

An Integrated Phytogenic Feeding Strategy for the Optimization of Hematological Health in Piglets: Evaluating the Therapeutic Potential of *Telfairia occidentalis* and *Pterocarpus mildbraedii*

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ABSTRACT

Piglet anemia remains a persistent constraint in intensive and smallholder pig production systems, particularly in resource-limited environments where access to conventional iron supplementation is inconsistent. This study develops and evaluates an integrated phytogenic feeding strategy utilizing *Telfairia occidentalis* and *Pterocarpus mildbraedii* as natural dietary interventions to optimize hematological health in piglets. The research adopts an experimental design framework that integrates phytochemical analysis, nutritional profiling, and hematological assessment to determine the efficacy of these plant-based supplements. Findings indicate that phytogenic supplementation contributes significantly to improved hemoglobin concentration, red blood cell count, and overall physiological resilience. The study further explores the biochemical mechanisms underpinning these effects, emphasizing antioxidant activity and micronutrient bioavailability. The results highlight the potential of plant-derived interventions as sustainable alternatives to synthetic supplementation, particularly in tropical and resource-poor production systems. This research contributes to advancing livestock nutrition strategies by proposing a scalable, cost-effective, and biologically efficient model for anemia mitigation in piglets.

Keywords: Phytogenic feed, Piglet anemia, Hematological optimization, *Telfairia occidentalis*, *Pterocarpus mildbraedii*, Nutritional intervention, Livestock health, Iron metabolism, Sustainable pig production.

INTRODUCTION

Bluff body Piglet anemia is a critical health issue characterized by insufficient hemoglobin levels, leading to reduced growth performance, weakened immunity, and increased mortality. Neonatal piglets are particularly susceptible due to low iron reserves at birth and rapid growth rates that demand high iron intake (Szudzik et al., 2018). Traditional management relies heavily on iron injections; however, such interventions may present logistical challenges, cost implications, and potential risks of iron overload (Lipinski et al., 2010).

In tropical and resource-constrained settings, improving pig husbandry practices is essential to address both productivity and health concerns. Studies have demonstrated that enhanced feeding strategies and management practices can significantly reduce disease prevalence and improve livestock outcomes (Lekule and Kyvsgaard, 2003). Despite these advancements, sustainable and locally available solutions for anemia control remain underexplored.

Phytogenic feed additives, derived from medicinal plants, have gained attention due to their nutritional richness and therapeutic properties. *Telfairia occidentalis*, commonly known as fluted pumpkin, is recognized for its high iron content and hematopoietic potential, while *Pterocarpus mildbraedii* exhibits strong antioxidant and mineral composition beneficial for physiological health (Usunobun and Igwe, 2016). These plants also contain bioactive compounds capable of enhancing nutrient absorption and immune function.

The objective of this study is to develop an integrated phytogenic feeding strategy that leverages these plant resources to improve hematological health in piglets. The research aims to evaluate their efficacy through controlled experimentation, analyze their biochemical impact, and propose a scalable model suitable for diverse production systems.

LITERATURE REVIEW

Existing literature provides a comprehensive understanding of piglet anemia and the role of nutrition in its management. Iron

deficiency is widely recognized as the primary cause, with studies indicating that neonatal piglets require external supplementation due to limited endogenous reserves (Chwen et al., 2001). While injectable iron remains the standard intervention, concerns regarding safety and efficiency have prompted exploration of alternative approaches (Lipinski et al., 2010).

The role of improved husbandry practices in mitigating livestock diseases has been emphasized in multiple studies. Lekule and Kyvsgaard (2003) highlighted that enhanced feeding, sanitation, and management systems significantly reduce disease risks, including those associated with nutritional deficiencies. This underscores the importance of integrating nutritional strategies into broader production systems.

Phytogenic plants have been extensively studied for their medicinal and nutritional properties. Doughari et al. (2009) identified phytochemicals such as flavonoids, tannins, and alkaloids as key agents with antimicrobial and antioxidant effects. These compounds contribute to improved physiological functions and disease resistance.

Specifically, *Telfairia occidentalis* has demonstrated significant hematological benefits. Fasuyi and Nonyerem (2007) reported improved blood parameters in poultry diets supplemented with its leaf meal, while Eze et al. (2019) observed enhanced hematological indices in animal models. Similarly, its antioxidant and hepatoprotective properties further support its therapeutic potential (Nwanna and Esther, 2008).

Pterocarpus mildbraedii also exhibits promising nutritional attributes. Usunobun and Igwe (2016) documented its rich mineral content and antioxidant activity, suggesting its role in enhancing metabolic and hematological functions. The presence of essential micronutrients supports erythropoiesis and overall health.

Despite these findings, there is a notable gap in integrating these phytogenic resources into piglet feeding strategies. Most studies focus on individual plant effects or other livestock species, leaving a lack of comprehensive models tailored to piglets. Additionally, limited research explores the synergistic effects of combining multiple phytogenic sources.

This study addresses these gaps by proposing a structured, integrative approach that combines phytochemical efficacy with practical feeding strategies, aligning with sustainable livestock production goals.

METHODOLOGY

Research Design

This study employs an experimental research design to evaluate the impact of phytogenic supplementation on piglet hematological health. A controlled feeding trial was conducted, dividing piglets into three groups: control (standard diet), *Telfairia occidentalis*-supplemented diet, and a combined phytogenic diet including *Pterocarpus mildbraedii*.

Experimental Framework

The integrated phytogenic feeding model is structured around three core components:

1. Nutritional Enrichment Layer – Incorporation of plant-based supplements into feed formulations to enhance micronutrient content.
2. Bioactive Optimization Layer – Utilization of phytochemicals to improve metabolic efficiency and antioxidant capacity.
3. Hematological Response Layer – Measurement of blood parameters to assess physiological impact.

This layered framework enables systematic evaluation of both direct and indirect effects of phytogenic feeding.

Feed Formulation

The experimental diets were formulated based on standard nutritional guidelines for swine (National Research Council, 2012). Plant materials were processed into leaf meal and incorporated at controlled inclusion rates. Nutritional analysis ensured balanced protein, energy, and micronutrient levels.

Data Collection

Hematological parameters were measured at baseline and at regular intervals, including:

- Hemoglobin concentration
- Packed cell volume
- Red blood cell count
- White blood cell count

These indicators provide a comprehensive assessment of blood health and immune status (Egeli et al., 1998).

Analytical Methods

Statistical analysis was conducted using comparative and variance-based techniques to determine significant differences between groups. Biochemical assays were used to evaluate antioxidant activity and mineral bioavailability.

Theoretical Basis

The methodology is grounded in nutritional physiology and phytotherapy principles. Phytogetic compounds are hypothesized to enhance iron absorption, reduce oxidative stress, and stimulate erythropoiesis. This aligns with findings that plant-based antioxidants play a crucial role in improving health outcomes (Mothana et al., 2009).

Practical Implementation Context

The model is designed for adaptability in both intensive and smallholder systems. In resource-poor settings, where access to pharmaceuticals is limited, phytogetic strategies provide a viable alternative. Improved feeding systems also contribute to broader disease reduction, as emphasized by Lekule and Kyvsgaard (2003).

RESULTS

The experimental findings demonstrate that phytogetic supplementation significantly improves hematological parameters in piglets. The group receiving combined *Telfairia occidentalis* and *Pterocarpus mildbraedii* exhibited the highest increase in hemoglobin concentration, indicating enhanced oxygen-carrying capacity and reduced anemia prevalence.

Red blood cell counts were notably higher in phytogetic-fed groups compared to the control, suggesting improved erythropoiesis. Additionally, white blood cell counts showed moderate elevation, reflecting enhanced immune responsiveness. These results align with previous studies indicating the hematopoietic benefits of phytogetic compounds (Eze et al., 2019).

The antioxidant activity observed in supplemented groups further supports the protective role of phytochemicals against oxidative stress, which is a contributing factor in anemia development. Mineral analysis confirmed increased bioavailability of iron and other essential nutrients.

Overall, the integrated phytogetic strategy demonstrated superior performance compared to conventional feeding, particularly in improving key hematological indices.

Discussion

The results validate the hypothesis that phytogetic feeding strategies can effectively mitigate piglet anemia through both nutritional and biochemical mechanisms. The observed improvements in hematological parameters can be attributed to the synergistic effects of micronutrient enrichment and antioxidant activity.

The findings are consistent with earlier research highlighting the importance of dietary interventions in livestock health. For instance, Fasuyi and Nonyerem (2007) demonstrated similar hematological

improvements in poultry, suggesting cross-species applicability of phytogetic feeds. Moreover, the role of improved feeding practices in reducing disease risk reinforces the broader implications of this approach (Lekule and Kyvsgaard, 2003).

However, certain limitations must be considered. Variability in plant composition due to environmental factors may affect consistency in outcomes. Additionally, the long-term effects of phytogetic supplementation require further investigation.

From a practical perspective, the integration of locally available plant resources offers a cost-effective and sustainable solution. This is particularly relevant in developing regions where access to conventional veterinary interventions is limited.

CONCLUSION

This study establishes that an integrated phytogetic feeding strategy utilizing *Telfairia occidentalis* and *Pterocarpus mildbraedii* significantly enhances hematological health in piglets. The approach provides a viable alternative to conventional iron supplementation, combining nutritional adequacy with therapeutic benefits.

The research contributes to advancing sustainable livestock nutrition by proposing a scalable and biologically efficient model. Future studies should explore dosage optimization, long-term effects, and broader applications across livestock systems.

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