)			Finisher Phase (g)			Overall (g)
	1-2 Wks	3-4 Wks	1-4 Wks	5-6 Wks	7-8 Wks	5-8 Wks	9-10 Wks	11-12 Wks	9-12 Wks	1-12 Wks
T ₁	195.23a $\pm$ 1.43	462.48a $\pm$ 1.94	667.71a $\pm$ 3.37	449.63a $\pm$ 0.29	881.48a $\pm$ 0.16	1331.11a $\pm$ 0.45	984.04a $\pm$ 0.15	874.78a $\pm$ 2.89	1858.82a $\pm$ 2.34	3747.70a $\pm$ 0.29
T ₂	192.73b $\pm$ 0.44	454.46a $\pm$ 0.16	647.19b $\pm$ 0.61	439.53b $\pm$ 0.44	800.02b $\pm$ 0.45	1239.55b $\pm$ 0.89	952.12b $\pm$ 1.14	816.81b $\pm$ 0.28	1768.93b $\pm$ 1.43	3652.35b $\pm$ 0.30
T ₃	179.64d $\pm$ 0.33	440.93b $\pm$ 0.16	620.57c $\pm$ 0.19	443.67b $\pm$ 0.28	807.33b $\pm$ 0.28	1251.00b $\pm$ 0.57	866.40c $\pm$ 0.16	815.43bc $\pm$ 0.57	1681.83c $\pm$ 0.74	3557.25c $\pm$ 0.15
T ₄	182.94c $\pm$ 0.59	444.65b $\pm$ 0.15	627.59c $\pm$ 0.75	436.98b $\pm$ 0.33	751.02c $\pm$ 0.33	1188.00c $\pm$ 0.66	816.18d $\pm$ 0.17	800.40d $\pm$ 0.17	1616.58d $\pm$ 0.34	3461.54d $\pm$ 0.29

Means within columns bearing distinct superscript letters differ significantly ($P < 0.05$)

Body weight gain

The cumulative body weight gains recorded at week 12 were 1128.82 $\pm$ 0.15 g (T₁), 1207.97 $\pm$ 0.53 g (T₂), 1275.13 $\pm$ 0.52 g (T₃), and 1285.32 $\pm$ 0.11 g (T₄). The body weight gains of all wheat grass-supplemented birds were significantly higher ($P < 0.05$) than those in the control group. The T₄ group demonstrated the highest live body weight gains during the starter phase, finisher phase, and overall experimental period (Table 3).

These findings indicate that the rich mineral, protein, and enzyme profiles of *Triticum aestivum* stimulate protein synthesis and tissue accretion in guinea fowls. This response mirrors the findings of Erenner *et al.* (2011) [5], and Singh (2006) [10], who reported marked improvements in both feed consumption efficiency and final body weight gains in commercial broiler chicks administered green extracts and wheat grass juice relative to non-supplemented controls.

Table 3: Effect of Wheat Grass Supplementation on Body Weight Gain (mean $\pm$ SE) of Guinea Fowls

Treatments	Starter Phase (g)			Grower Phase (g)			Finisher Phase (g)			Overall (g)
	1-2 Wks	3-4 Wks	1-4 Wks	5-6 Wks	7-8 Wks	5-8 Wks	9-10 Wks	11-12 Wks	9-12 Wks	1-12 Wks
T ₁	109.29d $\pm$ 0.29	190.73d $\pm$ 0.14	300.02d $\pm$ 0.43	140.42d $\pm$ 0.17	232.21d $\pm$ 0.29	372.63d $\pm$ 0.44	249.96d $\pm$ 0.87	205.86d $\pm$ 0.16	455.82d $\pm$ 1.02	1128.82d $\pm$ 0.15
T ₂	119.17c $\pm$ 0.17	199.68c $\pm$ 0.12	318.85c $\pm$ 0.28	151.10c $\pm$ 0.29	234.43c $\pm$ 0.28	385.50c $\pm$ 0.57	267.86c $\pm$ 0.29	235.01c $\pm$ 0.58	502.87c $\pm$ 0.86	1207.97c $\pm$ 0.53
T ₃	127.36b $\pm$ 0.18	206.24b $\pm$ 0.29	333.60b $\pm$ 0.47	162.67b $\pm$ 0.17	258.21b $\pm$ 0.03	420.88a $\pm$ 0.21	281.36b $\pm$ 0.33	239.26b $\pm$ 0.51	520.62b $\pm$ 0.84	1275.13b $\pm$ 0.52
T ₄	136.25a $\pm$ 0.17	210.01a $\pm$ 0.27	346.35a $\pm$ 0.44	189.14a $\pm$ 0.02	200.21a $\pm$ 0.18	389.35b $\pm$ 0.20	287.64a $\pm$ 0.15	262.03a $\pm$ 0.17	549.67a $\pm$ 0.32	1285.32a $\pm$ 0.11

Means within columns bearing distinct superscript letters differ significantly ($P < 0.05$)

Feed conversion efficiency and performance index

The mean overall FCR values were 3.33 $\pm$ 0.01, 3.31 $\pm$ 0.00, 3.19 $\pm$ 0.01, and 3.14 $\pm$ 0.01 for the T₁, T₂, T₃, and T₄ treatment groups, respectively. Birds in groups T₃ and T₄ demonstrated significantly improved ($P < 0.05$) feed conversion efficiency compared to the control. The best (lowest) FCR was achieved by the T₄ group (3.14 $\pm$ 0.01). Similarly, the cumulative Performance Index (PI) values tracked in an identical manner, with values of 338.98 $\pm$ 0.05

(T₁), 364.94 $\pm$ 0.01 (T₂), 399.72 $\pm$ 0.01 (T₃), and 409.33 $\pm$ 0.05 (T₄). All wheat grass-supplemented cohorts displayed significantly ($P < 0.05$) optimized PI profiles, with maximum values observed in the T₄ group (Table 4). These significant improvements in FCR and PI across the starter, grower, and finisher phases show that the bioactive elements in fresh wheat grass improve gut health and nutrient absorption.

Table 4: Effect of Wheat Grass Supplementation on the Performance Index (mean $\pm$ SE) of Guinea Fowls

Treatments	Starter Phase			Grower Phase			Finisher Phase			Overall
	1-2 Wks	3-4 Wks	1-4 Wks	5-6 Wks	7-8 Wks	5-8 Wks	9-10 Wks	11-12 Wks	9-12 Wks	1-12 Wks
T ₁	61.39d $\pm$ 0.05	79.14c $\pm$ 0.11	143.55d $\pm$ 0.07	49.61c $\pm$ 0.03	64.14b $\pm$ 0.01	115.72c $\pm$ 0.02	63.44c $\pm$ 0.03	45.04c $\pm$ 0.05	107.25d $\pm$ 0.08	338.98d $\pm$ 0.05
T ₂	67.71c $\pm$ 0.01	83.20b $\pm$ 0.13	153.29c $\pm$ 0.02	53.96bc $\pm$ 0.60	65.11b $\pm$ 0.08	120.46bc $\pm$ 0.18	68.85b $\pm$ 0.08	53.16b $\pm$ 0.01	121.17c $\pm$ 0.04	364.94c $\pm$ 0.01
T ₃	78.13b $\pm$ 0.05	88.51a $\pm$ 0.02	168.48b $\pm$ 0.03	59.58b $\pm$ 0.04	82.49a $\pm$ 0.08	134.46a $\pm$ 0.02	77.29a $\pm$ 0.01	54.62b $\pm$ 0.02	129.83b $\pm$ 0.06	399.72b $\pm$ 0.01
T ₄	84.10a $\pm$ 0.02	91.30a $\pm$ 0.02	176.70a $\pm$ 0.14	70.31a $\pm$ 0.28	57.03c $\pm$ 0.28	125.59b $\pm$ 0.14	77.95a $\pm$ 0.08	63.44a $\pm$ 0.02	137.41a $\pm$ 0.04	409.33a $\pm$ 0.05

Means within columns bearing distinct superscript letters differ significantly ($P < 0.05$)

3.4 Economic Viability

Dietary incorporation of fresh wheat grass systematically reduced baseline feed costs in groups T₂, T₃, and T₄ due to reduced basal feed intake. Concurrently, the live sale value of the meat birds increased noticeably in groups T₃ and T₄ due to higher market weights (Table 5).

However, evaluating the comprehensive production costs specifically the combination of basal feed costs and wheat grass production expenses revealed that the highest net

profit margin was achieved by the control group (T₁: Rs. 52.75). This was followed by T₃ (Rs. 47.34), T₂ (Rs. 45.54), and T₄ (Rs. 43.22). The lower net profit in the supplemented groups is directly due to the added agronomic and management costs of cultivating fresh wheat grass. Despite these differences in margins, positive economic returns were achieved across all experimental groups, confirming that wheat grass supplementation remains a financially viable approach.

Table 5: Economic Analytics of Wheat Grass Supplementation in Guinea Fowls

Economic Parameters	T ₁	T ₂	T ₃	T ₄
Wheat grass level/bird (Cumulative trial)	0.00 g	472.50 g	945.00 g	1417.50 g
Feed cost (Rs.)	76.28	74.33	72.38	70.47
Wheat grass production cost (Rs.)	0.00	6.96	14.16	21.26
Total Feeding Cost (Feed + Wheat grass) (Rs.)	76.28	81.29	86.54	91.73
Sale price of individual bird (Rs.)	129.03	126.83	133.88	134.95
Net Profit over Feed and Forage Cost (Rs.)	52.75	45.54	47.34	43.22

Conclusion

The findings of this study demonstrate that dietary wheat grass supplementation significantly improves the growth performance, feed conversion efficiency, and performance index of guinea fowls across all growth phases. The highest biological efficiency and maximum body weight gains were achieved by supplementing up to 7.5 g of wheat grass (T₄). From an economic perspective, while wheat grass supplementation effectively lowers commercial basal feed costs and enhances final bird market values, the additional production costs of the forage reduce overall net profit margins relative to the control group. Nonetheless, all treatments generated solid positive net returns. Wheat grass can therefore be recommended as a highly effective, natural nutritional supplement to maximize growth and biological efficiency in commercial guinea fowl production.

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