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Comparison of Broiler Chicken Performance on Different Phase Feeding Programs

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Abstract:
Literature reveals that different feeding regimes affect performance of broiler chickens. A study was conducted to investigate the effects of different phase feeding programs on performance of Cobb broiler chickens (n = 90) using commercial broiler diet fed ad libitum under similar conditions for 36 days under a positivist research design. Treatment 1 (T1), was the control group under two phase compared to three (T2) and four phase (T3) feeding programs. Treatments were replicated three times. Growth rates, carcass weight and feed conversion ratio were measured. Results of the study showed that broiler chickens under T1 were significantly lighter ($p<0.05$) at 1789g than T3 (1871g) at day 36. Carcass weights and weights of internal organs were significantly different amongst the feeding phases, with superior weights noted on T3 feeding program. Broilers on T3 had significantly ($p<0.01$) heavier feet weights than those on T1 and T2. T2 had the least feed conversion ratio of 1.34 compared to T2 (1.32) and T3 (1.28). We recommended that small scale broiler farmers should adopt four phase feeding program to achieve superior growth rates, carcass weight and higher feed conversion ratios.

Keywords: *broiler production, carcass weight, phase feeding*

1. Introduction

Successful production of high quality broiler chickens depends on effective integration of housing, feeding, watering, disease control, slaughtering and processing operations. Feed plays a critical role through the provision of carbohydrates, minerals, proteins and vitamins of good quality and right amount at every growth stage. According to Jongbloed and Lenis (1992), dietary manipulation provides the opportunity to influence broiler production. Some producers tend to oversupply nutrients such as protein and lysine to chickens by feeding a single or two diets throughout the growing and finishing period. Protein oversupply results in increased loss of nutrients through excretion and it reduces feed efficiency (Herkelman, 2014). Therefore, accurate estimates of nutritional requirements are essential to optimize dietary nutrient balance and to minimize emissions hoping that efficiency in animal production can be achieved through phase feeding programs.

Phase feeding is a nutritional management strategy in which the ingredient and chemical composition of the diet is modified over time, so that the diet more closely meets the nutrient requirements of an animal (Salatin, 2001). The program is important in terms of diet optimization, production efficiency and environmental control. However, in poultry production one can use two, three or four-stage feeding program, changing the feed as chicks mature. Broiler chicken diets are formulated to provide the energy and other nutrients essential for health and efficient production (Ross, 2009).

Broiler chicken requirements for proteins and amino acids change over time, so a constant use of one diet for a long time would result in a surplus or deficiency of nutrients in most of the growth period (Tolimir, Peric, Milosevic and Bogdanovic, 2010). Belyavin (1999) suggests that broiler chickens, during that period of growth should be given different diets. Their diet should be based on multi-phase feeding program, which is important in terms of diet optimization, production efficiency and environmental control. Multi-phase feeding meets nutrient requirements of broiler chickens at specific points of their life cycle, through optimizing diets such as matching mash feed ingredients with nutrient requirements of broilers in certain stages of growth. Ferket *et al.*(2002) pointed out that feeding requirements are like "moving targets", having in mind considerable genetic variations in characteristics of growth, especially when it comes to protein retention.

Eits (2004) and Saharei (2013) noted that proteins are important nutrients of broiler diets, because they affect production performances, feed costs and nitrogen excretion and the quality of carcass. Mash feeds with reduced protein content do not affect body weight only, but also affect fattening efficiency (Warren and Emmert, 2000). According to Aviagen Poultry Site (2007), feed costs

per bird can be reduced with the diet lower in balanced protein. Increasing nutrient levels decreases feed costs but can also decrease profit margin. The diet of lower nutrient density is less cost effective when expressed per kg live weight. Modern poultry producers feed broiler chickens using two, three or four phase programs, hence there is need to study the efficiency of different phase feeding phases.

1.1. Statement of the Problem

Two phase feeding program for broiler chicken practiced by small scale farmers is not efficient and the farmers remain poor due to low production levels impacting negatively on viability (Manyonga-Matingo, 2013). The changes in technology, both in the poultry genetics and feeding strategies ensure efficient broiler production. Large scale commercial poultry producers such as Irvine's Zimbabwe and their contract growers are dynamic in their feeding programs and have since moved from two to three and four phase feeding programs (Mpofu, 2012) and it is proving to be efficient as compared to the traditional two phase feeding program being practiced by small scale poultry producers.

Proper management practices including phase feeding, will improve on the growth rate of broiler chickens. Broiler chickens have a potential of reaching 2kg within 36 days (5 weeks) and this can lead to quick turn over and less costs of production. The objective of the study was to evaluate the economic benefits and effectiveness of different phase feeding programs compared to the traditional two phase feeding programme through measuring the growth rate, feed conversion ratio, amount of feed (cost) used and slaughter weights of broiler chickens.

1.2. Materials and Methods

1.2.1. Study Site

The experiment was conducted at plot number 24, Duma, Bikita district in Masvingo Province and is located 80km East of Masvingo town. The area is mountainous characterized by steep slopes with sandy-loamy soils. The district is found in the low lying agro-ecological regions of III, IV and V and the mean annual rainfall range from 400mm to 700mm (Mushore, Muzenda and Makovere, 2013). Agriculture is the major livelihood activity in the area with maize being the dominant crop grown (Matthew, 2003). The mean annual temperature is 28^0C and is characterized by hot summer and cold winter seasons.

1.2.2. Research Design

A completely randomized experimental design was used on Cobb-500 day old broiler chicks, (n=90). Broiler chicks were bought from Irvine's Zimbabwe from a parent flock age of 34 to 36 weeks. The broiler chicks were vaccinated against Gumboro disease, infectious bronchitis and Newcastle disease at the hatchery. Broiler chicks were randomly assigned to the three treatments in three replicates of ten birds.

1.2.3. Brooder Preparation

The chicken runs were cleaned and disinfected two weeks prior to chick arrival using San G detergent. The brooding areas were prepared using black plastic sheets. Wood shavings were used as bedding at a height of 12cm on the floor. Pre heating was done a day before chicks arrival with infra-red lamps.

1.2.4. Chick Arrival

The chicks were given stress pack through drinking water for two days after arrival and randomly assigned to the following treatments.

- Two phase, control group (T1) - broiler chickens were given starter crumples with 23% crude protein from day 1 to day 21; then finisher crumbs with 18.5% crude protein at day 21 to day 36.
- Three phase (T2) – broiler chickens were fed starter mash with 23% crude protein from day 1 to day 7, followed by a growers mash with 21.5% crude protein given from day 7 to day 21, then finisher mash (18,5% crude protein) from day 21 to day 36.
- Four phase (T3) – broiler chickens were given a pre-starter mash with 23% crude protein from day 1 to 7, followed by a starter mash with 22.5% crude protein given from day 7 to day 14; then growers mash with 21.5% crude protein from day 14 to day 21 followed by finisher mash (18.5% crude protein) from day 21 to day 36.

1.2.5. Management of the Chicks

Chicks were monitored three times daily. Infra-red lamps were used to provide warmth during the brooding period and adjusted in height every two days depending on chick behavior. Brooder ventilation was checked regularly to avoid colds and accumulation of ammonia gas in the houses. The bedding was turned frequently using a fork depending on the level of compaction. Wet bedding on areas around water troughs were removed regularly and replaced with new beddings. Clean fresh water and feed was supplied three times daily.

1.3. Data Collection

Data of live weight gains, feed cost and amount as well as carcass weights was collected. Live weight measurements of five birds per cage were recorded on arrival, then on weekly intervals up to day 36. A kitchen scale (Adams-Nicolas scale) was used. Feed

consumption was recorded daily. Carcass weight was also measured at slaughter from a sample of five chickens which had been randomly picked from each trial. Measurements were done with a precision balance, ± 0.1g accuracy. Head, feet, liver, intestines, gizzard and heart were weighed.

Statistical analysis

Data were analyzed using Genstat Package Version 3 for comparison of means.

2. Results

2.1. Live Weight

Day old, 7 day and 14 day old chicks showed no significant difference in live weight for the three treatments. The broilers on two phase (T1) were significantly lighter compared to four phase (T3) ($p<0.05$) at day 21, 28 and 36. There was no significant difference at day 21 for three phases (T2) compared to T3, but at day 28 and day 36 there was a significant difference between trials T2 and T3. Weekly live weight gains of broiler chickens are shown in Table 1. At day 36, broiler chickens showed significant ($p<0.05$) difference in live weights for all the phases.

Age	Weight (g) of birds		
	T1	T2	T3
Day old	42.8	41	42
7 day	179.2	178.7	179.7
14 day	454.6	458.9	461.1
21 day	885.8^{a}	888.8^{a}	892.7^{b}
28 day	1425.5^{a}	1452.3^{b}	1453.4^{b}
36 day	1788.9^{a}	1821.1^{b}	1870.8^{c}

Table 1: Live weight of broiler chickens on different feeding phases

^{abc} Means in the same row with the same subscript are not significantly different ($p>0.05$)

2.2. Slaughter Weights

At day 36, the live weights of broiler chicken were recorded as well as the weight of carcass, feet, head, gizzards, hearts and intestines as shown in Table 2. Only the feet had significant weight difference ($p<0.01$) T3 had superior feet weight compared to T2 and T1. Liver, gizzard, heart, head and intestines had no significant difference amongst the three trials.

Organ	T1	T2	T3
Carcass	1181.4	1189.1	1194.2
Liver	37.9	38.9	39.3
Gizzard	53.3	54.2	54.9
Heart	24.8	25.7	26.2
Feet	58^{a}	59.1^{a}	62.2^{b}
Head	48	48.6	48.7
Intestines	198.6	200.2	200.1

Table 2: Mean weight (g) of internal organs of dressed broiler chickens.

^{abc} Means in the same row with the same subscript are not significantly different ($p>0.05$)

2.3. Feed Conversion Ratio (FCR)

The feed conversion ratio was in T3 was significantly higher ($p<0.05$) than in T1 and T2 as indicated in Table 3.

Treatment	Feed consumed(g)	Final weight(g)	Feed conversion ratio
T1	2400	1788.7	1.34^{a}
T2	2400	1821.1	1.32^{a}
T3	2400	1870.8	1.28^{b}

Table 3: Feed conversion ratio of broiler chickens on different feeding phases.

^{abc} Means in the same row with the same subscript are not significantly different ($p>0.05$)

2.4. Feed Cost

The cost of feed used for 36 days on T1 was lower than on T2 and T3 as illustrated in Table 4.

	Feed type in kg				
	Pre-starter	Starter	Growers	Finisher	Total cost($)
T1	0	8.8	0	15.2	32.28
T2	0	3.3	7.2	13.5	33.60
T3	1.3	2.8	4.7	15.2	33.60

Table 4: Amount and cost of feed used

3. Discussion

No mortality was recorded. Arbor Acres Broiler Management guide (2008) pointed out that if a good quality chick is provided with proper management and nutrition, it should have less than 0.7% mortality and is able to achieve target live weight uniformly over the first seven days. This agrees with Mpofu (2012) who pointed out that broiler mortality rate should be of 5% and below, under good management. According to Ahsan-ul-Haq (2003), mortality in broiler chickens is caused by a number of factors including genetics, nutrition, toxins, poor brooder management and relaxed biosecurity measures. Biosecurity measures are to be maintained well to reduce chances of disease outbreaks such as omphalitis, salmonellosis and colibacillosis (Ahmed, Sarker and Rahman, 2009). Nutritional toxins and mycotoxins such as fusarium species in the feed ingredients have been reported to be acutely toxic to young chicks (Javed *et al*., 1993). The farmer has to practice high levels of management and monitor feed quality for molds, give fresh feed and potable water all the time. All this, was done during the course of the study.

The two major factors for a successful and economic broiler production are fast growth rates and efficient feed conversion (Arbor Acres Broiler Management guide, (2008)). This is achieved through efficient management practices that ensure effective disease prevention and control coupled with availability of high quality feed (Amakiri, Owen and Etokeren, 2011). The broiler chicks managed to attain 454.5g (T1), 458.9 grams (T2) and 461.1g (T3) in 14 days. According to Walne (2015), a broiler chick will have increased its day old body mass eight fold within a space of 14 days under optimum conditions. The experimental broiler chicks performed better and managed to increase their day old mass by more than 10 fold in 14 days in all the three trials.

According to Ross Broiler Management Guide (2009), broilers attain an average weight of 1815 grams in 35 days. In this experiment, the broiler chickens reached an average weight of 1788.7 grams (T1), 1821.1 (T2) and 1870.8 grams (T3) in 36 days. There was not much deviation for the three phase feeding program weight compared to the target weight requirements of the RMG (2011). T1 was 26.3 grams less and T3 was 55.8 grams superior to the standard.

There was a significant difference in the weight of feet. Bilgil, Alley, Hess and Nagaraj (2006) found that feet weight and carcass yields were significantly affected by diet, age and sex. The birds were of the same age, mixed sex but fed on different dietary phases.

Tegel Poultry of New Zealand (2012) noted that improved types of broiler chickens now have a feed conversion ratio of 2 to 1. The FCR in this study was within this range. FCR was superior in when using four phases compared to two and three phase feeding.

Feed as the major component of input cost accounts for up to 70% of the total production costs (Aviagen Poultry Site, 2007). The feed costs per kg can be reduced with the diet lower in balanced protein. Decreasing nutrient levels decreases feed costs but can also decrease profit margin. The diet of lower nutrient density is less cost effective when expressed per kg live weight.

4. Conclusion and Recommendations

Based on results obtained, we can conclude that four phase feeding programme yielded better results when compared to two and three phase feeding programmes as shown by superior live weight gains, carcass weight and feed conversion ratio. We recommend that small scale farmers should adopt four phase feeding program in their broiler production so as to achieve superior growth rates, carcasses weight and high feed conversion ratio.

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