

Effect of Phase Feeding on Different Broiler Production Parameters: A Review

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Abstract: Phase feeding is a nutritional strategy in broiler production that involves adjusting dietary nutrient levels according to the age-specific requirements of birds. This approach has gained importance for commercial broiler production. The present review critically examined the results of many research studies of phase feeding on different parameters of broiler production. Most findings suggest that phase feeding did not affect body weight gain, feed conversion ratio, carcass traits and weekly mortality. It also contributes to reduce fat deposition and production cost hence phase feeding proved profitable for broiler production.

Keywords: Broiler phase feeding, weight gain, feed conversion ratio, carcass trait, weekly mortality, fat deposition, production cost

INTRODUCTION

Feed constitutes approximately 60-70% of total broiler production costs (Saveewonlop, 2019) [29]. The broiler industry has been developed into the most efficient animal production sector. This development has been brought about through development and advancement of research in the fields of poultry science and related subjects. The most significant of these developments were in the fields of genetics and nutrition, which lead to the breeding of commercial broiler chicks capable of rapid growth and efficient utilization of feed (Anonymous, 2013; Mehmood *et al.*, 2014) [3] [16]. Since feed cost constitutes the major cost item of producing broiler meat, considerable research effort was concentrated in improving nutrition and efficiency of feed utilization of the broiler chicks. The broiler chicks are known

to be exacting in their nutrient requirements for rapid growth and development, and that they need to be supplied with adequate diets capable of satisfying these requirements in a utilizable form (Skinner-Noble *et al.*, 2001) [31].

Further research development indicated that the nutrient requirements of the broiler chicks vary with its advancement of growth according to the increase in body weight and nature of growth. The growth curve established that young broiler chicks during the first 3-4 weeks of life are at their most active phase of growth, and the nature of growth during this period is mostly in the form of tissue protein and very little fat (Skinner-Noble *et al.*, 2001) [31]. In this respect, different diets of variable nutrients composition have been advocated for phase feeding of broilers, based on increasing

the energy content of the diet and reducing its crude protein content with the advancement of age (Roush *et al.*, 2004) ^[25]. Saleh *et al.* (1997) ^[27] noted that reduction in the protein content of feed led to reduction in feed cost so that it is economically beneficial to change the diet within short interval. According to Waller (2007) ^[36] when we are facing with the crisis of increased cost of feed and its ingredients then the first option was to see the economic impact of reduction in nutrient specification of feed to minimize the cost of the feed on the business. Previous research has concluded that amino acid levels may be decreased weekly or even every other day with a phase feeding program without negatively affecting growth performance or carcass yield (Warren and Emmert, 2000 ^[37]; Pope and Emmert, 2001) ^[23].

The main objective of phase feeding programs is to define the proper level of nutrients in a diet using different mixtures, considering the performance and economic advantage of production, and often the environmental sense (Saleh *et al.*, 2004) ^[26]. According to Sutton (2003) ^[32], phase feeding of multiple diets during the grow-out period can significantly lower nitrogen (N) and phosphorus (P) excretion. Another authors Roush *et al.* (2004) ^[25], Tolimir *et al.* (2012) ^[35] described phase feeding as the application of nutrition programs to indicate the optimum level for production by giving due attention to economics and the environment with changing starter, grower, and finisher mixtures fed at different frequencies to birds. Generally, phase feeding requires careful assessment of the nutrient requirements for production, growth, and maintenance as it balances diet in relation to requirements (Leeson and Summers 2008) ^[15]. Therefore, the present review critically examines the existing literature on phase feeding strategies in broilers, with emphasis on their effects on weight gain, feed conversion ratio, carcass traits, weekly mortality, fat deposition, production cost and profitability.

EFFECT OF PHASE FEEDING ON BROILER WEIGHT GAIN

Warren and Emmert (2000) ^[37] tested phase feeding programme on broilers in two experiments and found no differences in weight gain. Pope and Emmert (2001) ^[23] stated that there were no differences in growth performance between birds fed phase feeding and National Requirement Centre-based diets. Pope *et al.* (2002) ^[24] in a study in which broilers using a phase-feeding approach with diets switched every other day from forty-two to sixty-three days of age found no effect on body weight gain. Nasril (2003) ^[20] indicated that intensive multi-phase feeding improved body weight gain. Roush *et al.* (2004) ^[25] in an experiment designed to determine the period of starter, grower, and finisher phase feeding and found no significant differences in final body weight. Hooshmand (2006) ^[13] in a study compared four feeding programs on broiler parameters and found no significant differences in final body weight. Dozier *et al.* (2006) ^[9] stated that broilers fed provision of a high amino acid density diet increased body weight gain, also he reported that diets formulated to a high nutrient density in the 3-phase schedule increased body weight and body weight gain. Gutierrez *et al.* (2008) ^[11] found that during early age, birds on both continuous multiphase feeding programs had significantly greater cumulative body weight gain compared to the 4-phase feeding program. Zhao *et al.* (2009) ^[38] conducted a study to evaluate the effects of varying nutrient density with constant ME:CP ratio in 2 distinct broiler breeds of male chickens and found that in both breeds, the higher nutrient density increased body weight gain. Tolimir *et al.* (2010) ^[34] concluded that multiphase feeding had an effect on performance especially the level of food utilization. Tikate *et al.*, (2020) ^[33] during their research found that the broilers fed with the multiple phase feeding showed the significantly higher live body weight and

weight gain during first, second, fifth and sixth week of age and also during overall duration of the experiment as compared to control feeding. Salem *et al.* (2023) [28] reported that the three treatments (phase feeding) at various ages ranging from day one to six weeks did not differ significantly in live body weight, total or daily weight gain. Dawood Rahoma (2023) [7] concluded in their review that broiler performance was not affected by the different

phase feeding programs. Mijena and Getiso (2024) [17] concluded in their review that phase feeding enhances productivity in broilers. Nawab *et al.* (2025) [21] found the dietary treatments did not affect weight gain over the entire study period from days 14 to 21. The effect of phase feeding on different parameters of broiler production is summarized in Table 1 and Table 2.

Table 1: Effect of Phase Feeding on Growth Performance of Broilers

Feeding Strategy	Body Weight Gain	Feed Intake	Feed Conversion Ratio (FCR)	Mortality	Overall Effect
Single diet (no phase feeding)	Slightly higher or similar	Higher	Slightly poorer	No significant change	Excess nutrient intake, lower efficiency
Two-phase feeding	Comparable	Slightly reduced	Improved	No significant change	Better nutrient utilization
Three-phase feeding (Starter-Grower-Finisher)	Comparable	Reduced	Improved	No significant change	Standard efficient system
Multi-phase feeding (4-5 phases)	No significant change	Optimized	Further improved	No significant change	Precise nutrient matching
Precision feeding (frequent adjustments)	Comparable	Optimized	Best efficiency	No significant change	Maximum nutrient utilization

Source: Compiled by authors for this review

Table 2: Effect of Phase Feeding on Nutrient Utilization, Economics, and Carcass Traits

Parameter	Conventional Feeding	Phase Feeding	Effect/Trend
Feed Conversion Ratio (FCR)	Higher	Lower	Improved efficiency
Feed cost per kg gain	Higher	Lower	Better profitability
Protein utilization	Less efficient	More efficient	Reduced nutrient wastage
Nitrogen excretion	Higher	Lower	Environment-friendly
Phosphorus excretion	Higher	Lower	Reduced pollution
Carcass yield	Similar	Similar	No negative impact
Breast meat yield	Similar	Slightly improved	Depends on diet design
Overall production efficiency	Moderate	Higher	Better economic return

Source: Compiled by authors for this review

WEEKLY FEED CONVERSION RATIO (FCR)

Roush *et al.* (2004) [25] in an experiment designed to determine the period of starter, grower, and finisher phase feeding and found no significant differences in feed conversion ratio. Dozier *et al.* (2006) [9] stated that broilers fed provision of a high amino acid density diet decreased feed conversion ratio. Gutierrez *et al.* (2008) [11] found that continuous multiphase feeding programs showed improved feed

conversion ratio compared to the traditional 4-phase feeding program. Mehmood *et al.* (2014) [16] recorded improved FCR in 4-phase feeding program as compared to single, two and three phase feeding pattern. Mudhunguyo and Masama (2015) [19] reported that the better feed conversion ratio was observed under four phase feeding program as compared to two or three phase feeding program. Mostert (2016) [18] reported that cumulative feed conversion ratio was improved in birds fed with high

protein diet compared to the birds fed low protein diet. Tikate *et al.* (2020) ^[33] found that the overall feed conversion ratio in the multiple phase feeding group B (treatment group, changing the diet in every week) was found improved @2.79% than the control group A (Control group, ad libitum feeding). Salem *et al.* (2023) ^[28] in their study found that there was an insignificant difference in feed conversion ratio at all studying periods between the three feeding broiler programs. Dawood Rahoma (2023) ^[7] concluded in their review that phase feeding reduces feed losses and subsequently production cost. Nawab *et al.* (2025) ^[21] found that birds offered the precision nutrition diets and blended standard diets had a lower FCR compared to those fed the control diet.

EFFECT OF PHASE FEEDING ON CARCASS TRAITS

Saleh *et al.* (1997) ^[27] stated that increasing the duration of feeding a starter diet significantly affected dressing percentage, and breast meat, while wings were not significantly affected. Warren and Emmert (2000) ^[37] concluded that phase-feeding programs (where diets are changed frequently, such as every 2-7 days) for broilers did not impair carcass traits compared to traditional, less frequent feeding changes diet. Pope and Emmert (2001) ^[23] stated that no differences were observed in broiler carcass, breast, wing, or leg yield by feeding 10 % reduced nutrient phase feeding regime (PF 10) compared to those fed the NRC diet. Pope *et al.* (2002) ^[24] found that no differences in the percentage of breast, wing, and leg were observed among all finisher periods. Roush *et al.* (2004) ^[25] in an experiment designed to determine the period of starter, grower, and finisher phase feeding and found no significant differences in hot carcass weight, dressing percentage, and breast muscle. Shahin and Abd Elazeem (2005) ^[30] reported that the proportion of total carcass muscle and total bone and their percentage in breast, drumstick, wing, and

bone weight were not significantly affected in broiler chicken by dietary treatments. Hooshmand (2006) ^[13] in a study compared four feeding programs on broilers parameter and found no significant differences in organs weight. Nawaz *et al.* (2006) ^[22] investigated the effect of different levels of energy and protein on live performance and carcass responses in broiler chicks and reported that non-significant differences were observed on all of the carcass traits (Carcass, gizzard, heart, liver weight and Shank weight). Kamran *et al.* (2008) ^[14] stated that reducing dietary crude protein (CP) levels while maintaining a constant metabolisable energy (ME):CP ratio did not significantly affect carcass characteristics in broiler chickens, specifically breast meat yield, thigh yield, and relative weights of the liver and heart remained unchanged. Corzo *et al.* (2008) ^[5], reported that total carcass yield and breast meat protein content were unaffected by varying nutrient densities, while **high amino acid densities maximize breast meat yield**. Zhao *et al.* (2009) ^[38] concluded that **when nutrient levels (specifically lysine/energy) were manipulated or when grower diets were adjusted, it led to a decrease in carcass chemical composition**. Result study of Brewer *et al.* (2012) ^[4] suggested that phase feeding in broilers did not affect carcass yield or meat quality. Algarni *et al.* (2020) ^[2] found no significant differences in carcass yield when given phase feed to the broilers. Nawab *et al.* (2025) ^[21] found that the breast, thigh and drumstick weight on day 28 and 42 was not affected by dietary treatments.

WEEKLY MORTALITY

Saleh *et al.* (1997) ^[27] stated that increasing the duration of feeding a starter diet significantly affected mortality. De Basilio *et al.* (2003) ^[8] stated that sequential feeding recently proved to be effective in reducing mortality under acute heat challenges during the finishing period (4-6 weeks of age). Dozier *et al.* (2006)

^[9] stated that the incidence of mortality were unaffected when broilers fed a high amino acid density diet. Tikate *et al.* (2020) ^[33] found that the multiple phase feeding has not put any negative effect on percentage mortality in broilers.

EFFECT OF PHASE FEEDING ON FAT DEPOSITION

Holsheimer (1980) ^[12] reported that the grower diet had a pronounced effect on decreasing fat content. Saleh *et al.* (1997) ^[27] stated that extending the duration of the starter diet significantly affects abdominal fat content of broiler chickens. Warren and Emmert (2000) ^[37] stated that feeding the lower nutrient grower diet throughout the grow-out period increased the carcass fat, and feeding the higher nutrient starter diet decreased the carcass fat deposit. Pope and Emmert (2001) ^[23] stated that *abdominal fat was found to be increased significantly in broilers when using certain phase-feeding programs (specifically, PF10 or PF15 regimens where amino acid requirements were reduced by 10% or more) compared to those fed a standard National Research Council (NRC) diet.* Roush *et al.* (2004) ^[25] in an experiment designed to determine the period of starter, grower, and finisher phase feeding and found no significant differences on abdominal fat pad. Kamran *et al.* (2008) ^[14] concluded that abdominal fat was significantly higher for the group fed on a diet with 20% crude protein. Kamran *et al.* (2008) ^[14] stated that carcass abdominal fat was not affected by the treatments in broiler chicks. Corzo *et al.* (2010) ^[6] reported that fat content was unaffected by dietary treatments, whereas abdominal fat percentage was increased in birds fed the low nutrient density diets. Piotrska *et al.* (2011) ^[22] reported that phase feeding significantly decreased triglyceride content and total cholesterol in the blood of growing broiler chickens reared under farm conditions. Aghaei *et al.* (2012) ^[1] claimed that diet supplementation with fish oil *in broilers was found to significantly alter fatty acid profiles.*

EFFECT OF PHASE FEEDING ON PRODUCTION COST

Emmert and Baker (1997) ^[10] used National Research Centre diet [1] and reported that phase feeding may support the elimination of some excess dietary crude protein and supplementation amino acids, thereby potentially reducing dietary costs and nitrogen excretion. Warren and Emmert (2000) ^[37] concluded that phase feeding reduced dietary costs without sacrificing growth performance or carcass yield. Pope and Emmert (2001) ^[23] stated **phase feeding (PF) in broilers significantly reduces production costs by lowering feed costs without sacrificing growth performance or carcass yield.** Tikate *et al.* (2020) ^[33] during their research found that the broilers fed with the multiple phase feeding showed the significantly higher net profit per bird and also per kg of body weight as compared to the broilers fed on the control diet. Dawood Rahoma (2023) ^[7] concluded in their review that phase feeding reduces feed losses and subsequently production cost. Mijena and Getiso (2024) ^[17] Suggested in their review that phase feeding reduces broiler production costs by lowering feed costs through decreasing excess amino acids (protein) as birds grow.

Conclusion: Based on the findings reported in various studies, it is concluded that phase feeding has been widely recognized as an effective nutritional management strategy in broiler production. Adjusting the dietary nutrient levels according to the different growth phases, phase feeding is an effective nutritional strategy to optimize broiler performance by providing diets that closely match the changing nutrient requirements of birds at different growth stages. By adjusting protein, energy, amino acids, and other nutrient levels according to the starter, grower, and finisher phases, phase feeding improves live body weight, weight gain, feed conversion ratio and higher net profit per bird and also per kg of body weight as compared

to the broilers fed on the traditional control diet and also by using phase feeding, we can economically produce reducing fat deposition lean meat with economically less production cost. Therefore, adopting a well-planned phase feeding program can enhance economic efficiency and sustainable broiler production.

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