Improved Shelf Life of Fresh Buro (Fermented Fish with Rice) through Vacuum Packaging

Asia Pacific Journal of Multidisciplinary Research
Vol. 3 No.5, 97 - 100
December 2015 Part IV
P-ISSN 2350-7756
E-ISSN 2350-8442
www.apjmr.com

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Date Received: October 16, 2015; Dare Revised: December 10, 2015

Abstract - *The study determined the effects of mass of frozen packed fresh buro (fermented fish with rice) (factor A), the length of time the vacuum pressure was applied (factor B), the amount of vacuum pressure applied (factor C), on the shelf life of vacuum- packed buro (fermented fish with rice). Using three-factor analysis of variance, it was found out that factors A,B,C and factor B vs. C significantly increased the shelf life of frozen fresh buro. All other interactions are significant. Higher amounts of vacuum pressure applied and longer duration of its application gives the maximum shelf life for a given mass of frozen fresh buro. Results also show that on the average, the shelf life of frozen fresh buro was doubled when vacuum-packed. Future studies are recommended to the best effect of nitrogen gas add-on in shelf life of frozen fresh buro.*

Keywords: *buro, fermented fish with rice, fermentation, vacuum sealed*

INTRODUCTION

The Buro Project assisted by Department of Science and Technology (DOST) helped improve the formula, processing, packaging and prolonged shelf life of buro (Phillipine Star, January 2009) or fermented fish. The generated technology resulted to an improved "Odorless and delicious buro" now called burolocious [1]. It also expanded the market of commercialized cooked buro. It created big demand for cooked buro. Buro Project also improved the post-harvest of fresh water fish in Mangabol and other fish ponds and revived the culture of fresh water fish festival (malangsi Festival) in Bayambang. During the period of abundance of fish fishermen are able to preserve dalag (Ophicephalus) as well as small types of fresh water fish like tilapia.

Gourami (Trichogaster) and small type of tilapia (Tilapia) are seldom eaten among barangay folks in Mangabol thus, considered a waste. However, due to the generated technology fresh buro (molantong) also increased in sales. Molantong is sold in the market fresh and wrapped in plastic. The fresh buro both molantong and dalag increased in sales and demand. Thus, there a need to improve the packaging of fresh buro to prolong its shelf life. Since fresh buro last for four days while frozen buro last for four to six months.

Vacuum packaging is another effective way to increase the shelf life of food products. The product is placed in an air-tight pack where the air is sucked out and the package is sealed. Removing air from around the product minimizes oxygen levels in the packaging and hinders the ability of aerobic bacteria to grow and spoil the product. The lack of oxygen also reduces the amount of spoilage due to oxidation [2].

However, only a partial vacuum is created because a certain amount of oxygen will remain since it is physically impossible to create total vacuum at ordinary conditions. As the air is withdrawn during the process, the pressure inside the package is reduced relative to outside pressure resulting negative or vacuum [3].

With these, it is implied that freezing and vacuum packaging of fresh buro will increase shelf life compared to just at room temperature and or frozen that which, these factors can slow down or stops the further growth of fermenting bacteria [4]. While this is obvious, it still needs to be proven significantly. Shelf life in this study means shelf life of frozen fresh buro. With increased shelf life, vendors increase their sales and profit.

The study aimed to prove that vacuum packaging significantly increases the shelf life. It also seeks to

determine the effects of the mass of fresh buro packed (factor A), the length of time the vacuum pressure was applied (factor B), and the amount of vacuum pressure applied (factor C) on the shelf life. We represent factor A by mass, factor B by time, and factor C by pressure.

These hypotheses were tested at the 0.05 level of significance:

a. Individual factors (mass, time, pressure) does not significantly affect shelf life.

b. Two factor interactions (mass vs. pressure, mass vs. time, pressure vs. time) does not significantly affect the shelf life

c. Three factor interaction (mass vs. pressure vs. time) does not significantly affect the shelf life

MATERIALS AND METHODS

The study used weighing scale, freshly harvested buro, perforated packaging plastics, freezer, vacuum packaging films, labels, and table top Promarks Vacuum Packaging System.

Experimental method of research was used to test the effects of factor A, B, C on the shelf life. The freshly harvested buro were weighed and were put into perforated packaging food grade plastics with the following masses: ¼ kg, and ½ kg, and 1 kg. Eighteen (18) packs for each of the masses were prepared and were then frozen to prevent fly-off during the vacuum packaging process. A total of 54 packs were prepared for vacuum packaging.

Promarks Vacuum Packaging System was used to pack each mass with 360 mmHg or 720 mmHg vacuum pressures applied at the time intervals of 10 seconds, 20 seconds, and 30 seconds. The vacuum packaging system has friendly digital user interface used to manipulate the amount of vacuum pressure and the length of vacuum packaging according to the set values.

All of the procedures were done in the laboratory room to prevent contaminations from dust and like. Each pack was labeled to easily recognize groupings. The vacuum- packed fresh buro were then put to freezer again and was observed monthly for signs of spoilage like change of color from white to yellowish white.

A group of 12 freshly harvested buro, 4 of each group of mass, was also prepared to serve as the control group. They were also labeled and frozen. The control and experimental groups were simultaneously observed monthly for signs of spoilage. The elapsed time in terms of months when first sign of spoilage was observed both for the experimental and control group was recorded.

STATISTICAL ANALYSIS

The three-way analysis of variance was used to test the three-hypotheses. The software Statistical Packages for the Social Sciences (SPSS) v. 17.0 was used to compute the results of the test in a fast, reliable, and neat way. The P-values for each factor (mass, pressure, time), two- factor interactions (mass vs. pressure, mass vs. time, pressure vs. time) and three- factor interaction (mass vs. pressure vs. time) were compared to the level of significance, 0.05. Factors that have resulting P –values less than or equal to 0.05 significantly affect shelf life. To determine whether on the average vacuum- packaging increase the shelf-life, the average shelf life for the control group was compared to the average vacuum- packed shelf life from the experimental group.

RESULTS AND DISCUSSIONS

The number of months elapsed when the first sign of spoilage appeared for each pack from the control and experimental group was recorded.

Table 1. Observed Shelf Life Relative to Factors A,B,C

	Pressure, C					
	360 mm Hg			**720mm Hg**		
	Time, B			**Time, B**		
Mass A	10 s	20 s	30s	10 s	20 s	30 s
	10	12	14	12	15	18
¼ kg	10	12	13	12	14	18
	9	11	14	13	15	17
	9	10	12	11	13	16
½ kg	9	10	11	10	14	16
	8	10	11	12	13	17
	6	9	10	10	11	14
1kg	6	8	9	10	11	14
	7	9	10	9	12	13

The table above shows that the masses of fresh buro were divided into three groups: ¼ kg, ½ kg, 1 kg. the time intervals 10 seconds, 20 seconds, 30 seconds are the duration of vacuum packaging; the amount of vacuum pressure applied is either 360 mmHg or 720 mmHg. There were three samples for each

combination of the three factors to average out possible outliers.

For buro mass of ¼ kg, ½ kg and 1 kg, maximum shelf life of 18 months, 17 months, and 14 months were observed, respectively. All these maximum shelf lives were obtained from a combination of 30- second time interval and 720 mmHg vacuum pressure. Also, for the same mass, increasing either time or pressure results to an increased shelf life. These observations hold for all groups of masses. The results seen on Table 1 allows to say that for each of the given mass of fresh buro, larger amount of vacuum pressure and longer time of vacuum packaging gives rise to maximum shelf life. The maximum shelf life was 18 months arising from mass of ¼ kg, time of 30 seconds, and pressure of 720 mmHg. The results of the three-factor analysis of variance further confirmed this observation.

Table 2. Test of Between Factors Effects in Buro Shelf life

Source	Type III sum of squares	df	Mean square	F	P-value
Corrected model	419.648	17	24.685	70.158	.000
Intercept	7326.685	1	7326.685	20823.211	.000
Mass	103.815	2	51.907	147.526	.000
Pressure	153.352	1	153.352	435.842	.000
Time	152.148	2	76.074	216.211	.000
Mass * pressure	.259	2	.130	.368	.694
Mass * time	1.852	4	.463	1.316	.283
Pressure * time	6.370	2	3.185	9.053	.001
Mass * pressure* time	1.852	4	.463	1.316	.283
Error	12.667	36	.352		
Total	7759.000	54			
Corrected Total	432.315	53			

a. R Squared = .971 (adjusted R Squared = .957)

In order to determine which among the three factors and their interactions significantly affect the vacuum- packed shelf life, the three- factor analysis of variance was used. The table above was result of the test carried out using SPSS 17.0. The significance level was set at the usual 0.05 and the resulting P-values of the interactions were compared with this value. As stated earlier, P-values of factors that are lesser than or equal to 0.05 significantly affect the vacuum-packed shelf life.

Results show that the P-values for factors mass, time and pressure are significant because their P-values are lesser than 0.05. in the two-factor interactions, only the time vs. pressure is significant. Mass vs. pressure and mass vs. time are not significant. The three-factor interaction mass vs. pressure vs. Time is also not significant. We refer to Table 1 for the interpretation of results.

The first column of table 1 under 360mmHg vacuum pressure and 10 second time interval shows that if we increase mass while keeping time and pressure and pressure constant, the shelf life is observed to be shorter. Since the factor mass is significant, shelf life significantly decreases as the mass increases.

Longer time of application of vacuum pressure, keeping mass and pressure is constant produces longer vacuum-packed shelf life. Since the factor time is significant, longer time of application of pressure results to increase in shelf life. The shelf lives under 360 mmHg and 720 mmHg vacuum pressure shows that higher amounts of pressure for constant mass and time produces longer shelf life. Since the factor pressure is significant, increasing the pressure significantly increases the shelf life.

The pressure vs. time interaction being significant means that increasing one of them, while one is kept constant increases the shelf life. Increasing them simultaneously gives the same results. This could be easily confirmed by going back through Table 1. For 360 mmHg vacuum pressure, the maximum shelf life is obtained if the vacuum packaging time is maximum (30 seconds). This pattern is also observed if the pressure is 720 mmHg. The maximum shelf life is attained at the maximum vacuum packaging time (30 seconds). The other two-factor interactions and the three-factor interaction are not significant. This directly implies that if we want to increase the shelf life by vacuum-packaging, the focus should be on the amount of vacuum pressure to be applied and to the length of time of its application. And the trend is that shelf life and the pressure and time are directly proportional.

The average shelf life for the control group was 6 months while the average shelf life for the experimental group was 12 months more. This means that on the average, the shelf life is doubled when vacuum-packed.

CONCLUSIONS

It can be concluded from the findings of this study that on the average, the shelf life is doubled by vacuum-packaging. Increasing mass of frozen fresh buro decreases shelf life significantly, given constant vacuum pressure and time of its application. On the other hand, increasing the vacuum pressure applied and the length of time of its application increases shelf life significantly. It also established that for a given mass of buro, the shelf life is directly proportional to the amount of vacuum pressure applied and to the length of vacuum packaging time.

RECOMMENDATIONS

It is highly recommended that future studies incorporate a nitrogen gas add-on to the vacuum packaging process to test its effect in the shelf life. Nitrogen gas is insert and using it as gas add-on that flushes the gas not drawn out from each of the vacuum packed buro, will result to expected lesser chances of spoilage compared to plain vacuum packaging used in the study.

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