Vol. 10 · October 2012
Print ISSN 2012-3981 • Online ISSN 2244-0445
doi: http://dx.doi.org/10.7719/jpair.v10i1.183

JPAIR Multidisciplinary Research is produced by PAIR,
an ISO 9001:2008 QMS certified by AJA Registrars, Inc.

Development of a Sugar Free Chewy Candy Utilizing Pili Pulp Flour and Oil

GERALDINE F. DE JESUS
ORCID ID - 0000-0001-6367-553X
gigidejesus95@yahoo.com

CONCEPCION J. CAMBALIZA
SOFIA V. CATABIAN
Sorsogon State College, Philippines

Abstract - The development of a sugar free chewy candy is formulated as an additional product of pili utilizing the pili pulp oil and flour. This is considered to be a non caloric food since no sugar was added to the product,but aspartame was used instead.A total of 20 panelists evaluated the sample using a 9 Hedonic scale method. Two trials were made, one with the addition of sugar syrup which is termed as low calorie and the other is without the addition of sugar syrup thus termed as a sugar free chewy candy. Comparative test result revealed that the former was rated as *like slightly* and the later as *like moderately.* Nutrition information was computed based on the nutritional content of the raw materials used, and the following were obtained at 50g per serving or approximately 10 pieces of the product. Calories 80, calories from fat 15, total fat 1.4g with daily value of 2%, transfat 0g, saturated fat 1g with 5% DV, cholesterol 13.6g with 5% DV, sodium 94 mg with 4%DV. The total carbohydrates is 10g, 4%DV, dietary fiber is 0, sugar 0, protein 7.5g. Others were Vitamin A 1%,Vitamin C 2%, Calcium 25% and Iron 1%.

Keywords - Sugar Free, Chewy candy, Pili pulp oil, Pili flour, low calorie, non caloric food

INTRODUCTION

The Bicol Region is known for its "pili" products. They say that your trip in Bicol will never be completed unless you have tasted pili. It is scientifically known as *Canariumovatum.* It is considered one of the most abundant plants in Sorsogon City. In 2005, they produced 2,574 metric tons of pili nuts of the 4,462 tons produced from the region. (PNA Features 2010).Before,pili are served in the table as appetizer and others are being sold as candied pili. Nowadays various products can already be made from this fruit utilizing almost all its parts.

This study is supplementary to the completed research of Catabian and Detera (2002), entitled "Developing Pili Pulp Baked Products" and Cambaliza et al (2009), The Utilization of Pili Pulp Flour and Pili Pulp Oil in Cookery.

Many food preparations today invariably make use of sugar and similar products as components necessary for flavor enhancement. Because of this, demand for sugar increases in food processing industries particularly in the field of confectionery. Humans, naturally have an appetite for sugary things. In excess, it adds up to surplus calories, which can contribute to weight gain. In order to lose weight, the total calories from foods, especially those with lots from sugar must be decreased (Henkel 2009).

In the past, most of the hard and chewy candies sold are added with artificial color and flavor with very minimal nutritive value (de Leon 1992). Nowadays, varieties of candies are being developed. Sugar free, low calorie, fiber rich,are only some description of this. Consumers can walk into any mass retailer, grocery or drug store and find an array of sugar free products, from dairy based hard candies with sophisticated flavor combinations to chocolate bars choked full of nougat, caramel and nuts. This development is due to the demand of a far more healthy food. Many became conscious of the kind of food that they are buying. Others would even compute for the calorie content, verify for the nutrition facts, and others are thoroughly looking for a sugar free label.

It is termed sugar free since the total amount of sugar added is replaced by an aspartame or sugar substitute that contains zerocalories. Aside from this, the other ingredients used in this study such as milk

powders, pili pulp flour, pili oil and eggs have no sugar content. Another significant feature of our product is the addition of pili oil and pili pulp flour which is supplementary beneficial since the former is considered an unsaturated fat with while the latter is fiber rich, not to mention the other food nutrients from the raw materials used.

FRAMEWORK

With the utilization of pili oil and pili pulp flour, Cambaliza et al(2009) in their completed research entitled "Development of Pili flour and oil" were able to prepare 10 recipes; 7 of which utilized pili flour and 3 used the pili pulp oil. To name some of these products are pilichoco drops, mayonnaise dressing, muffins and cookies.

In the same manner, the study of Pelea et al (2001) also aimed to develop technologies on the utilization of pili oil for dressing, fish canning, frying oil and margarine manufacture. Results of their study showed that pili oil mayonnaise had no significant difference from olive oil mayonnaise relative to most sensory characteristics. In addition to this, analysis was conducted by DOST Region V comparing pili oil with olive oil. Results showed that pili pulp oil has more beta carotene, a known source of Vitamin A, caroteneoids, tocopherols (vitamin E) and phytosterols. These substances are antioxidants that protect cells from oxidation and neutralize unstable free radicals.Aside from this, pili pulp oil is also a good source of protein, iodine and calcium. (DOST).

Likewise, Yee of Sorsogon City, was able to produce organic oil from pili pulp which is suitable for culinary purposes, salad dressing, shortening, for canned sardines and other food preparations. Not only this, according to her the oil is suitable for people with delicate skin and are health conscious because it is organic and contains an anti-aging element that prevents wrinkled acne and pimples.

There are also numerous uses of pili oil and pili pulp aside from utilizing it in food processing. In a feasibility study conducted by Aquino et al (2006), the pili nut shell was used as a cheaper biodegradable alternative to synthetic adhesives. The hard stony shell of the pili seed is also used in cooking, for which it makes an excellent fuel (Coronel 1996).

On the other hand, synthetic sweeteners, another ingredient used in

making sugar free chewy candy are non caloric sweeteners; they add sweetness without adding energy value, which is desirable in body weight reduction and diabetic diets. As such, synthetic sweeteners are aptly referred to as non nutritive sweeteners. To dramatize the functions of sugar in food preparation, it would be interesting to observe the effects of using artificial sweeteners as a sugar substitute in standard recipes of frozen desserts, candies cookies and many more.

In addition, The American Dietetic Association (ADA) recently evaluated aspartame and its effects on weight, appetite and desire for sweetness. They reaffirmed the conclusion of regulatory and scientific authorities that the artificial sweetener is not associated with the adverse effects for the general population including hypersensitivity reactions, elevated methanol or brain cancers. In 1980, the FDA convened a Public Board of Inquiry (PBOI) consisting of independent advisors charged with examining the purported relationship between aspartame and brain cancer. The PBOI concluded that aspartame does not cause brain damage, but it recommended against approving aspartame at that time, citing unanswered questions about cancer in laboratory rats. A U.S. FDA task force team investigated allegations of errors in the preapproval research conducted by the manufacturer, and found only minor discrepancies that did not affect the study outcomes.

Moreover, the American Dental Association (ADA), representing well over 100,000 professionals and experts in the field of dentistry and dental health, also agrees that sugar-free foods do not promote tooth decay. The ADA has officially acknowledged this conclusion in their policy statement "Role of Sugar-Free Foods and Medications in Maintaining Good Oral Health."

Some consumers are hesitant to buy sugar free candies because they are thinking that it would have lesser sweet taste considering that it is a sugar free product. This was verified on the study of Miller (2009) regarding the preference of consumer on sugar free candies. A sample of 100 people in the UK, and 129 in Australia were put to the test with different fruit and mint-flavored candies. A similar test was conducted in Spain with 154 respondents. The method in all the tests was a paired comparison between the sugar-free candy and the sugar version, both being produced with the same manufacturing recipe and flavor. The sugar free candy was preferred because of its lower

sweetness, higher flavor intensity and more appropriate flavor, lower stickiness and better mouth feel.

Mentioning all the beneficial qualities and health effects of an artificial sweetener as well as the utilization of the pili oil and pili pulp flour, this has prompted the researchers to develop a sugar free, fiber rich chewy candy which will cater not only health conscious individuals, but also children and those with diabetes and suffering from obesity. Moreover, more research studies were conducted using pili oil and pulp in many food variations yet none of which has developed a sugar free candy utilizing pili pulp oil and pili flour.

OBJECTIVES OF THE STUDY

This study aims to develop a sugar free, fiber rich chewy candy utilizing pili pulp flour and pili oil, compute for the nutrition information of sugar free chewy candy and to determine the acceptability of the product through sensory evaluation.

MATERIALS AND METHODS

The study was developed utilizing the pili pulp oil and pili flour in making sugar free candy. A total batch weight of 1000grams was made which yielded 750 grams of candy or 75% output. Total time incurred from the preparation of materials until the packing of the finished product was 80 minutes.

Figure 1 shows the processing of sugar free chewy candy. The first step is to sift all the dry ingredients such as the milk powders, pili pulp flour and the sugar substitute followed by the weighing of all the ingredients; an accurate and calibrated weighing scale is desired in measuring the ingredients since inexact measurement will greatly affect the quality of the product. The dry ingredients were mixed together in a mixing bowl and transferred to a blender. The pili oil and water are added to the mixture andosterized for at least 5-7 minutes or just enough that the ingredients were well blended. The blender should be opened once in a while to scrape off the sides to remove smear and spillages. The next step is to transfer the homogenized mixture into a clean saucepan and add the beaten eggs.

Figure 1. Steps in processing of sugar free chewy candy

The batch was cooked at 118-120°C for 20 to 25 minutes with constant stirring. After reaching the desired time and temperature, the product will be spread in a cooling table then rolled and cut into desired pieces. Approximately, chewy candy should weigh at least 5.0±0.5 grams per piece. The product will be wrapped and packed in a polyethylene bag by 50's and stored under favorable conditions.

The finished product was stored for one week before conducting the sensory evaluation test to determine if the sugar free chewy candy is acceptable. The Hedonic Scale method is used in this study; these were presented singly and rated on a scale where 9 categories range from *dislike extremely* to *like extremely*. Results showed that overall acceptability of sugar free chewy candy was rated as *like moderately*.

RESULTS AND DISCUSSION

This research is conducted in two trials. The first trial is a chewy candy with the addition of sugar syrup usually called a low calorie candy since the sugar used is a non sweetener. Three treatments were made with different variations of pili,oil, milk powders and pili pulp flour. Among the three trials, T1 was best preferred by the panelists and overall acceptability resulted as *like slightly* using the 9 Scale Hedonic scale.

The second trial was done without the addition of sugar syrup.This product is termed sugar free since glucose was eliminated that makes the product zero calorie. The formulation for T1 was used in this trial but with the addition of eggs. Three treatments were done. Overall acceptability as evaluated by the panelists was also *like moderately.*

Based on the results of the comparison test between the two samples, the chewy candy without the sugar syrup or sugar free,was best preferred with an overall acceptability rated as *like moderately.* Tables 1 and 2 below shows the result of the evaluation for low calorie candies, Tables 3 and 4 indicate the results for sugar free chewy candy and Table 5 present the comparison test between the two samples.

Table 1. Grams and percentage of three treatments made for chewy candy with sugar syrup

Ingredients	**T1**		**T2**		**T3**	
	%	Grams	%	Grams	%	Grams
Pili Oil	4.8	25g	4.8	25g	4.8	25g
Non Nutritive Sweetener	1.0	5g	1.0	5g	1.0	5g
Milk Powders	55.8	290g	52	270g	47	245g
Pili pulp flour	5.8	30g	9.6	50g	14.6	75g
Water	28.8	150g	28.8	150g	28.8	150g
Sugar Syrup	3.8	20g	3.8	20g	3.8	20g
Yield	**70**	**364g**	**69**	**360**	**67**	**348**

Table 1 show the grams and percentage of the three treatments made for chewy candy with sugar syrup. Total batch weight made for the three treatments is 520 grams, however, the total output for T1 is 364 grams showing a 70% yield, 360 with 69% for T2 and 348 grams, 67% output for T3. Percentage value of pili oil,non nutritive sweetener, water and sugar syrup is constant at 4.8%, 1%, 28.8% and 3.8% respectively, while pili pulp flour and milk powders have different variations.

Table 2. Sensory evaluation result for chewy candy with sugar syrup

9 Hedonic Scale	**T1**	**T2**	**T3**
Like extremely (9)			
Like very much (8)			
Like moderately (7)	×		
Like slightly (6)		×	×
Neither like nor dislike (5)			
Dislike slightly (4)			
Dislike moderately (3)			
Dislike very much (2)			
Dislike extremely (1)			

Table 2 shows the result of the sensory evaluation for chewy candy with sugar syrup. Twenty (20) panelists evaluated the sample using a 9 point Hedonic Scale. Overall acceptability of the product demonstrated that 11 preferred T1 and rated it as *like moderately* while 4 and 5 panelists favored for T2 and T3, respectively, which is ranked as like *slightly*.

Table 3. Grams and percentage of three treatments made for chewy candy without sugar syrup

Ingredients	**T1**		**T2**		**T3**	
	%	Grams	%	Grams	%	Grams
Pili Oil	4.3	25g	4.3	25g	4.3	25g
Non Nutritive Sweetener	1.0	5g	1.0	5g	1.0	5g
Milk Powders	51.8	290g	48.3	270g	43.8	245g
Pili pulp flour	5.4	30g	8.9	50g	13.4	75g
Water	26.8	150g	26.8	150g	26.8	150g
Eggs	10.7	60g	10.7	60g	10.7	60g
Yield	**75**	**420g**	**73**	**410**	**70**	**390**

Table 3 demonstrates the grams and percentage of the three treatments made for chewy candy without sugar syrup. Total batch weight made for each of the three treatments is 560 grams. Total output for T1 is 420 grams showing a 75% yield, 410 with 73% for T2 and 390 grams, 70% output for T3.The percentage value of pili oil, non nutritive sweetener, and water and sugar syrup is constant at 4.3%, 1%, 26.8% and 10.7% respectively, while pili pulp flour and milk powders have different variations. T1 was highlighted since this was the best preferred by the panelists compared to T2 and T3.

Table 4. Sensory evaluation result for chewy candy without sugar syrup

9 Hedonic Scale	**T1**	**T2**	**T3**
Like extremely (9)			
Like very much (8)			
Like moderately (7)	×		
Like slightly (6)		×	×

Neither like nor dislike (5)			
Dislike slightly (4)			
Dislike moderately (3)			
Dislike very much (2)			
Dislike extremely (1)			

Table 4 illustrates the outcome of the sensory evaluation for chewy candy without sugar syrup. As rated by the panelists, overall acceptability of the product showed that 10 preferred T1 and rated it as *like moderately* while 5 panelists favored for T2 and T3 which is ranked as *like slightly.*

Table5. Comparative test between chewy candy with and without sugar syrup

Product	Color	Aroma	Texture	Taste	Overall Acceptability
T1*	Like moderately (7)	Like slightly (6)	Neither like or dislike (5)	Like slightly (6)	**Like slightly 6**
T2**	Like moderately (7)	Like moderately (7)	Like slightly (6)	Like moderately (7)	**Like moderately (6.75)**

* Low Calorie Chewy Candy
** Sugar Free Chewy Candy

Table 5 demonstrates the comparison between the low calorie chewy candy and sugar free. Although both products used a sugar substitute which is aspartame, still there are differences in some of the physical attributes such as the aroma, taste and texture. Overall acceptability shows that T2 is best preferred.

Table 6. Nutrition information of the sugar free chewy

Nutrition Facts	
Serving Size 10 pieces (50g)	
Amount Per Serving	
Calories from Fat 15	
Calories 80	
	% Daily Values*
Total Fat 1.4	**2**%
Saturated Fat 1g	**5**%
Cholesterol 13.6mg	**5**%
Sodium 94mg	**4**%
Total Carbohydrate 10g	**4**%
Dietary Fiber 0g	**0**%
Sugars 0g	
Other Carbohydrate 0g	
Protein 7.5g	
Vitamin A 1% • Vitamin C 2%	
Calcium 25% • Iron 1%	
* Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.	

Table 6 shows the computed nutrition facts of sugar free chewy candy.The computation was based on the nutritional contents of the raw materials used such as the pili oil and flour, eggs, milk powders and the non-sweetener. Serving size is approximately 10 pieces, which is equivalent to 50 grams. The percent Daily Values are based on 2000 calorie diet.

CONCLUSIONS

Result of this study shows that a sugar free, fiber rich chewy candy can be developed using a non sweetener, pili pulp oil and flour . The computed nutrition information/ facts confirmed that the product is indeed sugar free. Comparative test shows that the panelists preferred best the sugar free rather than the low calorie chewy candy.

RECOMMENDATIONS

For this product to be out in the market, it is recommended that chemical and microbial analysis be first conducted to ensure that the product is safe to consume. After which, a consumer test maybe conducted to strengthen the overall acceptability of the product. At the same time, a shelf life study may also be made by storing samples in different conditions. Once the results of the above studies are satisfactorily met, production may ensue.

LITERATURE CITED

Catabian and Detera
2009 Completed research entitled " Acceptability, Shelf life and Microbiological Analysis of Pili Pulp Baked Food Products."

Cambaliza, Janer,Habla andDetera
2009 Completed research entitled Utilization of Pilipulp Flour and oil in cookery.

Henkel, J.
2009 Sugar Substitutes: Americans Opt for Sweetness and Lite. American Journal on Foods.

Geiselman, P.J., et al.
2009 Effects of Gum Chewing on Specific Macronutrient and Total Caloric Intake in an Afternoon Snack (Abst. 101.3). Experimental Biology 2009, New Orleans (April 19).

Pelea, N. and M.A. Oronan
2002 Bicol Univ., Legaspi City (Philippines).Utilization of Pili Oil in Processing.

Pursuant to the international character of this publication, the journal is indexed by the following agencies: (1) Public Knowledge Project, a consortium of Simon Fraser University Library, the School of Education of Stanford University, and the British Columbia University, Canada; (2) E-International Scientific Research Journal Consortium; (3) Philippine E-Journals; (4) Google Scholar; (5) Index Copernicus; (6) Scholastica; (7) Researchgate; (8) Lacriee of France; and, (9) University Library of Leipzig, Germany.