Influence of Salt Concentration on the Fermentation Rate of Fish Sauce From Anchovies, *Stolephorus spp*

Accepted 26th April, 2016

ABSTRACT

Good quality fish sauce produced from anchovies (*Stolephorus spp*, Family: *Engraulidae*) was allowed to ferment with 15% salt concentration at room temperature for two months with the application of low temperature processing during the preparation process. Fish sauce from anchovies with 15% salt concentration has a 60-day fermentation period to attain the percent solids of 32% (FDA standards) based on simple linear regression analysis. This product was significantly different from fish sauce with 30% salt concentration based on t-test at 5% level of significance. It contained 82.2% moisture, 0.94 Aw, 15.1% protein, 0.4% fat and 1.40% ash content. The results of the descriptive and preference tests of fish sauce with 15% salt concentration gave the significant difference results as to its flavor for descriptive tests and acceptability test based on t-test at 5% level of significance. The product has a light brown color, moderately salty flavor, fishy odor and soft texture. The bacterial count was $1.04 \times 10^4$ cfu/g, figure not greater than and falls within the range of $10^4$ to $10^6$ cfu/g for the total number of organisms. Thus, fish sauce with 15% salt concentration is safe for human consumption.

Key words: Fish sauce, fermentation, fisheries.

INTRODUCTION

The product produced by the process is known as fish sauce which is straw yellow to amber in color, obtained from the liquefaction of the mixture of fish or shrimp and common salt, and has a strong salty taste with traces of fishy odor (FDA, 1970). Most of the fermented products in the local market contained more salt and the digestion process is too long and usually it takes more than six months before fish sauce can be extracted. Addition of histidine accelerated hydrolysis of fish protein during fermentation in the manufacture of fish sauce and after 4 months fermentation yielded a product typical of traditional fish sauce (Sanceda et al., 1993). The effects of salt concentration and washing preparation on the quality of fish sauce from anchovies were investigated by Macachor et al. (2001). Thus, the study aimed to determine the influence of salt concentration on the fermentation rate of fish sauce from anchovies.

MATERIALS AND METHODS

The experimental method of research on the influence of salt concentration on the fermentation rate of fish sauce from anchovies (*Stolephorus spp*, Family: *Engraulidae*) (Figure 1) was used in conducting the study employing the laboratory techniques and procedures. The study aimed to determine the influence of salt concentration on the fermentation rate of fish sauce from anchovies based on its physico-chemical characteristics and sensory attributes. The experimental samples of anchovies were divided into two treatments as shown in Figure 2, such as:

- Treatment 1 = Anchovies with 15% salt;
- Treatment 2 = Anchovies with 30% salt.

The two treatments in triplicates were subjected to
Figure 1. Stolephorus spp, Family: Engraulidae.

Figure 2. Fish sauce with varying salt concentration.
physical-chemical analyses (percent solids) and sensory evaluation using descriptive (15 trained panelists) and preference (50 panelists) tests. The data gathered was subjected to weighted mean and t-test for test of significance at 5% level. The microbial count including bacterial total plate count in colony forming unit per gram (cfu/g) sample and proximate composition of the research sample were determined to characterize the quality of the product. In order to determine the quality of the newly processed fish sauce, physical-chemical, microbiological and sensory analyses were conducted. The product yield and cost analysis were likewise determined.

RESULTS AND DISCUSSION

This study were based on the physical-chemical analysis, proximate composition, microbiological analysis and sensory evaluation results of fermented anchovies.

Physico-chemical analysis

The fermented anchovies after every week of aging process are subjected to the determination of percent solids to determine its fermentation rate. After eight (8) weeks of monitoring the change of percent solids of fish sauce with varying salt concentrations it resulted in the rejection of the null hypothesis (Ho). This implies that the differences between 15% salt and 30% salts are large enough to be significant. The major concern for this study is the determination of relationship between the rates of fermentation of fish sauce by determining the change of percent solids. The result appears that there is a negative relationship between the days of fermentation and change of percent solids observed in both 15 and 30% salt concentrations respectively. Since the test of hypothesis caused the rejection of the Ho based on t-test at 5% level of significance, then, the inverse relationship between the rate of fermentation and percent solids is significant. Therefore, it would be that as the days of fermentation increases, the percent solids decreases correspondingly. This would imply that the rate of fermentation could be associated with low salt concentration, since the percent solids with 15% salt decreases significantly faster than with 30% salt concentration. After eight (8) weeks (56 days) of sampling, the percent solids of fish sauce at 15% salt decreases from 62.2 to 37.0% solids respectively, that is, 40.51% fermentation rate. However, fish sauce with 30% salt, the percent solids decreased from 75.5 to 53.5% respectively, that is, 29.14% fermentation rate. The higher the fermentation rate (40.51%) observed, the faster the process of production, thus, having a low cost of production. Orejana and Liston (1979) found out that small fish in a nearly saturated salt concentration (usually 20% salt or more) had over a period of six months to a year and a half of fermentation period (NSDB, 1980). The fermentation period of fish sauce using anchovies at 30% salt in this study, confirms the work of Orejana and Liston (1979); however, anchovies at 15% salt, ferments only after two to three months (Macachor, 2001). During fermentation, the softening of fish tissue is considered desirable, however, only to a certain point with a total solid not less than 32% (FDA, 1970).

Proximate composition

The moisture content of fermented products using 15 and 30% salts was 82.5 and 63.5%, respectively. Its percent salt content level was 6.96 and 7.25% and percent fat content of 0.64 and 1.3%, respectively. The water activity of the fermented products with 15 salt and 30% salt was 0.94 and 0.92, respectively. This study revealed that the fermented anchovies with 15.1% protein; 0.4% fat; 2.0% ash while the fermented anchovies with 30% salt concentration has a physical-chemical composition of 63.5% moisture; 15.6% protein; 1.3% fat; and 2.5% ash.

Microbiological analysis results

Lupin (1982) as cited by Macachor (2001) pointed out that products with water activity ranging from 0.60 to 0.95 are still perishable to bacteria, yeasts and mold growth. In this study, fermented anchovies with 15 salts and 30% salt had a bacterial count of 1.04 × 105 and 8.29 × 10^4 cfu/g, and corresponding water activity of the products of 0.94 and 0.92, respectively. Thus, the fermented anchovies after eight (8) weeks of aging process are safe for human consumption. Degradation in traditional processes is controlled primarily by the addition of salt. The most common putrefactive microorganisms on fish are inhibited at salt contents above 6 to 8% (Wheaton and Lawson, 1985).

Sensory evaluation results

Descriptive test

Fermented aquatic products are prepared in variety forms ranging from whole fish to fish sauces and pastes. In the developed countries, fermentation is generally employed to provide a desired taste and/or flavor. Since the sauces and pastes prepared are salty and spicy, they provide a significant departure from a rather bland cereal diet. Because the high salt content limits the volume of intake, sauces and pastes often serve as flavor enhancers. It is desirable to reduce the process time and product salt content while preserving the characteristic
taste, odor, and texture of the traditional products (Wheaton and Lawson, 1985). In this study, the sensory qualities of the fermented anchovies with varying salt concentration was determined based on its descriptive test which had a light brown in color, moderately salty flavor, fishy odor and a slightly soft texture for anchovies with 15% salt concentration as perceived by the panelists. The fermented anchovies with 30% salt concentration had gray in color, strong salty flavor, salty odor and tough texture.

Preference test

The acceptability scores of flavor were assessed by fifteen (15) trained panelists and fifty (50) untrained consumer panelists. The data was treated for test of significance using t-test at 5% level. The results indicated that the fermented anchovies with 15 and 30% salt concentration when judged on the basis of flavor preference test using 9-point hedonic scale were found significantly different from each other. The fermented anchovies had the mean flavor scores of 7.27 and 6.87 for 15 and 30% salt concentration, respectively which means “like moderately”. The paired differences of % salt concentration values for fermentation rate resulted in the rejection of the Ho. This implies that the differences between 15 and 30% salts are large enough to be significant. As such, one may conclude that percent salt concentration of fish sauce with the flavor scores are not the same. The preference tests results as perceived by the fifteen (15) trained panelists was confirmed by the results obtained from the fifty (50) untrained panelists. The results indicated that the fermented anchovies with 15 and 30% salt concentrations when judged on the basis of acceptability were found significantly different from each other. The fermented anchovies had the mean acceptability scores of 6.5 and 6.7 for 30 and 15% salt concentrations, respectively. Thus, the product has acceptability hedonic rating scores of “6.7” for fermented anchovies with 15% salt, and “6.5” for 30% salt concentration, which means “like moderately”. The paired differences of percent salt concentration values for fermentation rate resulted in the rejection of the Ho. This implies that the differences between 15 and 30% salts are large enough to be significant. Since salt concentration may affect the acceptability of fish sauce.

ACKNOWLEDGEMENT

The researchers would like to express their sincere thanks to the Cebu Technological University management and researchers headed by Pres. Rosein A. Ancheta Jr., Department of Science and Technology (DOST) Philippines and to the editorial staff of Academia Journal of Biotechnology and to all people who in one way or another make this publication a reality.

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Cite this article as:
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