



Product Formulation from a By-Product from the Production of Coconut - Based Food Delicacies

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Abstract This study aims to create healthy food products thus economical since it utilizes a so-called “scrap” of coconut as a main ingredient. Coconut residue may be considered as residual but studies shows that it contains health-affirming benefits. The coconut residue gathered from the local delicacy vendors are submitted to the DOST Laboratory for microanalysis to test if it is safe for production. Consequently, it contains the following result: aerobic plate count- 2.5×10^6 cfu/g, total coliform count - 3.7×10^3 cfu/g, E. coli count - $< 1.0 \times 10$ cfu/g, enumeration of *S. aureus* - 9.0×10 cfu/g, salmonella detection – negative, mold and yeast count - 2.5×10^5 cfu/g. The report of microanalysis reflects that the coconut residue collected from the rice cake vendors is not safe to be processed. Thus, the coconut residue utilized in this study is firsthand gathered by the researcher with the observance of utmost food safety to avoid from microorganism. For the sensory attributes, the color got the highest numerical rating of 8.66 described as “like extremely”, while the rest of the attributes are at the range of “like very much”. The texture got the average weighted mean of 7.5, for the aroma, 7.74, for the taste, 7.56 and for the general acceptability 7.72. This result indicates that the coco nuggets is generally acceptable to the consumers, however, 34 or 68% of the participants suggested that the coco nuggets is best served with a dipping. For the nutritional content, coco nuggets contain the vital nutrients like protein, carbohydrates, dietary fiber, calcium and potassium.

Keywords coconut residue, coco nuggets, microanalysis, nutritional content

INTRODUCTION

The Philippines is a tropical country where growing the most versatile crop can be easily cultivated. Coconut *Cocos nucifera* is known as the tree of life all of its parts have a function. It has been part of Filipino cuisine and became the staple ingredient for some Filipino delicacies. It is also believed as a “functional food” since it provides many health benefits beyond its nutritional content.

The endosperm consists of liquid and solid portions. The liquid endosperm is in high demand as a freshwater or sports beverage product attributed to isotonic properties due to its mineral, sugar, and vitamin contents (Prades et al., 2016). The solid endosperm forms a white layer lining in the inside of the shell, and when it is extracted from mature coconut and dried, it is known as copra, which is commonly used as a source of coconut oil (Patil et al., 2017). When extracted from young fruit, the solid endosperm is gelatinous, a consistency that makes it useful in producing desserts or as a food supplement. No matter if it is grown and/or processed on artisanal or industrial scales, the coconut fruit is a vital income source for coconut growers in producing countries (Angeles et al., 2018).

The health-affirming characteristics of the coconut have become widely known over the past 10 years, and the spread of coconut-inspired health foods looks set to continue. As well as being a great addition to almost any diet, the coconut is also renowned for its versatility and the many

different foods that can be created from it. (Richards, 2017). In addition, Coconut meat has some nutrients including proteins, fats, carbohydrates, calcium, phosphorous, iron, ascorbic acid, and water (Sinaga et al., 2015). However, many people prefer this coconut residue which is considered as “leftover” because it does not contain any gluten or grains, making it ideal for those with a digestive problem or gluten intolerance. It is also rich in fiber and protein.

This study introduces coconut residue as the main ingredient in a food item. This may be considered as residual but studies show that it contains health-affirming benefits. Related studies on coconut residue are hardly available but nevertheless, coconut flour will be presented as there is a slight difference, especially in the process. The only difference is that it does not undergo the grinding and pulverizing process.

Coconut flour has 5 grams of fiber per tablespoon, which is significantly more than whole-grain flour's 0.8 grams or white flour's 0.2 grams of this indigestible carbohydrate. A large portion of this fiber is the insoluble variety, which gives your stool more weight, makes you feel fuller, prevents constipation, and improves colon health. Make smoothies, sauces, or baked products with coconut flour to help you consume the daily recommended 25 to 38 grams of fiber (Boldt, 2011).

Dietary fiber can be classified into insoluble dietary fiber and soluble dietary fiber. Soluble dietary fiber (SDF) could fully hydrolyze in the colon, promote the growth of intestinal probiotics, and inhibit lipid transport, cardiovascular disease, and scavenge free radicals (Huang et al., 2015). The composition of SDF is an essential index for the quality of dietary fiber. SDF is composed of carbohydrate-based polymers, including pectic substances, gums, mucilage, and some hemicelluloses, which significantly benefit human health; it can prevent heart disease, obesity, and cancers (Du et al., 2019).

For those with and without diabetes, fiber is an essential nutritional component. Despite being a form of carbohydrate, fiber doesn't cause blood sugar to rise. In contrast to other types of carbohydrates, fiber does not affect blood sugar levels in the same way since it is not digested by your body. Soluble and insoluble fibers are mixed together in foods. The first kind turns into a gel after dissolving in water and aids in slowing glucose absorption. Soluble fiber-rich diets may help lower blood sugar levels. The other form of fiber increases stool volume, encouraging regularity, rather than dissolving in water (Renee, 2017).

When compared to conventional grain flours, coconut flour has a significantly lower carbohydrate content. The proximate analysis of coconut flour per 100 g sample is as follows: moisture, 3.6%; ash, 3.1%; fat, 10.9%, protein, 12.1%; and carbohydrates 70.3%. Coconut flour contained 60.9% total dietary fiber, 56.8% insoluble and 3.8% soluble. Table 1 shows the short chain fatty acids produced from dietary fiber fermentation of fiber isolates of coconut flour. The dietary fiber from coconut flour was fermentable and produced short chain fatty acids with butyrate > acetate > propionate (Trinidad et al., 2006)

Coconut flour indicated higher levels of protein, ash, fibre, and fat compared to wheat flour. Coconut meal defatting has the potential of increasing its protein content because the crude fat and soluble carbohydrates were removed in the extraction process (Makinde and Eyitayo, 2019).

A serving of food's total amount of carbohydrates should be taken into account, but it's also crucial to examine the type of carbohydrates you consume. The glycemic index makes predictions about how food's carbohydrate content will affect your blood sugar levels. Low glycemic index foods help stabilize blood sugar levels, which helps you lose weight and prevent chronic diseases at the same time. High glycemic index foods cause significant swings in your blood sugar levels. According to a 2003 article in the "British Journal of Nutrition", foods with a higher percentage of coconut flour had a lower glycemic index, making them healthier carbohydrate options (Jacob, 2017).

Another advantage of using the grated coconut leftover is that an ample quantity will be obtained in view of the fact that Bohol is producing a native sticky sweet delicacy locally known as “kalamay” which coconut milk is one of the main ingredients. After extracting the coconut milk, as per the knowledge of the researcher, the coconut residue is typically thrown or used as livestock feed.

In view of the above idea of introducing a coco-nuggets recipe, it does not only satisfy the taste buds and hunger but also may also give nutritional content. Hence, the researcher finds this study a worthwhile undertaking.

OBJECTIVE

The main thrust of this study is to develop a value-added food product by utilizing leftover materials from the production of coconut-based food delicacies.

METHODOLOGY

Collecting of Coconut Residue

Food safety is the most taken importance. Therefore, right after extracting the coconut milk, the collected coconut residue was placed in a zip lock packaging and immediately submitted to the Department of Science and Technology Regional Standards and Testing Laboratory to examine if the coconut residue is safe to be used.

Recipe Formulation

The ingredients used in this study were summarized in Table 1.

Table 1 Ingredients used in this study

Description	Quantity	Unit
Garlic, minced	15	grams
Onion, minced	42	grams
White pepper, ground	5	grams
Salt, fine	15	grams
Eggs, large	200	grams
All-purpose flour	155	grams
Coconut residue, slightly dehydrated	220	grams

Ingredients and quantities are formulated by multiple trials.

Preparation

The coconut residue was prepared using a food processor to ensure dry residue. The ingredients were measured accurately using a weighing scale then mixed well. The mixture was then molded into a flat circle shape and weighed to 10 grams to ensure uniform size. Then, the molded mixture was deep-fried until golden brown.

Evaluating of Sensory Characteristics

In this evaluation for acceptability, fifty participants from were randomly selected. It is composed of eight food technology instructors, thirty-five food technology students, and seven housewives. The participants were presented with the coco-nuggets and were asked to indicate their degree of preference through a 9-point hedonic scale anchored by “dislike extremely” and “like extremely”. The food tasting was done between 2:00 to 3:00 PM because according to Edelman, S. 2014, in his book on sensory evaluation, panelists should not ingest any food 1 hour before food tasting and it is considered the best time of the day that the panelists are not overly hungry or full that can possibly affect their rating.

Nutritional Analysis

To determine the nutrient content of the coco nuggets, the product was subjected to nutrition analysis at the Department of Science and Technology Regional Standards and Testing Laboratory. As recommended by the laboratory personnel, a total of 250 grams were submitted in a plastic stand-up pouch.

RESULTS AND DISCUSSION

To comply with the Republic Act No. 10611, an act to strengthen the food safety regulatory system in the country to protect consumer health and facilitate market access of local foods and food products, and for other purposes, the coconut residue collected from the vendors of local delicacy with coconut milk was submitted to a microbiology analysis at the DOST Laboratory to determine if it is safe for production.

Table 2 Report of micro analysis of the fresh coconut residue

Parameter	Results
Aerobic plate count	2.5×10^6 cfu/g
Total coliform count	3.7×10^3 cfu/g
E. coli count	$< 1.0 \times 10$ cfu/g
Enumeration of S. aureus	9.0×10 cfu/g
Salmonella detection	negative
Mold and yeast count	2.5×10^5 cfu/g

According to the Philippine National Standards – Bureau of Agricultural and Fisheries Product Standards 25:2007, the microbial count shall not exceed the following limits: salmonella – negative, total plate count – 5,000 cfu/gram, coliform count – 50 cfu/gram, yeast 100 cfu/gram, molds 100 cfu/gram, *E. coli* - < 3 mpn/gram. Furthermore, according to Microbial Guidelines for Food revised 2014, *Staphylococcus aureus*, the limit is 10,000 cfu/gram. Therefore, the report of microanalysis in table 1 reflects that the coconut residue collected from the delicacy vendors is not safe to be processed. Thus, the coconut residue utilized in this study is firsthand gathered by the researcher with the observance of utmost food safety to avoid microorganisms.

Table 3 Sensory evaluation result of the coco nuggets

N=50

Sensory Attributes	Rating (Mean)	Description	Standard Deviation
Color	8.66	Like Extremely	0.593
Texture	7.5	Like Very Much	1.129
Aroma	7.74	Like Very Much	0.922
Taste	7.56	Like Very Much	1.146
General Acceptability	7.72	Like Very Much	0.927

Table 3 reflects the sensory attributes of the coco nuggets. The color got the highest numerical rating of 8.66 described as “like extremely”, while the rest of the attributes are at the range of “like very much”. The texture got the average weighted mean of 7.5, for the aroma, 7.74, for the taste, 7.56, and for the general acceptability 7.72. This result indicates that the coco nuggets are generally acceptable to the consumers, however reflected in the comment section of the questionnaire, 34 or 68% of the participants suggested that the coco nuggets are best served with a sauce or dipping.

Food has to be analyzed or tested because the knowledge of the chemical composition is important to the health, well-being, and safety of consumers. (Nollet, 2015). The nutrition facts panel on food packages was designed to provide comprehensible quantitative nutrition information that would allow consumers to make more informed food choices that could result in significant long-term health benefits (Burton et al., 1999).

Table 4 shows the computation of nutrition facts of the coco nuggets examined by the Department of Science and Technology Regional Office No. 7 - Regional Standards and Testing Laboratory (DOST-RSTL).

Table 4 Nutrition information / facts / declaration

Nutrition facts	
9 servings per container	
Serving size	4 pieces (43 g)
Amount per serving	
Calories	140
	(% daily value*)
Total fat 2 g	3%
Sodium 560 mg	23%
Total carbohydrates 27 g	9%
Total dietary fiber 7 g	27%
Total Sugars 0 g	
Includes 0g added sugars	0%
Protein 3 g	
Calcium	2%
Potassium	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

This is based on Philippine Recommended Energy and Nutrient Intakes (RENI) for males ages nineteen (19) to twenty-nine (29). For every serving size of 4 pieces (43 grams), coco nuggets contain 140 kilocalories of energy, 2 grams of Total Fat, 560 milligrams of Sodium, 27 grams of Total carbohydrates, 7 grams of Total Dietary Fiber, and 3 grams of Protein. The coco nuggets also contain minerals like calcium and potassium. RENI's are levels of energy and nutrient intakes that are considered adequate for the maintenance of health and well-being of persons belonging to a particular age group. The figure given is a percentage of this target level.

Physiologically, potassium is the most abundant cation in the intracellular fluid, where it plays a crucial role in cell function, maintaining intracellular fluid (ICF) volume and transmembrane electrochemical gradients (Ekmekcioglu et al., 2016).

CONCLUSION

The main thrust of this paper is to introduce a new recipe that utilizes residual from coconut which has been used for processing coconut-based delicacies. This is to utilize the coconut residue out from the producer/vendor of the local delicacies that coconut milk is an ingredient. The report of the microanalysis in Table 1 reflected that the collected coconut residue from the local delicacies' vendor is not safe to be processed, so for the product formulation, the researcher collected the coconut residue firsthand to assure utmost food safety. Lectures for the producers of local delicacies and thorough implementation and monitoring on Good Manufacturing Practices (GMP) and Good Operating Practices (GOP) is highly recommended to ensure that the residual is still safe for processing, thus, meeting the purpose of this study.

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