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RESEARCH PAPER

Proximate Composition Analysis of Coco-Nipa Cookie: Basis for Product Optimization and Production

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ABSTRACT

The study evaluates the nutritional profile of a cookie formulated using coconut flakes and nipa palm fruit flour. The chemical analysis reveals a balanced macronutrient composition, with moderate caloric density, reasonable fat and protein levels, and modest sodium content. These findings highlight the potential of the Coco-Nipa cookie as a sustainable and health-promoting food option. The use of coconut flakes provides dietary fiber, healthy fats, and natural sweetness, contributing to cardiovascular benefits and improved digestion. Meanwhile, nipa palm fruit flour enriches the product with essential carbohydrates and nutrients, enhancing its overall nutritional value. Despite aligning with dietary guidelines, the analysis underscores areas for optimization, including the quality of fats, sources of carbohydrates, and potential supplementation with protein to enhance its role in a balanced diet. Furthermore, enhancing its fiber and micronutrient content is recommended to support metabolic and heart health. These insights serve as a foundation for product improvement, ensuring that the Coco-Nipa cookie not only appeals to health-conscious consumers but also addresses their dietary needs. This study underscores the significance of utilizing locally available, sustainable ingredients like coconut and nipa palm fruit in functional food production. Future studies can explore flavor variations, shelf-life stability, and additional health benefits, solidifying the Coco-Nipa cookie's potential as a nutritious, innovative product for diverse consumer markets.

HIGHLIGHTS

- Nipa Palm (*Nypa fruticans wurmb.*) is one of the most widely distributed and useful palms in the mangrove forests of Southeast Asia
- Coconut is the edible fruit of the coconut palm tree (*Cocos nucifera*), commonly found in tropical regions.
- Coco – Nipa cookie offers numerous health benefits including rich fiber content, antioxidant properties and healthy fats from coconut oil. These cookies are also gluten-free, making them suitable for those with gluten intolerance.

Keywords: Coco-Nipa cookie, proximate composition, coconut flakes, nipa palm fruit flour, sustainable food production, nutritional optimization

Cookies are a popular snack food consumed by people of all ages. Cookies can be produced from various ingredients such as flour, sugar, butter, eggs, and flavourings. The use of unconventional ingredients in cookie production has become a trend in recent times. The use of Coconut flakes and Nipa flour is one of such unconventional ingredients. Coconut flakes is a rich source of dietary fiber, protein, and healthy fats. It is also a good source of essential minerals such as potassium, magnesium, and iron. Nipa (*Nypa fruticans*) is a tropical palm tree that grows in swampy areas. Its flour is a rich source of carbohydrates and fiber. It is also low in

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fat and contains some essential minerals such as calcium and iron.

A study by Oyebanji *et al.* (2019) evaluated the physicochemical and sensory properties of cookies produced from blends of wheat flour, flaked coconut, and Nipa flour. The study found that the addition of flaked coconut and Nipa flour improved the nutritional value and sensory properties of the cookies. Another study by Chandra *et al.* (2017) investigated the use of Nipa flour as a partial replacement for wheat flour in bread production. The study found that the use of Nipa flour improved the nutritional value and sensory properties of the bread. Similarly, a study by Srimongkol *et al.* (2016) evaluated the use of coconut flour as a partial replacement for wheat flour in muffin production. The study found that the use of coconut flour improved the nutritional value and sensory properties of the muffins. Overall, the mentioned studies suggest that the use of unconventional ingredients such as Coconut flakes and Nipa flour in food production can improve the nutritional value and sensory properties of the final product.

This study aimed to determine the proximate composition of cookies produced from Coconut flakes and Nipa palm fruit. The proximate composition of food refers to the percentage of nutrients present in it. The proximate analysis includes the determination of moisture, ash, fat, protein, and carbohydrate content of food and it helps in determining the nutritional quality and value of food. The results from the proximate analysis will give us the baseline data for product optimization that will lead to the production of Coco-Nipa Cookie for commercialization.

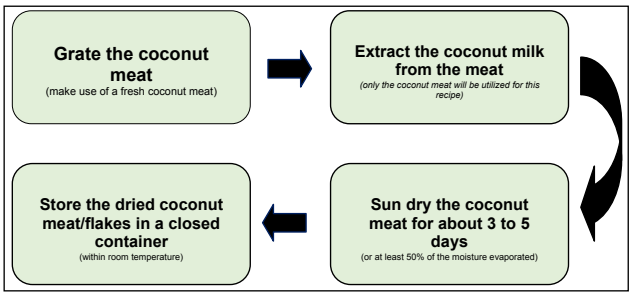
MATERIALS AND METHODS

This study utilized an experimental-quantitative approach. The experimental approach allows the researcher to process and produce Coco-Nipa cookies while the quantitative approach focuses on gathering of numerical data to evaluate the proximate composition of the Coco-Nipa cookies. The preparation and processing of the Coco-Nipa cookies was done at North Eastern Mindanao State University – Cantilan campus food laboratory while the laboratory testing for the proximate composition analysis of the cookies was conducted at DOST Caraga laboratory.

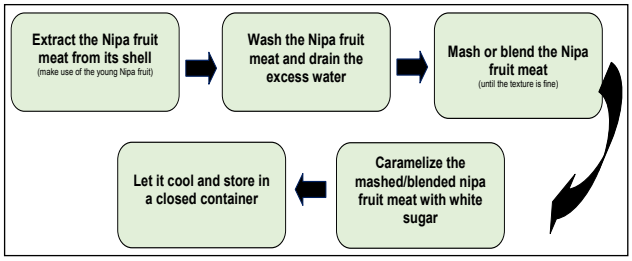
The researchers gathered all the necessary ingredients including the two main ingredients in the cookie making process such as Coconut flakes and Nipa palm *(Nypa fruticans)* fruit. In preparing the cookie, the following procedures was observed:

Step 1: *Collection of ingredients and processing of Coco-Nipa cookie*

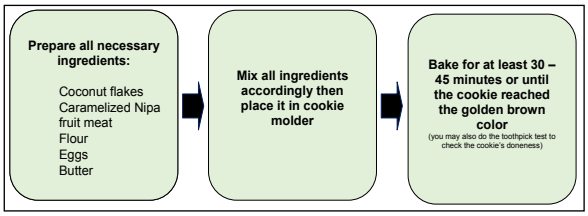
1.1 *Preparation of Coconut flakes:*



1.2 *Preparation of Nipa palm fruit:*



1.3 *Preparation of Coco – Nipa Cookie:*



Step 2: *Proximate Composition analysis of Coco-Nipa cookies*

The proximate composition analysis of Coco-Nipa cookies was conducted at the laboratory of DOST Caraga using the following methods:

1. **Ash Content**: AOAC Official Method 935.39 B, Official Methods of Analysis of AOAC International, 2023, 22nd ed., vol. 2.
2. **Moisture**: AOAC Official Method 925.10, Official Methods of Analysis of AOAC International, 2023, 22nd ed., vol. 2.
3. **Crude Protein**: AOAC Official Method 954.01, Official Methods of Analysis of AOAC International, 2023, 22nd ed., vol. 1.

4. **Total Fat**: AOAC Official Method 2003.06, Official Methods of Analysis of AOAC International, 2023, 22nd ed., vol. 1.
5. **Sodium**: AOAC Official Method 999.10, Official Methods of Analysis of AOAC International, 2005, 18th ed., 2nd rev.

RESULTS AND DISCUSSION

Table 1: Chemical Analysis of Coco-Nipa Cookie

Sample	Parameter	Result
Coco-Nipa Cookie	Moisture	25.67 g/100g
	Ash Content	1.11 g/100g
	Crude Protein	6.61 g/100 g
	Total Fat	11. 68 g/100g
	Sodium	201.66 mg/100g

The chemical analysis of the Coco-Nipa cookie, as presented in Table 1, provides insight into its nutritional composition. The moisture content is 25.67 grams per 100 grams, which is a critical factor for shelf life and texture. High moisture levels in baked goods can lead to shorter shelf stability due to the potential for microbial growth (Labuza & Hyman, 1998). Thus, packaging and storage conditions must be optimized to prevent spoilage and maintain quality.

The ash content, indicating the total mineral content, is 1.11 grams per 100 grams. This level suggests a modest contribution of essential minerals in the cookie, aligning with studies that emphasize the importance of minerals in dietary intake for bone health and metabolic function (Institute of Medicine, 2001). While the ash content alone does not specify which minerals are present, further analysis could highlight contributions from key micronutrients such as calcium and iron, which are vital for overall health.

The Coco-Nipa cookie also has a crude protein content of 6.61 grams per 100 grams. This protein level is relatively high for a snack item, which can support satiety and muscle maintenance, especially when included as part of a balanced diet. Protein intake has been shown to play an essential role in weight management and muscle repair (Pasiakos *et al.* 2015). Including this protein-rich snack in a diet could, therefore, provide benefits for active individuals or those looking to improve their protein intake.

With a total fat content of 11.68 grams per 100 grams, the Coco-Nipa cookie contributes a significant amount of dietary fat, which is necessary for the absorption of fat-soluble vitamins and energy provision. However, considering the implications of high fat intake, especially saturated fats, it is crucial to balance this snack with other lower-fat foods throughout the day to maintain a heart-healthy diet (American Heart Association, 2020).

The sodium content in the Coco-Nipa cookie is 201.66 milligrams per 100 grams, which is within a typical range for processed snacks but still requires attention for individuals monitoring their salt intake. High sodium consumption is associated with an increased risk of hypertension and cardiovascular diseases, making it important for consumers to be mindful of their daily intake (WHO, 2012). For those with high blood pressure or those aiming to reduce their salt intake, this snack may need to be consumed in moderation. This emphasizes the value of understanding nutritional information for making health-conscious choices.

Table 2: Computation of Nutritional Facts

Food Nutrient	Result of chemical analysis (per 100g)*	Amount of food nutrient per serving size (Rounded value)	% Daily value (based on 2000 calorie diet, rounded value)**	% RENI (based on FNRI reference adult requirement of males 19-29 years old
Calories	351.28	160		6
Calories from fat	105.12	45		
Total fat (g)	11.68	5	6	
Sodium (mg)	201.66	90	4	
Total carbohydrates (g)	54.93	25	9	
Protein (g)	6.61	3	6	4

**Based on the report of chemical analysis; ** The % daily value is based on the new nutrition facts labeled finalized May 20, 2016.*

The table 2 provides a detailed nutritional profile of a food item based on chemical analysis, showcasing its nutrient contributions per 100 grams and per serving. This analysis is grounded in the updated nutrition labeling guidelines finalized on May 20,

2016, which provide a basis for assessing daily intake values for a 2000-calorie diet (FDA, 2016). Each 100g of this food item contains 351.28 calories, while a standard serving size offers 160 calories, accounting for 6% of the daily caloric needs (FNRI, 2016). Of these calories, 105.12 originate from fat in every 100g portion, which reduces to 45 calories in a serving. The total fat content is 11.68 grams per 100g, or 5 grams per serving, which corresponds to 6% of the recommended daily value for fat intake (FNRI, 2016).

Sodium levels reach 201.66 milligrams per 100g, translating to 90 milligrams per serving, but the table does not specify the percentage of daily value for sodium. High sodium intake is widely recognized as a factor in hypertension and cardiovascular disease, and guidelines by the World Health Organization (WHO) suggest an upper limit of 2,000 mg per day for adults (WHO, 2012), indicating that this product's sodium content, while moderate, could contribute to sodium management in the diet. Carbohydrates make up a significant portion, with 54.93 grams per 100g and 25 grams per serving, providing 9% of the daily carbohydrate requirement (FNRI, 2016). Research on carbohydrate intake suggests that dietary sources with moderate carbohydrate content, particularly when derived from whole and unprocessed foods, help maintain stable blood sugar levels and support energy needs throughout the day (Ludwig *et al.* 2018).

The protein content is 6.61 grams per 100g, equating to 3 grams per serving, covering 6% of the daily protein needs for the average adult on a 2000-calorie diet and 4% of the Recommended Energy and Nutrient Intake (RENI) for young adult males aged 19-29 (FNRI, 2016). Protein is essential for muscle repair, immune function, and general metabolic health, and studies highlight its importance in satiety and weight management (Pasiakos *et al.* 2015). For physically active individuals or those with higher protein needs, additional protein sources would be beneficial to meet daily requirements (Sacks *et al.* 2017).

These values reflect the standards established by the Food and Nutrition Research Institute (FNRI) for young adult males, with % Daily Value calculations aiding in understanding each nutrient's contribution relative to standard dietary requirements (FNRI, 2016). This analysis serves as a guide for balanced nutrient intake, aligning with FDA guidelines to support informed dietary choices (FDA, 2016).

Table 3: Nutrition Facts based on Philippine requirement

Nutrition facts		
Serving size: 1 piece (45g)		
No. of servings per container/pack: 1		
	Amount per serving	**% RENI***
Calories (kcal)	160	6
Calories from fat (kcal)	45	
Total fat (g)	5	
Sodium (mg)	90	
Total Carbohydrates (g)	25	
Total protein (g)	3	4

**Percent RENI values are based on FNRI reference adult requirement of males 19-29 years old. However, if a product is specifically intended for a different age bracket group.*

**for coconut product, Medium Chain Triglycerides (MCTs) is predominant*

The nutritional breakdown of this food product offers a window into its potential health implications, especially within the context of the Recommended Energy and Nutrient Intake (RENI) standards set by the Philippine Food and Nutrition Research Institute (FNRI). Each serving provides 160 kcal, making it a moderately energy-dense food. Studies indicate that calorie density plays a crucial role in weight management and overall health, with lower-calorie-dense diets being linked to weight loss and improved dietary satisfaction (Rolls, 2009). Thus, the moderate calorie density of this product could make it suitable for individuals who aim to manage their energy intake without sacrificing essential nutrients, provided it is consumed in appropriate portion sizes.

The product's total fat content per serving is 5 grams, with 45 kcal derived from fat. While fat is an essential nutrient, a higher intake of saturated and trans fats has been associated with increased risks of cardiovascular disease (Mozaffarian *et al.* 2010). Therefore, the quality of fat (e.g., unsaturated vs. saturated) within the food product would be a crucial consideration for assessing its impact on heart health. Unfortunately, the provided data does not specify fat types, limiting a full evaluation. However, it aligns with general dietary

recommendations that moderate fat intake supports overall energy needs and satiety, particularly when the fats are of higher quality (i.e., unsaturated) (Sacks *et al.* 2017).

The sodium content, at 90 mg per serving, is relatively moderate and falls well within daily intake guidelines. High sodium intake is a known risk factor for hypertension and cardiovascular disease (He *et al.* 2013). The World Health Organization (WHO) recommends limiting sodium intake to less than 2,000 mg per day for adults (WHO, 2012). This food product's sodium content would contribute a manageable amount toward that limit, making it a reasonable option for those monitoring their sodium intake, assuming moderate consumption.

Each serving contains 25 grams of carbohydrates, meeting 9% of the daily RENI for carbohydrates, and aligns with dietary guidelines emphasizing carbohydrate-based foods for energy. However, the source and quality of carbohydrates are important, as refined carbohydrates may lead to blood sugar spikes and contribute to metabolic issues, while complex carbohydrates and dietary fiber promote stable energy and digestive health (Ludwig *et al.* 2018). The data does not specify carbohydrate type or fiber content, but incorporating whole grains or fiber-rich sources could enhance this product's health benefits, as studies show that high-fiber diets reduce the risk of several chronic diseases (Reynolds *et al.* 2019). The protein content is relatively low at 3 grams per serving, contributing only 4% of the daily RENI for protein. Protein is essential for muscle repair, immune function, and metabolic health. Research supports the importance of higher protein intake for individuals with active lifestyles or those aiming to build or maintain muscle mass (Pasiakos *et al.* 2015). Given the low protein content, this product may be better suited as a supplementary source rather than a primary protein source, particularly for those with higher protein requirements.

While this product offers a balanced macronutrient profile that aligns with RENI guidelines for moderate energy intake, considerations regarding fat quality, carbohydrate type, and additional protein sources could optimize its role in a balanced diet. These nutritional factors underline the importance of evaluating foods not just for their calorie content but for the quality of macronutrients they provide in meeting health goals.

Table 4: Nutrition Facts label Based on US FDA

Nutrition Facts	
1 serving per container	
Serving size	**1 piece (45g)**
Amount per Serving	
Calories	**160**
	% Daily Value*
Total Fat 5g	6%
Sodium 90mg	4%
Total Carbohydrate 25g	9%
Protein 3g	6%

**The % Daily Value (DV) tells you now 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 nutrition label, based on the U.S. Food and Drug Administration (FDA) standards, provides information for a single 45-gram serving of a food item, offering a breakdown of key macronutrients. Each serving contains 160 calories, with 5 grams of total fat, representing 6% of the recommended daily value. This fat content, while moderate, can have implications for dietary management, as research shows that controlled fat intake can support heart health and prevent weight gain when balanced with other nutrients (American Heart Association, 2020). Sodium levels are 90 milligrams per serving, contributing to 4% of the daily recommended intake. High sodium intake has been associated with hypertension and cardiovascular disease, emphasizing the need for careful monitoring in individuals with elevated blood pressure (WHO, 2012). The carbohydrate content is substantial, with 25 grams per serving, accounting for 9% of the daily value. Carbohydrates are an essential source of energy, particularly in high-energy-demand situations. However, studies have shown that the type and quality of carbohydrates play a significant role in health outcomes, with an emphasis on complex carbohydrates over simple sugars for stable blood glucose levels and overall metabolic health (Ludwig *et al.* 2018). This product's carbohydrate content may be beneficial for those needing quick energy, but should be consumed alongside fiber-rich foods to avoid spikes in blood sugar. Additionally, the protein content stands at 3 grams per serving, fulfilling 6% of the daily recommended intake.

Protein is a fundamental nutrient required for muscle repair, immune support, and overall cellular function. Protein intake has also been shown to improve satiety and aid in weight management, making it an essential component for balanced meals (Pasiakos *et al.* 2015). Although the protein amount is moderate, it could complement other protein sources to help meet daily requirements, especially for active individuals or those with higher protein needs.

The inferences of this label align with FDA guidelines, which recommend awareness of daily values to support informed dietary choices (FDA, 2016). Monitoring daily intake of fats, sodium, carbohydrates, and protein can aid individuals in achieving a balanced diet and reducing the risk of chronic conditions, such as cardiovascular disease, diabetes, and obesity (CDC, 2020). Thus, this label serves as a practical tool for consumers seeking to maintain a nutritious and balanced diet within the standard 2,000-calorie daily framework.

CONCLUSION

The chemical analysis of Coco-Nipa cookies highlights their balanced macronutrient composition, offering moderate caloric density, reasonable fat and protein levels, and modest sodium content. While the product aligns with dietary guidelines, considerations about fat quality, carbohydrate sources, and supplementary protein are necessary for optimizing its nutritional role. Its potential as a nutritious, sustainable food choice complements consumer goals of health and dietary balance. Future research could explore enhancements to its fiber and micronutrient profile to support its benefits for metabolic and heart health.

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