Desiccated Coconut Milk Wastes into Coconut Flour: An Organic Ingredient in Baking Cookies

Anabelle E. Villaceran [1]

[1] Doctor of Philosophy, Department of Technology Management,
Head of the Food Technology Research and Development,
Center of Northern Negros State College of Science and Technology,
Sagay City, Negros Occidental, Philippines

Abstract

The desiccated coconut meat wastes were recycled into coconut flour and utilized in bakery products like cookies; furthermore, it was aimed to assess the microbiological and biochemical content; and evaluate the shelf-life and acceptability of the coconut cookies. Three samples were developed with desiccated coconut flour as the dependent variable such as sample 1 with 25%, sample 2 with 50%, and sample 3 with 75%. Fifty mothers were the participants in the evaluation of the acceptability using systematic random sampling from a community of 500 households. Nine-point Hedonic Scale was the survey instrument using the organoleptic properties parameter. Desiccated coconut flour was within the food safety limit; this had intensified micronutrients which were fiber, fat, iron, and magnesium. Maillard reaction and the sodium bicarbonate contributed to the 175 days and 62 days shelf-life of the desiccated coconut flour and cookie. Sample 1 which had 25% desiccated coconut flour had the highest acceptability in appearance, flavor, and mouthfeel including general acceptability; sample 2 in the aroma, and sample 3 in the color. An increase in the amount of desiccated coconut flour, the higher the moisture fiber, iron, magnesium, and potassium (except for the potassium in sample 3); on the contrary, there were lower amounts of protein, fat, carbohydrates, sugar, sodium, calories, calories from fat, total fat, and total carbohydrates; and the lesser the amount of coconut flour in the food composition, the higher its acceptability.

Keywords: Desiccated coconut meat wastes, cookies, bakery products, recycling, Maillard reaction.

1. Introduction

Sustainable Development Goals (SGD 12), envisions ensuring sustainable consumption and production so that by 2030, this world can achieve the environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with the agreed international frameworks and significantly reduce their release to air, water, and soil in order to minimize their adverse impacts on human health and the environment. Substantially reduce waste generation through prevention, reduction, recycling, and reuse. In lieu of this SGD, the Philippine government set the Republic Act 9003, the "Ecological Solid Waste Management Act of 2000". Aside from ensuring the protection of public health and the environment, this act mandates to set of guidelines and targets for solid waste avoidance and volume reduction

through source reduction and waste minimization measures, including composting, recycling, re-use, recovery, green charcoal process, and others, before collection, treatment, and disposal in appropriate and environmentally sound solid waste management facilities in accordance with ecologically sustainable development principles. The Philippine government is promoting national research and development programs for improved solid waste management and resource conservation techniques, more effective institutional arrangements, and indigenous and improved methods of waste reduction, collection, separation, and recovery.

Desiccated coconut meat wastes are residues of coconut milk after separating the milk from its meat. Usually, it is included in domestic wastes and sometimes thrown somewhere else which can generate gases and contributes to an unhealthy environment when improperly disposed of. The utilization of desiccated coconut meat wastes in this study was a form of the circular economy since the recycling of wastes and the development of new products were made. In the same situation, food security is achieved and climate change is mitigated.

Desiccated coconut flour in this study was a desiccated coconut meat waste, a residue from coconut milk after the filtration and oven-drying process. As stated in Table 2, a 45g/ serving has 4.2 moisture, 4.2 Protein, 1.7 Fiber, 41.2 Fat (unsaturated fat), and 41.7 Carbohydrates. This flour was utilized as organic ingredients in bakery products like cookies. Organic ingredients according to USDA (United States Department of Agriculture) is a labeling term that indicates that food or other agricultural product has been produced through approved methods. These methods integrate cultural, biological, and mechanical practices that foster the cycling of resources, promote ecological balance, and conserve biodiversity. Things like synthetic fertilizers, sewage sludge, irradiation, and genetic engineering may not be used. The National Organic Program regulates all organic crops, livestock, and agricultural products certified by the Department of Agriculture (DA) organic standards. This agency also conducts oversight of organic certification, compliance, enforcement activities, and product labeling. In order to sell, label, or represent their products as organic, operations must follow all of the specifications set out by the DA organic regulations. Since desiccated coconut meat wastes were within this practice and management so were considered an organic ingredient. In this study, coconut flour from desiccated coconut meat wastes was mixed with all-purpose flour into three different samples with different contents of desiccated coconut flour to develop cookies, a type of bakery product that is used as comfort and functional food.

Generally, the purpose of this study was to produce coconut flour from desiccated coconut milk wastes to be utilized as an ingredient in baking cookies. Furthermore, this study aimed to assess the microbiological and biochemical content of coconut flour and coconut cookies; evaluate shelf-life and acceptability using organoleptic properties (affective test). Northern Negros State College of Science and Technology Food Research and Development recycled desiccated coconut meat wastes into coconut powder and utilized them as ingredients in baking bakery products like cookies.

2. Materials and Methods

Research Design

This study was conducted to assess the microbiological and biochemical content in both desiccated coconut meat wastes flour as ingredients in bakery products. This is descriptive research in quantitative design. A Descriptive was employed because it describes the characteristics of every ingredient being utilized in the development of desiccated coconut meat wastes flour, and baking coconut meat waste cookies and identifies the microbiological and biochemical content of the different samples. The descriptive method is to gather information about the present existing condition of a thing (Creswell, 1994). A quantitative design was used because it generates numbers or frequencies and percentages of every ingredient and at the same time the number of bacteria and nutrients present in each sample. This is a process of collecting and analyzing numerical data (Bhandari, 2022). This study also generates nutrition facts for every sample which are highly accepted by the audience during the conduct of acceptability using organoleptic evaluation.

Locale of the Study

This study was conducted at the Food Technology Research Centre of NONESCOST, and the coconut meat milk waste was taken from the coconut meat milk wastes of the local ice cream producers of Brgy. Old Sagay, Sagay City, Negros Occidental.

Materials

Desiccated coconut meat wastes from the local ice cream house of Brgy. Old Sagay, Sagay City, Negros Occidental, Philippines which was developed into desiccated coconut flour, all-purpose flour, unsalted butter, raw sugar, baking soda, egg, and cholate chips for toppings. A specialized drying oven was used for drying and baking as a timer, temperature scale, and moisture analyzer.

Desiccated Coconut Cookies Food Ingredients Chemistry

Flour

Flour was the primary ingredient in baking, all-purpose flour typically has a protein content ranging from 10% to 12% aside from carbohydrates. This ensures that the baked cookie has a good texture, crispy exterior, and tight structure. Coconut flour contains good cholesterol that has an important function in the human body. When all-purpose flour and coconut flour were mixed, macronutrients from this food composition were enhanced.

Butter

Unsalted butter gave flavor, tenderness, and flaky layers to baked goods. It has a little liquid which contributes to rise and structure. This can enhance butter or inhibit gluten development, which in turn affects the shape, spread, and texture of baked food products or cookies.

Sugar

Raw sugar-sweetened, tenderized, and moistened the texture of cookies. When dissolves with other ingredients, sugar absorbs moisture which slows down the development of gluten and starch. It helps the dough becomes crumbly rather than tough. This caramelizes the texture of the cookies and when heated above its melting point and turns golden brown or gets a Maillard reaction. This coloring deepens the cookie's surface and creates a delicious aroma that contributes also to strengthening cookies' shelf life. Another role of sugar in baking cookies is, it helps in the expansion of the structure of cookies since sugar melts when it is

heated. This also stabilizes the form of cookies. Sugar adds the bulk of the cookie and helps slow the coagulation thus contributing to food shelf life.

Sodium bicarbonate

Sodium bicarbonate was the leavening agent that helps cookies to rise and become fluffy. When baking soda comes in contact with an acidic ingredient such as chocolate and butter, it reacts and creates carbon dioxide gas. This gas makes the cookies expand and become lighter in texture. When combined with an acid or butter this produces the carbon dioxide that helps the dough or batter rise. Baking soda also encourages raising the mixture's pH, which slows protein coagulation, this gives the dough more time to set before the eggs set which resulted in a more evenly baked cookie.

Eggs

Eggs contributed to the appearance, color, texture, flavor, aroma, and mouthfeel of cookies and also to the rise and uniformly open cell structure which influences eating quality. Aside from nutrients contributing to cookies, eggs serve as a binding ingredient and a flavor neutralizer.

Chocolate

Chocolate chips in cookies were an example of both chemical and mechanical Aeration. Chemical Aeration was a process of mixing air into a substance by means of a chemical agent in order to make the end product palatable and easily digestible. The chemical agent used here was sodium bicarbonate. Mechanical aeration was the process of mechanically mixing air into the substance using a whisk attached to a stand mixer or hand blender. Both processes incorporate air into the mixture and the gas produced by the reaction of baking powder with the acid will be trapped in these air pockets and held in place by the gluten present in the flour. This (the gas) will expand on heating (in the oven) thereby increasing the volume, which is then held by the coagulation of the gluten (in the flour) and any other proteins present, making the end product light and digestible. This simply means butter whips with sugar (in the process of creaming) to create air pockets.

Methods

Experimental Design

This study used a 3x1 factorial design of experiments (DoE) in a completely randomized design (CRD). Factor A: was using 125 g or ¼ kilo of total flour (Coconut and all-purpose flour). A1: 25% coconut flour (31.25g) and 75% all-purpose flour (93.75g); A2: 50% coconut flour (62.5g) and 50% all-purpose flour (62.5 g); and A3: 75% coconut flour (93.75g) and 25% all-purpose flour (31.25g). Factor B or B1: 113 grams, of unsalted butter; 110 grams, of raw sugar; 1 whole egg; 5.69 grams, of baking soda; and 75 grams of chocolate.

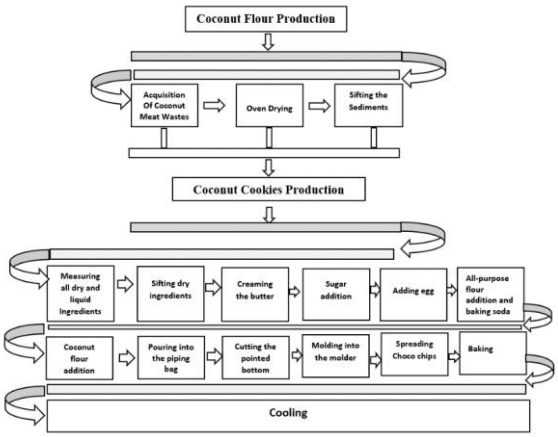
Process of Producing Coconut Flour

The following was the process of producing coconut flour: drying the desiccated coconut meat waste in a specialized oven using 170^{o} C for 40 minutes; cooling the dried desiccated coconut meat waste, tossing the cooled dried desiccated coconut meat waste; testing sediments or nanoparticles using a magnifying glass, storing into safe bottles the quality-controlled desiccated coconut flour.

Process of Baking Coconut Cookies

The following was the process of producing coconut meat wastes cookies: measuring all dried and liquid ingredients needed in baking cookies; sifting all the measured dry ingredients; creaming the unsalted butter in a mixing bowl; adding sugar gradually on a creamed unsalted butter in a mixing bowl; adding a whole fresh egg on the mixture of creamed unsalted butter and sugar; adding the sifted all-purpose flour with baking soda in a mixture of creamed unsalted butter, sugar, and egg until it became soft and fluffy; adding desiccated coconut flour in the mixture of creamed unsalted butter, sugar, eggs, and all-purpose flour with baking soda; mixing thoroughly the mixture of creamed unsalted butter, sugar, eggs, all-purpose flour with baking soda, and coconut flour until it became soft and fluffy; pouring the mixture of creamed unsalted butter, sugar, egg, all-purpose flour with baking soda, and desiccated coconut flour into a piping bag; cutting the pointed bottom of the piping bag for mixture opening; molding the desired amount of cookie mixture through the bottom opening of the piping bag into the cookie molder; spreading the molded cookie mixture in the molder with chocolate chips; placing the cookie molder with cookie mixture with Choco chips in the baking pan; baking the molded cookie mixture with spreaded Choco chips in preheated oven with 170^0 C in 40 minutes or until browning or Maillard reaction is reached.

Flow Chart of Coconut Flour and Coconut Cookies Production



Development of Coconut Cookies Samples in 3x1 Factorial in a Completely Randomized Design

Assessment of Microbiological Content

After the production of desiccated coconut flour and desiccated coconut cookies, the products were packaged and delivered to Negros Prawn Producers Cooperative Analytical and

Diagnostic Laboratory for microbiological and biochemical assessment. The microbiological assessment and test methods used were the following: the Aerobic Plate Count was done using the pour plate method by plate count agar; the Total Coliforms were determined using the serial dilution and compact dry media methods; E. coli was determined using compact dry media; S aureus was determined using the compact dry media; salmonella was determined using the 3M Petrifilm Salmonella Express; Listeria was determined using Reveal 2.0 for Listeria and yeasts and molds were determined using the Pour Plate Method.

Aerobic Plate Count

This test was based on the assumption that each cell can form a visible colony when mixed with agar containing the appropriate nutrients. This is a generic test for organisms that grow aerobically at mesophilic temperatures such as (25 to 40ºC or 77 to 104ºF). This can be used to gauge sanitary quality, organoleptic acceptability, which adheres to good manufacturing practices, and to a lesser extent, an indicator of food safety and provide information regarding shelf life or impending organoleptic change in food.

Escherichia Coli

E. coli count was part of a measure of the overall quality of a food product or ingredient. Generally, high coliform counts indicate low product quality. In finished products, high coliform counts can be related to contaminated raw ingredients, under-processing, or mishandling during or after processing. Elevated counts could indicate a potential health hazard in which pathogens and or toxins may be present. If coliform counts are high, conditions may be favorable for pathogenic bacteria. The identification of Escherichia coli in products or ingredients can indicate possible fecal contamination. This method is applicable to all types of food products and ingredients, (AACC Approved Methods of Analysis, 11th Edition).

Total Coliform

Coliforms are defined as Rod-shaped Gram-negative non-spore forming and motile or non-motile bacteria that can ferment lactose with the production of acid and gas when incubated at 35–37°C. Total and Fecal Coliform are commonly used as indicators of the sanitary quality of foods and water. A positive coliform test means possible contamination and a risk of waterborne disease. A positive test for total coliforms always requires more tests for fecal coliforms or E. coli. A confirmed positive test for fecal coliforms or E. coli means you need to take action as advised by your water system.

Salmonella

Salmonella is a foodborne pathogen that causes enteric and systemic illness if ingested. This can survive at wide pH and temperature ranges and can even lay dormant for long periods of time on surfaces and in foods, including dried grains. A single cell of Salmonella bacteria can cause illness in at-risk individuals, including people who are pregnant, young, elderly, or have weakened immune systems, so there are no acceptable levels for Salmonella contamination in food products. Dirty packaging and workers' hands and clothing are sources of Salmonella. This was tested to ensure the safety of the foods developed.

Staphylococcus Aureus

Staphylococcus aureus is a microorganism that can produce a heat-stable enterotoxin. Consumption of foods containing staphylococcal enterotoxin has resulted in illness. The

enumeration of S. aureus is important, but results need to be interpreted carefully. In most cases, large numbers of the pathogen must be present to produce enough enterotoxin to elicit a clinical response. Foods containing large numbers of S. aureus are not necessarily unsafe. It is therefore important to determine whether the isolated strain is enterotoxigenic or possesses markers that are linked to toxigenic strains (i.e., coagulase).

Listeria

Listeria monocytogenes is a ubiquitous microorganism responsible for listeriosis, a rare but severe disease in humans, who can become infected by ingesting contaminated food products, namely dairy, meat, fish, and vegetables. Although it can occur in healthy humans, listeriosis mainly affects the elderly, immunocompromised, person's pregnant women, and newborns, (Magalhaes, R., Encyclopedia of Textbooks, 2014).

Yeasts and Molds

Both yeasts and molds cause various degrees of deterioration and decomposition of foods. They can invade and grow virtually any type of food at any time; they invade crops such as grains, nuts, beans, and fruits in fields before harvesting and during storage. They also grow on processed foods and food mixtures. Their detectability in or on foods depends on food type, organisms involved, and degree of invasion; the contaminated food may be slightly blemished, severely blemished, or completely decomposed, with the actual growth manifested by rot spots of various sizes and colors, unsightly scabs, slime, white cottony mycelium, or highly colored sporulating mold. Abnormal flavors and odors may also be produced. Occasionally, a food appears mold-free but is found upon mycological examination to be contaminated. Contamination of foods by yeasts and molds can result in substantial economic losses to producers, processors, and consumers, (Tournas, V. et al 2017).

Assessment of Biochemical Content of Samples

The biochemical assessment was done using the Official methods of analysis of the association of analytical chemists and the ASEAN Manual of food analysis Regional Centre of the ASEAN Network of Food Data System was used. It was important to determine the number of nutrients that were needed by every individual or consumer.

Evaluation of the Shelf-life of Samples

After the desiccated coconut flour and coconut cookies had been produced, these were placed on a shelf in the storage area at room temperature together with other food products. The moisture content of each sample before and after the baking process was determined and the browning or Maillard reaction and the content of baking of each sample were considered.

Evaluation of Acceptability Using the Organoleptic Properties of Food Samples

After the assessment of microbiological and biochemical contents and ensuring that samples were under the food safety limit, the acceptability was determined through organoleptic evaluation using these parameters: Appearance, color, aroma, flavor, mouthfeel, and texture. The nine-point Hedonic scale survey instrument for food was utilized for acceptability evaluation.

Research Instrument

Systematic random sampling was used in the determination of the acceptability level using the sensory and organoleptic evaluations. Five hundred mothers aged from 18 to 69 years old

of Brgy. Paraiso, Sagay City, Negros Occidental, Philippines was identified and underwent systematic random sampling as participants through Brgy. Health Workers" (BHW) leaders. Fifty mothers were chosen from the list as every ninth of ten until 50 names were completed.
This study used Nine-point Hedonic Scale as a survey instrument in gathering the data, the scale was designed to range from 0 – 1.99 and to 9 - 9.99, and below is its modality.

1. (Disliked extremely, 0-1.99),
2. Disliked very much, 2-2.99),
3. (Disliked moderately, 3-3.99),
4. (Disliked slightly, 4-4.99),
5. (Neither liked nor disliked, 5-5.99),
6. (Liked slightly, 6-6.99),
7. (Liked moderately 7-7.99),
8. (Liked very much, 8-8.99), and
9. (Liked extremely, 9-9.99).

Participants of the Study

Mothers are the taste bud enhancers of their children. So, to increase the chances of the child being an adventurous, healthy eater, the mother shall strive to consume a varied diet both during pregnancy and after. Recent researches reveal that, whether pregnant or breastfeeding, children's health is from the food the mothers ate. Infants' taste preference starts in the womb. According to new research from the Monell Chemical Sciences Center, a non-profit institute in Philadelphia, the foods a mother eats during pregnancy may shape her infant's taste preferences for a lifetime. The smell and scent of the foods a mother eats during pregnancy are transmitted through amniotic fluid in the second and third trimesters of pregnancy. The growing baby is exposed to these flavors just as taste receptors on their tongue and nasal cavity are quickly developing. The flavor of the amniotic fluid, determined by the foods the mother eats, appears to influence the developing baby's future palette. Distinct flavors such as vanilla, garlic, carrot, and mint have been shown to be more strongly transmitted to amniotic fluid. Consequently, the types of food eaten by women during pregnancy and, hence, the flavor principles of their culture may be experienced by the infants before their first exposure to solid foods. The present study tested the hypothesis that experience with a flavor in amniotic fluid or breast milk modifies the infants' acceptance and enjoyment of similarly flavored foods at weaning, (Grunebaum, A., 2018 & Mennella, J. A., Jagnow, C. P., & Beauchamp, G. K., 2001).

Data Gathering Procedure

The food compositions were designed meticulously in reference to food chemistry to enhance its appearance, color, texture, flavor, aroma, and mouthfeel. The characteristics of each ingredient were carefully analyzed so that each ingredient could harmonize with the others. After the food products were developed into 3 replications, those were then finalized for microbiological, toxicity, and biochemical assessments. The data for these were gathered and analyzed. After the determination that the samples were on food safety levels, the acceptability procedure was then prepared. For food acceptability, The BHW (Barangay Health Workers) of the assigned parks were trained on the conduct of the survey. There were

two BHWs in each purok for the distribution of samples and survey instruments. Orientation to every mother before the start of the taste test was done simultaneously.

The 3 samples and bottled water were packed safely in a safe container and the taste test was started by gargling the mouth with distilled water and one sample of each gargling until the 3 treatments were finished. Then each mother rated the survey instrument meticulously and data were collected.

Data Analysis Procedure

In the development of the samples, this study used percentage, ratio, proportion, mean, standard deviation, and t-tests in data analysis. In the microbiological, toxicity, and biochemical analysis, Negros Prawn Producers Cooperative Analytical and Diagnostic Laboratory used the Official methods of analysis of the association of analytical chemists and the ASEAN Manual of food analysis Regional Centre of ASEAN Network of Food Data System were used.

Ethical Considerations

Prior to the conduct of the study, notice to proceed certification was processed, then the location of the study was prepared and the sampling techniques were considered. The people involved were informed through online communication and a formal letter. The study was discussed with the leader and its constituents of the community.

3. Results and Discussion

Table 1: Results of the Assessment of Microbiological Content of Desiccated Coconut Flour and Samples 1,2,3 and Control A

Parameter	Food Safety Limit	Coconut Flour	Sample 1 (25%) (Desiccated Coconut Flour)	Sample 2 (50%) (Desiccated Coconut Flour)	Sample 3 (75%) (Desiccated Coconut Flour)	Control A
Aerobic Plate Count (CFU/G) (Pour Plate Method)	$<10^4$ (or less than 100,000)	30	15	35	20	50
Escherichia coli CFU/G (Compact dry Media)	<20	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1
Total Coliform (CFU/G) (Compact Dry Media)	10^2 or 100 of 100	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1
Staphylococcus Aureus (CFU/G) (Compact Dry Media)	<20	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1
Salmonella (3MPetrifilm)	**Should not be detected in 25g sample**	Not Detected at 10^1	Absent in 25 g	Absent in 25 g	Absent in 25 g	Absent in 25 g
Listeria (Reveal 2.0 for Listeria)	Absent in 100 CFU/g or not Detected in 25 g	Negative	Negative	Negative	Absent in 25 g	Negative
Yeast (CFU/g) Pour Plate Method, 72 hours)	10^3 or 1000g	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1
Molds (CFU/g) Pour Plate Method, &2 hours)	10^3 or 1000g	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1	Not Detected at 10^1

Table 1 shows the microbiological assessment of the 4 samples which included the desiccated coconut flour as an ingredient for the 3 samples of desiccated coconut cookies and the Control A. These results show that four samples and control A were within the food safety standards of the Food and drug administration (FDA) including Control A.

Table 2: Results of the Assessment of Biochemical Content (Proximate Analysis) of Desiccated Coconut Flour, Samples 1,2,3 and Control A

Parameter (45g/Serving)	Baseline	Desiccated Coconut Flour	Sample 1 (25%)	Sample 2 (50%)	Sample 3 (75%)	Control A
Moisture	Below 5% after baking	4.2	2.5	5.4	7.3	8
Protein		4.2	5.5	3.6	3	1
Fiber	25g	1.7	1.1	24	31	1
Fat	20g	41.2	33.3	27	24	35
Carbohydrates		41.7	50.5	34	25	45

Table 2 shows the biochemical (proximate analysis) assessment of desiccated coconut flour including the three samples in which the desiccated coconut flour and all-purpose flour were the varying ingredients. As noted, when there was an increase in the amount of desiccated coconut flour, the higher the moisture and fiber; on the contrary, there were lower amounts of protein, fat, and carbohydrates.

Table 3: Results of the Assessment of Biochemical Content (Nutri-Facts) for Desiccated Coconut Flour and Samples 1,2,3 and Control A (45g/serving)

Parameter	Baseline	Desiccated Coconut Flour	Sample 1 (25%)	Sample 2 (50%)	Sample 3 (75%)	Control A
Calories	400-700	258	236	177	115	245
Calories from Fat	1,000-1,600	170	135	109	75	160
Total Fat	25 g	19	15	12	17	24
Total Carbohydrates	300g	20	23	15	12	24
Fiber		≤ 1	0.5	11	13	1
Sugar	50 g	3	3	**≤1**	**≤1**	**53**
Protein	50 g	2	2.5	2	2	1
Iron	18 mg	0.1 mg	1.2 mg	0.8 mg	0.9 mg	nil
Iodine	150 mcg	nil	nil	nil	nil	nil
Magnesium	400 mg	9 mg	26 mg	29 mg	34 mg	---
Potassium	3500 mg	70 mg	33.4 mg	138 mg	65 mg	---
Sodium	2400 mg	143 mg	81 mg	10 mg	7 mg	---

Table 3 shows the results of the assessment of biochemical contents (Nutri-facts) 45g/serving) of desiccated coconut flour and the three samples of desiccated coconut cookies including the controlled product. The total fat, carbohydrates, and fiber were determined by the chemistry of different ingredients. As noted, when there was an increase in the amount of desiccated coconut flour in the three samples, the lower the content of sugar, sodium, calories, calories from fat, total fat, and total carbohydrates. On the contrary, the higher the amount of fiber, iron, magnesium, and potassium in samples 1 and 2.

Table 4: Results of the Evaluation of the Shelf-life of the Desiccated Coconut Flour and Samples 1,2,3 and Control A

Samples	Baking Duration in Minutes		
	20	30	40
Desiccated Coconut Flour	10 Days	90 Days	175 Days
Sample 1 (25%)	15 Days	22 Days	62 Days
Sample 2 (50%)	15 Days	22 Days	62 Days
Sample 3 (75%)	15 Days	22 Days	62 Days
Control A	15 Days	18 Days	30 Days

Table 4 shows that the browning or Maillard reaction and including the sodium bicarbonate contributed to the 175 days and 62 days shelf-life of the coconut cookies food product.

Table 5: Evaluation of the Significant Difference in the Acceptability of Desiccated Coconut Cookies Using Organoleptic Properties (Affective Test)

Parameter	N	Sample 1 (25%)	Sample 2 (50%)	Sample 3 (75%)	Control A	P-Value
	50					
Appearance	50	7.82	7.66	7.24	7.68	0.00
Color	50	7.90	8.40	8.44	7.92	0.00
Aroma	50	8.54	8.78	8.60	7.56	0.00
Flavor	50	8.74	7.84	6.24	7.78	0.01
Mouthfeel	50	8.82	7.40	6.32	7.70	0.01
Texture	50	8.70	7.36	6.44	7.74	0.01
General Acceptability	50	8.42	7.91	7.21	7.73	0.00

Table 5 shows the significant difference in the acceptability of desiccated coconut cookies of the three samples compared with the control used. There was a significant difference in the p-value of every parameter. This observation noted that each ingredient, specifically the amount of desiccated coconut flour contributed to the significant difference between each sample. Sample 1 was the best in appearance, texture, flavor, and mouthfeel; sample 2 had the highest aroma acceptance, and the most acceptable color was sample 3. Coconut flour contributed to color acceptability. The characteristics of each ingredient were within the food chemistry and the lower the coconut flour the higher the acceptability.

4. Conclusions

Desiccated coconut flour was within the food safety limit; this had intensified micronutrients which were fiber, fat, iron, and magnesium. Browning or Maillard reaction and the sodium bicarbonate contributed to the 175 days and 62 days shelf-life of the desiccated coconut flour and cookie food products. Sample 1 which had 25% desiccated coconut flour had higher acceptability in appearance, flavor, and mouthfeel including general acceptability. Sample 2 had the highest acceptability in the aroma, and sample 3 in color. An increase in the amount of desiccated coconut flour, the higher the moisture fiber, iron, magnesium, and potassium (except for the potassium in sample 3); on the contrary, there were lower amounts of protein, fat, carbohydrates, sugar, sodium, calories, calories from fat, total fat, and total carbohydrates; and the lesser the amount of coconut flour in the food composition, the higher its acceptability.

5. Recommendations

Reinvestigation of potassium content in all samples, other vitamins, and trace minerals; and a further study on the desiccated coconut flour and cookies standard packaging to promote shelf-life.

6. Acknowledgements

This study shows gratitude to Dr. Renate A. Egcas, the president of Northern Negros State College of Science and Technology. Also, this study wouldn't be successful without these groups: Local Ice Cream Makers of Brgy. Old Sagay, the Mothers' Care of Brgy. Paraiso and Fabrica, Negros Prawn Producers Analytical and Diagnostic Center, Mrs. Phoebe N. Montano, the food technologist, Ms. Ana P. Amacna, the science specialist. Finally, this study shows also gratitude to Iida Farm, Sagay City Department of Agriculture, Mrs. Julie A. Delima, Mr. Vincent Kenneth K. Rivera, and Mr. Raph Phael R. Gonzaga for helping this study useful to the community of Sagay City.

Conflict of Interests

The author declares that this article has no actual, potential, or perceived conflict of interest.

References

[1] AACC Approved Methods Analysis, 11th Edition.

[2] Agricultural Marketing Service; United States Department of Agriculture; September, 2011

[3] Aryal, S. (2019, August 15) Benedict's Test—Principle, Composition, Preparation, Procedure and Result Interpretation.

[4] Bhandari, P., 2022, What is Quantitative Research? Revised on 10 October 2022.

[5] Creswell, J. W. (1994). Research design: Qualitative & quantitative approaches. Sage Publications, Inc.

[6] Environmental Health Bureau, Canada, 2010.

[7] Food and Environmental Hygiene Department, Hongkong 2001.

[8] Grunebaum, A., 2018, A Matched Cohort Study of Postpartum Placentophagy in Women with a History of Mood Disorders: No Evidence for Impact on Mood, Energy, Vitamin B12, Levels, or Lactation, 2019, Journal of Obstetrics and Gynaecology Canada.

[9] Jacques, J.A., Journal of the Franklin Institute, Volume 335, Issue 2, March 1998, Pages 259-279,

[10] Republic Act 9003, the "Ecological Solid Waste Management Act of 2000".

[11] Sustainable Development Goals Agenda 2030, United Nations.

[12] https://microbiologyinfo.com/benedicts-test-principle-composition-preparation-procedure-and-result-interpretation/

[13] https://www.webmd.com/diet/guide/calories-chart.

Reference Guide, Daily Value Changes, www. FDA.Gov.NutritionFactsLabel