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GROWTH PERFORMANCE AND MEAT QUALITY OF BROILER CHICKENS RAISED UNDER DIFFERENT MANAGEMENT SYSTEMS

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Abstract

This study investigated the influence of three rearing systems—battery cage, deep litter, and semi-intensive—on the growth performance and meat quality of broiler chickens. A total of 90 broilers were randomly allocated into three treatments: Battery Cage Broilers (BC-B), Deep Litter Broilers (DL-B), and Semi-Intensive Broilers (SE-B), each replicated three times with ten birds per replicate. Growth performance parameters measured included initial and final body weight, weight gain, average daily and weekly weight gain, feed intake, feed conversion ratio (FCR), and feed efficiency (FE). Feed and water were provided *ad libitum*, and feed intake was measured using a weighing scale. At the conclusion of the trial, breast meat samples were analyzed for proximate composition (moisture, crude protein, ether extract, ash, and crude fibre). Results showed that broilers in battery cage and deep litter systems achieved significantly higher ($p<0.05$) final body weight, feed intake, and growth rates compared with semi-intensive broilers. Battery cage broilers recorded the most efficient FCR and FE ($p<0.05$). Proximate analysis revealed that semi-intensive broilers (meat) had significantly higher crude protein and fibre content ($p<0.05$), while battery cage broilers (breast meat) exhibited the highest moisture and fat levels. Ash (mineral) content was highest in semi-intensive birds ($p<0.05$). These findings demonstrate that rearing system significantly affects broiler productivity and meat quality, with intensive systems maximizing yield, while semi-intensive systems enhance protein and mineral content.

Keywords: Broiler chicken, growth performance, management system, meat quality, proximate composition

Description of Problem

The increasing demand for poultry meat in Nigeria is driven by its affordability, accessibility, and high-quality protein content. As consumer preferences shift towards more nutritious and health-conscious meat options, emphasis is now being placed not only on rapid growth and productivity, but also on the nutritional composition and quality of poultry meat [1]. Among commercial poultry breeds, broiler chickens are widely favored for their rapid growth rate, superior feed conversion, and high carcass yield, making them the primary choice for intensive poultry production systems [2, 3].

However, the influence of rearing system on both growth performance and meat quality has gained renewed attention [4], especially with growing interest in sustainable and health-friendly poultry production. Management systems such as battery cage, deep litter, and semi-intensive offer varying degrees of confinement and environmental exposure, which affect energy use, feed utilization, and muscle development in broilers [5, 6].

Previous studies have shown that intensive housing systems, particularly battery cages, enhance growth rate and feed efficiency due to controlled feeding and minimal activity [7], whereas systems with more freedom of movement may impact carcass and meat characteristics through changes in muscle structure and metabolism [5]. These effects extend to meat quality parameters, including moisture, fat, protein, and mineral content, which are influenced by activity level, diet exposure, exposure to pasture and insects, and stress response during rearing [8].

This study, therefore, aims to evaluate the growth performance and meat quality of broiler chickens

raised under three different management systems: battery cage, deep litter, and semi-intensive systems, with the goal of providing recommendations backed by research, for optimizing production efficiency and meat nutritional value in line with market demands.

Materials and Methods

A total of Ninety 90 broiler birds were used in a completely randomized design across three treatments and three replicates per treatment. The treatments were: Battery cage broilers (BC-B), deep litter broilers (DL-B) and semi-intensive broilers (SE-B), with 30 birds per treatment which were replicated thrice across the management systems with 10 birds per replicate. Birds were raised for 10 weeks under standard management practices, feed and water was provided *ad libitum*, while birds on semi-intensive have access to forage. The experiment was conducted at the Teaching and Research Farm, Poultry unit, College of Agriculture, Engineering and Science, Bowen University, Iwo, Osun State.

The body weight of the birds was taken upon arrival, and subsequently, on a weekly basis using a digital weighing scale. Feed served and feed remnant was also recorded daily. A branded commercial feed was used throughout the experimental period. The feed nutrient composition of the branded commercial feed for starter and finisher feed is provided in table 1. Parameters measured include body weight, weight gain, feed intake, feed conversion ratio (FCR), dressing percentage, feed efficiency and meat qualities/proximate analysis including Moisture content, crude fibre, ash (minerals), ether extract, and protein.

Statistical Analysis: Data collected was subjected to, and analyzed using Anova (Analysis of Variance) using the general linear model. Differences between means were separated using Duncan's Multiple Range Test (DMRT) at 5% probability ($p<0.05$) level of significance using Statistical Package for the Social Sciences (SPSS) software.

Results and Discussion

Table 1 shows the nutrient composition of feeds, while Table 2 presents growth performance of meat raised under battery cage, deep litter, and semi-intensive systems. Meat raised in battery cage and deep litter systems achieved significantly higher ($p<0.05$) body weight (2.52 kg & 2.49 kg respectively), weight gain (0.45kg), and highest daily weight gain among the battery cage meat (65g) than semi-intensive final body weight (1.87 kg) [9]. Although differences among groups were not statistically significant ($p>0.05$), the trend supports that intensive systems reduce energy expenditure and enhance growth [5]. Feed intake followed a similar pattern, with higher consumption in confined systems. However, no significant differences ($p>0.05$) were observed across treatments, suggesting feed availability was sufficient, and despite varied weight gains, proportional growth remained stable across rearing systems [10,11].

In terms of efficiency, feed conversion ratio (FCR) was significantly better **(**$p<0.05$**)** in battery cage and deep litter systems, indicating more efficient nutrient utilization. Semi-intensive meat recorded the highest FCR, reflecting lower efficiency likely due to increased physical activity and foraging behavior [11]. This confirms earlier findings that energy expenditure in free-range birds can compromise feed efficiency [12]. Feed efficiency (FE) followed an inverse pattern to FCR. Broilers (meat) raised in battery cage and deep litter systems showed significantly higher FE ($p<0.05$) than those raised semi-intensively, meaning they converted feed into body mass more effectively. The differences between battery cage and deep litter were not significant, reinforcing their suitability for fast and efficient broiler production [8].

In table 3, the proximate composition of broiler breast meat rose under battery cage, deep litter, and semi-intensive systems were presented. The proximate composition of broiler breast meat differed significantly ($p<0.05$) across rearing systems. Battery cage meat had the highest moisture (71.7%) and fat (3.3%) but lowest protein ($p<0.05$), reflecting inactivity-induced fat deposition [4]. Semi-intensive meat showed lowest moisture (69.1%) and fat (2.4%) but

highest protein (22.1%) and crude fibre (0.2%), likely due to increased mobility, foraging, and fibrous diet intake [5, 8, 11]. Bird on deep litter had intermediate values. Higher activity in outdoor systems promotes leaner muscle with denser fibres, greater protein content, and reduced water retention [8], while confined systems favour fat accumulation. These findings highlight the nutritional benefits of mobility and natural feeding in broiler production [4]. In table 3, Ash content, representing mineral concentration, was significantly higher in semi-intensive and deep litter systems than in battery cage birds ($p<0.05$). This may be due to exposure to varied mineral sources like soil and insects from the outdoor environment [13].

Table 1: Nutrient composition of experimental diet

Nutrient Parameter	Starter Feed	Finisher Feed
Crude Protein (%)	20.50	19.00
Crude Fat (%)	5.00	5.50
Crude Fibre (%)	5.00	5.00
Calcium (%)	0.90	0.80
Available Phosphorus (%)	0.40	0.38
Metabolizable Energy (Kcal)	3100	3150
Lysine (%)	1.15	1.05
Methionine (%)	0.52	0.46

Table 2: Rearing System on Growth Performance of Broiler Chickens

PARAMETERS	Battery Cage	Deep Litter	Semi-intensive
Body Weight (kg)	2.52 ± 0.13^{a}	2.49 ± 0.90^{a}	1.87 ± 0.51^{a}
Body Weight Gain (kg)	0.45 ± 0.22^{b}	0.45 ± 0.22^{b}	0.27 ± 0.07^{a}
Average Daily Weight Gain (g)	65.0 ± 30.88^{b}	64.4 ± 31.36^{b}	38.3 ± 9.92^{a}
Growth Rate (%)	27.3 ± 17.89^{a}	28.2 ± 20.32^{a}	17.8 ± 6.24^{a}
Average Feed Intake (kg)	1.47 ± 0.32^{a}	1.48 ± 0.31^{a}	1.37 ± 0.35^{a}
Average Daily Feed Intake (kg)	0.21 ± 0.05^{a}	0.21 ± 0.04^{a}	0.19 ± 0.05^{a}
FCR	3.7 ± 1.74^{a}	3.9 ± 1.69^{a}	5.4 ± 1.20^{b}
FE	0.3 ± 0.15^{b}	0.3 ± 0.16^{b}	0.2 ± 0.06^{a}

^{abc} means along the same row with different superscripts are significantly different ($p<0.05$)

Table 3: Effect of Rearing System on Proximate Composition of Broilers meat

PARAMETERS (%)	Battery Cage	Deep Litter	Semi-intensive
Moisture	71.7 ± 0.21^{c}	70.9 ± 0.07^{b}	69.1 ± 0.13^{a}
Crude fibre	0.1 ± 0.01^{a}	0.2 ± 0.00^{b}	0.2 ± 0.01^{c}
Ash	0.9 ± 0.01^{a}	1.1 ± 0.01^{b}	1.2 ± 0.01^{c}
Ether extract	3.3 ± 0.23^{b}	2.7 ± 0.22^{ab}	2.4 ± 0.17^{a}
Protein	19.2 ± 0.42^{a}	21.4 ± 1.04^{b}	22.1 ± 0.31^{b}

^{abc} means along the same row with different superscripts are significantly different ($p<0.05$

Conclusion and Application

This study confirms that rearing systems affect broiler growth performance and meat quality. Intensive systems, such as battery cage and deep litter, promote higher carcass yield (2.5 kg & 2.49 kg), efficient feed conversion (3.7 & 3.9), carcass fat (3.3% & 2.7%) and water retention (71.7% & 70.9%) due to limited activity. Conversely, semi-intensive systems enhance crude protein (22.1%), fibre (0.2), and mineral (ash) content (1.2%), producing nutritionally superior meat. These findings highlight that housing conditions

influence both productivity and nutrient composition, aligning with earlier reports. Therefore, system selection should depend on production goals: deep litter or cage systems for rapid market weight and efficiency, while semi-intensive systems suit sustainable practices and improved nutritional quality.

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