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Properties of Papaya *(Carica Papaya L.)* as an Alternative Sweetener

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Abstract:* In the field of food and beverages, sugars are incorporated within them for their biological, sensory, physical, and chemical properties. However, excessive intake of sugar may lead to fatty liver disease, diabetes, raise blood pressure, and increase chronic inflammation. This study aimed to scrutinize the properties of Papaya (Carica Papaya L.) as an alternative sweetener in terms of its taste, appearance, and shelf life—and to observe and compare the performance between Papaya Sweetener and Conventional Sweetener in terms of their taste, appearance, and shelf life. Hence, the study utilized an experimental approach to systematically process the properties of papaya to develop an alternative sweetener. The findings revealed that the papaya fruit naturally incorporates a sweetness level of 45 °Bx, equivalent to 45% sweetness. Statistical comparisons indicated no significant difference in terms of its Taste performance, Appearance and Shelf life, supporting the potential uses of Papaya to create a substitute sweetener. In conclusion, the study highlights the potential of utilizing the properties of papaya (Carica papaya L.) as a viable alternative sweetener, offering significant health benefits by reducing excessive sugar consumption. This research contributes to advancing the development of healthier sweetening options.
Keywords: Appearance, Papaya, Shelf life, Sweetener, Taste.

I. INTRODUCTION

Papaya *(Carica Papaya L.)*, is a fruit with numerous nutritional benefits, including high levels of vitamins, fiber, and phytonutrients. It is low in calories, cholesterol-free, and fat-free, making it an ideal choice for weight-loss diet programs. Moreover, the Carica Papaya can be also classified as an alternative sweetener since the fruit contains principal sugars, which include glucose (29.8 g/100 g), sucrose (48.3 g/100 g), and (21.9 g/100 g) of fructose (Tacio H.D., 2018) [12], Koul et al. (2022) [5]. It can be used in desserts, ice cream, canned and dried fruit, jam, jelly, and nectars Wongs-Aree and Noichindra (2022) [16]. Papaya has potential for pharmacological actions and medicinal uses, as it contains antioxidant, anti-bacterial, anti-helminthic, anti-fungal, anti-hypertensive, anti-fertility, and free radical scavenging activity (Kong et al., 2021) [4], (Raviraja et al., 2020) [10].

The fruit contains a mix of glucose and fructose, which are quickly digested by the body, providing energy Bruso J. (2018) [2]. One of the unique aspects of papaya is that it can be produced without excess sugar consumption. Sugars contribute significantly to fruit taste, and the fruit's sweetness is a major factor in determining its flavor and quality (Laurel N.R., Magdalita P., Dela Cueva F.M., 2021) [7]. It also contains two biologically active compounds: chymopapain and papain, which are widely used for digestive disorders.

In this study, the papaya was mainly used as an alternative for conventional sweeteners whereas it aims to decrease sugar consumption while the sweetness level of the food and beverages remains. The study focused on the utilization of papaya and taking advantage of its health benefits by processing it using all-organic ingredients. By this, the researchers aimed to try the sweetener on food variations that will explore the potential uses of papaya as it was used in other studies.

II. METHODOLOGY

In this study, the researchers employed experimental research under the experimental branch of quantitative research design. The experimental research is a meaningful relationship based on quantitative surveillance, which means the researchers have complete control over the process in the specific study (Voxco, 2021) [15]. By using this design, the researchers were able to determine whether the Properties of Papaya (Carica Papaya L.) is effective as a substitute of sweetener.

The researchers utilized ripe Papaya *(Carica Papaya L.)* for the main ingredients of the experiment, integrated with water to soften and liquefy the papaya and help alter its form. An observational checklist was also used by the researchers to record data of papaya sweetener observations in terms of taste, appearance and shelf life. This tool enables the researchers to track and organize observations for further review (Lampe et al., 2023) [6]. The researchers also conducted a likert scale that supported the data gathered from the checklist (McLeod, S., 2023) [8].

The study used a one sample t-test on every variable to test the hypothesis that the population mean is equal to a particular value and to know the standard deviation and variability of the sweetener if it's feasible or not (Ross, A., & Willson, V. L., 2017) [11]. The researchers also made use of the Analysis of Variance (ANOVA) test to determine the influence that independent variable (Papaya) have on the dependent variable (Sweetener), as well as the Multivariate Analysis of Variance (MANOVA) to determine the impact that independent variables (Papaya) have on the dependent variable (Sweetener) (Acob et al., 2024) [1], (Verma, 2012) [14].

III. RESULTS AND DISCUSSION

Table 1. Comparison of *(carica papaya l.)* Sweetener and conventional sweetener (honey) in terms of sweetness measure based on the observational checklist

Sweetness Measures		(by itself)		Baked Goods	
		Papaya	Honey	Papaya	Honey
Measured Sweetness	Brix Degrees (°Bx)	45 °Bx	70°Bx	13°Bx	17°Bx
	Percent (%)	45%	70%	13%	17%
Sweetness Level	Not Sweet (13°Bx below)			✓	
	Sweet (14-19°Bx)				✓
	Very Sweet (20°Bx above)	✓	✓		

Table 1 shows that the measured sweetness of papaya sweetener alone is higher than the measured sweetness when mixed in beverage, baked goods, and dessert. The papaya sweetener by itself measured 45 degrees Brix (°Bx) indicating that it is considered as very sweet, while the beverage measured 14°Bx and dessert with 18°Bx earning its label as sweet and baked good being the lowest with 13°Bx and is considered not sweet. Other ingredients can mask or inhibit sweetness (Trumbo, Appleton, Graaf et al., 2020) [13], which led to the suppression of sweetness when the sweetener was mixed into beverage, baked goods, and dessert. The table also indicates that the honey is much sweeter by itself than when it is mixed in beverages, baked goods, and desserts. It shows the brix of the honey which is triple the sweetness when mixed with beverages, baked goods, and desserts. According to Trumbo, Appleton, and Graaf et al. (2020) [13], other ingredients can mask or inhibit sweetness that may have caused the reduction of sweet taste when the honey was mixed with beverage, baked goods, and dessert.

IV. DISCUSSION

One-Sample Test

	Test Value = 57.5					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
SWEETNESSM_BYITSELF_PAPAYA	-2.833	2	.105	-42.500	-107.04	22.04
SWEETNESSM_BYITSELF_HONEY	-1.464	2	.281	-34.167	-134.56	66.23

The findings on the taste of papaya sweetener have determined that its sweetness level (45%) is lower than the sweetness level of honey (70%). However, the results of the data on the taste of both the papaya sweetener and honey, do not differ much when they are mixed in food and beverages. The papaya mixed with lemonade (beverage) has a sweetness level of 13%, meanwhile using honey gives 20% of sweetness level. In cookies (baked goods), the sweetness level that the papaya provides is 13%, which is 17% when honey is used. Lastly, papaya sweetener on meringue (dessert) has 18% of sweetness level, while there is 20% with honey.

Throughout the preparation process, the amount of papaya used and the length of time it is boiled and simmered affect how the papaya sweetener looks. The papaya is initially solid and opaque, lacking any transparency. The mixture changes during the cooking process, becoming a vibrant, sheer orange liquid. At this point, tiny pieces of papaya pulp are floating throughout, giving it a textured, somewhat hazy appearance (Gupta, 2017) [3]. The sweetener returns to an opaque state after cooking is finished and cools, assuming a thick, syrup-like consistency.

V. CONCLUSION

The study highlights the taste of Papaya *(Carica Papaya L.)* compared to conventional sweetener. It shows that its sweetness level is lower than honey, measuring 45% compared to honey's 70%. However, when mixed in food and beverages, the sweetness levels of papaya and honey are not very different. Results show that the papaya sweetener is highly sweet alone, but its sweetness decreases when added to beverages, baked goods, and desserts. Its color, opacity, and viscosity vary during processing, and it dissolves best in hot, then warm, then cold water. Therefore, it posits potential characteristics as an alternative sweetener. The Papaya (Carica Papaya L.) sweetener also exhibits no significant differences between Conventional sweeteners in terms of taste, appearance, and solubility, which confirms the effectiveness of the potential of Papaya (Carica Papaya L.) as an Alternative Sweetener.

VI. LIMITATION

The scope of this study was to further examine the potential of the Properties of Papaya *(Carica Papaya L.)* as an Alternative for Sweetener. This study aimed to come up with a health-friendly natural sweetener from the Papaya *(Carica Papaya L.)*. The researchers focused on producing an all-organic sweetener from the Papaya *(Carica Papaya L)* by using 2 ingredients only, which are the Papaya *(Carica Papaya L.)* and water. The researchers used the water to soften the Papaya *(Carica Papaya L.)* and get the extract which plays a significant role to produce natural sweetener. The study limits its coverage on utilizing ripened Red Lady variety of Papaya in the alteration of sweetener.

Moreover, the scope of testing the potential of papaya as an alternative sweetener is delimited to plain soft cookies on baked goods. In terms of appearance, testing of the papaya sweetener as an alternative is also tried to the beverage, baked good, and dessert mentioned in the scope of the study. For solubility, the papaya sweetener is delimited to testing the papaya sweetener's dissolution under hot (54°C - 71°C)), warm (18°C - 30°C), and cold (6°C - 17°C) temperature waters.

Lastly, the study focused on small-scale production under controlled testing circumstances. It is recommended to future researchers to explore the feasibility of larger production to be used in real-world situations for better assessment of its functionality and its appeal to the consumers.

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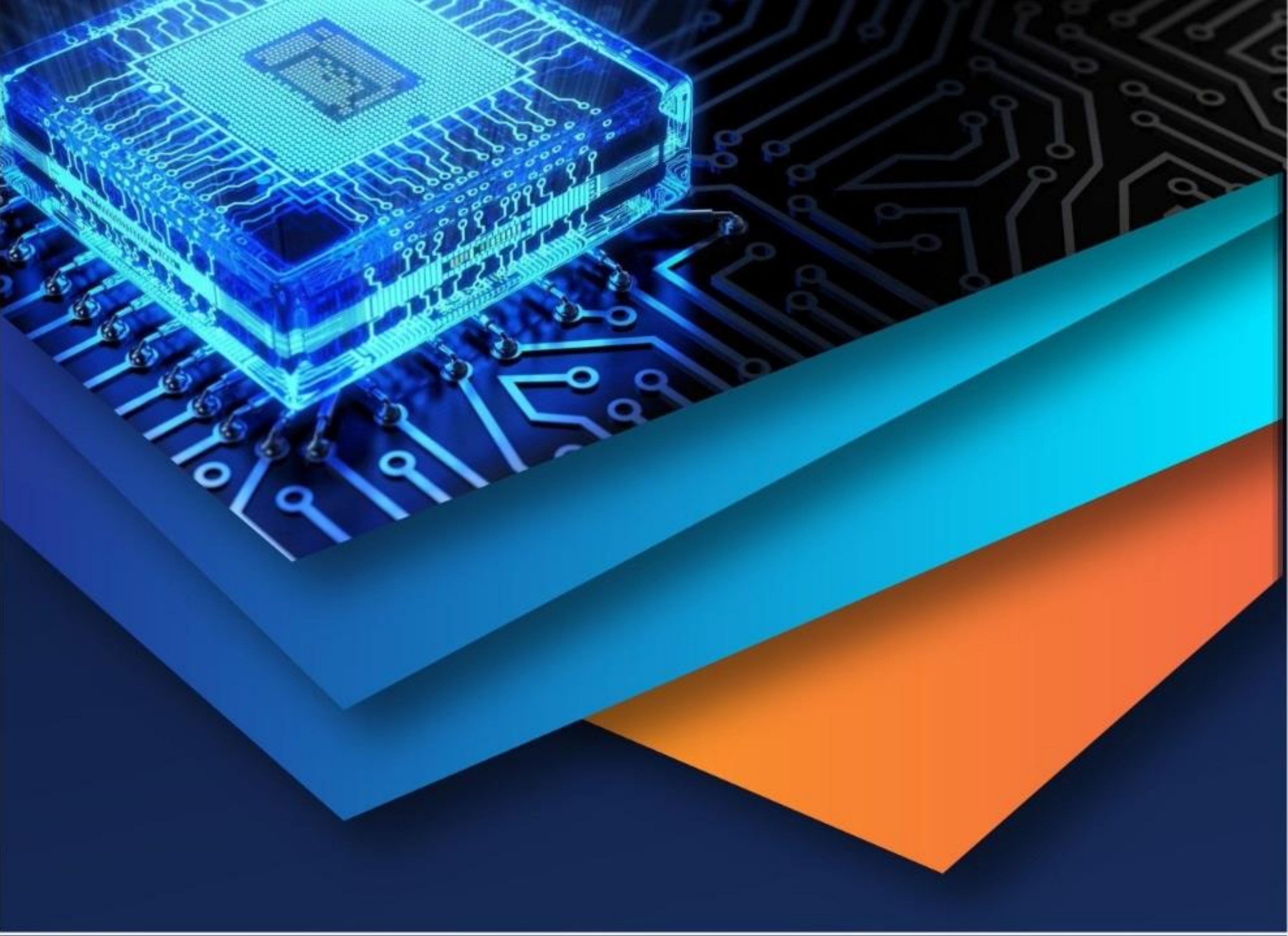

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