

EFFECT OF ENVIRONMENTAL ENRICHMENT ON THE GROWTH PERFORMANCE, CARCASS AND INTERNAL ORGAN WEIGHT OF BROILER CHICKENS

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ABSTRACT

An experiment was carried out to determine the effects of environmental enrichment on the performance, carcass characteristics and internal organ weight of broiler chickens for 7 weeks. A total of 72 unsexed Cobb 72 broiler chicks of mean weight 42.50 ± 0.50 g were used for the study. The chicks were sourced from a commercial hatchery and randomly assigned to four experimental pens, each with a floor space of 3 m², maintaining a stocking density of six birds per square meter. Each treatment group was replicated three times, with six birds per replicate and 18 birds per treatment group. T1 was control without any enrichment material. T2 consisted of Perching substrates (Water leaf), coloured balls were used as T3 and Perches (plastic crates) were used for T4. A 0.4m layer of wood shavings was provided as bedding material on the pen floors. At the time of chick placement, the average air humidity was 61.8%, and the ambient temperature was maintained at 34°C. The data obtained was subjected to one-way Analysis of Variance in a completely Randomized Design, using the statistical package for social science version 21. Significant means were separated using Duncan's New Multiple Range Test. There were no significant differences ($P > 0.05$) on the growth performance parameters, carcass quality and internal organ weights of the broiler chickens. Based on the findings of this study, it is recommended that environmental enrichment materials such as perching substrates, coloured balls, and perches (plastic crates) can be explored as potential methods to enhance the welfare of broiler chickens.

Keywords: Environmental enrichment, Growth performance, Carcass traits, Internal organ weight, Broiler chickens

INTRODUCTION

The natural habitat of chickens is marked by unique environmental features that support their instinctive behaviours and physiological needs. These include a dusty environment suitable for dust bathing, scattered feed that promotes foraging, and natural grasslands that provide opportunities for perching and accessing natural sources of vitamins. Such environments encourage chickens to engage in their innate behaviours like wing flapping, spatial distribution, scratching, feather pecking, exploring, locomotion, and floor pecking/scratching, which are vital for their growth, physical and psychological well-being (Almeida Paz *et al.*, 2017; Riber *et al.*, 2018). Environmental enrichment in poultry production has garnered significant interest as an innovative step to improving the welfare and productivity of broiler chickens (Riber *et al.*, 2018). This concept involves modifying the birds' living conditions to provide mental stimulation and encourage their natural behaviours (Estevez *et al.*, 2021).

In contrast, modern broiler production often confines chickens to environments that lack these enriching elements. Conventional housing systems prioritize efficiency, typically limiting the birds' ability to exhibit natural behaviours, which could impact their performance, carcass quality, health, and overall welfare (Son *et al.*, 2022). As a result, there is growing interest in understanding the role of environmental enrichment in broiler production systems. This research aims to evaluate the impact of environmental enrichment on broiler chickens, focusing on key performance indicators such as growth rate, carcass traits and internal organ weights.

MATERIALS AND METHODS

Experimental Site

The research was conducted at the Poultry Unit of Teaching and Research Farm in the Annex campus, Uyo, Akwa Ibom State, Nigeria. Uyo is located within Nigeria's tropical rainforest zone. The average yearly rainfall in this area is between 2200 and 3500 mm. Uyo is located between latitude 4°31' and 6°30' north and longitude 7°30 and 8°20 east of the equator. The area's temperature ranges from 26°C to 28°C. The average height above sea level is 38.1 meters. There are 1400–1500 hours of sunshine and 71%–80% relative humidity on a yearly basis (University of Uyo Meteorological Station, 2014).

Experimental Design and Birds Management

This study utilized 72 unsexed 1-day-old Ross 308 broiler chicks with a mean weight of 42.50 ± 0.50 g housed in a well-ventilated deep litter system. Birds were Arranged in a Completely Randomized Design with four treatments and three replicates per treatment; each replicate contained six chicks. Treatment 1 birds received commercial feed and water without enrichment. Treatment 2 had waterleaf suspended as a pecking substrate, while Treatment 3 included colourful balls distributed on the pen floor. Treatment 4 introduced elevated perforated plastic crates. Each pen, measuring 3 m² with wood shavings bedding, housed six birds per square meter. Pens were fumigated, cleaned, and prepared before the chicks' arrival. Glucose and vitamins were added to drinking water, and vaccination and medication protocols were strictly followed.

Experimental Diets

The chickens were fed *ad libitum* with commercial broiler starter - Chikun feed (21.7% CP and 3.060 kcal of ME per kg) from 1 to 25 days and a finisher diet (17.6% CP and 3.212 kcal of ME per kg) from 26 to 49 days and had free access to clean water. Nutrients and energy concentrations of diets met or exceeded the NRC minimum nutrient recommendations NRC (1994).

Data Collection

Growth Performance

The initial body weights of the chicks were taken on day 1 using a 5kg sensitive scale and subsequently weighed weekly as detailed by Scott *et al.* (1969). The weight of the chickens was also taken at the end of the experiment using a 20 kg scale to determine the final weight. Data on feed consumption were recorded daily from the second to seventh week of the rearing cycle on a pen basis. Feed intake (g) was calculated as the difference between the weight of the feed offered in the morning and the weight of the remaining feed the following morning. The feed conversion ratio was calculated as the ratio of daily feed intake to the ratio of daily weight gain.

Organ weight and carcass characteristics

At the end of the feeding trial, 12 chickens (three chickens randomly selected from each treatment group) were sampled for carcass evaluation. The broiler chickens were fasted for 12 hours, individually weighed, and humanely slaughtered by severing the jugular vein with a sharp knife for proper bleeding. The feathers were manually removed after immersing in warm water at a temperature of 60 °C for 30 seconds. The internal organs: heart, liver, pancreas, lungs, gizzard and proventriculus were excised and weighed using a 5 kg electronic weighing balance. These were calculated as a percentage of the pre-slaughter live body weight. The detailed procedure for carcass processing by Ndelekwute *et al.* (2014) was strictly followed.

Data Analysis

The data were subjected to one-way Analysis of Variance (ANOVA) in a completely Randomized Design using the statistical package for Social Science version 21. Significant means will be separated using Duncans New Multiple Range Test according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The result of the growth performance of broiler chicken as affected by environmental enrichment is presented in Table 1. These results revealed that environmental enrichment did not have any significant effect ($p > 0.05$) on growth parameters in broiler chickens across the treatment groups in the experiment.

Table 1: Effect of Environmental Enrichment on Growth Performance of Broiler Chickens

Parameter	T1	T2	T3	T4	SEM
Initial weight (g)	42.50	42.50	42.50	42.50	0.16
Final weight (g)	2438.10	2198.43	2241.93	2283.30	101.89
Weight Change (g)	2395.60	2155.93	2199.43	2240.80	101.85
Daily Wt Change (g)	48.89	43.99	44.88	45.73	2.08
Growth rate (g)	4888.98	4399.86	4488.64	4573.06	207.93
Feed Intake (g)	36246.67	36196.67	36253.33	36500.00	358.04
Daily Feed Intake (g)	123.29	123.12	123.31	124.15	1.22
Feed Conversion Ratio	2.53	2.81	2.75	2.73	0.13
Feed Efficiency	0.39	0.36	0.36	0.37	0.02
Mortality(%)	0.00	0.33	0.00	0.67	0.24

A higher value for final weight was observed in T1 with 2438.10 g. The present result differs from the report of Jordan *et al.* (2011), who found that the final body weight was 13% lower in broilers with the feed scattered in the bedding once compared with the conventional feeding system. This result agrees with the findings of Elsayed *et al.* (2024), who found that body weight did not differ ($P > 0.05$) between the control and treatment groups at 7, 21, and 35 days of age. Jacob *et al.* 2019 reported that environmental enrichment affected body weight. The results obtained for Daily feed intake agree with the reports of Elsayed *et al.* (2024), who reported that there was no significant difference in daily average feed consumption throughout the rearing period between any of the enrichment and control groups. These results also collaborate with the findings of Bizeray *et al.* (2022) and Nazareno *et al.* (2022), who stated that the application of environmental enrichment did not reduce production but improved bird welfare.

The effect of environmental enrichment on carcass characteristics in broiler chickens is presented in Table 2. The results on the table revealed that environment enrichment did not have a significant effect ($p > 0.05$) on the carcass and organ weight in the broiler chickens studied. A higher value for live weight was recorded for T3 (2383g), and the highest value was obtained for dressed weight in T2, with gizzard recording a higher value of 2.68 across the treatment groups. The present result on internal organs is consistent with the findings of Elsayed *et al.* (2024).

Table 2: Effect of Environmental Enrichment of Carcass and Organ Weights of broiler chicken

Parameters	T1	T2	T3	T4	SEM
Live Weight (g)	2316.67	2116.67	2383.33	2355.27	123.56
Dressed weight (g)	1706.67	1620.00	1636.67	1432.36	142.36
Dressing %	73.72	76.43	74.96	76.34	1.32
Head (g)	4.18	4.97	4.61	3.10	0.52
Neck (g)	3.52	2.87	3.10	0.99	0.19
Breast (g)	7.26	11.06	13.63	6.13	1.55
Thigh (g)	29.91	22.10	30.25	16.31	2.36
Drumstick (g)	14.25	14.56	13.63	8.59	2.32
Back Cut (g)	16.91	16.31	22.34	12.95	1.85
Wing Cut (g)	4.47	2.36	5.32	3.32	0.89
Shank (g)	5.27	5.04	2.98	2.98	0.48
Organs					
Gizzard (g)	2.35	2.68	2.48	2.32	0.15
Liver (g)	2.57	2.31	1.98	1.69	0.56
Heart (g)	0.57	0.57	0.56	0.56	0.16

CONCLUSION

From the findings of this study, environmental enrichment does not have significant effect on growth performance, carcass characteristics and organ weights in broiler chickens.

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