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THE MICROBIOLOGY AND VOLATILE ACID ANALYSIS OF  
FERMENTED ANCHOVY (*Stolephorus commersonii*)  
WITH ADDED RICE (Tinomayan Bolinao)

A Thesis

Presented to the

Faculty of the College of Home Economics  
UNIVERSITY OF THE PHILIPPINES SYSTEMS

In Partial Fulfillment  
of the Requirements for the Degree of  
Master of Science in Food Science

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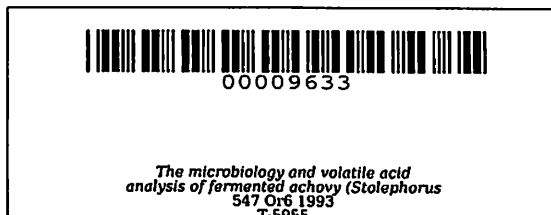
Ma. Anuncien Valenzuela - Oranon

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## ABSTRACT

"Fermented fish with added rice" (*tinomayan*) is a high salt fermented product prepared from either siganid fry or small anchovy. The fermentation process involves an initial fermentation stage which includes salting of the fish and fermentation of the fish-salt mixture for fifteen days. A final fermentation stage follows wherein the fermented fish is mixed with cooked rice and allowed to complete fermentation at ambient temperatures.

The changes in pH during the initial fermentation stage were characterized by a continual decrease during the first week of fermentation, and was followed by an increasing trend on the second week. The pH values decreased steadily during the final fermentation stage. These changes in the pH values of the fermenting fish were complemented with a general increase in titrable acidity values with fermentation time.

Microbiological investigation revealed an overlapping growth of two groups of salt-tolerant bacteria -- *Micrococcus sp.* and *Pediococcus sp.*, during the initial fermentation stage. A sequential but overlapping growth of lactic acid bacteria was observed on the final stage of fermentation. The *Streptococci*,

which appeared one day after the addition of cooked rice, were outnumbered by the *Leuconostocs* after two days. The *Pediococci* coexisted with the *Leuconostocs* and were noted to have dominated the microflora of the fermenting mixture. *Lactobacillus* strains, which were mostly low-acid producing atypical colonies, appeared later but did not exhibit a major role in the fermentation process.

Qualitative and quantitative analyses of the volatile organic acids by gas chromatography revealed that acetic acid was the predominant acid in fermenting anchovy with added rice (*tinomayan bolinao*). Propionic acid, n-butyric acid, iso-butyric acid and iso-valeric acid were also detected at low concentrations.

The role of microorganisms in the production of volatile organic acids was determined by pasteurization treatment and pure culture inoculations. It was observed that inoculation with *Pediococcus* sp. yielded total volatile acid values which approximate the values obtained from the uninoculated lot.

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## INTRODUCTION

Traditionally fermented fish products are classified into two main groups. The first group consists of fish-salt mixtures, which contain more than 20% salt of the total product weight. The mixture is fermented for several weeks to one year or more until the desired color, flavor and aroma are attained. The second group consists of fish-salt-carbohydrate mixtures, wherein the final product is acidic and has a somewhat cheesy aroma. Products from this group contain less than 20% salt, and thus is classified as low-salt fermented products.

In the Philippines, the typical examples of fermented fish are *patis* (fish sauce) and *bagoong* (fish paste), which are both high-salt fermented fish products, and *buro*, a low-salt fermented fish with cooked rice. *Bagoong* is characterized as "a clean, sound product obtained from the fermentation of properly prepared whole or ground fish or shrimp roe" (Espejo, 1980). *Patis* is a clear liquid resulting from the slow digestion of salted fish. "*Buro*" is produced from fish or shrimp with salt and cooked rice added.

These Filipino products have been identified as potential dollar earners. Statistics showed that *bagoong* registered export earnings totaling to 750,030