



Development and Product Evaluation of Adlai Butter Spread

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ABSTRACT

This study was conducted to develop Adlai butter spread in different formulations. It aimed to determine the product quality of Adlai butter spread in terms of texture, appearance and taste, and to measure its Total Suspended Solid (TSS), pH, crude fat, and total protein. To produce the butter spread, the Adlai Seed was treated first and it involved several trials in determining appropriate time for soaking of seed, cooking method, and water proportion. The treated seed then received formulations or treatments for butter spread: T1:1 cup Adlai seed+2½ cup water; T2:1 cup Adlai Seeds+1½ cup water; and T3:1 cup Adlai seed+1 cup water. The organoleptic evaluation of the 30 panel of evaluators was then conducted. As for the result, it was discovered that the longer the seed is soaked the softer is its texture. In terms of the method of cooking, the Adlai seed could have its best result when it undergone boiling than frying and oil-blanching. In addition, three treatments were more or less comparable in terms of texture and taste. However, in terms of appearance the treatment 2 and 3 got the same rating of appealing. Thus, it was found out that there is no significant difference among the three formulations in terms of appearance, texture and taste. The physico-chemical analysis of the Adlai butter spread had the TSS of 30%, pH of 6.05, total acidity of 0.42, crude fat of 7.19%, and moisture of 51.42% and total protein of 3.91%. In terms of microbial analysis, the product stored in chilled temperature using the foil (Ziplock) and Glass bottle packaging materials obtained lesser microorganism. Furthermore, treatment 3 got a remarkable ROI of 23%.

Keywords: Adlai seed; Fruit butter; Sensory evaluation; Microbial analysis; Packaging materials; Physico-chemical analysis

INTRODUCTION

Varieties of butter spreads were developed from nuts, fruits, and seeds. The butter is commonly spread in sandwich and some added it into dishes. Peanut butter is a healthful option to people who wants it as part of their balanced diet because it is rich in several nutrients, including protein and magnesium. Eating peanut butter may help protect the heart and manage blood sugar and body weight [1].

However, eating too much peanut butter can increase a person's daily intake of saturated fat, sodium, and calories the saturated fat in food response the body to increase the amounts of both harmful Low-Density Lipoproteins (LDL) and protective High-Density Lipoproteins (HDL) in circulation. Eating a lot of saturated fats promotes artery-clogging atherosclerosis which underlies most of cardiovascular disease [2]. In contrast, unsaturated fats, which make up the majority of the fat content in peanut butter, help reduce LDL cholesterol and lower the risk of heart disease. As cited by Lorenzo (2018) in medical news today that persons who have

a peanut allergy should avoid peanut butter as it could trigger a potentially deadly reaction [1].

With the problem rises in peanut butter, the researchers are looking for an alternative that may serve same purpose of the peanut butter but reduce the risk in having health problems the department of agriculture together with various state colleges and universities promoting the Adlai production and its consumption. According to the Philippine Nuclear Research Institute (PNRI), Adlai seed is a good substitute to country's staple food crops such as rice and corn because it is rich in carbohydrates and protein. The crop is known to have anti-inflammatory, antihistaminic, muscle reluctant, fever reducing and sugar lowering properties (Department of Agriculture RFU XI, 2013). Adlai seed contains thiamine, riboflavin, niacin and ascorbic acid, comprises of 10.83% moisture, 13.05 g protein (protein content approximately double to that of rice), 5.45 g fat, 68.60 g carbohydrate, 0.36 g fiber and 1.3 g ash and 2.25% amylase. The major protein is coixin which is rich in proline and leucine but poor in lysine.

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Recently, Gomez AM (2017) conducted the pre-experimental study about developing adlai seed into butter spread [3]. Gomez AM (2017) deep fried the seed and undergoes milling [3]. The study found out that the Adlai seed can be made into butter spread however it needs to improve its texture quality. Thus, the researchers wanted to continue the study of Gomez in developing adlai butter spread which aimed to improve the texture quality using cooking method with appropriate formulation.

Objectives

This study was conducted to develop and determine the product quality of Adlai Butter Spread. Specifically, it aimed to:

- Develop butter spread out from adlai seeds using cooking method with different formulation;
- Screen and evaluate the Total Suspended Solids (TSS), °Brix, crude fat, crude protein, total acidity, pH value, and moisture of Adlai butter spread, and the total bacterial count of Adlai butter spread;
- Determine the product quality of Adlai butter spread in terms of texture, appearance, and taste;
- Find out the significant difference on the different formulation used in preparing Adlai butter spread in terms of texture, appearance, and taste;
- Create Adlai Butter Spread product label and packaging; and
- Evaluate profit and Return on Investment (ROI) of Adlai butter spread.

METHODOLOGY

Formulation and development of the Adlai butter spread

To develop the adlai butter spread, the standard recipe of peanut butter was utilized. This means that the peanut was replaced with the boiled Adlai seeds and added with other ingredients. To produce the butter spread, the Adlai Seed was treated and underwent with several trials as to determine the appropriate time for soaking of seed (6 hrs, 8 hrs, and 12 hrs); cooking method (boiling, oil-blanching, and frying); and Adlai-water ratio/proportion (T1-1 cup Adlai seed+2 cups water; T2-1 cup adlai seed+1½ cups water; T3-1 cup Adlai seed+1 cup water). Each treatment was added with the other ingredients, though the other ingredients were mixed together and divided into three portions and each portion was added to each treatment. This is to establish a homogenous mixture [4].

Physical, chemical, and microbial analysis of Adlai butter spread

After for chemical analysis, the products/treatments were submitted to a chemical laboratory. This would allow the study to determine the Total Suspended Solids (TSS-°Brix), total acidity, pH value, moisture, crude fat, and crude protein content of the products. On the other hand, bacterial analysis was done to determine the bacterial count on the products for shelf life and appropriate packaging and or storage. Similar to chemical analysis, the products/treatments were submitted to a laboratory where experts analyzed the bacteria in the product in room temperature and chilled temperature for 1 month.

Organoleptic assessment on adlai butter spread

Product quality evaluation is the subjective evaluation of the Adlai Butter spread which is an organoleptic evaluation of foods. The product qualities were texture, appearance (color), and taste. This means that the products/treatments were submitted to thirty panels of evaluators, who were randomly selected faculty and staff of USM-KCC. The evaluators were placed in a well illuminated and ventilated room wherein they were given with the products/treatments in different containers and spoons. They were also given with a glass of water to aid their palate in evaluating the product. To have their evaluation, an analytic method of was utilized sensory evaluation score sheet, which the qualities were described by likert scale and distributed to the evaluators. The evaluation of the products was done in three replications for the validity of the result. The researcher will make sure that the evaluators from replication 1-3 were the same. Time of the day was considered as one way of getting the best evaluation of the products. To determine the best product quality and general acceptability among the three treatments, frequency distribution and weighted mean were utilized as statistical tool. In addition, significant difference among the treatments in terms of texture, appearance (color) and taste will be analyzed through one way analysis of variance [5].

Packaging and labeling in Adlai butter spread

The right packaging material was one of the targets of this study. Packaging materials that utilized for experimentation were the following: Clear plastic jar with seal, clear glass jar with seal, and half clear half silver/metallized stand-up pouch with ziplock. The three treatment sample products were placed in the three types of packaging materials and submitted to a laboratory for bacterial analysis. The product in the various packaging materials were stored in room and chilled temperature for 1 month, thus the analysis for its shelf life was tested. On the other hand, labeling of the product was agreed among researchers with the aid of an IT expert. It will consider restrictions and provisions of DTI.

Adlai butter spread marketability and profitability

In evaluating the profit of the Adlai butter, analysis would consider the identification of Total Revenue (TR) and less the Total Cost (TC), the fixed and the variable cost using the formula $\text{TR}-\text{TC}$. On determining the return on investment, the formula to be used is the $\text{ROI}=\text{Net Profit}/\text{Total Investment} \times 100$.

RESULTS AND DISCUSSIONS

Develop butter spread out from adlai seeds

The Adlai Seed was treated and underwent several trials in determining appropriate time for soaking of seed, cooking method, and Adlai-water ratio. There were three treatments of each category: Time of soaking of seed were T1: 6 hrs, T2: 8 hrs, and T3: 12 hrs; cooking methods involves T1: boiling, T2: oil-blanching, and T3: frying; and Adlai-water ratio were Treatment 1-1:2 ½, Treatment 2-1:1 ½, and Treatment 3-1:1. The two categories (time of soaking the seed and cooking method) were evaluated by thorough observation. Meanwhile, the Adlai-water ratio utilized quality test [6-10].

The data revealed that T3: 12 hrs of soaking the Adlai seed produces

softest texture among the treatments. Addition too, boiling method gave soft and mushy texture also compared to oil-blanching and frying. However, the color of the cooked Adlai seeds was pale or ivory white. As cited in the book of the chemical reactions of food which is polysaccharides such as starchers, cellulose, and pectin are prone to hydrolysis with resulting loss in texturizing ability [2]. When starch hydrolyzed, it loses their gelling properties. In cooking, starch takes the form of tiny granules to which water, broth, or other liquids bond. As the starch absorbs liquids, the liquid thickens. Further, when starch is heated with water, the starch granules swell and burst, causing them to break down and release the glucose molecules into the water (Figure 1).

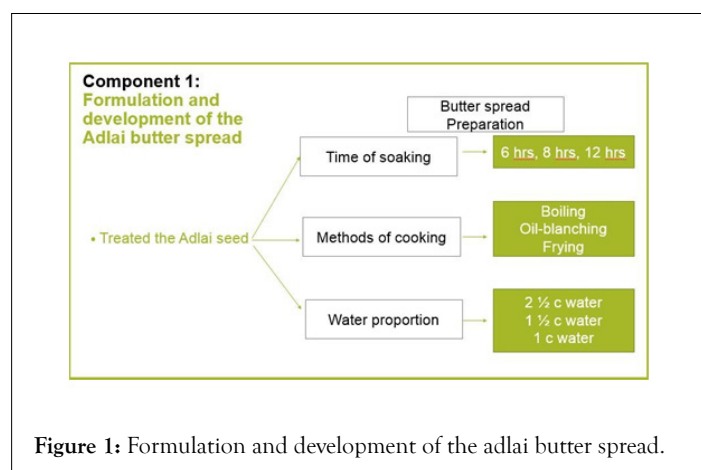


Figure 1: Formulation and development of the adlai butter spread.

Chemical and microbial analysis of adlai butter spread

The Table 1 shows the chemical analysis of Adlai butter spread. There were six test namely crude fat, crude protein, total suspended solids (TSS-°Brix), total acidity, pH value, and moisture. At 200 g of adlai butter spread, the result revealed that the following tests got 7.19, 3.91, 30, 0.42, 6.05, and 51.42 respectively. According to requirements for specific standardized fruit butters, jellies, preserves, and related products, it said that the soluble solids content of the finished fruit butter is not less than 43%, as determined by the method prescribed in "Official Methods of Analysis of the Association of Official Analytical Chemists" (AOAC), 13th Ed. (1980), section 22.024, under "soluble solids by refractometer in fresh and canned fruits, fruit jellies, marmalades, and preserves-official final action," which is incorporated by reference, except that no correction is made for water-insoluble solids [11] (Table 1).

Table 1: The chemical analysis of Adlai butter.

Test Analysis	Result
Crude fat (%)	7.19
Crude protein (%)	3.91
Total suspended solid (°Brix)	30
Total acidity	0.42
pH value	6.05
Moisture (%)	51.42

The Table 2 shows the microbial analysis of Adlai butter spread using aerobic plate count and yeast and molds tests. The sample product underwent with two conditions of temperature and packed in three different packaging materials. The data revealed that in room temperature, the product packed in Glass bottle obtained the lowest result of 2 CFU/g in Aerobic Plate Count (APC) and product packed in Foil (Ziplock) got 3 CFU/g in Yeast and Molds

(YM) Test. Meanwhile in chilled temperature, the Foil (Ziplock) and Glass bottle packaging materials got <1.0 CFU/g in Aerobic Plate Count (APC) and the Foil (Ziplock) obtained 3.50×10 CFU/g in Yeast and Molds (YM) test. It implied that the sample products packed in Foil (Ziplock), Plastic Bottle, and Glass Bottle stored in room temperature in 1 week spoiled easily compared to the chilled temperature. Based on the Aerobic plate count (APC) in chilled temperature the butter spread packed in Foil (Ziplock) and Glass bottle obtain <1.0 CFU/g which means microorganism was not detected [12] (Table 2).

Table 2: Aerobic plate count and yeast and molds analyses of Adlai butter spread.

Sample Code	Sample Source Container	Test Analyses Requested	Result
Sample 1 (Week 1-Room Temperature)	Foil (Ziplock)	APC	1.36×10^2
		CFU/g	CFU/g
		YM	3 CFU/g
	Plastic bottle	APC	7.60×10 CFU/g
		CFU/g	3.60×10^3 CFU/g
		YM	2 CFU/g
Glass bottle	APC	7.53×10^2 CFU/g	
	CFU/g		
	YM		
Sample 2 (Week 1-Chilled Temperature)	Foil (Ziplock)	APC	<1.0 CFU/g*
		CFU/g	
		YM	3.50×10 CFU/g
	Plastic bottle	APC	6.8×10 CFU/g
		CFU/g	3.40×10 CFU/g
		YM	
	Glass bottle	APC	<1.0 CFU/g*
		CFU/g	
		YM	3.67×10^2 CFU/g

Note: * <1.0 CFU/g-microorganism not detected; YM: Yeast and Molds; APC: Aerobic Plate Count.

The product quality of Adlai butter spread

The appearance quality of Adlai Butter Spread was shown in Table 3. The data revealed that treatment three and two got the weighted mean of 3.73 g and 3.72 g respectively with a rating of appealing. The product has medium brown in color but shiny. Moreover, the treatment 1 had the rating of moderately appealing with the weighted mean of 3.51 g. The standards of identity of fruit butter which prescribed by subpart B-requirements for specific standardized fruit butters, jellies, preserves, and related products are the smooth, semisolid foods each of which is made from a mixture of one or a permitted combination of the optional fruit ingredients (Table 3).

Table 3: Appearance quality of Adlai butter spread.

Treatments	R1	R2	R3	R4	Mean	Verbal description
T1(1c Adlai+2 1/2c Water)	3.2	3.6	3.57	3.67	3.51 g	Moderately appealing
T2(1c Adlai+1 1/2 c Water)	3.53	3.7	3.87	3.77	3.72 g	Appealing
T3(1c Adlai+1c Water)	3.83	3.77	3.5	3.83	3.73 g	Appealing

The Table 4 shows the texture quality of Adlai Butter Spread. The three treatments were rated thick with the weighted mean of 3.92, 4.05, and 4.07 respectively. The product is slightly grainy and sticky consistent. Where, as treatment three got the highest weighted mean among the treatments the data was supported with the concept that fruit butter have a texture similar to dairy butter because it is thick, soft butter-like texture. That's why fruit butters are used as spreads for breads [13,14] (Table 4).

Table 4: Texture quality of Adlai butter spread.

Treatments	R1	R2	R3	R4	Mean	Verbal description
T1(1c Adlai+2 ½ c Water)	3.73	3.8	4.07	4.07	3.92 g	Thick
T2 (1c Adlai+1 ½ c Water)	4.0	4.07	3.93	4.2	4.05 g	Thick
T3(1c Adlai+1 c Water)	3.97	4.23	4.03	4.03	4.07 g	Thick

The Table 5 presents the taste quality of Adlai butter spread. The data revealed that the three treatments were rated moderately tasty which the product has slightly sweet, less nutty and slight creamy taste. The three treatments got the weighted mean of 3.9 g, 3.90 g, and 4.21 g respectively. However, the treatment three got the highest weighted mean among the treatments. Sonido D et al (2009) define fruit butters are sweet spreads which made from cooking fruit pulp with sugar [2] (Table 5).

Table 5: Taste quality of Adlai butter spread.

Treatments	R1	R2	R3	R4	Mean	Verbal description
T1(1 c Adlai+2 ½ c Water)	3.63	3.97	3.93	4.07	3.9 g	Moderately tasty
T2 (1 c Adlai+1 ½ c Water)	3.93	3.93	3.83	3.9	3.90 g	Moderately tasty
T3(1 c Adlai+1 c Water)	4.2	4.47	4.0	4.17	4.21 g	Moderately tasty

Significant difference on the different formulation used in preparing Adlai butter spread in terms of appearance, texture, and taste

Table 6 shows the analysis of variance of the three treatments of appearance, texture and taste. Data revealed that there is no significant difference among the three treatments in terms of appearance, texture and taste with computed p-value of 0.6416, 0.6685, and 0.6271 respectively. It was interpreted as not significant at 0.05%, thus the hypothesis was not rejected [15,16] (Table 6).

Table 6: Test of differences on Adlai butter spread in terms of appearance, texture, and taste.

Qualities	F-value	P-value	Interpretation	Decision
Appearance	0.58	0.6416	Not significant	Ho is not rejected
Texture	0.54	0.6685	Not significant	Ho is not rejected
Taste	0.61	0.6271	Not significant	Ho is not rejected

Create Adlai butter spread product label and packaging

Based on the findings in the microbial analysis, the most

recommended packaging material used in storing the Adlai butter spread were the Foil (Ziplock) and Glass bottle under chilled temperature fruit butters should be stored in well ventilated, cool and dark places. Furthermore, the label 1 got the highest frequency of 32 (32.65%), and next to it was label 4 at 30.61% with the frequency of 30 (Figure 2) (Table 7).



Figure 2: Label design of Adlai butter spread.

Table 7: The Adalai butter spread label.

Label	Frequency	Percentage
Label 1	32	32.65%
Label 2	19	19.39%
Label 3	17	17.35%
Label 4	30	30.61%

Evaluate profit and Return on Investment (ROI) of Adlai butter spread

The Table 8 shows the profit and return on investment for Treatment one, two and three of Adlai butter spread. It states that the said treatments costs Php 73.912, Php 74.445, and 81.920 respectively. Wherein, for the ingredients, Php 12.287, Php 12.820, and 13.653. The different treatments have the same cost for packaging amounting to Php 25.00, for the label per packaging amount to Php 15.625, while labor cost amounted to Php 21.00 per packaging. It implies that, the Treatment 1 utilized least volume of water which matters on the costing that Treatment 1 has the cheapest butter spread production [17].

The net income states that with a retail price of Php 98.00 per packaging, Treatment one has a net income of Php 24.09, Treatment two Php 23.56, and Treatment three Php 22.72 with an ROI of 25%, 24% and 23% on three treatments respectively [18] (Table 8).

Table 8: Cost of production per packaging.

Variables	Treatments		
	Treatment 1 cost per packaging (in php)	Treatment 2 cost per packaging (in php)	Treatment 3 cost per packaging (in php)
Adlai seeds	8	8	8
Granulated	1.05	1.05	1.05
Water	1.133	1.667	2.5
Vegetable oil	0.6	0.6	0.6
Butter	1.5	1.5	1.5
Salt refined	0.003	0.003	0.003
Sub-total	12.287	12.82	13.653
Packaging	25	25	25
Labelling	15.625	15.625	15.625
Labor cost	21	21	21
Total cost	73.912	74.445	81.92
Retail price	98	98	98
ROI	0.25	0.24	0.23
Net profit	24.09	23.56	22.72

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, the researchers concluded that Adlai seed can be made into butter spread. It was found out that the longer the Adlai seed to be soaked the softer the seed. However, even that the three treatments were comparable to each other, the treatment three with a proportion of 1 cup Adlai seed and 1 cup water got the highest mean among the other treatments in term of appearance, texture and taste. With the packaging material used, the foil (Ziplock) and glass bottle/jar help extend the shelf life of the product the net income states that with a retail price of Php 98.00, the treatment 3 has a net income of Php 22.72 with an ROI of 23%. Based on the result, the researchers recommend the following for the improvement of the study:

- Add spices or flavoring to improve its taste of Adlai butter spread.
- Improve the process of cooking to produce better appearance of butter spread.
- Develop a portable adlai grinder for manufacturing butter spread.

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