**A**

**SEMINAR PRESENTAION**

**ON THE TOPIC:**

**PERFORMANCE OF BROILER CHICKENS FED DIET WITHOUT CORN**

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**SUMMARY**

Broiler chickens diet is dominated by cereal grains, especially maize or corn *(Zea mays)* which serves as the main carbohydrate component and serves as the principal energy source in poultry diets. Maize is highly palatable and contributes up to 50-55% of poultry and other monogastric feeds, but the increase in demand with the concurrent competition with humans and its production has led to its high price and need to source alternative energy sources and formulation of broilers feed without corn. Hence, this seminar evaluates the performance of broiler chickens fed diet without corn in terms of growth performance, serum and biochemical parameters, economic evaluation and carcass quality.

**INTRODUCTION**

Many investigations on poultry nutrition fundamentally deal with the replacement of one ingredient by another but making sure of maintaining a well-balanced diet especially for, energy and protein. The above has given way to the assessment of agricultural by-products (non-conventional feed ingredients) and the addition of suitable ones in poultry feeds to reduce the cost of production (Laporte, 2007). The use of agricultural by-products in poultry nutrition indicates valuable means of the secondary production of food from waste with the intention of confront competition between humankind, animals and agro-processing industries (Thiruma-laisamy *et al,* 2016). A typical poultry diet is dominated by cereal grains, especially maize or corn *(Zea mays)* which serves as the main carbohydrate component and serves as the principal energy source in poultry diets (Olympio *et al,* 2014). According to Okereke *et al,* (2012), maize is highly palatable and contributes up to 50-55% of poultry and other monogastric feeds, but the increase in demand with the concurrent competition with humans and its production has led to its high price. Also, high consumption by man, in the feed of monogastric animals and utilization by the brewery and bio-fuel industries creates occasional shortage (Ranum *et al,* 2014). Several types of grains have been proposed as an alternative for corn in broiler chicken diets, serving as alternative sources of dietary carbohydrates. Hence, this seminar reviews the performance of broiler chickens fed diet without corn.

**IMPORTANCE OF BROILER PRODUCTION**

Broiler chickens are a specialized breed of poultry that are raised specifically for meat production. They play a significant role in the global poultry industry due to their rapid growth rate, efficient feed conversion, and high-quality meat. The importance of broiler chickens can be observed from various perspectives, including economic, nutritional, and environmental aspects.

* **Economic significance:** Broiler chickens contribute significantly to the global economy. According to the Food and Agriculture Organization (FAO), the production of broiler meat has been steadily increasing over the years, reflecting the rising demand for poultry meat worldwide (FAO, 2020). Broiler production creates job opportunities, particularly in rural areas, where poultry farming is often a source of income for small-scale farmers (Santhi, 2012). Furthermore, the trade of broiler meat and related products plays a crucial role in international agricultural markets, generating revenue for both exporting and importing countries (USDA, 2019).
* **Nutritional importance:** Broiler chickens are an excellent source of affordable and high-quality animal protein. Their meat is rich in essential amino acids, vitamins (such as vitamin B12 and niacin), and minerals (such as iron and zinc) (Ratriyanto, 2019). Due to their rapid growth rate and short rearing period, broiler chickens can provide a consistent and readily available source of meat to meet the growing protein requirements of an increasing global population. Additionally, broiler meat is lean with lower fat content compared to other meat sources, making it a healthier choice for consumers (USDA, 2021).
* **Environmental sustainability:** Broiler production systems have evolved over time to become more environmentally sustainable. Improved breeding techniques, better nutrition management, and efficient waste management practices have reduced the environmental impact of broiler production. For instance, modern broiler breeds exhibit better growth rates and feed efficiency, resulting in reduced feed requirements and associated greenhouse gas emissions (FAO, 2019). Moreover, innovative practices such as utilizing chicken litter as organic fertilizer can contribute to soil fertility and minimize the need for synthetic fertilizers (Ohimain, 2019).

**NUTRIENT REQUIREMENTS OF BROILER CHICKENS**

* Broiler chickens are a popular breed raised for meat production worldwide, and providing them with appropriate nutrition is essential for their growth, health, and overall performance. Properly balanced diets must be formulated to satisfy their nutrient requirements at different stages of development. Here is an exhaustive overview of the nutrient requirements of broiler chickens;
* **Energy:** Dietary energy is primarily supplied by carbohydrates and fats, with a minor contribution from proteins. The energy requirement increases as broilers grow, with starter diets typically having higher energy density than finisher diets. The commonly used energy units for broiler diets are metabolizable energy (ME) or net energy (NE) and they requires about 3500ME and 3000ME at starter and finisher phases respectively (Leeson and Summers, 2005)
* **Protein:** Dietary protein is essential for muscle development and feather growth. The recommended protein levels vary depending on the broiler's age and performance objectives. Starter diets typically contain higher protein content (20-23%) compared to finisher diets (15-19%) (NRC, 1994)
* **Amino Acids:** Essential amino acids (EAAs) must be provided in adequate amounts in the diet. Methionine, lysine, and threonine are the most limiting EAAs in broiler diets. Supplementing diets with synthetic amino acids is common to ensure optimal performance (Baker and Han, 1994).
* **Minerals:** Essential minerals include calcium, phosphorus, sodium, potassium, chlorine, magnesium, and trace minerals like zinc, copper, iron, manganese, and selenium. Calcium and phosphorus are particularly critical for bone development and should be balanced in the diet. Phytase enzyme supplementation enhances phosphorus availability (Scott, 2008)
* **Vitamins**: Broilers require vitamins A, D, E, K, C, and a range of B-vitamins. Vitamin supplementation is necessary, particularly vitamin D3 for skeletal development, and vitamin E as an antioxidant. Natural sources of vitamins, such as grains, oilseeds, and green forages, contribute to dietary requirements (Khan and Iqbal, 2012)
* **Water**: Adequate and clean water is crucial for normal physiological functions, digestion, and nutrient utilization in broilers. Water intake should be consistently available, and water quality must be monitored (Pesti and Bakalli, 1996).

**EMPIRICAL REVIEW ON THE PERFORMANCE OF BROILER CHICKENS FED DIET WITHOUT CORN**

The performance of broiler chickens fed diets without corn has been a subject of interest in poultry nutrition research. Corn is a commonly used ingredient in poultry diets due to its high energy content and digestibility. However, there are several reasons why researchers have explored the use of alternative feed ingredients in broiler diets, including the aim to reduce production costs, improve sustainability, and address potential issues related to corn allergies or intolerance.

Numerous studies have investigated the effects of replacing or excluding corn in broiler diets with other feed ingredients such as; wheat, barley, soybean meal, or alternative grains. These studies have examined various aspects of broiler performance, including; growth rate, feed efficiency, carcass characteristics, serum and biochemical parameters as well as overall health.

* **Effect on Growth Performance**

The growth performance of broiler chickens fed diets without corn has been a topic of interest in poultry nutrition research. Several studies have investigated the effects of corn removal from broiler diets and evaluated alternative feed ingredients for optimal growth performance. Sáyago-Ayerdi, (2010) conducted a study to evaluate the growth performance and carcass characteristics of broilers fed corn-free diets. They found no significant differences in body weight gain, feed intake, or feed conversion ratio between broilers fed corn-free diets and those fed corn-based diets.

Zhao, (2013) investigated the effects of substituting corn with other energy sources, including wheat, barley, and sorghum, on the growth performance of broiler chickens. The study revealed that substituting corn with these alternatives had no adverse effects on body weight gain, feed intake, or feed conversion efficiency.

Daskiran, (2019) investigated the performance of broilers fed corn-free diets supplemented with soybean meal and poultry by-product meal as alternative ingredients. The results indicated that broilers fed these diets achieved satisfactory growth performance and carcass quality. Aljumaah, (2014) compared the performance of broilers fed with different grain combinations, excluding corn. Their results demonstrated that broilers fed diets without corn had comparable growth performance to those fed corn-based diets. Abd El-Hack, (2016) evaluated the impact of corn omission from broiler diets and found that alternative energy sources such as rice, wheat, and sorghum had no negative effects on growth performance. Additionally, the study suggested that the inclusion of enzymes and exogenous phytase could improve nutrient utilization in corn-free diets. Boonsinchai, (2017) studied the effects of replacing corn with cassava root meal in broiler diets and reported no significant differences in growth performance, carcass traits, or gut morphology. However, they found an increase in gut microbial diversity and improvements in intestinal health in birds fed cassava-based diets.

Adeola, (2019) explored the consequences of corn elimination from broiler diets and its substitution with other cereal grains. The researchers concluded that broiler chickens could achieve similar growth performance when fed with alternative grains in place of corn. O'Dea, (2010) compared corn-based diets with corn-free diets using wheat, barley, or a blend of soybean meal and barley in broiler chickens and reported no significant differences in body weight gain or feed conversion ratio among the dietary treatments. Ghazi, (2021) conducted a meta-analysis on the growth performance of broiler chickens fed corn-free diets. This comprehensive study reinforced the previous findings, indicating that the exclusion of corn from broiler diets did not significantly affect body weight, feed intake, or feed conversion ratio.

Hence, from this review, the growth performance of broiler chickens fed diet without corns could have significant effect.

* **Effect on Carcass Quality**

Carcass quality in broiler chickens is significantly influenced by their diets. While corn is commonly included in broiler feed formulations due to its high nutritional value, there are situations where diets without corn may be used. This can be due to factors such as corn allergies, cost considerations, or the need for alternative feed ingredients (Karimi, 2014). Carcass characteristics play a vital role in determining meat quality. Research by Vieira, (2020) explored the carcass characteristics of broilers fed corn-free diets. The study observed no significant differences in carcass yield, dressing percentage, or breast and thigh muscle weights between broilers fed corn-free diets and corn-based diets. Studies has also shown that broiler chickens fed corn-free diets may exhibit differences in carcass composition compared to those fed traditional corn-based diets. For instance, research by Choct, (2008) found that replacing corn with alternative grains such as wheat or barley resulted in higher carcass protein content and lower fat content at the same body weight. A study by Leske, (2019) investigated the partial replacement of corn with alternative grains such as wheat, barley, and sorghum in broiler diets. The researchers found that the inclusion of these alternative grains led to similar carcass weights, dressing percentages, and breast meat yields compared to corn-based diets. However, leg meat yields and abdominal fat deposition were affected. In another study by Saleh, (2020) evaluated the complete replacement of corn with rice bran and wheat bran resulted in reduced carcass weights and breast meat yields, but increased abdominal fat deposition in broiler chickens.

Meat quality attributes such as tenderness, juiciness, flavor, and color are important factors affecting consumer satisfaction. When evaluating the meat quality of broiler chickens fed diets without corn, researchers have focused on alternative ingredients used to replace corn. Studies have investigated the inclusion of alternative grains (e.g., wheat, barley, sorghum) and oilseed meals (e.g., soybean meal, canola meal).

Karimi, (2014) studied the meat quality of broilers fed wheat-based diets in comparison to corn-based diets. The study revealed comparable sensory attributes and meat color values between the two dietary groups, indicating that wheat could serve as a suitable alternative to corn in broiler diets. Certain meat quality parameters may be altered when broiler chickens are fed corn-free diets. For example, a study by Jin, (2000) reported that diets without corn led to an increase in drip loss, which is an indicator of lower meat quality. However, it is important to note that the negative effects on meat quality can be minimized by incorporating other high-quality ingredients and optimizing diet formulations.

* **Effect on Serum and Biochemical Parameters**

However, there may be instances wherein corn is excluded from broiler diets, and it is important to understand the impact of this exclusion on the serum and biochemical parameters of the birds. Hence, this section.

Dietary modifications may influence the serum protein profile of broiler chickens. A study by Hassanpour *et al.,* (2018) revealed that excluding corn from broiler diets resulted in a significant increase in serum total protein levels.

Blood glucose levels are important indicators of energy metabolism in broiler chickens. Research by Ahmed *et al.,* (2017) showed that broilers fed diets without corn had significantly lower blood glucose levels compared to those fed diets with corn. Liver enzymes play a vital role in various metabolic processes. Research by Hassanpour *et al.,* (2018) demonstrated that broilers fed corn-free diets exhibited alterations in liver enzymes such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Dietary changes can affect lipid metabolism in broiler chickens. A study by Reverter *et al.,* (2017) reported that excluding corn from broiler diets resulted in changes in serum lipid profiles, including total cholesterol, triglycerides, and low-density lipoprotein (LDL) cholesterol levels.

Specific serum and biochemical parameters of broiler chickens fed diets without corn can vary depending on factors such as the composition of the alternative feed ingredients, nutrient density, and duration of the feeding trial.

* **Economic Significance**

Feeding broilers, a balanced diet is crucial for their growth, health, and overall production. Traditionally, corn has been a staple ingredient in poultry feed due to its high energy content and affordability. However, in recent years, alternative diets without corn have gained popularity due to concerns related to corn supply, price volatility, and sustainability (Fruge, 2011). The economic significance of broiler chickens fed a diet without corn depends on several factors, including the availability and cost of alternative feed ingredients. If corn prices rise significantly or become scarce, poultry producers may look for substitutes or alternative feeding strategies. However, there can be potential implications when altering the feeding regimen. Relying on alternative ingredients or modifying the diet composition might impact the growth performance, feed conversion efficiency, and overall health of broiler chickens. This, in turn, can affect the economic viability of broiler production. Potential challenges can arise in achieving the desired body weight, meeting market demands, and maintaining profitability (Fotiadis I. (2019). When exploring alternatives to corn, other grains like wheat, barley, or sorghum can be considered. However, their economic viability depends on factors such as availability, regional pricing, nutritional profiles, digestibility, and processing requirements. Non-grain ingredients such as soybean meal, canola meal, or animal byproducts might also be used to balance the diet and provide necessary protein (Viana G.S. (2020). Several studies have assessed the cost-effectiveness of a corn-free diet for broiler chickens. For example, Sánchez-Serrano, (2015) conducted a comparative economic analysis of different broiler diets, including corn-based and corn-free diets. Their findings indicated that corn-free diets can be economically viable if alternative ingredients are sourced at competitive prices and properly balanced to meet the nutrient requirements of broilers.

**CONCLUSION**

In conclusion, broilers as a significant contributor to the nutrients requirement and economy of the population could not be over exaggerated and the need to increase it productivity is essential, hence the need to mitigate the high cost of broiler feed. The performance of broiler chickens fed diet containing zero corn replaced by alternative energy sources from this review is shown significant in terms of growth performance, health status and carcass quality.

**RECOMMENDATION**

While alternative feed ingredients can be used to formulate balanced diets, their cost dynamics, growth performance, and environmental impact should be carefully considered. Future research should focus on optimizing alternative ingredient usage, exploring novel feed ingredients, and continuously evaluating the economic feasibility and environmental sustainability of corn-free diets for broiler production.

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