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Study on the Effect and Importance of Nutritional Supplements on Productivity Enhancement in Poultry

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Abstract

This study aimed to evaluate the effect of various nutritional supplements on the productive performance and carcass characteristics of broiler chickens, as well as their impact on poultry health and productivity. The focus was on amino acids, vitamins, and minerals.

Arandomized controlled trial (RCT) was conducted to compare the effects of dietary supplements against a control group. The experiment lasted 40 days, starting from day one to day 40, and was carried out at Al-Abbasia Field (Private Sector) under controlled environmental conditions compliant with standard poultry farming climate criteria.
Control Group (n=20): Fed a basal diet with no additives.
Experimental Group (n=20): Fed a basal diet supplemented with a blend of probiotics + selenium + vitamins + enzymes + amino acids.

The experimental group showed a significant increase ($p < 0.05$) in:
Final body weight (2850g vs. 2450g).
Daily growth rate (71.25g/day vs. 61.25g/day).

Additionally, the feed conversion ratio (FCR) improved in the supplemented group (1.65 vs. 1.85), indicating higher feed efficiency. Incorporate nutritional supplements (probiotics, enzymes, amino acids) into broiler diets to enhance growth and feed efficiency. Monitor FCR to evaluate feed utilization and adjust dietary formulations as needed.Optimize environmental conditions (temperature, humidity, ventilation) to maximize supplement efficacy.

Keywords: Nutritional supplements, Productivity enhancement, Poultry nutrition .

I. Introduction

Livestock production, including poultry, plays a vital role in contributing to the net domestic agricultural output. It serves as a primary source of protein, meeting the growing global demand driven by population growth—particularly in developing countries—where improved living standards and awareness of nutritional value have increased consumption.

In recent years, most countries have intensified efforts to develop poultry production (meat and eggs) as a high-quality animal protein source. Poultry products also supply raw materials for various industries and serve as a key economic activity by generating employment and optimizing land use. They convert crop byproducts unsuitable for human consumption into nutritionally valuable meat and eggs.

Poultry production is a critical agricultural sector that supports national economies. In Iraq, however, a significant gap exists between domestic production and rising demand, widening notably since the 1970s. This has led to heavy reliance on imports to balance supply and demand—a costly burden given escalating meat and egg prices.

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Dependence on imports, controlled by technologically advanced nations, underscores the urgency of **self-sufficiency** in poultry production. Strengthening this sector through local resources can enhance **economic and political independence**, ensure **food security**, and conserve foreign currency for further development.

II. Materials and Methods

Experimental Study

Study Design: A randomized controlled trial (RCT) comparing the effects of dietary supplements against a control group.

Duration: 40 days (from day 1 to day 40).

Location: Conducted at Al-Abbasia Field (Private Sector) under controlled environmental conditions compliant with standard poultry farming climate guidelines (Date: 1/1/2025).

2-2 Group Allocation

Animals: 40 unvaccinated, healthy Cobb 500 broiler chicks sourced from a certified hatchery.

Randomization:

Control Group (n=20): Fed a basal diet with no additives.

Experimental Group (n=20): Fed a basal diet + supplement blend (probiotics + selenium + vitamins + enzymes + amino acids).

Exclusion Criteria: Chicks showing pre-trial signs of disease were excluded.

Environmental Conditions

Housing: Sterilized plastic cages (10 birds/m²) with intermittent lighting (23L:1D).

Ventilation: Controlled system maintaining ammonia <10 ppm.

Temperature:

Week 1: 32°C

Gradual reduction to 24°C by day 40.

Vaccination: Standard program for Newcastle & Gumboro diseases (farm protocol).

Dietary Supplements

Supplement Composition:

Probiotic: *Lactobacillus acidophilus* (1×10^9 CFU/kg feed; Sigma-Aldrich, Cat# L1293).

Organic Selenium: 0.3 mg/kg feed (DSM Nutritional Products).

Vitamin E: 50 IU/kg feed.

Mixing: Homogeneously blended into feed using an industrial mixer.

Feeding Protocol

Basal Diet:

Composition: Corn (60%), soybean meal (30%), vitamin/mineral premix (10%).

Pellet size: 3 mm diameter; 22% crude protein, 3000 kcal/kg ME.

Feeding System:

Ad libitum access to feed and water.

Daily feed intake recorded per group for FCR calculation.

Measured Parameters

Growth Performance:

Body weight (BW): Weekly measurements (digital scale ±1g).

Average daily gain (ADG):

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$$\frac{\text{Final BW} - \text{Initial BW}}{\text{Experimental days}} = \text{ADG}$$

$$\text{Feed conversion ratio (FCR):}$$

$$\frac{\text{Total feed intake}}{\text{Weight gain}} = FCR$$

$$\frac{Weight gain}{Total feed intake}$$

B. Physiological Parameters:
Blood samples: 2 mL from wing vein (day 40; local anesthesia).
Hemoglobin (Hemocue®).
Total cholesterol & liver enzymes (AST, ALT) (spectrophotometry).

C. Health Status:
Mortality rate: Daily recording with cause analysis.
Clinical signs: Diarrhea, lethargy, feather abnormalities.

Statistical Analysis
Software: SPSS v28.
Tests:
One-way ANOVA for group comparisons.
Tukey's test for significant differences ($p < 0.05$).
Data presentation: Mean ± standard deviation.

III. Results and Discussion

Data were analyzed using **SPSS v28**, applying:
T-test for two-group comparisons.
One-way ANOVA for multi-group comparisons.
Significance was set at $\alpha \leq 0.05$.

Table 1: Growth and Productivity Performance of Broiler Chickens

Parameter	Control Group (n=20)	Experimental Group (n=20)	Difference (%)	p-value
Final weight (g)	2450 ± 75	2850 ± 90	+16.3%	<0.05
Average daily gain (g/day)	61.25 ± 2.3	71.25 ± 3.1	+16.3%	<0.01
Feed conversion ratio (FCR)	1.85 ± 0.15	1.65 ± 0.10	-10.8%	<0.05
Total feed intake (kg)	4.53 ± 0.25	4.47 ± 0.20	-1.3%	>0.05 (NS)
Mortality rate (%)	5%	2%	-60%	<0.05

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Table 2: Physiological and Hematological Parameters

Parameter	Control Group	Experimental Group	Difference (%)	p-value
Liver weight (% of total weight)	2.5 ± 0.3	2.8 ± 0.2	**+12%**	**<0.05**
Amylase activity (U/mL)	120 ± 10	150 ± 12	**+25%**	**<0.01**
Hemoglobin (g/dL)	9.5 ± 0.8	11.2 ± 1.0	**+17.9%**	**<0.05**
Total cholesterol (mg/dL)	140 ± 10	120 ± 8	**-14.3%**	**<0.01**
White blood cells ($\times 10^3/mm^3$)	18.5 ± 1.5	22.0 ± 2.0	**+18.9%**	**<0.05**

Discussion of Results (Table 1)

The experimental group showed significant improvements ($p < 0.05$) in all growth metrics compared to controls:
Final weight increased by 400g (16.3%), aligning with Al-Alawi (2020), who reported that probiotics enhance growth rates by 12–15% in broilers.
FCR improved from 1.85 to 1.65 (−10.8%), indicating higher feed efficiency. This supports Al-Zahrani (2019), where organic selenium boosted FCR by 8–10%.
The non-significant difference in feed intake ($p = 0.15$) suggests that FCR improvements stem from enhanced digestibility and absorption, not reduced consumption, consistent with Al-Qahtani (2021).

Discussion of Results (Table 2)

Physiological and Hematological Parameters Hemoglobin rose from 9.5 to 11.2 g/dL (+17.9%), likely due to vitamin E's role in erythrocyte production (*Al-Saadi, 2018*). Total cholesterol decreased by 14.3% (120 vs. 140 mg/dL), corroborating Al-Harbi (2020), who found organic selenium reduces cholesterol by 15–20%.
No significant change in ALT ($p = 0.08$) indicates no liver toxicity, matching Al-Ghamdi (2021) on the safety of the tested supplements. Probiotics The results highlight the role of probiotics in enhancing growth performance, as demonstrated in Mohamed's (2019) study, which reported a 10% increase in body weight following the administration of Lactobacillus strains (Mohamed Hassan 2019) ، However, these findings contrast with Samir's (Samir, Nasser 2021) study, which observed no significant improvement, potentially due to differences in poultry breeds .
Enzymes Evidence supports the efficacy of enzymes (e.g., phytase) in breaking down phytate, thereby improving phosphorus absorption—a finding consistent with Al-Abdullah's (Al-Abdullah, Reda ،2017) research ،Discrepancies in poultry responses to supplements may stem from factors such as Basal diet composition Variability in feed protein content (influenced by temperature and storage conditions) (Gamal, Leila ،2015). Optimal dosage: Certain supplements (e.g., selenium) require precise dosing to avoid toxicity (Kamel, Amr ،2018).

Study limitations: The small sample size (40 chickens) may restrict the generalizability of findings (Murad, Ali ،2020) ، Future recommendations Investigate supplement efficacy under heat stress or infectious disease conditions (Noor, Suha ،2019) .

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IV. Conclusions

Based on the results obtained from this study evaluating the effects of dietary supplements (probiotics, amino acids, enzymes, and vitamins) in broiler chicken diets over 40 days, the following conclusions can be drawn:
Improved Growth and Productivity Performance
The experimental group showed significant ($p < 0.05$) increases in:
Final body weight (2850g vs 2450g)
Daily weight gain (71.25g/day vs 61.25g/day)
Improved feed conversion ratio (1.65 vs 1.85) indicating enhanced feed efficiency
60% reduction in mortality rate (2% vs 5%), demonstrating improved health status and stress resistance
Enhanced Physiological Parameters
Significant increase in liver weight (2.8% vs 2.5%), suggesting improved lipid and protein metabolism
Elevated amylase activity (150 U/mL vs 120 U/mL), indicating better carbohydrate digestion and absorption
Improved Hematological Indices
Increased hemoglobin levels (11.2 g/dL vs 9.5 g/dL), reflecting better oxygen transport capacity
Reduced total cholesterol (120 mg/dL vs 140 mg/dL), suggesting improved lipid metabolism
Higher white blood cell count ($22 \times 10^3/mm^3$ vs $18.5 \times 10^3/mm^3$), indicating enhanced immunity

General Conclusion

The dietary supplement blend improved production performance, enhanced physiological health, and boosted immune efficiency, making it an effective option for improving poultry farming quality.

Recommendations

Based on study findings, the following recommendations are proposed:
Practical Recommendations for Farmers
Incorporate nutritional supplements (probiotics, enzymes, amino acids) in broiler diets to improve growth and feed efficiency
Monitor FCR to evaluate feed utilization and adjust dietary formulations as needed
Optimize environmental conditions (temperature, humidity, ventilation) to maximize supplement efficacy
Future Research Directions
Investigate effects of different supplement types (e.g., prebiotics, essential oils) on broiler performance
Conduct cost-benefit analysis of supplement use versus production benefits
Perform longer-term studies to evaluate cumulative effects of supplements
Policy Recommendations
Promote safe supplement use in poultry farms through financial or technical support programs
Establish quality standards for poultry feed supplements to ensure efficacy and safety

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