



DETAILED RESEARCH & DEVELOPMENT PROJECT PROPOSAL

(To be accomplished by the participants)

(1) Title/Leader/Gender/Agency/Address/Telephone/Fax/Email

Project Title: Balakat NutriBar: One Local Nutrition Snack, One Healthy Community
Leader/Gender: Frenchie Ann B. Yamauchi/ F
Agency/Address: Mabalacat City College/
Institute of Arts and Sciences/
Brgy. Dolores, Mabalacat City,
Pampanga **Telephone/Fax/Email** N/A

(2) Cooperating Agencies

City Health Office of Mabalacat
MCC Kayantabe

(3) MCC - Internalization Office

(4) Site of Implementation/Municipality/District/Province/Region

Mabalacat City/ 1st District/ Pampanga/
Central Luzon (III)

(5) Classification

Research:

- Biotechnology
- Alternative Energy
- ICT
- Environment
- Health Products/Pharmaceutical

(6) Mode of Implementation

- Single Agency
- Multi Agency

Development:

- Basic Research
- Applied Research

(7) Sector/Commodity

LGU/ Product-based Commodity

**Mabalacat City College
Mabalacat City, Pampanga**

BASIC INFORMATION

- I. Project Title: **Balakat NutriBar: One Local Nutrition Snack, One Healthy Community**
- II. Project Leader: Frienzie Ann B. Yamauchi
Science Society-Adviser
Proj. Assistants: Ally Julian Liwanag
Biene Kiana Mie B. Julian
Kintaro G. Kawabe
Krisa Marie Jose
Anthoinette D. Lavarias
Jhovel Clyre G. Abuan
- III. IMPLEMENTING AGENCY:
Mabalacat City College
Mabalacat City, Pampanga
- IV. FUNDING AGENCY:

C/O: OVPGROW
- V. Duration: **2 Year Project**
- VI. TOTAL BUDGET COST: **Unknown**

Background of the Study

The Philippines is amidst the campaign against poor nutrition. According to findings of the Nutritional Assessment and Monitoring Division (NAMD) headed by DOST-FNRI in 2019, the problem of undernutrition has made little headway, and now overnutrition has also become a major worry. According to the report, about four million children under the age of five suffer from stunting, which makes it unlikely that they will develop to their full mental and physical potential. Over the past 20 years, the percentage of adults who are overweight or obese has nearly doubled, greatly worsening public health issues. These nutritional dilemmas in turn affect the country's potential for social and economic progress (UNICEF, 2019; Gumar, 2019).

The prevalence of nutritional dilemma among children in the Philippines is of "very high" public health concern. According to the 2015 national nutrition survey, a substantial portion of Filipinos continue to experience chronic malnutrition issues such as protein-energy malnutrition and micronutrient deficiencies, anemia, vitamin A insufficiency, and iodine-deficiency illnesses (Capanzana & Aguila, 2019). In addition, about 11% of adult women were deemed to be chronically underweight and energy deficient in 2015. Among young teenagers (18 to 20 years old), the prevalence of underweight was close to 28%, with notable variations across socioeconomic class. On another note, according to the strategic review of Briones et al. (2017), the prevalence of obesity has also become a health issue, which has increased from 1.1% in 1990 to as much as 5.1% in 2013. Although it decreased to 3.1% in 2016, this level of concern still exists.

The nutritional status of children is also strongly predicted by maternal height in addition to maternal undernutrition. Due to the mother's physical restrictions, which limit fetal growth in gestation, short maternal height is connected with low birthweight and eventually child stunting. Shorter mothers may also have lower macronutrient (protein) and energy storage as well as smaller reproductive organs, which could provide less capacity for fetal growth (Addo et al. 2013). Furthermore, stunting, which causes children to be underweight for their age, affected one in three children (29%) under the age of five in 2019.

In addition to under- and overnutrition, acute nutrient deficiencies are also a problem more pronounced in young children. The physical and intellectual development of young children, especially those under five, is affected by a number of conditions, including iron deficiency anemia (IDA). The frequency of anemia cases for instance, has significantly decreased over the past two decades across all age categories, but in 2013, the IDA levels for children under three, particularly infants, remained alarmingly high.

The determinants of poor nutrition fall into three categories: immediate, underlying, and basic. A child can experience undernutrition on an immediate level due to poor or improper nutritional intake, illness, or both—these two factors frequently interact negatively. These immediate risks result from inadequate care and feeding practices for women and children, insufficient access to health and environmental services, and deficiencies in household or community food security (Acayan, 2021).

Like many other regions in the country, problems in nutrition are also experienced by the residents of Pampanga. According to Cuyco (2020), five out of ten homes (51%) of households suffer acute food insecurity. This was particularly pronounced in lower-income households, while three out of ten (31.9%) households experienced chronic food insecurity. In the province, the prevalence of stunting was 21.2% among children under five and for underweight was 17.4% among infants and children aged 0 to 5 months. These problems with public health were substantially more prevalent in poor households than in non-poor households. According to the WHO cut-offs, 5.0% of wasting/thinness

was considered poor. It should not be taken for granted that they will not be at risk for NCDs later in life because the prevalence of obesity was 6.7%, which is much higher in the province than the national estimate. Additionally, non-poor households have much greater rates of overweight than poor households. Anemia prevalence, on the other hand, was 8.0% in children aged 6 months to 5 years, which is regarded as a "mild" public health issue. With the rates being substantially lower than national predictions, malnutrition did not spare school-age children, who ranged in age from 5 to 10. In Pampanga, the prevalence of underweight is 18.8%, whilst the prevalence of stunting is 15.2%. The ENNS showed that every two (2) out of ten school-age children were underweight (18.8%), stunted (15.2%), and wasted (9.2%), while only nine out of one hundred were. Children of school age who were underweight and wasted were more prevalent among males and in low-income homes.

Infants and females are also highlighted in the nutritional crises of the province. Generally, in the case of infants, five out of every ten (53.8%) started nursing within an hour of birth. In 4 out of 10 of these situations (44.2%) infants were exclusively breastfed for the first six months of life. Only a tiny portion of young children (6-23 months) (6.8%) had a little amount of nutritional diversity (18.6%) in their diets. Among women of reproductive age (15 to 49 years old), over nutrition (40.0%) was a more common problem among non-pregnant/non-lactating women. Two in every 10 (23.0%) pregnant women were nutritionally-at-risk in Pampanga. Breastfeeding mothers in Pampanga were nutritionally at-risk or had Chronic Energy Deficiency at a rate of 13.3%, which had a "medium" impact on public health. Over nutrition (31.1%) was also a new issue for this population. Anemia was of 'mild' public health significance among non-pregnant/non-lactating women (11.5%) and lactating mothers (13.6%) in the province.

Currently, shifting to plant-based foods has become a global trend that has been mainly observed during the COVID-19 pandemic (NCC, 2022). Plant-based nutrition products promote environment friendly consumption and campaign for healthier eating lifestyles. This is due to the natural compounds, vitamins, minerals and also phytochemicals that supplement nutrition. Adoption of plant-based also enhances the economic well-being in the sustainable food system since plants are everywhere and readily available.

Plant-based foods contain a lot of dietary fiber, protein, fatty acids, and phytochemicals that has been related to a lower incidence of chronic diseases and a changed gut microbiota makeup. In order to improve global human health and sustainable food systems, the EAT-Lancet Commission advises increasing the consumption of fruits and vegetables. Plant-based diets are also advised in order to lessen environmental harm from nitrification, climatic change, deforestation, 7 and other factors. According to the Cahiles-Magkilat (2023), the board of investment in the Philippines wants to establish an investment promotion in conducting an appraisal study to develop a Philippine plant-based food industry road map. Together with the University of the Philippines through the College of Home Economics Department of food Science and nutrition presented a series of webinars which presented the overview of the local and global plant-based food industry and the opportunities for its further development. They all agree that because of the pandemic people in the Philippines invest widely on plant-based products because of the health benefits they can provide. Furthermore, it also gives a forecast on the opportunities people can get in terms of business and economics in the plant-based products.

A 2021 survey by the Statista Research Department reveals that Filipinos said that they often consumed plant-based milk such as soy, rice and almond. The survey also found out that the majority consume plant-based food often times in a week. As of November 2021, 77% consumed plant-based milk (soy, rice, almond, oat milk, etc.), 51% had dairy product substitutes (vegan ice-cream, soy, yogurt, vegan cheese, etc.), 45% had plant-based meat alternatives (plant-based burgers, mock meats, plant-based 'chicken' nuggets, etc.), and 31% consumed egg substitutes and/or vegan 'egg'.

In line with this, Filipinos are continuously urged by DENR to adopt a plant-based diet in order to lessen their impact on the environment and fight climate change. Reduced water use, factory farming, and greenhouse gas emissions can all be attributed to plant-based diets (Miguel, n.d.).

Ziziphus talanai with the common name of Balakat Tree, is an endemic plant found in Mabalacat City, Pampanga. The plant has been studied and found out to contain various phytochemicals such as flavonoids, tannins, phenols, and alkaloids which are associated with the plant's therapeutic properties (Reyes et al., 2016). These secondary metabolites are found to exhibit antibacterial, antifungal, and antioxidant properties (David, 2018; Aquino, 2018), as well as potentials for neuroprotection (Nolasco et al., 2022; Tejano, 2017), reprotection (Reyes, 2016), and cardioprotection in mice models (Yamauchi, 2019).

This study aims to integrate the therapeutic potentials of the Balakat tree in a nutrition-packed snack bar to address the common nutritional problems experienced by the residents of Mabalacat City. The study is directed as a potential intervention to solve local nutrient crises in chosen barangays within the city.

Program/project leader

Project Leader

Name: **Frienzie Ann B. Yamauchi**
Field of Specialization: Biology
Designation/Position: Instructor 1/ Science Lab Custodian
Contact Address: MCC, Mabalacat City, Pampanga

Percentage Time for Research: 50%

Implementing Agency

Mabalacat City College, Mabalacat City, Pampanga

Cooperating Agency

City Health Office, Mabalacat City, Pampanga

Significance of the proposal

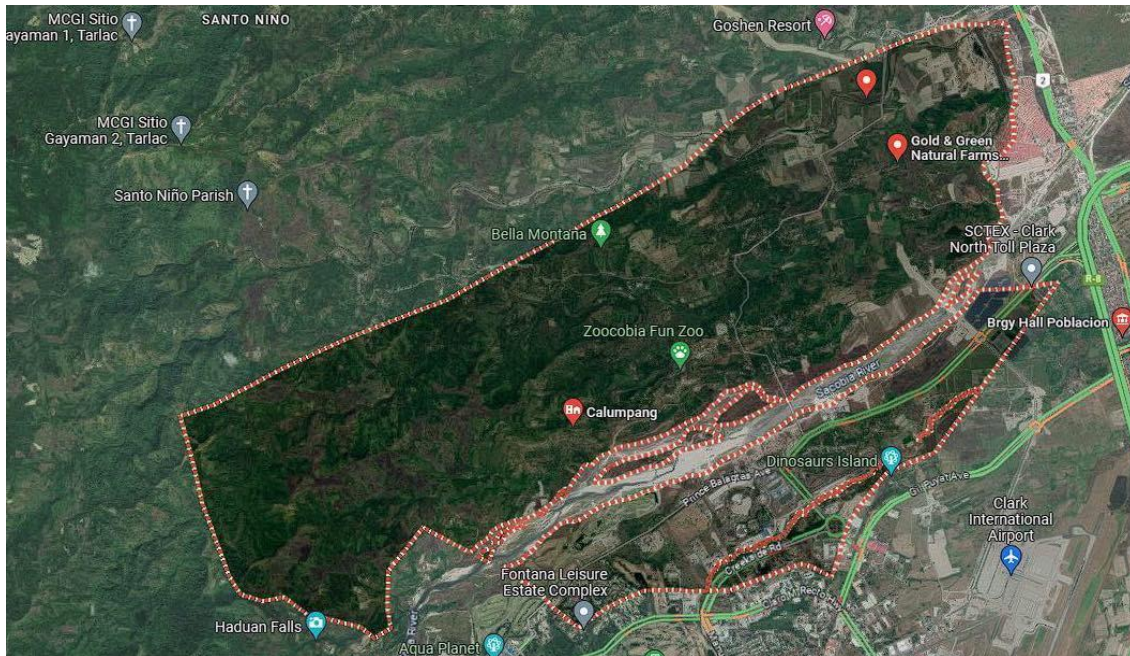
This research proposal targets to address four SDG goals to provide affordable and nutritious food for the community. This will serve as a potential essential source of nutrients to promote good health for the inhabitants in the chosen communities. Specifically, these are SDG Nos: 2 (Zero Hunger), 3 (Good Health and Well Being), 9 (Industry, Innovation, and Infrastructure), and 12 (Responsible Consumption and Production).

The significance of this study is to provide a nutritious snack to address the nutritional deficiencies for the communities of Calumpang, Marcos Village, and Macapagal Village. The product of this research aims to address the lack of essential nutrients to communities that lack basic health care and food supply.

Various approaches are enforced in order to develop the Balakat NutriBar. Foremost, the identification of the target communities to aid must be determined through gathering health data and information. The NutriBar is formulated by following safety and health protocols to ensure quality, and additives of powdered Balacat leaves are also incorporated to give additional flavors to the products. Nutrient labels of the product must also be listed to provide transparency to its content.

Study Areas

The targeted areas of the study are the Marcos Village, Macapagal Village, and Calumpang Villages. All areas are located in Clark Freeport, Mabalacat, Pampanga. As a result of the locations' proximity to Clark, only a small number of vehicles are permitted entry, making driving to the mentioned locations difficult.



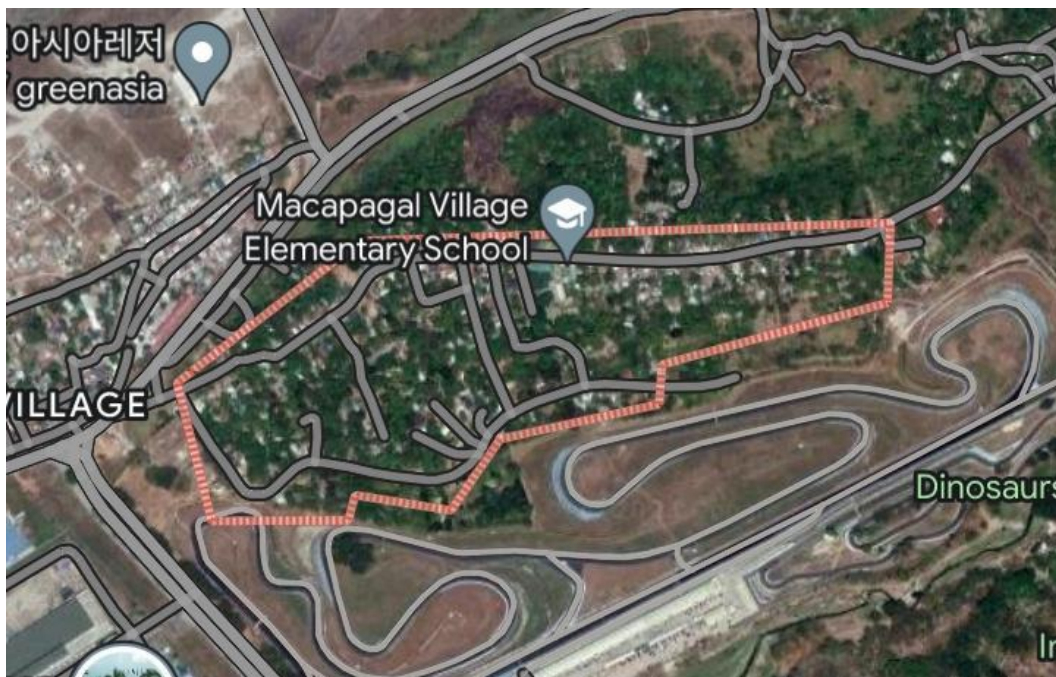
Barangay Calumpang. Courtesy: Google Maps

Barangay Calumpang is a village in Mabalacat City Pampanga. As of the 2020 Census, the total population of this barangay is 2,017. This accounted for 0.69% of Mabalacat's whole population. It has a latitude of 15.2135 degrees (15° 13' North) and a longitude of 120.5231 degrees (120° 31' East) with an estimated elevation of 184.4 meters (605.0 feet).



Marcos Village. Courtesy: Google Maps

The Barangay Marcos Village is located in the City of Mabalacat, Pampanga. There were approximately 4,957 residents as of the 2020 Census. About 1.69% of Mabalacat entire population is comprised of the villagers. It is located at a latitude of 15.2089, and longitude of 120.5309, about 15° 13' North and 120° 32' East. It is located at an elevation of 167.5 meters, or 549.5 feet, above mean sea level.



Macapagal Village. Courtesy: Google Maps

Macapagal Village is a village that is located in the Mabalacat City, Pampanga. According to 2020 census of Macapagal Village has 4,202 population that represents the 1.43% of the total population of the whole Mabalacat City population. It has estimated elevation 169.3meters that is 555.1 in feet. The coordinates are 15.2112° (15° 13' North) latitude and 120.3376° (120° 32' East) longitude.

Objectives

This project aims to create a nutritional bar with the Balakat tree leaves as primary ingredient to help address the nutritional problems of selected barangays in Mabalacat.

Specifically, this project targets to meet the following objectives:

1. What is the proximate composition of Balakat Nutribar in terms of:
 - a. Moisture content
 - b. Crude fiber
 - c. Crude protein
 - d. Crude lipid
 - e. Calorific Value, and
 - f. Ash content?
2. What are the hydration properties of the Balakat Nutribar in terms of:
 - a. Swelling capacity (SWC)
 - b. Water holding capacity (WHC), and
 - c. Oil Holding Capacity (OHC)?
3. What are the organoleptic values of the nutribars in terms of:
 - a. Texture profile analysis
 - b. Color profile analysis
 - c. Appearance
 - d. Taste, and
 - e. Aroma?
4. What are the physical analysis values of the Balakat Nutribar in terms of:
 - a. Weight (g)
 - b. Length (cm)
 - c. Width (cm)
 - d. Thickness (cm), and
 - e. Density (g/ml)?
5. Are there any significant differences between the baseline and 2-week consumption anthropometric measurements of the respondents from the selected barangays in terms of:
 - a. Height
 - b. Weight
 - c. MUAC
 - d. Head circumference
 - e. Skinfold
 - f. Systolic blood pressure (mmHg)
 - g. Diastolic blood pressure (mmHg)

- h. Waist circumference, and
- i. Hunger score?

6. Are there any significant differences between the baseline and 2-week consumption biochemical measures of the respondents from the selected barangays in terms of:

- a. Lipids,
- b. hsCRP, and
- c. glucose metabolism?

(12) End-users/target beneficiaries

The community residents of Calumpang, Marcos Village, and Macapagal Village will benefit on the production and distribution of the Balakat NutriBar. The product targets not only addressing nutrition crisis, but also aims to promote the proliferation of Balakat tress and sustainable food production.

(13) Program/project duration

This project will be conducted for a period of 2 years.

Methodology

The following outlines the general methodology of the study:

A. Collection and Processing of Z. talanai leaves

A total of 10kg of mature *Z. talanai* leaves will be manually collected at Xevera, Tabun, Mabalacat City, Pampanga. The leaves will be thoroughly washed with clean water and dried at 60C using an oven for 8 hours. The dried leaves will then be pulverized using a mechanical blender and sieved to remove large and unwanted particles. The powdered plant material will then be stored in air tight glass container until further use (Udayangani et al., 2019; Reyes et al., 2016).

B. Processing methods and preparation of Nutri Energy Bar

The protocol for making the NutriBar is based from the studies of Abdalem-salam et al. (2020) and Udayangani et al. (2019). For a 100g nutriBar, a base will be made of cowpea, soya beans, and green gram will be roasted at 150C and ground into powder. These powders will then be mixed with sweet potato, banana flour, and golden syrup. The control group will have 0% *Z. talanai* powder, while treatments 1 and 2 will have 5% and 10% of the plant powder respectively. After incorporating all ingredients, the mixture will be placed into pans and stored in the refrigerator for further tests.

C. Proximate and Hydration Analysis

The analysis will be performed to determine the bars' calorific value, fiber, protein, lipid, vitamin, and mineral constituents. Aside from this, the calorific value, moisture content, and ash content will also be tested. Swelling capacity (SWC), water holding capacity (WHC), and oil holding capacity (OHC) will also be determined. All parameters will be quantified by the Department of Science and Technology, Taguig.

D. Organoleptic Analysis

Organoleptic analysis for the bars will utilize a hedonic scale to determine the texture and color profiles, as well as the appearance, taste, and aroma. A 9-point scale will be used to evaluate each

characteristic. A total of 25 respondents with food critic experiences will be asked to respond to the evaluation for each control and treated groups (Udayangani et al., 2019).

E. Physical Analysis

The weight of all samples will be measured in grams using a digital balance. The length, width, and thickness will all be measured in centimeters using a ruler. For the bulk density in g/ml, a graduated cylinder will be used to determine the displacement, following also the formula of mass/volume (Wandhekar et al., 2020).

F. Study Cohort and Intervention

Twenty-five individuals will be identified from the selected barangays and will be asked to participate in the study. The individuals will have their anthropometric measures be evaluated before and after the two-weeks trial of nutri-bar consumption. Specifically, the subjects will take the bars twice each day, and will be advised to discontinue the consumption of all nutraceuticals and supplements for the time being. Upon eating the bar each at noon, and in the evening, the subjects will be advised to take 250ml of water together with it. Self-report hunger scores prior and 20 minutes after eating the bar will also be collected. Participants with infectious diseases, hypertension, diabetes, and dyslipidemia are all excluded. A consent form will also be signed by all respondents prior to their participation in the study (Mietus-Snyder et al., 2012).

G. Statistical Analysis

The experimentation will be performed in triplicate. All data will be presented in mean and standard deviation, and will be analyzed using One-way ANOVA for the determination of significant differences at $p < 0.5$, followed by Tukey's Multiple Comparisons test. Graphpad Prism Ver. 9.5.1.

Work plan schedule

Below is the chronological order of each activity to be undertaken throughout the course of the project:

Activities/Conduction	Year 1				Year 2			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Inception Meeting and MOA Signing								
Search for sponsorship/funds								
Preliminary assessment of data from CHO								
Plant material collection and processing								
Creating the product nutri-bar								
Biochemical tests								
Intervention								
Assessment of data								
Presentation of Data/Publication								

(16) Ethical/biosafety clearance

Ethical/biosafety clearances will be secured from concerned agencies as deemed before the start of any experiment.

(17) Research utilization

To ensure that the project's findings would be helpful in resolving some health issues and promoting the proliferation of local flora and sustainable food production, research results will be shared with concerned agencies, researchers and health workers, academics involved in related projects, and policy makers. Additionally, information can be disseminated through publishing outputs and presenting results in forums. When additional funding support is provided as the study moves forward, the findings will be incorporated and arranged in a sourcebook for publication.

(18) Estimated budgetary requirements

Specifics to be followed.

Line Item Budget (LIB)

Estimated budgetary requirements

Funding Requirement

Particulars	Source of Fund (PhP)	
	(Unknown)	MCC
I. Honoraria		
Project Leader		
Project Staff		
Laboratory Aide		
Sub-Total		
II. Maintenance and Other Operating Expenses		
Supplies and Materials (Office and Lab supplies)		
Travelling, Transportation/Gasoline Expenses		
Representation/Training Expenses		
Communication Expenses		
Printing and binding expenses for draft book and report		
Other Professional Expenses & Services (Statistician, Consult Methodologist, Photography services, Taxonomist, etc.		
Rental expenses (Lab services)		

	Sub-Total				
	PS + MOOE				
	III. Administrative Cost (7.5%PS + MOOE)				
	TOTAL				

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