



Safe Fish, Safe Families: Strengthening Food Safety in Tuguegarao City's Wet Markets



Food Science & Chemistry

Jinky Marie T. Chua*, Ma. Krischen Z. Austria, Gail Ann P. Pascual, Rosalia B. Cabalza and Jay Andrea Vea D. Israel

College of Allied Health Sciences, Cagayan State University, Andrews Campus, Tuguegarao City, Philippines

Corresponding Author: jchua@csu.edu.ph

Key Findings and Policy Implications

- Common fish species of Tilapia and Hito had the highest freshness and quality based on pH levels and QIM scores.
- Galunggong showed quality deterioration, likely due to poor transport and storage.
- Lead and Cadmium levels were within safe limits, but prolonged exposure may still pose health risks.
- Continuous monitoring of fish quality and contamination is essential to ensure food safety and public health.
- Enforce routine testing of fish to ensure compliance with food safety standards.
- Require proper handling, storage, and sanitation in fish markets to reduce spoilage.
- Educate consumers on selecting fresh, safe fish and understanding health risks.
- Strengthen environmental policies to prevent water pollution and contamination.

Background

Fish is an important component of the Filipino diet since it offers many households a significant source of protein and other necessary nutrients. However, irregular handling, storage, and possible contamination with heavy metals like lead (Pb) and cadmium (Cd) have raised questions about food safety in wet markets.

Research Objectives

The primary objective of this study is to assess the physicochemical properties and heavy metal contamination of fish sold in Tuguegarao City's wet markets to ensure food safety and public health protection. Specifically, the research aims to:

- Evaluate the freshness and quality of commonly sold fish species (Bangus, Galunggong, Tilapia, and Hito) based on physical, sensory, and chemical parameters such as length, weight, pH, and appearance.
- Determine the levels of heavy metals (lead Pb and cadmium Cd) in fish samples and assess whether they comply with permissible safety limits set by food safety authorities.

Methodology

- Fish samples from four commonly sold species (Bangus, Galunggong, Tilapia, and Hito) were randomly collected from different vendors in the Tuguegarao City Fish Depot to ensure variability and representativeness.
- The length, weight, skin appearance, gill color, eye clarity, and odor of the fish were assessed using standard quality indicators and the Quality Index Method (QIM) to determine freshness.
- The pH of fish meat was measured using a digital pH meter to evaluate freshness and potential spoilage.
- Heavy Metal Analysis (Lead and Cadmium Testing)
 - a. Fish samples were digested using nitric and perchloric acid before analysis.
 - b. Flame Atomic Absorption Spectrophotometry (FAAS) was used to determine the concentration of lead (Pb) and cadmium (Cd) in the fish samples.

Key Findings

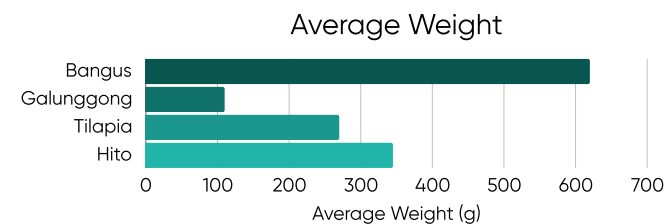


Figure 1. Average Weight of Common Fish in Tuguegarao Wet Markets.

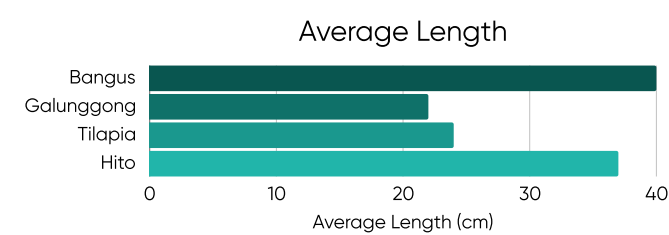


Figure 2. Average Length of Common Fish in Tuguegarao Wet Markets.

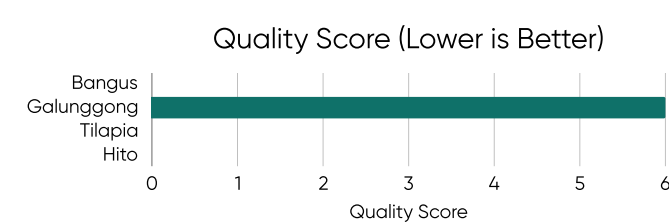


Figure 3. Quality Score Assessment of Common Fish in Tuguegarao Wet Markets.

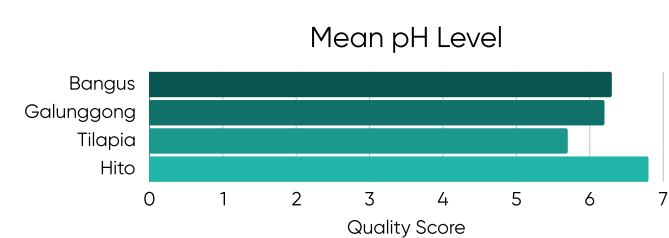


Figure 4. Mean pH Level of Common Fish in Tuguegarao Wet Markets.

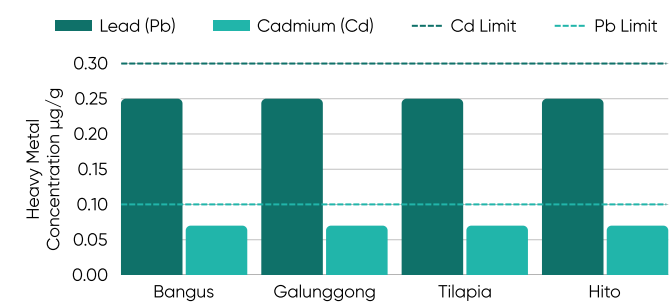


Figure 5. Lead (Pb) and Cadmium (Cd) Levels in Common Fish Samples.

Conclusion

To ensure the safety and quality of fish sold in Tuguegarao City's wet markets, this study highlights the urgent need to improve handling practices, raise consumer awareness, strengthen food safety monitoring, and enforce environmental safeguards. While heavy metal levels in fish were within safe limits, risks persist due to inconsistent storage and limited public knowledge.

Collaboration among stakeholders, market administrators, and government agencies is crucial.

Strengthened regulations, better storage infrastructure, and public education campaigns are essential to protect consumers and promote a safer food system. Preventing environmental contamination is equally vital to secure the long-term integrity of local fish supplies.

Policy Recommendations

Strengthen Food Safety Monitoring and Regulation (DA-BFAR, FDA)

Establish routine heavy metal testing and enforce market compliance through vendor protocols and regular inspections.

Improve Handling and Storage Practices (LGUs, Market Admin, DTI)

Implement vendor training and upgrade market facilities with cold storage and sanitation to maintain fish quality.

Enhance Consumer Awareness and Protection (DOH, DepEd)

Launch campaigns on assessing fish freshness and promote labeling for traceability and safety information.

Enforce Environmental Safeguards (DENR, DA-BFAR)

Tighten pollution controls and adopt sustainable aquaculture standards to reduce contamination in fish.

Checklist for Ensuring Fish Freshness in Wet Markets



Visual Appearance

- Skin is shiny, metallic, and not dull or discolored.
- Scales are intact and firmly attached.
- Belly is firm and not aburst or bloated.

Eyes

- Eyes are clear, shiny, and slightly bulging.
- Avoid fish with sunken or cloudy eyes.

Smell

- Smells fresh and slightly like sea or clean water.
- No sour, musty, or ammonia-like odor.

Gills

- Gills are bright red or pink (not brown or gray).
- No foul or rotting smell from the gills.

Target Policy Actors and Beneficiaries



References

Chua, J. M. T., Austria, M. K. Z., Pascual, G. A. P., Cabalza, R. B., & Israel, J. A. V. D. (2024). Physico chemical analysis of fishes sold in wet market in Tuguegarao City, Cagayan, Philippines. *Journal of Biodiversity and Environmental Sciences*, 24(6), 46–51.

Department of Agriculture-Bureau of Fisheries and Aquatic Resources. (2022). The Philippine milkfish industry roadmap (2021–2040). DA-BFAR.

Do-Yeong, K., & Shin, H. S. (2023). Evaluation of Freshness Indicators in Fish Storage and Quality Control. *Food Science and Biotechnology*, 32(12), 1719–1725. <https://doi.org/10.1007/s10068-023-01300-z>

Food and Drug Administration. (2021). Closer to Zero: Reducing childhood exposure to contaminants from foods. U.S. Food and Drug Administration. Retrieved from <https://www.fda.gov/food/environmental-contaminants-food/closer-zero-reducing-childhood-exposure-contaminants-foods>

Freitas, J., Vaz-Pires, P., & Camara, J. (2021). Quality Index Method for Fish Quality Control: Applications and Trends. *Trends in Food Science & Technology*, 111, 333–345. <https://doi.org/10.1016/j.tifs.2021.03.003>

Hyldig, G., Bremner, A., Martinsdottir, E., & Schelvis, R. (2007). Quality Index Methods for Fish Freshness Evaluation. In L. M. L. Nollet (Ed.), *Handbook of Meat, Poultry and Seafood Quality* (pp. 529–548). Blackwell Publishing Ltd.

Editor's Note

This policy brief is based on results of the CSU-funded project "Physicochemical Analysis of Fishes Sold in Wet Market in Tuguegarao City, Cagayan" This project was implemented by the Cagayan State University - Andrews Campus. The CSU - Andrews Campus project team is composed of Jinky Marie T. Chua, Ma. Krischen Z. Austria, Gail Ann P. Parel, Rosalia B. Cabalza, Jay Andrea Veal D. Israel.



About CSU Policy Brief

Our policy brief offers an in-depth analysis of contemporary challenges and opportunities within higher education, with a special focus on the unique context of Cagayan State University. Through rigorous research and stakeholder engagement, we examine key areas such as academic innovation, research advancement, community engagement, and administrative excellence. Each recommendation is carefully developed to foster an environment of growth, equity, and sustainability. **This policy brief is published bi-annually.**

Our approach is built on transparency and inclusiveness. By integrating comprehensive data analysis with practical insights from experts and the broader university community, we ensure that our policy recommendations are not only academically robust but also practically implementable. This process underscores our commitment to creating a positive and lasting impact on the university's future.

The policy brief also serves as a platform for translating research outputs into practical policy insights across six strategic thematic areas including Science and Technology in Agriculture, Natural Resources, Education, Food Science and Chemistry, Public Health and Medicine, and Behavioral and Social Sciences. These areas reflect the university's research priorities and address emerging concerns related to agriculture and livestock, environmental management, teaching and learning, food innovation, clinical diagnostics, and community resilience.

While these publications provide science-based interventions for regional and national development, the analyses and recommendations are those of the authors and do not necessarily represent the official positions of Cagayan State University. Any reproduction, distribution, or citation of this work must acknowledge the author and the CSU Policy Brief.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means without prior permission from Cagayan State University. This Policy Brief is part of the CSU Policy Brief.



Get in touch with us via:



facebook.com/csuktmpo



csu_ktmooffice@csu.edu.ph



csu.org.ph/policybrief



Cagayan State University

Knowledge & Technology Management and Publication Office

RDE Bldg., CSU- Andrews Campus Caritan Sur, Tuguegarao City, Cagayan

Editorial Board

Gilbert C. Magulod Jr., PhD
Editor-in-Chief

Patianne M. Padua, PhD
Associate Editor-in-Chief

Peer Reviewers

Audy R. Quebral, DPA

Josie Y. Bas-Ong, PhD

Anderson G. Gonzales, PhD

Charmie S. Calvo, DIT

Editorial Staff

Jamaica C. Pedro
Managing Editor

Marcel W. Visitacion
Layout Artist

Technical Staff

Christian Dave E. Columna
IT Technician

Interagency Local Advisory Board

Cagayan State University

University of the Philippines Diliman

University of Santo Tomas

Bureau of Fisheries and Aquatic Resources

Department of Agriculture

Department of Education

Department of Trade Industry

Department of Economy, Planning, and Development



POLICY BRIEF

Cagayan State University
Knowledge & Technology Management and Publication Office



csu.org.ph/policybrief