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Bilimbi Fruit (*Averrhoa bilimbi*) Juice: Nutritional Analysis and Microbial Analysis

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Abstract— *Food's nutritional analysis guarantees that it contains the correct number of vitamins and minerals while also allowing for a better understanding of the food's fat, carbohydrate dilution, protein, fiber, sugar, etc. Identifying pathogens and food spoilage microorganisms is essential tofood microbiology because it ensures consumer safety, prevents brand desecration, and reducesthe cost of remediation after failed inspections or food poisoning outbreaks. This study's primary objective was to determine the nutritional content and identify the hazardous microbes in the Bilimbi Fruit (Averrhoa bilimbi) Juice. The study used an experimental methodology and underwent careful analysis to get detailed results regarding the product. To ascertain the product'snutritional value, samples of the three treatments—plain, grapes, and apple—were sent to theF.A.S.T. Laboratory. Analysis revealed that Bilimbi Fruit (Averrhoa bilimbi) Juice contains Vitamins and minerals that benefit consumers; it includes Crude Fiber, Calcium, Vitamin C, and phosphorus. The result is that each of the three treatments' nutritional contents of "Bilimbi Fruit Juice" is within the recommended dietary requirement for Filipinos. Microbial Analysis reveals nohazardous microbes and bacteria found in the products. Therefore, Bilimbi Fruit Juice is an organic and nutritional juice safe for consumption and an excellent alternative to existing fruit juiceon the market.*

Keywords— ***Natural resources, Nutritional Content, Microbial Analysis, malnutrition, and Food Security.***

I. INTRODUCTION

Everyone should have access to nutritious food that is both affordable and of high quality. People with mild food insecuritymust make trade-offs between the quantity and quality of food consumed because they are uncertain about their ability to obtainfood. According to Egal (2019), theprevalence of overweight and obesity is rising across the board, especially among school-age children and adults. This issue was widespread in the Philippines, which is backed by the claim made by Talukder et al.in 2010 that micronutrient malnutrition among mothers and children is a severepublic health issue in Bangladesh,Cambodia, Nepal, and the Philippines. The economic consequences of contaminated food are felt at different levels in society. At the individual and family level, illness caused by the consumption of unsafe food results inexpenditure on care, be it institutionalized health care or self-care. Income is lost because of illness—the consequence of foodborne illness--death is severe and results in significant socioeconomic and psychological trauma. It is mandatory in thePhilippines to label food products, whether locally manufactured or imported. Bilimbi Fruit Juice is an organic juice created with natural fruit and natural flavoring. In line with this Bilimbi Fruit Juice was subjected to nutritional analysis to distinguish the nutritional value of a product that conforms to the Recommended Dietary Allowance in the Philippines, and it is undergone to microbial

analysis to ensure that there are no hazardousmicrobes and bacteria present for safe consumption. This can be one of thesolutions to the existing problem, which is obesity and micronutrient deficiency in the Philippines and the global order.

Food According to a survey on organic food consumption conducted by Rakuten Insight on September 2021, 32 percent of respondents in the Philippinesstated that they sometimes bought organic food products. The same survey revealed that consumers tend to buy these products

because they are perceived to be healthier and more nutritious. Increased consumption of nutrient-dense beverages (100% fruit juice, milk) and water as part of a varied dietshould be encouraged.

Department of Health Administrative Order no. 2014-0030 known as Revised Rules and Regulations Governing the Labeling of Prepackaged Food Products Further Amending Certain Provisions of Administrative Order No. 88-B s. 1984 or The Rules and Regulations Governing the Labeling of Pre-packaged Food Products Distributed in the Philippines," and For Other Purposed stated: All nutrient quantities shallbe declared in relation to the average or usual serving in terms of slices, pieces or a specified weight or volume. The declaration of the nutrients can also be expressed eitherin units per serving or % RENI or both. Locallymanufactured food products intended for local consumption shall also indicate the corresponding Recommended Energy andNutrient Intake (RENI).

Department of Trade and Industry Bureau of Philippine Standards Republic ActNo. 7394 known as The Consumer Act of thePhilippines Article 2, states that It is the policy of the State to protect the interests of the consumer, promote his general welfare, and establish standards of conduct for business and industry. Towards this end, the state shall implement measures to achieve one objective mentioned is to protect against hazards to health and safety.

The ancient theory of nutrition datesback to the time of Aristotle and Galen. Theyconsidered nutrition as a vital part of health, disease, performance, and healing. The power in each part of the body is believed tobe dependent on the blood flowing to that part. The blood is formed by the nutrients absorbed from the consumed foods.

Objectives of the study

The primary purpose of this studywas to determine the nutritional content of Bilimbi fruit (*Averrhoa bilimbi*) juice in terms of crude fiber, calcium, Vitamin C, and phosphorous and identify hazardousmicrobe present in the product for safer consumption.

II. METHODOLOGY

The primary purpose of this studywas to ascertain the nutritive value and identify the microbes present in the product to assure that the Bilimbi Fruit (*Averrhoabilimbi*) Juice in three different treatments (i.e., plain, grapes, apple) was safe for consumption through microbial analysis.

The researcher sent a sample of 100ml of Bilimbi fruit Juice to F.A.S.T. Laboratoryfor analysis. The method used for nutritional analysis was Ankom Fiber Analysis, Flame AAS, Titrimetry, and Colorimetry. For microbial analysis E.coli, S. aureus Count (CFU/g), Yeast and Mold Count, (CFU/g), andSalmonella, in 25 grams. Those were the threats bacteria for processed food and beverages. The nutritional and microbial analysis were obtained by subjecting the samples to First Analytical Services and Technical Laboratory in Cebu City.

Nutritional Content

Serving size: 1L/230ml

Nutrients	T1 (Plain BilimbiFruit Juice)	T2(BilimbiFruit Juice Grapes Flavor)	T3 (BilimbiFruit Juice Apple Flavor)
Crude Fiber	4.51%	3.68%	4.70%
Calcium	50.5 mg/kg	25.6 mg/kg	35.6 mg/kg
Vitamin C	29.5 mg/L	30.6 mg/L	38.0 mg/L
Phosphorus	37.6 ppm	54.2 ppm	46.9 ppm

Results identified the following nutritive content of Bilimbi Fruit *(Averrhoa bilimbi)* Juice. The crude Fiber content of T1 is 4.51%, T2 is 3.68%, and T3 is 4.70 %.

T1 has the highest Crude Fiber content whileT2 has the lowest. Crude fiber is one type of dietary fiber, and an obsolete nutritional term for fiber, as mentioned by Recommended Dietary allowances, 10th edition, 2002. The recommended dietary fiber intake per day forages 16 to 49 is 20-25 grams, as Food and Nutrition Res recommends. Institute DOST,2015.

The Calcium content in T1 is 50.5 mg,T2 is 25.6 mg, and T3 is 35.6 mg. T1 had thehighest content of calcium, while T2 had theleast. Tanaka et al. The Philippine Journal ofScience provides information that a higher calcium intake is significantly associated with

a lower prevalence of the periodontal disease. Aside from its major role in skeletal function,calcium plays a regulatory role in a number of specialized functions in muscle contraction, neurotransmitter secretion,digestion, and blood coagulation. The Philippine Dietary Reference Intakes' (PDRI 2015) recommended daily nutrient intake (RNI) of calcium for 6 to less than 12-month infants is 400 mg, among 1-2-year-oldchildren 500 mg, among 3-5-year-old children 550 mg, among 6-9-year-old children 700 mg and 10-12-year-oldchildren 1000 mg (FNRI-DOST 2015).

The Vitamin C content of T1 is 29.5 mg, T2 is 30.6 mg, and T3 is 38 mg. T3 had the highest content of Vitamin C, while T1 had the least. The current recommendeddietary allowance (RDA) for vitamin C, as proposed by the Food and Nutrition Board/National Research Council in 1980and reconfirmed in 1989, is 60 mg daily. The 1989 recommendation for Filipinos was retained for the 2002 RENI based on a localstudy that determined intake levels that maintained "acceptable" serum vitamin C levels among Filipino men and women.

The Phosphorous content in T1 is

37.6 ppm, T2 is 54.2 ppm, and T3 is 46.9 ppm. T2 had the highest content of phosphorus, while T1 had the lowest. Phosphorus works with calcium to help buildbones. You need the right amount of both calcium and phosphorus for bone health.Phosphorus also plays an important structural role in nucleic acids and cell membranes. And it's involved in the body's energy production (Rogers, G.,2016). The Recommended Nutrient Intake per day of phosphorus for adults and children is 1250 mg (Food and Nutrition Res. Ins. DOST,2015.)

The data above signify that all the nutritional contents of "Bilimbi Fruit Juice Flavored Drinks" in the three treatments are within the recommended dietary allowance for Filipinos. Hence it is an excellent organicfruit juice substitute for an existing product inthe market.

Microbial Analysis

Analysis	***Result***	***TolerableLimit***
S.aureusCount	< 1 *Est* CFU/g	<20CFU/g
Yeast and Mold Count(CFU/g)	41 CFU/g	40-49 CFU/ml
Salmonella, in2g	Negative	Not Detected in25g
E. coli	< 1 *Est* /Negative	Not Detected in25g

Based on the analysis of First Analytical Service and Technical Cooperative Laboratories, Bilimbi Fruit Juicehad microbial loads on S. aureus Count of <1 *Est* CFU/g and Yeast and Mold Count of 41CFU/g and its tested negative for Salmonellaand E.coli bacteria.

S. Aureus test results indicated good microbiological quality because the < 1

*Est*CFU/g is lower than the permissible limit of <20CFU/g. S. aureus toxin does not normally reach levels that will cause food poisoning until the numbers of the pathogen reach 500,000 to 1,000,000 per gram.

Yeast and mold tests showcontamination with a count of 41 CFU/g.Robinson and Tamime (2002) explicitly reported that yeasts as spoilage organisms generally enter food products as contaminants from the air. FDA Guidelines state that the acceptable level of Yeast and molds in concentrated Juice is 40- 49 CFU/ml. The result of the microbial analysis is within the acceptable or in the borderline limit of microbiological quality of microorganisms determined by a specified method; the values are generally based on levels that are achievable under Good Manufacturing Practice (FDA Revised Guidelines for the Assessment of

Microbiological Quality of Processed foods,2013). Meanwhile, according to Hariyadi,2013 The control of Yeast and molds has to be placed along the productionline, starting from receiving fruit as the primary raw materials. Only appropriately mature and sound fruits produced with GoodAgricultural Practices can be used. Sorting must be done to remove damaged 35 and spoiled parts of fruits. Trimming out a rotten apple for making apple juice, for example, has reduced 90 percent of patulin.

E. coli and Salmonella yield negative results. According to de Louvois et al. 2000, it is the opinion of the ACFDP that ready-to-eat foods should be free from Salmonella spp, Campylobacter spp, and E. coli O157 and other Verocytotoxin-producing E. coli. The ACFDP believes that there is nojustification for processed ready-to-eat foodsbeing contaminated with these organismsand that their presence, even in small numbers, results in such foods being of unacceptable quality/potentially hazardous.

According to the specification of Gulfstandards, the higher counts, however, may not necessarily pose a hazard to consumers'health, provided that there are probably no potential pathogenic strains such as E. coli and Salmonella species within the fruit juicesto be consumed (Babiye, 2017). Hence, the microbial analysis result denotes that theBilimbi Fruit Juice laboratory results is withinthe permissible limit for human consumptionthat fulfilled the criteria safe for human consumption

III. FINDINGS

After a thorough and careful analysis and interpretation of the laboratory results, it can be deduced that Bilimbi Fruit Juice is packed with different nutrients, whichis beneficial for the consumer's health. It is rich in Vitamin C, which can help boost the immune system. The data above signify that all the nutritional contents of "Bilimbi Fruit Juice Flavored Drinks" in the threetreatments are within the recommended dietary allowance for Filipinos. Hence it is an excellent organic fruit juice substitute for an existing product in the market.

Results revealed no hazardous or harmful bacteria in Bilimbi Fruit Juice. The microbial analysis result denotes that the Bilimbi Fruit Juice laboratory results are within the permissible limit for human consumption thatfulfilled the criteria safe for human consumption

Hence, are no hazardous microbes andbacteria present in the product. Hence Bilimbi Fruit Juice is safe for human consumption.

IV. CONCLUSION

The result signifies that bilimbi fruit juice can be an alternative to organic fruit juice in the market. Moreover**,** no detected level of hazardous or harmful bacteria inBilimbi Fruit (Averrhoa bilimbi) Juice. It contains nutrients within the recommended dietary value, which are healthy and valuablefor human consumption. Hence, Bilimbi FruitJuice is a feasible nutritious juice to be produced for consumption.

RECOMMENDATIONS

1. The product must be subject to nutritional facts for future use.
2. The product will be introduced to the market as an alternativenutritious organic juice.
3. The researcher may pasteurizethe bilimbi fruit juice to eliminate the yeast and molds present for safe consumption and to improveits keeping quality.
4. The researcher may secure the intellectual property protection of the product by patenting its process and composition.

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