

PROJECT PROPOSAL
2022 DOST-GIA FUNDING

I. PROJECT PROFILE

(1) Project Title: Development of a Non-dairy Probiotic Drink Using Coconut Sap as a Substrate				
(2) Project Leader/Sex: Dr. Ma. Edelwina M. Blase/F Agency: Marinduque State College Address/Telephone/Fax/Email:				
(3) Cooperating Agency/ies: DOST-MIMAROPA, UP-IFST				
(4) Site/s of Implementation (Municipality / District / Province / Region) Base Station: Boac, Marinduque, Region IV Other Implementation Site (s): _____				
(5) Project Duration: 12 months				
(6) Total Project Cost: (indicate Counterpart Funds; use Form A for the Line-Item Budget)				
Source of Fund / Site(s) of Implementation	PS	MOOE	EO	Total
MSC	544,648.00	75,000.00	0.00	619,648.00
DOST	0.00	550,970.00	275,000.00	825,970.00
TOTAL	544,648.00	615,970.00	275,000.00	1,445,618.00

II. PROJECT SUMMARY

<p>(7) Rationale (Not to exceed one page)</p> <p>In the Philippines, from 3 January 2020 to 4:53pm CET, 5 January 2022, there have been 2,861,119 confirmed cases of COVID-19 with 51,604 deaths, reported to WHO. The virus remains to spread with catastrophic impact on global health and economy amidst the continuous administration of existing vaccine doses. Differences in virus strains, rate of COVID-19 testing, quality, and access to the healthcare system, and preventive strategies are among the reasons of the inflating number of infected individuals. Moreover, Demographic characteristics such as the proportion of elderly, dietary and lifestyle patterns, comorbidities, and socioeconomic status, also influence the susceptibility, severity, and fatality of COVID-19 (Undela, 2020).</p> <p>Nutraceuticals and functional foods have become an important tool for consumers to manage their health and well-ness. Pre-, pro-, and symbiotics are a part of this group of products shown to have properties that can modulate gastrointestinal problems and improve general health and well-being (Dickson and Arbor, 2017).</p> <p>A pilot study conducted by Zuo et. al (2020) with sequencing faecal samples of 15 patients showed that COVID-19 infections significantly altered faecal microbiomes characterized by a decline in beneficial bacteria and enrichment of pathogens such as <i>Coprobacillus</i> and <i>Clostridium</i> species which have been correlated with the severity of COVID-19, demonstrating the influence of SARS-CoV-2 on gut microbiome. Similarly, Liu et al. (2021) and Yeoh et al. (2021) reported significant alterations in the gut microbiome and dysbiosis in COVID 19 patients, associated with disease severity and inflammatory markers.</p> <p>Gou W, et al. (2020) reported that the gut health of individuals is highly influential in the COVID-19 severity. Moreover, a study conducted by Dumas et al (2018), showed that the restoration of probiotic strains may enhance the recovery of the lung and the gut and immunomodulation of an individual and</p>
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can impact coronavirus infection. These evidences support the presumptive role of probiotics in the susceptibility, progression, and severity and both prevention and treatment of COVID-19 cases.

Several studies (Kummer et al. (2003), Lourens et al. (2000), Ouwehand et al. (2018)) reported that although probiotics have traditionally been added to yogurt and other fermented dairy products, nowadays, there has been an increasing demand for non-dairy probiotic products as the current industrial probiotic foods which are basically dairy products, may present inconveniences due to their lactose and cholesterol content.

In Marinduque, arrowroot and coconut production are the province's primary industry. Coconut has been successfully utilized locally for production of coco sweetener, flour, vinegar, and fermented beverage. With the abundance, the opportunities and possibilities are yet to be explored.

The coconut sap can be easily turned into tuba (fermented coconut sap liquor) and vinegar in two to three days of fermentation. Other product that the coconut sap can be processed into is coco amino. The sap is high in phosphorus and rich in ascorbic acid. Average chemical composition and nutritional value of coconut sap (Naka, 1996) are summarized in the table below.

Table 2. Average chemical composition and nutritional value of coconut sap

Parameter	Value (/100g or ml)
Carbohydrates	11.4g
Protein	0.22g
Fat	0.40g
Calcium	0.40mg
Phosphorus	20.0mg
Iron	0.18mg
Niacin	0.48 mg
Ascorbic acid	20.6 mg

(8) Project Description (Not to exceed 15 pages)

OBJECTIVES (General and Specific)

Considering the nutritional component of coconut sap as a non-dairy fermented media, this project aims to develop a non-dairy symbiotic drink based on the coconut sap, specifically to seek the following:

SPECIFIC OBJECTIVES:

1. Optimize the process of pasteurization of the coconut sap
2. Determine the population counts of *Lactobacillus* spp. in the developed probiotic drink
3. Characterize the developed non-dairy based probiotic drink from coconut sap in terms of PH, Titratable Acidity, and Sugar Concentration and sensory properties (smell, taste, color and general acceptability)
4. Determine the shelf life of the developed probiotic drink
5. Determine the Average Total Cost/Per-unit cost of the Coconut Sap Probiotic Drink

METHODOLOGY

Materials and Methods

Coconut sap samples will be taken from coconut trees in Marinduque and placed directly in sterile plastic bottles, having 200 ml of coconut sap in each bottle, and delivered to MSC microbiology laboratory as soon as after harvested.

PHASE 1. DEVELOPMENT OF COCONUT SAP PROBIOTIC DRINK

Microbiota Analysis of Harvested Coconut sap

Samples will be taken and immediately brought to the MSC Microbiological laboratory for microbial analysis. The pH and color of the samples will be immediately checked to confirm the quality of the harvested coconut sap. Fifty (50) ml of the sample from each bottle will be simultaneously taken out for culture-dependent microbial analysis. Ten (10)-ml aliquots of collected coconut sap will be serially diluted and pour plated in different agar media to enumerate the bacterial, fungal, and yeast populations. The plates were incubated for different time periods and then observed for colony-forming units of the microbial communities.

Pasteurization of Coconut sap

The harvested coconut sap will be pasteurized at different temperature and different duration and placed in sterile bottles and sealed. The pasteurized coconut sap will be stored at cool condition. The different treatments are summarized below.

Treatment	Temperature	Duration
1	65°C	10 minutes
2	70°C	8 minutes
3	80°C	5 minutes
4	95°C	3 minutes

Inoculation of Probiotic Starter Culture

The pasteurized drink will be inoculated with the probiotic starter culture then incubated at 37°C for 72h under anaerobic condition.

Viable Cell Count Determination

Samples of the probiotic drink will be sent to University of the Philippines – Institute of Food Science and Technology to determine the viability of *Lactobacillus* cultures in coconut sap probiotic drink. The analysis will be performed in three trials to determine the population counts of *Lactobacillus spp.*

PHASE 2. CHARACTERIZATION OF COCONUT SAP PROBIOTIC DRINK

Determination of pH, Titratable Acidity, and Sugar Concentration, and Nutritional Composition

The determination of pH and titratable acidity will be performed at the MSC – Food Testing Laboratory. Samples will be sent to the University of the Philippines – Institute of Food Science and Technology and subjected for sugar concentration determination using High – Performance Liquid Chromatography (HPLC) and proximate analysis for quantitative analysis of nutritional composition.

Sensory Evaluation

A sensory evaluation on the probiotic drink will be carried out in Marinduque State College – Food Testing Laboratory. The probiotic drink with maximum number of viable cells will be evaluated by 30 respondents in terms of the sensory attributes such as smell, color, texture, taste and general

acceptability.

Consumer testing

Consumer testing will be carried out on 3 age groups (teens, adults, seniors) with 30 respondents each. Consumers will be asked to rate the probiotic drink in terms of overall liking, and liking of appearance, odour, flavour, and aftertaste using a 5 – point hedonic scale. A rank preference test will also be performed on the developed probiotic drink and a commercially available probiotic drink. Responses will be collected and recorded.

PHASE 3. PRODUCT FINALIZATION (Shelf-life, Consumer-testing, Costing)

Shelf Life Testing using Direct Method

The shelf life of Yakult is 40-45 days from date of manufacture when kept under refrigerated conditions (10 °C). Samples of developed probiotic sample will be stored at ambient temperature and cold temperature (10 °C) in the MSC Food testing Laboratory to set the condition similar to what the product will actually face in terms of temperature. The samples will be monitored regularly for changes in physical appearance. Follow-up microbiological and physico-chemical analyses will be performed upon first appearance of any change.

Calculation for Average Total Cost of the Coconut Sap Probiotic Drink

To determine the average total cost or cost of the coconut sap probiotic drink per number, all fixed costs and variable costs of the production will be added up and divided by the quantity of product produced. The fixed costs are the expenses in production which do not change based on the number of products the company is producing such as the cost of the equipment; whereas, the variable costs increase or decrease based on the inputs such as the cost of the coconut sap and other materials used to create the product.

Market Analysis

A market analysis shall be conducted to understand the potential customer segments, if the product fits the needs, and the position of the competition of the developed coconut sap probiotic drink against commercially available probiotic drinks, and to develop a successful marketing strategy.

Scope and Limitations

This study will focus on the product development and formulation stage of the probiotic drink made from Coconut sap. A phase 2 project focused on clinical trial, population studies, etc may be done to establish the health claims. Once the product has been successfully developed, the formulated product may be scaled up for greater volume production and be opened for commercialization. The production will include a cold chain system for the transport and the distribution of the product to markets while maintaining the quality.

EXPECTED OUTPUTS

Patent/Intellectual Property

- 1 Optimized process for making coconut sap probiotic drink
- 1 Utility Model/Patent Applied

Product

- 1 developed product (non-dairy based probiotic drink from coconut sap);
- 1 Crafted proposal/plan for upscaling/mass production of the developed probiotic drink

Place and Partnership

Memorandum of Agreement with DOST-MIMAROPA and UP-IFST

EXPECTED OUTCOMES

A safer alternative for lactose-intolerant consumers with a similar beneficial effect to dairy-based probiotic drinks which cause adverse effects on their body. A product developed from coconut sap that can be adopted by local coconut processors and coconut farmers in Marinduque.

PERCEIVED IMPACT**Social Impact**

The project signifies research-based initiatives of the research institutions such as MSC and DOST in addressing health concerns on dairy products, promotion of functional foods, and provision of livelihood opportunities to small scale farmers. The College supports any action and collaboration from public and private sectors in developing scientific solutions to the needs and problems in the communities.

Economic impact

The process can be used by the coconut farmers and industries for the value addition and production of new products from the coconut. This will create additional livelihood opportunities for small scale coconut processors and local coconut farmers. The consumer acceptance and the provision of nutrient claims may be used by Food industries to improve market penetration of probiotic drink which spurs the initiatives for creation of similar new products in the same cycle.

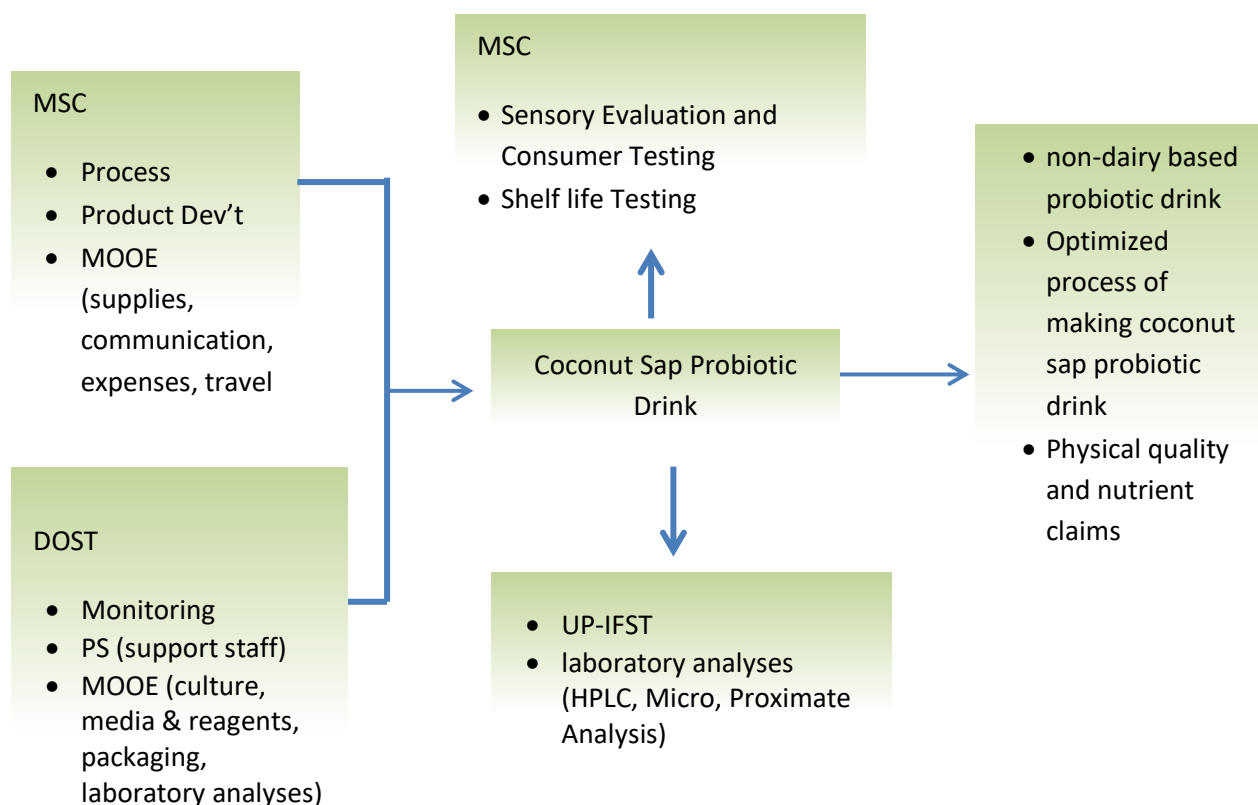
SUSTAINABILITY PLAN

A steady source of raw materials for the production of the probiotic drink shall be ensured. The coconut sap that will be used as the substrate will be sourced from local coconut farmers in Marinduque. A schedule for the coconut sap collection will be set. Proper maintenance of the equipment shall be assured by the engineers from the College. A regular schedule for clean-up will be set.

(9) Workplan (See Form B)

(10) Project Management (not to exceed one page)

The project shall be managed by the project team and faculty members from Department of Industrial Technology of Marinduque State College. The DOST-MIMAROPA shall be in-charge of the project monitoring and shall provide assistance in the procurement process of the equipment for the project. Coconut sap shall be outsourced from local farmers in the province of Marinduque. Developed products will be subjected to Application for registration through the Knowledge and Technology Transfer Office of the College.



I. Personnel Involved in the project


Name	Designation	Educational Background	Responsibilities	Percent time allotted to Project
Ma. Edelwina M. Blase	Project Leader	Ph.D. in Food Science	Oversee the implementation of the project Coordinate with DOST	6 units deloading (6 hours/week)
Christine Joy M. Manato	SRS 1 (Food Technologist)	BS in Food Technology	Facilitate the research activities of the project Submit necessary reports verified by the project leader	100%
To be hired	Support staff		Assist the Science Research Specialist in the conduct of research activities Collect and prepare samples from sources Record and assist in preparation of reports	100%

III. ATTACHMENTS (Please refer to the DOST-GIA Guidelines for the necessary documents.)

Prepared by:


CHRISTINE JOY M. MANATO
 SRS I

MARINDUQUE STATE COLLEGE


MA. EDELWINA M. BLASE
 VP-RDET
 MARINDUQUE STATE COLLEGE

Endorsed By:


BERNARDO T. CARINGAL
 PSTD
 PSTC Marinduque

Approved by:


MA. JOSEFINA P. ATILAY
 Regional Director
 DOST-MIMAROPA

DOST Form B
PROJECT WORKPLAN

(1) Program Title: Grant in Aid Program

(2) Project Title: Development of a Non-dairy Probiotic Drink Using Coconut Sap as a Substrate

(3) Total Duration (in months): 12

(4) Planned Start Date: July 2022 (5) Planned End Date: July 2023

(6) OBJECTIVES	(7) TARGET ACTIVITIES	(8) TARGET ACCOMPLISHMENTS (quantify, if possible)	Y1			
			Q1	Q2	Q3	Q4
Optimize the process of pasteurization of the coconut sap	Microbiota Analysis of Harvested Coconut sap Pasteurization of Coconut sap Inoculation of Probiotic Starter Culture	1 optimized process of making coconut sap-based probiotic drink				
Determine the population counts of Lactobacillus spp. in the developed probiotic drink	Viable Cell Count Determination	TMTC viable Lactobacillus populations				
Characterize the developed non-dairy based probiotic drink from coconut sap in terms of PH, Titratable Acidity, and Sugar Concentration and sensory properties (smell, taste, color and general acceptability)	Physico-chemical analysis -Determination of pH, Titratable Acidity, and Sugar Concentration, and Proximate analysis (Nutritional Composition) Sensory Evaluation Consumer Testing	Identified physicochemical characteristics, nutrient claims, and sensory attributes				
Determine the shelf life of the developed probiotic drink	Shelf life testing using Direct Method	Optimum condition for storage of product and identified shelf life				
Determine the Average Total Cost/Per-unit cost of the Coconut Sap Probiotic Drink	Calculation for Average Total Cost of the Coconut Sap Probiotic Drink	Estimated Cost of product				
(9) EXPECTED OUTPUTS (6Ps)	(10) DETAILS (quantify, if possible)		Y1			
			Q1	Q2	Q3	Q4
Publications						
Patents/IP	1 Optimized process for making coconut sap probiotic drink 1 Utility Model/Patent Applied					
Products	1 developed product (non-dairy based probiotic drink from coconut sap); 1 Crafted proposal/plan for upscaling/mass production of the developed probiotic drink					
People Services						
Places and Partnerships	Memorandum of Agreement with DOST-MIMAROPA and UP-IFST					
Policy						

DOST Form A

DEPARTMENT OF SCIENCE AND TECHNOLOGY

Project Line-Item Budget

CY 2022-2023

Program Title : Grant in Aid
 Project Title : Development of a Non-dairy Probiotic Drink Using Coconut Sap as a Substrate
 Implementing Agency : Marinduque State College
 Total Duration : 12 months
 Current Duration : 12 months
 Cooperating Agency : DOST-MIMAROPA, IFST
 Program Leader : Dr. Ma. Josefina P. Abilay
 Project Leader : Dr. Ma. Edelwina M. Blasé
 Monitoring Agency : DOST-MIMAROPA

		Counterpart Funding	
		Implementing Agency	DOST
		P	P
I. Personal Services			
<u>Direct Cost</u>			
Salaries			
Science Research Specialist I (Food technologist 28,754/month)		354,048.00	
Project Support staff (Job order 350/day)		85,000.00	
Honoraria			
Project Leader (8,800/month)		105,600.00	
Sub-total for PS		P 544,648.00	P -
II. Maintenance and Other Operating Expenses			
Traveling Expenses - local			50,000.00
Training Expenses			
Traveling Expenses - local - rental service vehicle		30,000.00	
Supplies and Materials			
Office supplies		20,000.00	35,000.00
Laboratory Supplies Expenses			20,000.00
media and reagents			82,000.00
disposable laboratory glasswares			32,000.00
Semi-Expendable-Equipment Expenses			49,500.00
Converter			5,000.00
pressurized washer with accessories			5,000.00
Other Supplies and Materials Expenses			
Raw Material (coconut sap)			30,000.00
Probiotic Starter Culture			2,500.00
Processing supplies and materials			20,000.00

DOST Form A

DEPARTMENT OF SCIENCE AND TECHNOLOGY

Project Line-Item Budget

CY 2022-2023

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 Current Duration : 12 months
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 Project Leader : Dr. Ma. Edelwina M. Blasé
 Monitoring Agency : DOST-MIMAROPA

Utility Expenses

Water Expenses

Electricity Expenses

Communication Expenses

Telephone Expenses - Mobile

39,970.00

Awards/Rewards Expenses**Other Professional Services**

IP registration application fees

10,000.00

Publication Fee

75,000.00

Laboratory Analyses

15,000.00

150,000.00

Other General Services**Repairs and Maintenance****Printing and Publication Expenses****Representation Expenses**

5,000.00

Other Maintenance and Operating Expenses

Sub-Total for MOOE

P

75,000.00

P

550,970.00

III. Equipment Outlay

HTST Pasteurizer 10L Cap.

P

P

275,000.00

Sub-Total for EO

P

P

275,000.00

GRAND TOTAL

1,445,618.00

P

619,648.00

P

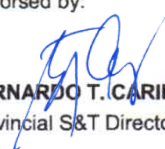
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Prepared by:




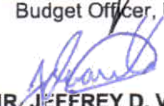
DR. MA. EDELWINA M. BLASE
VP-RDET, MSC

Endorsed by:


BERNARDO T. CARINGAL
Provincial S&T Director

Certified Funds Available:


JOMMEL LEAL
Budget Officer, MSC


MR. JEFFREY D. VARELA
Accountant III, DOST-MIMAROPA

Approved by:


DR. MA. JOSEFINA P. ABILAY
Regional Director, DOST-MIMAROPA