Review of: "The Growth Performance of Nile Tilapia (Oreochromis Niloticus) Fed Low-Cost Fish Feeds Formulated From Fish By-Products, Fishery By-Catch and Pig Blood-Meal"

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Potential competing interests: No potential competing interests to declare.

Review

The Growth Performance of Nile Tilapia (Oreochromis Niloticus) Fed Low-Cost Fish Feeds Formulated From Fish By-Products, Fishery By-Catch and Pig Blood-Meal

ABSTRACT

Lack of Control Group: The study lacks a control group where fish is fed with a standard commercial fish feed containing fish meal. Without a control group, it becomes challenging to determine if the observed growth performance differences are solely due to the alternative feed ingredients or if they could be influenced by other factors.

Limited Sample Size: The sample size of 20 fingerlings per aquarium, replicated three times, might not be sufficient to draw robust conclusions. A larger sample size would increase the statistical power of the study and improve the reliability of the results.

Lack of Nutrient Analysis: While the abstract mentions the replacement of fish meal with alternative ingredients, it does not provide detailed information about the nutrient composition of these alternative feeds. Without knowing the precise nutrient profiles, it is difficult to assess the adequacy of the diets in meeting the nutritional requirements of Oreochromis niloticus fingerlings.

Growth Performance Metrics: The abstract mentions that growth performance was highest in fish fed with 100% by-catch, but it does not specify which growth performance metrics were evaluated (e.g., specific growth rate, feed conversion ratio). Providing specific growth performance data would enhance the clarity and interpretability of the findings.

Potential Bias: The abstract states that locally available alternative ingredients were cheaper than commercial fish feed. This raises concerns about potential bias in the study design or interpretation of results, especially if the study was funded or conducted by entities with vested interests in promoting alternative feed ingredients.

Need for Further Validation: While the results suggest that alternative ingredients could replace fish meal in Nile tilapia diets, additional research is needed to validate these findings under different environmental conditions, with larger sample

sizes, and over longer feeding periods. Replication of the study by independent researchers would also strengthen the reliability and generalizability of the conclusions.

INTRODUCTION

Limited Citation of Recent Literature: While the introduction cites several studies to support its statements, the majority of these citations are relatively old, with the most recent being from 2016. Aquaculture research is a rapidly evolving field, and it is crucial to include more recent references to ensure the relevance and currency of the literature review.

Generalization of Findings: The introduction makes broad statements about the suitability of alternative feed ingredients without providing specific evidence or references to support these claims. For example, it asserts that "by-products and by-catch... are affordable and easily available" without citing specific studies or data to substantiate this assertion. Providing empirical evidence or case studies would enhance the credibility of these claims.

Incomplete Explanation of Methodology: The introduction briefly mentions that the study evaluated the growth, survival, feed intake, protein efficiency ratio, and feed conversion ratio of Oreochromis niloticus fed with various formulated diets. However, it lacks details on the experimental design, such as the number of treatment groups, the duration of the feeding trial, and the statistical methods used for data analysis. Providing more comprehensive information about the methodology would allow readers to better evaluate the study's validity and reproducibility.

Limited Discussion of Potential Limitations: While the introduction acknowledges that commercializing alternative feed formulations may be challenging due to quality limitations, it does not extensively discuss other potential limitations of the study, such as variability in nutrient composition of alternative feed ingredients, potential anti-nutritional factors, or differences in digestibility compared to traditional fish meal-based diets. Addressing potential limitations upfront would provide a more balanced perspective on the feasibility and applicability of the study's findings.

Geographical Specificity: The introduction highlights the importance of the aquaculture industry in Zimbabwe and the specific challenges faced by fish farmers in the country. While this information is relevant to the context of the study, it may limit the generalizability of the findings to other regions or aquaculture systems. Providing a broader discussion of the global significance of the research topic would enhance its relevance to a wider audience.

MATERIALS AND METHODS

Lack of Replication Details: The section mentions that the experiment was conducted using a completely randomized design with eight treatments, but it does not specify the number of replicates per treatment. Replication is essential for assessing the variability and reliability of experimental results. Without this information, it is difficult to determine the robustness of the findings.

Inadequate Information on Fish Handling: The description of fish handling procedures, particularly during acclimatization and feeding, lacks detail. For instance, it is unclear how fish were selected randomly for weighing and stocking in aquarium tanks. Additionally, the rationale for conditioning fish to the rearing environment for 48 hours without

feeding is not provided. Detailed procedures for fish handling and acclimatization are crucial for minimizing stress and ensuring consistent experimental conditions.

Water Quality Monitoring: While the section mentions the measurement of various water quality parameters, such as turbidity, pH, and dissolved oxygen, it does not specify the frequency or duration of water quality monitoring throughout the experiment. Continuous monitoring of water quality is essential for maintaining optimal conditions for fish growth and health. Without this information, it is challenging to assess the adequacy of water management practices during the study.

Limited Microbiological Analysis: The section briefly describes the microbiological analysis of fishery by-products, fishery by-catch, pig blood, and formulated feed for total coliforms and Escherichia coli. However, it does not provide details on the specific methods used for microbial enumeration or the criteria for assessing microbial safety. Detailed microbiological analysis procedures are necessary for evaluating the microbial quality and safety of feed ingredients, especially those derived from animal sources.

Incomplete Proximate Analysis: While the section mentions the proximate analysis of formulated fish feeds, it does not provide information on the specific methods used for analyzing each nutrient component (e.g., crude protein, crude fat). Detailed analytical methods and standards are essential for ensuring the accuracy and reliability of nutrient composition data.

Statistical Analysis Limitations: The section mentions that the data did not meet assumptions for parametric tests and were analyzed using non-parametric tests (Kruskal-Wallis ANOVA and Mann-Whitney pairwise comparisons). However, it does not provide details on the specific assumptions that were violated or the rationale for choosing non-parametric tests. Providing justification for the choice of statistical methods and addressing potential limitations of the analysis would enhance the transparency and interpretability of the results.

RESULTS

Lack of Statistical Presentation: Although the section mentions significant differences ($p<0.05$) in various parameters, it does not provide detailed statistical results such as test statistics, degrees of freedom, or p-values. Including these statistical details would enhance the transparency and reproducibility of the findings, allowing readers to better understand the strength of the reported associations.

Incomplete Reporting of Data: Some results are presented without corresponding measures of variability (e.g., standard deviation, standard error), making it challenging to assess the precision of the estimates. Providing measures of variability alongside mean values would improve the reliability and interpretability of the results.

Limited Discussion of Data Trends: While the section describes differences between treatments, it does not thoroughly discuss underlying trends or potential explanations for the observed outcomes. For example, it does not explore why certain diets led to higher or lower growth rates, feed conversion ratios, or protein efficiency ratios. Including a discussion of potential mechanisms or factors influencing the results would enrich the interpretation of the findings.

Absence of Graphical Representation: While the section mentions growth curves for O. niloticus over the experimental

period, it does not include any graphical representations of the data. Graphs or figures illustrating trends over time would provide visual clarity and aid in the interpretation of complex data patterns.

Cost-Benefit Analysis Limitations: The cost-benefit analysis provides valuable insights into the economic performance of different diets. However, it does not consider other important factors such as environmental sustainability, nutritional quality of the harvested fish, or potential market preferences. Including a more comprehensive analysis of the costs and benefits associated with each diet would provide a more holistic perspective on their overall viability.

Generalization Challenges: While the study provides valuable insights into the performance of specific diets in the experimental setting, it is important to acknowledge potential limitations in generalizing the findings to other contexts. Factors such as regional differences in aquaculture practices, fish species, and environmental conditions could influence the applicability of the results beyond the study setting.

DISCUSSION

Limited Interpretation of Findings: While the discussion highlights the agreement between the study's findings and existing literature regarding the protein and fat content of fishery by-products, it lacks deeper interpretation of the implications of these results. For instance, it does not explore the potential reasons behind discrepancies between this study's findings and those of previous research, nor does it discuss the broader significance of these findings for aquaculture practices.

Incomplete Explanation of Factors Affecting Growth Performance: While the discussion briefly mentions the influence of temperature on fish feeding behavior and growth performance, it does not thoroughly analyze other factors that may have contributed to the observed outcomes, such as water quality parameters, stocking density, or fish health. Providing a more comprehensive discussion of these factors would enhance the understanding of the experimental results.

Limited Discussion of Economic Implications: Although the discussion briefly mentions the cost-effectiveness of utilizing fishery by-products in feed formulation, it does not delve into the broader economic implications for aquaculture enterprises. Exploring factors such as production costs, profitability, and market demand for alternative feed ingredients would provide valuable insights for stakeholders in the aquaculture industry.

Absence of Future Research Directions: While the discussion briefly mentions the need for further studies to explore amino acid profiles and long-term effects of alternative feed ingredients, it does not provide specific recommendations for future research directions or experimental designs. Offering concrete suggestions for future studies would contribute to the advancement of knowledge in this field.

Limited Contextualization of Findings: The discussion could benefit from contextualizing the findings within the broader context of sustainable aquaculture practices and global food security challenges. Providing a discussion of how the study's results contribute to addressing these larger issues would enhance the relevance and significance of the research findings.

Absence of Limitations Discussion: The discussion lacks a dedicated section on the limitations of the study, including potential sources of bias, methodological constraints, and uncertainties in the results. Acknowledging these limitations would enhance the transparency and credibility of the research findings.