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Effect of Feed Restriction on the Economics of Broiler Production

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ABSTRACT
Despite that the financial efficiency of boiler feed restriction is not deeply studied, feed restriction could be a promising strategy to enhance the economic and financial performance of broiler production in the long turn. Restricted feeding has been used to alleviate the negative effects of *ad libitum* feeding of fast-growing modern broiler strains. Feed restriction is also claimed to improve feed efficiency, reduce abdominal fat pad deposition and reduce feed costs. Diluting diets with inter-filler in-digestible materials, providing lesser feed amounts than usual by limiting feeding time and reducing the energy and/or protein levels in the diets could also be useful strategies to reduce the feed costs of commercial diets. The objective of the present paper is to give a brief review of boiler nutrition, feed restriction methods and feed restriction as means to improve the economic performance of broiler chicks. The review is based on the original articles that dealt with adopting feed restrictions during the starter and the finisher periods. It is concluded that early and late age feed restriction programs could be effective strategies to improve the financial feasibility of the broiler production sector.

KEYWORDS
Broiler nutrition, feed cost, diet formulation, qualitative feed restriction, quantitative feed restriction

INTRODUCTION

Genetic selection and nutritional strategies aimed at pushing the meat broilers to grow faster have exerted these broilers to physiological stresses and pathological states of potential welfare concerns[1,2]. Growth rates of broiler strains used in 2005 increased by 400% compared with broiler strains used in 1957[3,4]. Feedstuff is an aspect of high economic importance in the rearing of commercial broiler strains, not only because it is primarily responsible for the growth response of birds, but mainly because it represents a high cost in the production cycle[5]. Many researchers found that the relatively higher cost of broiler feed is a major cause for less performance of the industry[6].

For instance, the broilers' energy requirements are responsible for 70% of the cost of the ration[5]. Since 70-75% of the total cost of broiler production is incurred on feed, there is a need to improve the efficiency of feed utilization. Broiler chicks are fed to gain more weight in a shorter time with good efficiency of nutrient utilization. Feeding broilers to a full gut has been believed the best for maximum weight gain, besides improvement of feed usage efficiency and breast size[3]. Broiler nutrition depends upon *ad libitum* feeding to provide optimum amounts of nutrients for the fast-growing broiler chicks. Some negative characteristics are associated with this rapid growth[7], including increased skeletal/leg defects[8-10], metabolic disorders[11-13] and meat quality defects[14,15].

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These fast-growing strains consume excessive amounts of feed. This habit is considered uneconomical because it requires formulating unnecessary amounts of feed. It is also found to increase the culls due to some health problems such as ascites and sudden death syndrome[16] increased mortality rate[17] and has affected negatively broiler immunity[18]. Therefore, feed restriction can be an effective method to reduce economic losses by reducing the incidence of metabolic disorders and mortality in fast-growing broiler chickens[19,20]. Feed restriction also resulted in a similar or better feed conversion ratio in several species, including broiler chickens[21].

Consuming excessive amounts of feed also resulted in increased abdominal fat pad deposition. Excessive fat deposition is one of the main problems facing the broiler industry since it not only reduces carcass yield and feed efficiency but also causes rejection of the meat by consumers and causes difficulties in processing. In general, the potential of feed restriction programs as a management tool is related to decreasing the incidence of metabolic disease, carcass fat deposition, reducing maintenance requirements and improvement of feed efficiency in broiler chicken production. Also can lead to economical savings in the cost of feeding in broiler chicken production, thus may be useful for commercial broiler chick production farms[22]. The objective of the present paper was to give a brief review of boiler nutrition, feed restriction methods and feed restriction as means to improve the economic performance of broiler chicks.

Diet formulation: Boiler diets are formulated to provide adequate energy and protein to meet the nutritional needs of the fast-growing broiler strains. The starter diet, which is offered during the first 3 weeks of a chick's life, is characterized by high energy and protein content and is thus more expensive than the finisher's diet. Feed restriction is considered more efficient as a feed cost-reducing strategy during early age because young chicks have 3 weeks of *ad libitum* feeding during which they can compensate for the weight loss due to restricted feeding. During the finisher period, the percentage of protein is reduced and the energy percentage is kept high to meet the high body maintenance requirements. Cereal grains provide the energy necessary for maintaining the birds' general metabolism and meat production. Leguminous meals or cakes such as groundnut and soybean meals beside animal by-product meals provide the protein and amino acids necessary for tissue building. Precise feed formulation based on the accurate nutrient content of the ingredients improves the productivity of broiler chickens without resulting in nutritional excesses or deficiencies[23]. The nutrient density level of broiler diets contributes significantly to feed costs. The most expensive ingredient in the diet is cereal grains which are added at 50-70% according to the metabolizable energy content of the diet. The protein sources are added at levels ranging from 23-19%. In general, about 70% of the cost is related to providing caloric needs. Consequently, minimizing these percentages to a level that does not affect market weight could be financially feasible.

Feed restriction: Restricted feeding is aimed to slow the early growth rate of young broiler chicks. These feeding programs synchronize the speed of body organs' growth and so decrease the bad effects of early fast growth[24]. Qualitative and quantitative feed restriction methods are used to improve broiler efficiency of feed utilization[25] and so decrease the feeding costs.

Qualitative feed restriction: Qualitative feed restriction improves feed utilization efficiency and reduces mortality and fat deposition. It includes diet dilution and the addition of chemical appetite suppressors. The former has been studied by quite a few researchers[25-33]. It requires the inclusion of ingredients of high fibre content[30,32] like wheat bran, sand, charcoal, oat husks, rice husks, bird feathers residue and sawdust. Chemical methods are also evaluated as appetite depressors to reduce feed intake.

Quantitative feed restriction: Quantitative feed restriction is found to be an effective method to reduce mortality, long bone abnormalities and culling. It improves feed conversion ratio as revealed by Tůmová *et al.*[20], Urdaneta-Rincon and Leeson[34] and Lee and Leeson[35]. Physical methods (percentage feed reduction)[35-39], skip-a-day feeding[39] and lightning are found in most of the studies to improve broiler performance.

Feed restriction as means to improve the economic performance of broiler chicks: Despite that the financial efficiency of boiler feed restriction is not studied, feed restriction could be a promising strategy to enhance the economic and financial performance of broiler production in the long turn. Feed restriction programs reduce feed costs as reported by many authors[18,38,40-43]. Physical feed restriction and limiting feeding time reduce the amount of feed usually consumed by broiler chicks[44,45]. Hence, consuming lesser amounts of feed without affecting the final body weight, due to compensatory growth, will save some feed costs. Replacing the expensive energy and/or protein sources in the diet with in-digestible cheap materials will also reduce feed costs. Reducing mortality and culls will increase profit. This is beside the better feed conversion ratio exhibited by early restricted chicks. In the same line, Yang *et al.*[18] agreed that feed restriction in broilers can reduce feed cost and mortality along with the production of quality meat at cheaper rates. Oyedeji and Atteh[46] concluded that initiating broilers to 50% of *ad libitum* feeding for 3 weeks starting at the 2nd week of age offered a better economic gain than the usual *ad libitum* feeding. Tesfaye *et al.*[47] suggested that the feed restriction at later days of age might be considered beneficial in terms of carcass cut characteristics and economic return. It is economically beneficial compared to the other early age-restricted groups based on partial budget analysis. Also, it can lead to economical savings in the cost of feeding in broiler chicken production, thus may be useful for commercial broiler chick production farms Sahraei[22]. Feed restriction could be an economical method of broiler production because, the addition of inter-filler materials such as fibre sources, sand and charcoal instead of the expensive energy and protein ingredients in the ration will reduce feed cost[48]. Therefore, feed restriction is better than *ad libitum* feeding for growth and economics too.

CONCLUSION

It could be concluded that better economic broiler production could be achieved nutritionally. Early and late-age feed restriction programs could be effective strategies to improve the financial feasibility of the broiler production sector. For early feed restriction, it is important to consider the increased feed intake of restricted birds during the re-feeding period and the added costs due to additional time required by restricted birds to compensate for the weight lost during the restriction period. It is also important to notice the environmental conditions that will affect the restriction program, especially when subjecting the chicks to early feed restrictions. The severity of restriction, age and duration of the restriction program must be considered to warranty the re-gaining of weight lost during the following re-feeding period.

SIGNIFICANCE STATEMENT

This study discovered the possible chances for minimizing broiler chicken feed costs. It helps the researchers to conduct further in-depth studies on the financial efficiency of broiler restricted feeding. The improved financial efficiency of early feed restriction can be beneficial for the broiler production companies and the consumer as well.

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