

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: mscredet2020@gmail.com				
(3) Cooperating Agency/ies: DOST-MIMAROPA, UP-IFST				
(4) Site/s of Implementation (Municipality / District / Province / Region) Base Station: Boac, Marinduque, MIMAROPA 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	459,648.00	75,000.00		534,648.00
DOST	85,000.00	550,000.00	355,000.00	990,000.00
TOTAL	544,648.00	625,000.00	355,000.00	1,524,648.00

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>

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 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 12 trained panelists in terms of the sensory attributes such as smell, color, texture, taste and general acceptability.

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.

Consumer testing

Consumer testing will be carried out on 3 age groups (teens, adults, seniors) with 25 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. Responses will be collected and recorded.

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.

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.

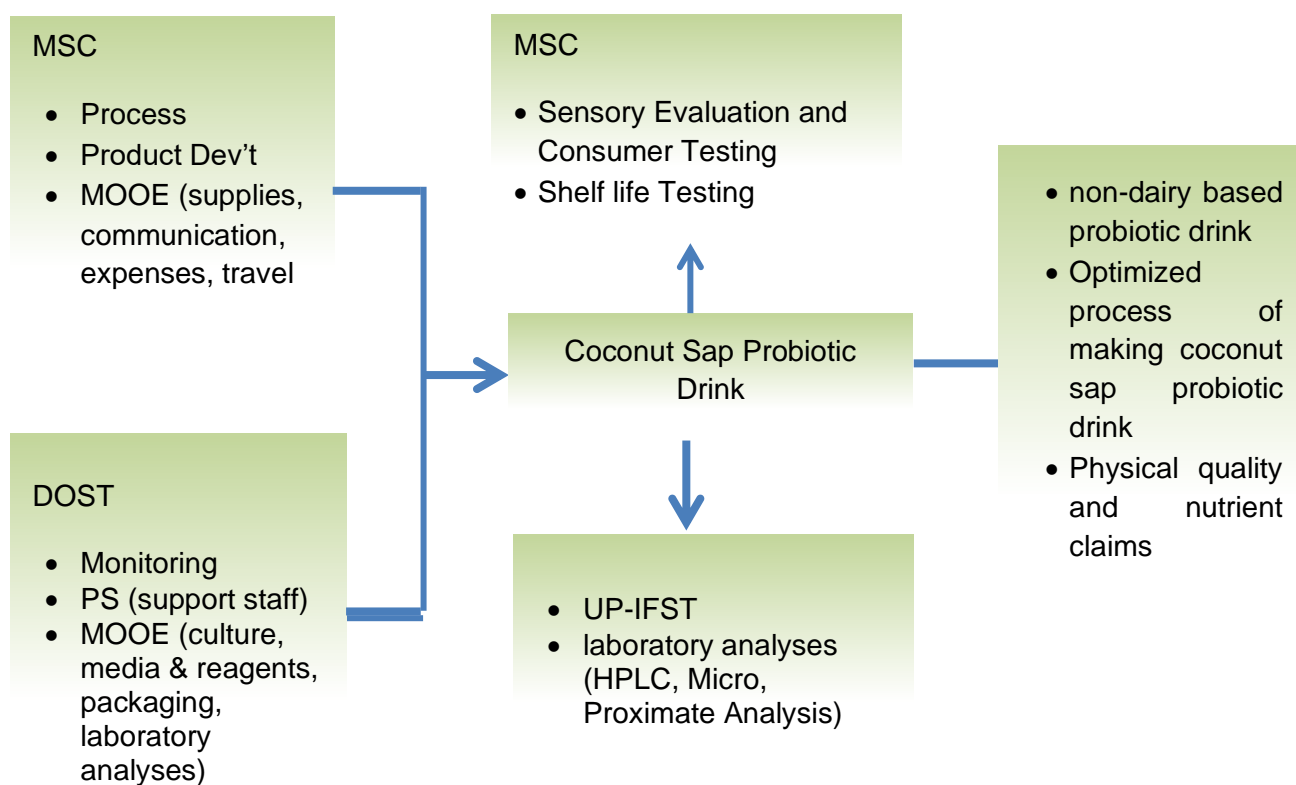
SUSTAINABILITY PLAN

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 Buenavista, Mogpog or Boac, 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 Buenavista, Marinduque. Developed products will be subjected to Application for registration through the Knowledge and Technology Transfer Office of the College.



Name	Designation	Educational Background	Percent time allotted to Project
<u>Ma. Edelwina M. Blase</u>	<u>Project Leader</u>	<u>Ph.D. in Food Science</u>	<u>6 units deloading (6 hours/week)</u>
<u>Christine Joy M. Manato</u>	<u>SRS 1 (Food Technologist)</u>	<u>BS in Food Technology</u>	<u>100%</u>
<u>To be hired</u>	<u>Support staff</u>		<u>100%</u>

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

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