IARCO RESEARCH PROPOSAL - Ervin Gomes.pdf

by Mr Adnan

Submission date: 14-Oct-2025 01:52PM (UTC+0300)
Submission ID: 2780775094
File name: IARCO_RESEARCH_PROPOSAL_-_Ervin_Gomes.pdf (196.53K)
Word count: 1979
Character count: 11612

IARCO RESEARCH PROPOSAL

Full Legal Name: Ervin Odrian Gomes
Institution: SFX Greenherald International School
Category: Junior
Grade: A2 level
Country: Bangladesh
Submission Date: 30/09/25
Registered Email Address: ervingomes72@gmail.com
Research topic: Food Science and Technology
TITLE: Increasing Shelf Life using Herbal Method: A Comparative Analysis on Natural Fixatives as Replacements for Formalin

RESEARCH PROBLEMS:

In developing countries like Bangladesh, the widespread use of toxic chemical preservatives in food, especially formalin (a formaldehyde solution), creates a severe public health crisis. Economic pressures to increase profits and extend the shelf life of perishable goods lead vendors and farmers to use these dangerous substances. Formaldehyde is a known cancer-causing agent linked to nasopharyngeal cancer, respiratory problems, organ damage, and other serious toxic effects.

Even though using formalin is illegal, it is still common due to weak enforcement, public ignorance about the health risks, and consumer desire for visually appealing "fresh" produce. Studies have found dangerously high levels of formaldehyde in common foods, such as fish (up to 23.3 mg/kg in Catla catla) and fruits (94% of mangoes in one study). This practice steadily poisons the population while prioritizing immediate profits over long-term health. There is an urgent need to create, confirm, and promote safe, affordable, and effective natural alternatives to formalin for preserving food.

RESEARCH QUESTIONS:

This proposal is guided by the following primary research question: Can a novel, low-temperature preservation method utilizing a combination of neem, turmeric, and clove oil extracts ("HerboChill") effectively preserve the shelf life and quality of perishable foods while serving as a non-toxic, affordable, and accessible alternative to formalin?

This main question will be evaluated through the following sub-questions:

1. How does the preservative efficacy of HerboChill (in terms of microbial inhibition, shelf-life extension, and maintenance of texture/color) compare directly to traditional formalin treatment for specific foods (e.g., tomatoes, fish)?
2. What is the synergistic effect of combining these plant extracts with low-temperature storage (clay pot/ice box) on preservation outcomes?
3. Is the proposed HerboChill method economically feasible and practical for implementation by small-scale farmers and vendors in Bangladesh?

INTRODUCTION:

Food adulteration is the deliberate addition of hazardous chemicals or substances to food items in order to increase its weight or visual appeal. Artificial colors, synthetic tastes,

chemical preservatives, pesticides, fertilizers, antibiotics, and hormones are the most prevalent types of adulterants detected in food. (1) Formalin, primarily composed of formaldehyde, poses significant health risks, including carcinogenicity and acute toxic effects. Exposure can lead to respiratory issues, skin irritation, and long-term health complications such as nasopharyngeal cancer (2). The medical community has recognized these dangers, prompting the exploration of safer alternatives for embalming and tissue fixation.To address these issues, we developed HerboChill, a non-toxic preservation agent based on plants which is less harmful to the environment and serves as a better alternative to formalin.

Importance of this research:

HerboChill leverages the proven antimicrobial and antioxidant properties of readily available natural agents—neem, turmeric, and clove oil—combined with simple low-temperature storage. The importance of this research lies in its potential to provide a safe, accessible, and economically viable alternative to formalin, directly safeguarding consumer health and empowering vendors with an ethical preservation choice.

The primary goals of this research are to:

1. Formulate and standardize the HerboChill natural preservative solution.
2. Scientifically evaluate and compare its efficacy against formalin in preserving food quality, microbial load, and shelf life under controlled conditions.
3. Assess the practical and economic feasibility of implementing this method for small-scale vendors and farmers in Bangladesh.

LITERATURE REVIEW:

RECENT RESEARCH ON THE PROBLEMS OF FORMALIN AND ITS EFFECTS:
These formalin are a prominent problem in developing countries like Bangladesh because fruits are maintained for a prolonged period, especially during transportation to far-off markets, by farmers and vendors for profit maximization. Also due to lack of enforcement in Bangladesh, the use of formalin in food is illegal, but they do not check frequently. Vendors understand that they are rarely punished. Along with that, customers will buy shiny and fresh looking fruits no matter what is inside. Formalin pauses decomposition and ripe progression, faking the indication of freshness. Moreover, there is a public awareness gap as many consumers do not know the health risks associated with formalin which are linked to cancer, organ damage and respiratory issues. Furthermore, limited resources and corruption reduce the effectiveness of food safety regulators like the Bangladesh Standards and Testing Institution (BSTI). There can be informal supply chains which have less traceability, making it difficult to identify the culprits. As these developing countries have high poverty rates so they tend to prioritize short term income more over long term health implications.(3)

This study highlights serious health concerns related to the presence of formaldehyde in commonly consumed fish in eastern India. Key findings include high levels being found in

frozen carp species. This includes the Labeo rohita in which 19.66 mg of formaldehyde was present per kg and the Catla catla which 23.3 mg of formaldehyde was present per kg. However, non-carp fish (*Anabas testudineus* and *Clarias gariepinus*) had very low or negligible formaldehyde content. When rats were fed contaminated carps, formaldehyde accumulated in the blood over 7 days. After 7 days when the histopathology tests were carried out it revealed that stomach damage including loss of protective mucus and tissue detachment had occurred in the rats Thus, it can be concluded that continuous consumption of formaldehyde-contaminated carps may pose serious health risks, emphasizing the need for strict monitoring and safer food handling practices. (4)

GAPS IN PRIOR RESEARCH: For years, the preservation of biological specimens has played a key role in medical teaching, anatomy learning, and pathology labs. The choice has always been formalin for its effectiveness and low price, making it a reliable means of preserving cellular structure and eliminating cellular decay. formalin is a 37-40% solution of formaldehyde in water. As cost-effective as formalin is to the laboratory, research has shown time and time again that formalin is associated with severe health related problems such as cancer, respiratory issues, muscle inflammation, and neurological disorders. (5) With the burden of globalization came the appeal to non toxic alternatives.

IMPICATION FOR RESEARCH DESIGN AND FOCUS: In the last two decades, researchers have tried out alternative fixatives like ethanol blends, glycerin solutions, and even phenoxyethanol. Some have produced limited results, but they lack safety, accessibility, or sustained preservation quality. More recently, plant-derived preservatives have shown great promise because of their built in antimicrobial and antifungal properties. Neem, turmeric, and clove oil boast a broad spectrum of biological activity that make them highly valuable in ethnomedicine. (6)

RESEARCH METHODOLOGIES:

This study will employ a mixed-methods approach that combines quantitative experimental data with qualitative insights to ensure a comprehensive evaluation of the HerboChill solution's efficacy and practicality.

QUANTITATIVE PHASE: It will consist of a controlled laboratory experiment designed to generate empirical data on preservative efficacy. A fresh, homogeneous batch of a highly perishable food item such as tomatoes or Labeo rohita fish will be procured and randomly divided into four treatment groups. Group 1 will serve as a control with no preservative treatment. Group 2 will be treated with the standardized Neem-Turmeric solution via dipping or spraying. Group 3 will receive the Neem-Turmeric solution enhanced with 0.5% clove oil. Group 4 will be treated with a 0.5% formalin solution as a positive control. All samples will be air-dried and stored in identical, sterile containers within a controlled environment chamber set to 15°C and 75% relative humidity to simulate the cool, damp conditions of a clay pot or insulated cooler.

QUALITATIVE PHASE: The qualitative phase will focus on feasibility and perception analysis through semi-structured interviews conducted with a purposive sample of key stakeholders including small-scale fruit and fish vendors from urban bazaars and supermarkets, local farmers, and officials from the Department of Agricultural Extension or BSTI. These interviews will explore current knowledge and concerns about formalin use, perceived barriers to adopting natural alternatives, feedback on HerboChill's practicality based on demonstrations, and suggestions for implementation and training.

DATA ANALYSIS: Data collection for quantitative metrics will occur at 24-hour intervals over a 10-day period. Microbial load will be assessed through swab samples from specimen surfaces which will be serially diluted and plated on nutrient agar and potato dextrose agar to quantify Total Viable Bacterial Count and Total Yeast and Mold Count. Several physicochemical parameters will be measured including weight loss percentage using a precision balance. A trained 5-member panel will perform blind sensory evaluations on day 0, 5, and 7 for attributes like color, odor, and overall acceptability. For qualitative, Statistical significance between treatment groups across the storage period will be determined using one-way or two-way analysis of Variance. Qualitative data from interviews will be transcribed verbatim and analyzed using thematic analysis to identify, analyze, and report patterns within the data through familiarization, code generation, theme searching, theme review, and theme definition and naming.

PROJECT PRACTICALITIES: the project is designed for completion within a 6-month timeline with months 1-2 dedicated to literature review, protocol finalization, and material procurement; months 2-4 for executing the quantitative experimental phase; month 5 for conducting qualitative interviews and simultaneous data analysis; and month 6 for integrating findings and preparing the final report. Essential resources include equipment such as an environmental chamber, autoclave, laminar flow hood, incubators, analytical balance, pH meter, refractometer, and penetrometer, along with lab consumables including Petri dishes, agar media, sampling swabs, sterile containers, gloves, and masks, plus raw materials like fresh neem leaves, turmeric roots/powder, clove oil, formalin, and fresh produce/fish. Ethical considerations mandate strict laboratory safety protocols for chemical handling, particularly formalin, requiring fume hoods and personal protective equipment; informed consent from all qualitative phase participants with guaranteed anonymity and confidentiality and freedom to withdraw; and proper disposal of all biological waste according to institutional biohazard guidelines.

CONCLUSION:

The Neem Tumeric chill method is a viable natural alternative to formalin and if it can be used in all households then it can be a big turning point on the health aspect of each and every family especially in developing countries. This can facilitate mental well being as well as the work rate of all the workers. While it may not match synthetic chemicals in longevity, its safety, affordability and eco friendliness can really make it a practical choice for small scale uses. The future of this product is to refine the technique for specific foods and climates, then promote through agricultural networks.

REFERENCES:

[1] Rahman, Md Bokthier, "An update on formaldehyde adulteration in food: sources, detection, mechanisms, and risk assessment - PubMed," PubMed, 2025[Online]. Available: https://pubmed.ncbi.nlm.nih.gov/37406446/

[2] Drahota, Petr, Filippi, Michal, "Secondary arsenic minerals in the environment: A review," Environment Health Perspective, vol. 35, no. 8, pp. 1243-1255, 2009, doi: 10.1016/j.envint.2009.07.004

[3] Joardder, Mohammad U. H., Hasan Masud, Mahadi, "Food Preservation in Developing Countries: Challenges and Solutions," Environment Health Perspective, vol. 50, no. 4, pp. 1470, 2019, doi: 10.1007/978-3-030-11530-2

[4] Kundu, Amit, "Adverse health risk from prolonged consumption of formaldehyde-preserved carps in eastern region of Indian population - PubMed," PubMed, 2025[Online]. Available: https://pubmed.ncbi.nlm.nih.gov/32124294/

[5] Swenberg, James A., Moeller, Benjamin C., Lu, Kun, Rager, Julia E., Fry, Rebecca C., Starr, Thomas B., "Formaldehyde Carcinogenicity Research," Environment Health Perspective, vol. 41, no. 2, pp. 181-189, 2012, doi: 10.1177/0192623312466459

[6] Wilkinson, Heather H., Spoerke, Jill M., Parker, Matthew A., "Divergence in Symbiotic Compatibility in a Legume-Bradyrhizobium Mutualism," Environment Health Perspective, vol. 50, no. 4, pp. 1470, 1996, doi: 10.2307/2410884

IARCO RESEARCH PROPOSAL - Ervin Gomes.pdf

ORIGINALITY REPORT

11%	10%	3%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.switch-asia.eu Internet Source	2%
2	refubium.fu-berlin.de Internet Source	1%
3	tools.niehs.nih.gov Internet Source	1%
4	hal-insu.archives-ouvertes.fr Internet Source	1%
5	ntnuopen.ntnu.no Internet Source	1%
6	www.reogma.com Internet Source	1%
7	mda.gesis.org Internet Source	1%
8	www.questia.com Internet Source	1%
9	www.researchgate.net Internet Source	1%
10	www.coursehero.com Internet Source	1%
	link.springer.com	

11	Internet Source	<1%
12	par.nsf.gov Internet Source	<1%
13	Chitra Purohit, Peram Rajyalakshmi. "Quality of products containing defatted groundnut cake flour", Journal of Food Science and Technology, 2010 Publication	<1%
14	www.me.ruet.ac.bd Internet Source	<1%
15	Amit Kundu, Prasanta Dey, Rammohan Bera, Ratul Sarkar, Boomin Kim, Sam Kacew, Byung Mu Lee, Sanmoy Karmakar, Hyung Sik Kim. "Adverse health risk from prolonged consumption of formaldehyde-preserved carps in eastern region of Indian population", Environmental Science and Pollution Research, 2020 Publication	<1%
16	Tom Allen, Andy Alderson, Alan Godfrey, Duane Knudson, James Webster, Kazuya Seo. "Routledge Handbook of Sports Technology and Engineering", Routledge, 2025 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	Off		