**ADVANCEMENTS IN POULTRY GUT HEALTH: THE IMPACT OF BIOTICS IN NIGERIAN FARMING**

**Abstract**

Poultry production is a crucial sector in Nigeria, contributing significantly to the economy, food security, and livelihoods of millions. However, productivity remains challenged by disease outbreaks, antibiotic resistance, and inefficient feed conversion. With growing restrictions on antibiotic use and increasing consumer demand for antibiotic-free poultry products, probiotics, prebiotics, and postbiotics are emerging as sustainable alternatives. These biotic additives play a key role in improving gut health, digestion, immunity, and overall poultry performance.

Probiotics are live beneficial microorganisms that help maintain gut microbial balance and prevent harmful pathogens from colonizing the intestines. Prebiotics are specific non-digestible feed components that promote the growth and metabolic activity of beneficial gut bacteria, enhancing nutrient absorption. Postbiotics, the metabolic byproducts of probiotics, provide additional immunomodulatory and antimicrobial benefits without the viability concerns of live probiotics. Together, these biotics contribute to better feed conversion, improved disease resistance, and greater sustainability in poultry production.

This paper reviews the latest developments in the use of probiotics, prebiotics, and postbiotics in Nigerian poultry farming, examining their mechanisms of action, effectiveness, and practical applications. It also explores emerging trends such as precision nutrition and innovative delivery technologies while addressing challenges related to adoption, regulation, and cost-effectiveness. Integrating these biotic strategies into poultry feeding programs can enhance productivity, reduce antibiotic reliance, and promote long-term sustainability in Nigeria’s poultry industry.

**Keywords: Advancements, Poultry, Gut, Health, Probiotics, Prebiotics, Postbiotics**

**Introduction**

The gastrointestinal (GI) tract of poultry plays a vital role in digestion, nutrient absorption, and immune function. A well-balanced gut microbiota ensures optimal digestion of complex nutrients and protects against harmful pathogens [1]. Historically, antibiotics have been widely used to promote growth and prevent diseases. However, growing global concerns over antibiotic resistance and the ban on antibiotic growth promoters in poultry have driven interest in alternative gut health strategies [2]. Additionally, consumer preference for antibiotic-free poultry has spurred research into natural gut health enhancers [3].

In Nigeria, poultry farmers face persistent challenges, including bacterial infections, malnutrition, and environmental stress. As a result, probiotics, prebiotics, and postbiotics have gained attention as viable solutions for improving poultry performance.

Probiotics, prebiotics, and postbiotics each play a unique role in gut health management. Probiotics are live microorganisms that offer health benefits when consumed in sufficient amounts [4]. Prebiotics are non-digestible food ingredients that selectively promote the growth of beneficial gut bacteria [5]. Postbiotics, which are metabolic byproducts of probiotics, provide immune-enhancing effects without requiring the presence of live bacteria [6].

A healthy and diverse gut microbiota is crucial for efficient digestion, metabolism, and immune function. An imbalance in gut microbes (dysbiosis) can compromise nutrient absorption and increase susceptibility to diseases (Stanley et al., 2014). Therefore, maintaining microbial diversity through dietary interventions is essential for enhancing poultry health and performance.

**The Impact of Probiotics on Digestive Health and Growth in Poultry**

In Nigerian poultry farming, probiotics are gaining attention as natural alternatives to antibiotics. Research shows they play a crucial role in maintaining gut health, improving digestion, and reducing harmful bacteria in poultry [7].

A study by [8] found that broiler chickens fed with probiotics showed significant improvements in weight gain and blood serum protein levels compared to those without supplementation. The findings highlight how probiotics help balance gut microbiota and strengthen the immune system.

Similarly, research by [9] demonstrated that probiotics are effective in preventing Salmonella infections—one of the major challenges in Nigeria’s poultry industry. These results support global research emphasizing probiotics' role in reducing enteric infections and enhancing feed conversion efficiency.

While most probiotics used in Nigerian poultry farming are imported, there is growing interest in developing locally sourced strains. As more farmers and researchers explore these beneficial microbes, probiotics could become a sustainable solution for healthier and more productive poultry farming in Nigeria.

 **Formulation of Probiotic-Based Poultry Feed Using Locally Available Ingredients in Nigeria**

The use of probiotics in poultry nutrition has gained increasing attention due to their ability to enhance gut health, improve nutrient absorption, and reduce reliance on antibiotics [10, 11]. In Nigeria, locally fermented foods such as maize gruel (*ogi*), fermented dairy products (*nunu*, *wara whey*), and palm wine sediment contain naturally occurring probiotic strains, particularly **Lactobacillus** spp. and **Saccharomyces cerevisiae** [7].

This field guide provides a standardized method for incorporating these natural probiotic sources into poultry feed, ensuring practical, cost-effective, and sustainable alternatives for smallholder farmers.

 **Ingredients for Probiotic Feed Formulation**

Table 1 : The following **locally available** ingredients can serve as **natural probiotic sources**:

| **Ingredient** | **Probiotic Strains Present** | **Function in Feed** |
| --- | --- | --- |
| **Fermented Maize or Sorghum (Ogi)** | *Lactobacillus acidophilus, L. plantarum, L. casei, L. fermentum* | Aids digestion, enhances gut microbiota |
| **Fermented Dairy Products (Nunu, Wara Whey)** | *Lactobacillus acidophilus, Bifidobacterium* | Enhances immunity, reduces pathogenic bacteria |
| **Palm Wine Sediment** | *Saccharomyces cerevisiae* (yeast) | Boosts immune function, aids digestion |
| **Molasses** | Enhances bacterial survival | Provides energy for microbial fermentation |
| **Commercial Probiotic Cultures (Optional)** | *Bacillus subtilis, Lactobacillus spp.* | Strengthens probiotic diversity in feed |

 **Probiotic Feed Preparation Protocol**

**Step 1: Ingredient Mixing**

* **Mix 5–10%** fermented maize/sorghum (*ogi*) into standard poultry feed.
* **Add 2–3%** of fresh whey (*nunu*, *wara whey*) or palm wine sediment.
* **Include 1–2% molasses** to support bacterial growth and fermentation.
* (Optional) **Add commercial probiotic cultures** at the recommended dose.

**Step 2: Fermentation Process**

* Allow the mixture to ferment **for 24 hours** in a controlled environment.
* Maintain a **temperature of 25–30°C** to encourage beneficial microbial activity.
* Stir occasionally to ensure even fermentation.

**Step 3: Storage & Administration**

* Store the fermented feed in **airtight containers** to maintain microbial viability.
* Use within **3–5 days** for maximum probiotic effectiveness.
* Feed poultry **twice daily**, replacing a portion of regular feed with probiotic feed.

The use of fermented local ingredients such as maize (ogi), dairy products (nunu, wara whey), and palm wine sediment as probiotic feed additives in poultry as given above has been informally practiced in Nigeria. While standardized formulations are lacking, studies [7, 10, 11] support the probiotic potential of these materials.

**Prebiotics: Boosting Gut Health and Nutrient Absorption**

While probiotics have gained attention in Nigerian poultry farming, the use of prebiotics remains relatively unexplored. However, research is beginning to uncover their potential in improving gut health and overall poultry performance.

A study by [7] examined the prebiotic properties of *Ocimum gratissimum* extract—a common herb in Nigeria—and its effectiveness in controlling *Escherichia coli* infections in broilers. The findings revealed that birds supplemented with the extract had healthier guts and lower mortality rates.

Similarly, [12] investigated dietary inulin and its role in promoting gut microbiota diversity. The study showed that inulin supplementation improved nutrient absorption and boosted growth performance in broiler chickens.

Despite these promising results, more research is needed to fully explore and optimize locally available prebiotics. By harnessing these natural solutions, Nigerian poultry farmers could enhance bird health and productivity in a sustainable way.

**Locally Available Prebiotic Sources:**

* **Cassava Peels (Dried and Processed) which** contains resistant starch and dietary fiber and supports gut bacteria growth.
* **Banana and Plantain Peels (Dried and Ground) which are** rich in fructo-oligosaccharides (FOS) and can be mixed into poultry feed.
* **Moringa Leaves (Dried and Powdered)** which acts as a prebiotic and contains antimicrobial compounds.
* **Palm Kernel Meal** which contains mannan-oligosaccharides (MOS) that improve gut health.
* **Garlic and Onion Extracts** are natural prebiotic components that enhance gut microbiota.

**Prebiotic Feed Preparation:**

1. **Dry and grind cassava peels, plantain peels, and moringa leaves.**
2. **Mix with poultry feed at 5–10% inclusion rate.**
3. **Add palm kernel meal (5%) and garlic powder (1–2%) for enhanced gut health.**
4. **Feed directly or mix with fermented probiotics for better results.**

**Postbiotics: A Promising Approach to Poultry Gut Health**

Postbiotics are gaining recognition for supporting poultry health without the need for live bacteria. Unlike probiotics, which rely on living microorganisms, postbiotics are beneficial byproducts of microbial fermentation that can enhance gut health and immunity.

[13] found that dietary postbiotics improved immune response and feed efficiency in Nigerian broiler chickens. More recently, [14] highlighted their antioxidant and antimicrobial properties, showing how postbiotics could help prevent oxidative stress and infections in poultry.

Despite their potential, postbiotics remain the least studied among the three biotics (probiotics, prebiotics, and postbiotics) in Nigeria. More research is needed to understand how they can be effectively integrated into different poultry production systems. If explored further, postbiotics could offer a safe, sustainable way to enhance poultry health and performance.

**3. Postbiotic Feed Formulation**

Postbiotics are metabolites produced by probiotics that provide immune-modulating and antimicrobial effects.

**Locally Available Postbiotic Ingredients:**

* **Fermented Rice Bran** that contains short-chain fatty acids (SCFAs) beneficial for gut health.
* **Yeast Culture Residue (From Local Breweries)** that is rich in beta-glucans and nucleotides.
* **Vernonia amygdalina (Bitter Leaf Extract)** which has postbiotic-like immune-boosting effects.
* **Butyric Acid (Produced in Fermented Cassava Waste)** which enhances intestinal integrity.

**Postbiotic Feed Preparation:**

1. **Ferment rice bran with *Lactobacillus* culture for 24–48 hours.**
2. **Mix 5–10% fermented rice bran with standard poultry feed.**
3. **Dry and grind yeast culture residue (5–7% inclusion).**
4. **Add 2–3% bitter leaf powder for added health benefits.**
5. **Ensure proper drying before storage.**

**Table 2 : Comparative Analysis: Probiotics vs. Prebiotics vs. Postbiotics**

| **Feature** | **Probiotics** | **Prebiotics** | **Postbiotics** |
| --- | --- | --- | --- |
| **Nature** | Live microbes | Non-digestible fibers | Metabolic byproducts |
| **Stability** | Sensitive | More stable | Highly stable |
| **Benefits** | Gut health, immune modulation | Supports beneficial bacteria | Direct gut health benefits |
| **Challenges** | Viability issues | Diet-dependent response | Standardization needed |

**Precision Nutrition and Innovative Delivery Technologies in Nigerian Poultry Farming**

As the demand for sustainable poultry production in Nigeria grows, biotic feed additives such as probiotics, prebiotics, and postbiotics are gaining attention. Recent trends focus on **precision nutrition** and **innovative delivery technologies** to maximize the efficacy of these additives and address challenges around adoption, regulation, and cost-effectiveness.

**Precision Nutrition: Customized Feeding for Enhanced Performance**

**Precision nutrition** is a data-driven approach that tailors feed formulations to the specific nutritional needs of poultry, based on breed, age, health status, and environmental conditions. When aligned with biotic supplementation, precision nutrition supports gut health, enhances nutrient absorption, and improves immunity in poultry flocks [15, 16].

In Nigeria, feed costs constitute up to 70% of poultry production expenses [17]. By minimizing nutrient waste and optimizing feed conversion ratios, precision nutrition presents a viable strategy for cost reduction and improved productivity. However, widespread adoption is limited by lack of access to real-time data, feed formulation tools, and technical know-how, especially among smallholder farmers [18].

**Innovative Delivery Technologies: Improving Stability and Efficacy**

Traditional methods of administering biotic additives through feed or water may not always ensure their stability and targeted release, particularly under tropical conditions. Emerging **delivery technologies** such as **microencapsulation**, **nanoparticle-based carriers**, and **controlled-release systems** offer improved protection and bioavailability of these additives in the gastrointestinal tract [19].

For example, encapsulating probiotics in alginate or chitosan matrices has shown to enhance their survival through feed processing and gastric passage [20]. While promising, these technologies are largely imported and costly, making them less accessible to Nigerian poultry producers.

**Challenges in Adoption, Regulation, and Cost-Effectiveness**

Despite scientific advancements, several barriers limit the successful integration of these strategies into Nigerian poultry systems.

**1. Adoption and Awareness**

Many poultry farmers are not fully aware of the benefits or application methods of biotics and precision nutrition. Extension services are under-resourced, and misconceptions about the efficacy of alternatives to antibiotics persist [11].

**2. Regulatory Oversight**

The regulatory framework for feed additives, including biotics, in Nigeria is still evolving. Inconsistent enforcement and lack of standardization pose risks for both producers and consumers. Regulatory clarity is essential to promote quality control, facilitate local research, and ensure safe adoption [21].

**3. Cost and Local Production**

The cost of importing probiotic strains and advanced delivery systems remains prohibitive. There is a pressing need for **local production** of microbial strains adapted to Nigerian poultry breeds and environments, as well as exploration of **indigenous prebiotic sources** such as cassava peel, moringa leaves, and fermented maize [22, 23].

**The Way Forward**

To harness the full potential of biotics in Nigerian poultry farming, the following steps are vital:

* **Investment in local R&D** to isolate effective native strains and develop homegrown delivery technologies.
* **Farmer education** and demonstration farms to bridge the awareness gap.
* **Regulatory reforms** that ensure product quality, safety, and encourage innovation.
* **Public-private partnerships** to subsidize the cost of biotics and promote local manufacturing.

With strategic investment and collaboration, Nigeria can build a resilient, antibiotic-free poultry industry rooted in science and sustainability.

**Conclusion**

Probiotics, prebiotics, and postbiotics have the potential to revolutionize poultry farming in Nigeria by reducing reliance on antibiotics and improving bird health. While probiotics have gained some attention, there is still much to uncover about the benefits of prebiotics and postbiotics. However, for these biotic feed additives to reach their full potential, challenges such as high costs, limited awareness, and the need for locally adapted strains must be addressed.

Locally available fermented products provide a **cost-effective and sustainable** way to integrate probiotics, prebiotics, and postbiotics into poultry feeding programs. By following the feed formulation protocol, Nigerian farmers can enhance poultry health, reduce reliance on antibiotics, and promote a more sustainable poultry industry.

With continued research, better education for farmers, and supportive policies, Nigeria can move toward a more sustainable and resilient poultry industry. By investing in these solutions today, we can ensure healthier poultry, safer food production, and a more prosperous future for Nigerian farmers.

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