

# Potential of Talisay Seeds (*Terminalia catappa*) as an Alternative Coffee

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**Abstract:** This study investigated the potential of Talisay (*Terminalia catappa*) seeds as an alternative coffee by evaluating their physicochemical properties and sensory attributes. The research utilized a quantitative descriptive approach to assess the overall acceptability of Talisay seed coffee in terms of appearance, aroma, texture, taste, and nutritional composition. A Hedonic Rating Scale and Descriptive Rating Test Were employed to gather consumer preferences. At the same time, laboratory testing analyzed its pH level, moisture content, crude protein, crude fiber, crude fat, ash, carbohydrates, and caffeine content. The findings reveal that Talisay seed coffee exhibits caffeine-free content, with aroma receiving the highest acceptability rating, while taste and texture require further refinement. The study concludes that Talisay seed coffee has strong potential as a viable caffeine-free alternative, particularly for consumers seeking a low-caffeine and antioxidant-rich beverage. Recommendations include further optimization of roasting, grinding, and brewing techniques to enhance sensory appeal and commercial viability.

**Keywords:** Talisay seed, alternative coffee

## I. INTRODUCTION

For centuries, people have relied on various plant species for fruits and nuts, often through cultivation and agriculture. However, many of these species have been neglected and underutilized despite their potential to contribute significantly to livelihoods and development (Augustino, 2018). One such species is the *Terminalia catappa* tree, the Talisay or Indian almond tree. This tree is part of the *Combretaceae* family and is widely found in coastal areas, roadsides, and parks due to its ornamental value and adaptability to salt and drought.

The Talisay tree blooms from November to March and is well-suited to full sun conditions. Its leaves initially appear green before turning shades of yellow, orange, and red, eventually falling and accumulating in surrounding areas. Despite its abundance, particularly in the Philippines, the seeds of the Talisay tree remain underutilized. These seeds are edible and like almonds but are often overlooked due to the difficulty in extracting them from their hard shells. It has been noted that *T. catappa* seeds contain chemicals resilient to strong winds during the rainy season (Carpio et al., 2022).

The seeds of *Terminalia catappa* have been found to possess beneficial properties, including the ability to lower low-density lipoprotein (LDL) cholesterol levels, which can help reduce the risk of heart disease and

blood clots (Abaya, 2022). However, their potential remains unrecognized mainly leading to their neglect. Groundskeepers often clear the leaves and seeds using leaf blowers and broomsticks, as they can litter driveways and potentially clog waterways (Dianala, 2019). In regions like Surigao del Norte, where the tropical climate favors the growth of Talisay trees, these seeds are particularly abundant.

Coffee is a widely consumed beverage globally, with increasing demand in traditional and non-traditional markets. In the Philippines, coffee is a staple drink and plays a significant role in the economy, serving as a source of income for many farmers and businesses (Tan, 2020; Laurico et al., 2021). However, excessive caffeine consumption can lead to health issues such as anxiety and insomnia, prompting a need for alternatives with lower caffeine content (Czarniecka-Skubina et al., 2021). While coffee has been part of Filipino culture for centuries, there is a growing interest in developing healthier coffee options.

This study aimed to explore the potential of using *Terminalia catappa* seeds as a coffee substitute, providing a healthier alternative with lower caffeine content. The study seeks to contribute to both health-conscious consumption and sustainable use of neglected plant species by developing a consumable coffee product from these underutilized seeds. This approach addresses the need for decaffeinated coffee options and highlights the potential of underappreciated resources in contributing to sustainable development. Previous studies have successfully transformed Talisay seeds into spreads and butter, but there is a gap in research regarding their use as coffee (Samoggia, 2019; Samoggia & Riedel, 2019).

## II. STATEMENT OF THE PROBLEM

The study aimed to determine the potential of Talisay (*Terminalia catappa*) seeds as an alternative coffee. Specifically, it aims to answer the following:

1. What is the demographic profile of the respondents in terms of:
  - 1.1 age
  - 1.2 sex
2. What are the physiochemical properties of the Talisay (*Terminalia catappa*) seeds in terms of:
  - 2.1 acid content,
  - 2.2 caffeine content; and
  - 2.3 basic nutritional content?
3. What is the level of consumer acceptability of Talisay (*Terminalia catappa*) seeds as coffee in terms of:
  - 3.1 appearance,
  - 3.2 aroma,
  - 3.3 taste; and
  - 3.4 texture?
4. What is the level of product recommendation of Talisay (*Terminalia catappa*) seeds as coffee in terms of:
  - 4.1 appearance,
  - 4.2 aroma,
  - 4.3 taste; and
  - 4.4 texture?
5. Based on the findings, what recommendations can be proposed?

## III. ASSUMPTION

It is assumed that the Talisay (*Terminalia catappa*) seeds have potential as an alternative coffee.

## IV. METHODOLOGY

This study explored the potential of Talisay (*Terminalia catappa*) seeds as an alternative coffee product using a product developmental research design with a quantitative descriptive approach. The goal was to assess the overall acceptability of the coffee derived from these seeds in terms of appearance, aroma, texture, taste, and physiochemical properties. Evaluations were conducted using a Hedonic scale and descriptive testing methods. Testers were selected through purposive criterion random sampling and included coffee drinkers, coffee experts, and non-coffee drinkers to ensure a diverse range of feedback.

To gather data, the researchers employed both observational and testing methods. A structured three-part questionnaire adapted from Cerezo, Delgado, and Destajo (2021) was used. The first section gathered demographic details such as name, age, and sex. The second part utilized a 9-point Hedonic Rating Scale to determine the level of consumer acceptability of the Talisay seed coffee. The third part included a 4-point

Descriptive Rating Scale to assess recommendations for the product. These tools helped collect comprehensive and relevant data for evaluating the product.

In terms of materials, the study used Talisay seeds and standard coffee preparation equipment including containers, a grinder, sieve, spatula, cooking pan, gas burner, food thermometer, French press, and a sharp-edged knife. These materials ensured that the processing and evaluation of the seeds adhered to typical coffee production standards.

The procedures began with the collection of mature Talisay seeds from the local community in Ponta Bilar, Surigao City. After collection, the seeds were thoroughly washed to remove dirt and contaminants. The cleaned seeds were then sun-dried for six hours a day over three consecutive days to ensure even drying and prevent mold formation. Once dried, the seeds were roasted in a cooking pan at 230°C for 10 minutes to achieve the desired roast profile. After roasting, the seeds were ground into a fine powder using a grinder, then sieved to remove larger particles and ensure a consistent texture. Brewing was performed using a French press with hot water at 92°C, allowing the grounds to steep for three minutes before separating the liquid.

For data gathering, researchers used a scorecard survey and instructed evaluators to cleanse their palates with water before tasting. The Hedonic scale measured sensory acceptability, while the descriptive test assessed recommendations. To evaluate the physiochemical properties, such as acidity level, caffeine content, and nutritional value, the researchers coordinated with F.A.S.T Laboratories for professional analysis.

Statistical analysis involved calculating the mean and standard deviation to interpret the respondents' preferences regarding the sensory attributes. Ethical considerations included obtaining formal approval from the school principal, ensuring environmental responsibility during seed collection, following strict safety and sanitation protocols, securing informed verbal consent from participants, maintaining confidentiality of personal data, and formally requesting laboratory analysis. These measures ensured that the study was conducted responsibly and ethically.

## V. RESULTS AND DISCUSSION

This chapter examines the findings and offers the data that the researchers collected in compliance with the ethics and protocols the researchers must follow throughout the investigation.

Profile	f (45)	%
<i>Age</i>		
17 – 26 years old	36	81
27 – 36 years old	2	4
37 – 46 years old	4	9
47 – 56 years old	1	2
57 – 66 years old	2	4
<i>Sex</i>		
Female	25	56
Male	20	44

**Table 1.** Profile of the Respondents

Table 1 presents the demographic profile of the respondents (N = 45) in terms of age and sex. The findings indicate that a significant majority (81%) of the respondents belong to the 17–26 age group, suggesting that younger individuals constitute the primary population under study. This demographic dominance has notable implications, as younger consumers are generally characterized by a greater willingness to explore new products, particularly in the food and beverage industry (Barska, 2014). Studies suggest that younger generations, particularly millennials and Gen Z, exhibit higher levels of curiosity and openness to novel taste experiences, alternative diets, and emerging market trends (Kılıç *et al.*, 2021). Their strong representation in the sample implies that the study's findings may primarily reflect the perspectives and preferences of this age cohort rather than those of older age groups who may exhibit more established consumption patterns and brand loyalty.

In contrast, the remaining age groups are represented in significantly smaller proportions, with only 9% of respondents aged 37–46 and even fewer (4% each) in the 27–36 and 57–66 age brackets. The least represented group is the 47–56 age range (2%), highlighting a potential generational gap in participation. This could indicate that older individuals are either less engaged in the study's subject matter or are less available or willing to

participate. It is also possible that their purchasing behaviors and preferences differ substantially from those of younger respondents, which could lead to a skewed interpretation of the overall market trends.

Regarding the gender distribution, the results show a slightly higher proportion of male respondents (56%) compared to female respondents (44%). While this difference is not drastic, it is worth noting that previous research has identified gender-based variations in food and beverage consumption patterns. Studies suggest that men are more inclined toward stronger, bitter flavors such as coffee, dark chocolate, and certain alcoholic beverages. In contrast, women generally exhibit a preference for sweeter or milder tastes. If the study focuses on a specific product category, such as specialty coffees, functional beverages, or plant-based alternatives, the slight overrepresentation of male participants may influence the overall findings.

Parameters	Results	Test Method
Titrateable Acidity as Citric Acid	0.139	Titrimetry

**Table 2.** *Physiochemical Property of Talisay (Terminalia catappa) Seeds as Coffee in terms of Acid Content*

Table 2 shows that the titrateable acidity (TA) of the sample, expressed as citric acid, was determined to be 0.139% using the titrimetry method. Titrateable acidity is a key parameter in food and beverage analysis as it quantifies the total acidic components, impacting taste and product stability. Citric acid, a naturally occurring organic acid, is commonly found in fruits and processed food products, contributing to the characteristic tartness and enhancing overall flavor perception. The measured acidity level suggests that the sample exhibits a mild level of tartness, which is generally desirable in many beverages and food formulations (Tsegay, 2020).

The titrimetry method used for this analysis is a standard technique for quantifying acidity by neutralizing the sample with a base of known concentration (Sadler & Murphy, 2010). This method provides a reliable measure of the acid content, ensuring product formulation and quality control consistency. The results indicate that the sample maintains an appropriate acidity level for its intended application, aligning with industry standards for products containing citric acid.

The 0.139% titrateable acidity suggests that the sample falls within an optimal range for products that rely on citric acid for flavor enhancement and preservation. In food and beverage applications, acidity plays a crucial role in sensory attributes, microbial stability, and overall consumer acceptance. A balanced level of citric acid can enhance flavor perception, prevent undesirable microbial growth, and improve shelf life.

Comparing this result to typical acidity levels in fruit juices and flavored beverages, which range from 0.10% to 0.50% depending on the formulation (Deka, 2000), the measured acidity of 0.139% suggests a mild tartness. This level is suitable for maintaining a refreshing taste without excessive sourness that could affect consumer preference. Moreover, acidity affects the solubility and effectiveness of other ingredients, such as preservatives and sweeteners, thereby influencing the product's overall stability and sensory experience (Lindsay, 2007).

The measured acidity level of 0.139% has significant implications for product formulation and consumer preference. The mild acidity suggests that the product is well-balanced in taste, making it suitable for a wide range of consumers, including those who prefer beverages with a subtle tartness rather than an overly acidic profile (Chen et al., 2023). Additionally, citric acid serves as a natural preservative, meaning that the acidity level may contribute to extended shelf life by inhibiting microbial growth (Sharif et al., 2017).

From a quality control perspective, maintaining consistent acidity levels is essential to ensuring product uniformity and stability. Variations in acidity could lead to differences in flavor perception, texture, and preservation efficacy, potentially affecting consumer satisfaction.

Further studies could assess pH levels, sensory analysis, and microbial stability tests to provide a more comprehensive evaluation of the product's acidity-related properties.

Thus, the titrateable acidity of 0.139% indicates that the sample maintains a harmonious balance between acidity and palatability. This level ensures an appealing taste while supporting microbial stability and shelf life. Given its role in taste modulation and preservation, maintaining a stable acidity profile is crucial for meeting consumer expectations and industry standards.

Parameters	Results (%)	Test Method
Moisture	2.27	Air Oven Drying
Protein (N x 6.25)	24.4	Kjeldahl
Ash	4.70	Ignition-Gravimetric
Fat	54.8	Soxhlet Extraction
Carbohydrates	13.8	By Computation
<sup>b</sup> Crude Fiber	6.98	ANKOM Fiber Analyzer

**Table 3.** *Physiochemical Property of Talisay (Terminalia catappa) Seeds as Coffee in terms of Basic Nutritional Content*

Table 3 presents the physiochemical analysis of Talisay (*Terminalia catappa*) seeds as a coffee alternative, shedding light on their nutritional potential. The high-fat content (54.8%), moderate protein level (24.4%), notable amounts of carbohydrates (13.8%), crude fiber (6.98%), ash (4.70%), and low moisture content (2.27%) indicate that these seeds possess unique properties that may influence their functionality when processed into a coffee-like beverage.

The fat content (54.8%), as determined using the Soxhlet extraction method, is the highest among the components analyzed, suggesting that Talisay seeds are rich in lipid.

These characteristics contribute to flavor development, mouthfeel, and aroma retention during roasting. In contrast, traditional coffee beans contain only 15-17% lipids (Surma *et al.*, 2023), significantly lower than Talisay seeds. As a result, the higher fat content may create a richer and creamier texture in brewed coffee, making it a desirable option for consumers who prefer a smoother coffee substitute. However, this raises concerns regarding oxidation and rancidity, requiring proper storage conditions (Ragnarsson & Labuza, 1977). This observation aligns with studies by Aryee *et al.* (2022), which emphasize the need for controlled processing methods to maintain the quality and stability of lipid-rich seeds.

The protein content (24.4%), determined using the Kjeldahl method, is significantly higher than that of conventional coffee beans, which typically contain 10-12% protein (Prandi *et al.*, 2021). This suggests that Talisay seeds could offer additional nutritional benefits, particularly for individuals seeking plant-based protein sources. Moreover, the high protein levels may influence the foamability and emulsification properties of the brewed beverage, potentially enhancing its textural appeal (Vilela *et al.*, 2020). Notably, this result aligns with findings from Chukwuma *et al.* (2024), who reported protein levels between 22-26% in *Terminalia catappa* seeds, reinforcing the nutritional consistency of these seeds across various studies. Consuming a protein-rich coffee alternative may contribute to muscle repair, satiety, and overall dietary protein intake, making it beneficial for individuals with high protein requirements. The carbohydrate content (13.8%), computed by difference, is lower than that of coffee beans, which typically contain 40-50% carbohydrates (Arya & Rao, 2007). This could influence the sweetness and body of the beverage, potentially leading to a less pronounced caramelized flavor after roasting. However, a lower carbohydrate content may have health benefits, as it could result in a reduced glycemic impact, making Talisay coffee a suitable alternative for individuals managing blood sugar levels (Sacks *et al.*, 2014). A low-carb coffee option may also support ketogenic and low-glycemic diets, appealing to health-conscious consumers.

The crude fiber content (6.98%), determined using the ANKOM fiber analyzer, is higher than that of traditional coffee, which generally contains 4-6% fiber (Núñez *et al.*, 2015). This suggests that Talisay-based coffee may contribute to improved digestion and gut health, supporting the findings of Fazilah *et al.* (2019), who highlighted the potential health benefits of fiber-rich plant-based beverages. Increased fiber intake has been linked to better bowel regularity, improved gut microbiome health, and reduced risks of digestive disorders, making Talisay coffee an attractive option for consumers seeking digestive health benefits.

The ash content (4.70%), measured using the ignition-gravimetric method, indicates the mineral content of the seeds, which contributes to their nutritional value and potential taste enhancement. A higher ash content is generally associated with increased mineral availability, including calcium, potassium, and magnesium, which play vital roles in metabolic functions (Paramisparam *et al.*, 2021). When compared to conventional coffee, which has an ash content ranging from 3.5% to 5.0% (Carvalho *et al.*, 2014), Talisay seeds exhibit a comparable mineral presence, supporting their viability as an alternative coffee source. Mineral-rich coffee substitutes may help support electrolyte balance, muscle function, and overall metabolic health.

The moisture content (2.27%), determined via air oven drying, is the lowest component analyzed and is significantly low. It is beneficial for shelf stability as it minimizes microbial growth and spoilage risks



(Bourdoux et al., 2016). This finding aligns with previous research on *Terminalia catappa* seeds, which reported moisture levels ranging from 2.0% to 4.5% (Halilu et al., 2023). Consequently, the low moisture content enhances the storage potential of Talisay seeds, making them suitable for long-term preservation. A dry, low-moisture coffee alternative is less likely to develop mold or microbial contamination, ensuring safer and longer-lasting storage. The physiochemical profile of Talisay seeds highlights their strong potential as a coffee alternative, particularly due to their high lipid and protein content, low moisture for stability, and notable mineral presence. The higher fat content may enhance the mouthfeel, while the moderate carbohydrate levels suggest that Talisay coffee may have a less sweet, nuttier, or earthy flavor profile. Additionally, the high protein content offers added nutritional value, making Talisay coffee a nutrient-dense alternative to conventional coffee.

When compared to previous studies, the findings align with earlier research on the proximate composition of *Terminalia catappa* seeds, reinforcing their suitability for food applications. However, it is crucial to address the challenges associated with oxidation stability due to the high-fat content, which necessitates further exploration of processing techniques such as roasting, controlled storage, and antioxidant incorporation to prevent rancidity.

The nutritional properties of Talisay seeds indicate that they could be positioned as a functional coffee alternative, particularly appealing to health-conscious consumers and individuals seeking plant-based, protein-rich beverages. Given their high fat and protein content, Talisay-based coffee could offer a smoother, creamier texture, making it attractive to consumers who prefer richer coffee substitutes.

Nevertheless, further research is highly recommended due to the oxidation risks associated with high lipid content. Future studies should investigate advanced processing techniques such as roasting, controlled packaging, and antioxidant fortification to enhance product stability and shelf life. Additionally, it would be valuable to explore Talisay coffee's bioactive compounds, caffeine content, and sensory acceptability to assess its commercial viability in the functional beverage industry. Thus, while Talisay seeds exhibit promising potential as a coffee alternative, further research and processing innovations are essential to optimize their quality, taste, and marketability.

Parameters	Results	Test Method
Caffeine	Less than 2*	HPLC

Unit: µg/g

**Table 4.** *Physiochemical Property of Talisay (Terminalia catappa) Seeds as Coffee in terms of Caffeine Content*

Table 4 presents the caffeine content of Talisay (*Terminalia catappa*) seeds when processed as a coffee alternative. The HPLC (High-Performance Liquid Chromatography) analysis reveals that the caffeine level is less than 2 µg/g, which is extremely low compared to conventional coffee. This finding suggests that Talisay-based coffee is a caffeine-free or nearly caffeine-free alternative, making it an ideal choice for individuals sensitive to caffeine or those looking to reduce their caffeine intake.

Caffeine is a naturally occurring stimulant in coffee beans, tea leaves, and other plants. To put this into perspective, Arabica coffee beans typically contain 10,000–12,000 µg/g (10–12 mg/g) of caffeine, while Robusta coffee can contain up to 27,000 µg/g (27 mg/g) (Satyanarayana, 2005). In contrast, the negligible caffeine content in Talisay seeds indicates that they do not naturally accumulate significant amounts of this stimulant. This observation is consistent with previous studies on *Terminalia catappa*, which have reported minimal or undetectable caffeine levels in its seeds (Hassan et al., 2011).

Given the extremely low caffeine content, a coffee-like beverage made from Talisay seeds would lack the typical stimulating effects associated with traditional coffee. This could be particularly beneficial for individuals who experience caffeine-related side effects, such as jitters, insomnia, increased heart rate, or anxiety (Radwan et al., 2022). Moreover, this aligns with growing consumer demand for decaffeinated or caffeine-free coffee alternatives, a trend fueled by concerns over caffeine dependency, hypertension, and acid reflux (Tahmouzi et al., 2024; Mazzafera et al., 2009).

However, while the absence of caffeine presents a health advantage, it may also impact the sensory characteristics of Talisay-based coffee. Caffeine plays a key role in coffee's bitterness and stimulating properties, contributing to its flavor richness and complexity (Sunarharum et al., 2014). Consequently, Talisay coffee may exhibit a milder, less bitter taste, which could influence consumer acceptance. To compensate for this, modifying roasting techniques or blending with other ingredients may be necessary to enhance flavor depth and mimic the sensory qualities of traditional coffee (Bagnulo et al., 2024).

According to a study by Aprilina *et al.* (2023), the low caffeine content of Talisay-based coffee positions it as a promising alternative for health-conscious consumers, particularly those avoiding caffeine for medical reasons or personal preferences, as their research on low-caffeine coffee varieties like Robusta and Liberica confirmed that factors such as bean maturity and processing methods influence caffeine levels while preserving quality and flavor.

Nevertheless, it is crucial to acknowledge the role of caffeine in shaping consumer expectations for coffee. Since caffeine contributes to taste and physiological effects, further research is needed to optimize the sensory attributes of Talisay-based coffee. Caffeine is known to impart bitterness to coffee, influencing the overall sensory experience. Its presence can enhance the perception of specific flavor attributes, such as bitterness and mouthfeel, while also contributing to the beverage's stimulating effects (Samoggia & Riedel, 2019).

In conclusion, while talisay-based coffee may not be a direct substitute for traditional coffee in terms of caffeine content, its nutritional profile, absence of stimulants, and potential health benefits make it a viable caffeine-free option for a specific consumer market. With proper processing and formulation, Talisay coffee could emerge as an attractive alternative for those seeking a healthy, caffeine-free beverage without the drawbacks of caffeine stimulation (Alingal *et al.*, 2023).

<i>Indicators</i>	<b>M</b>	<b>SD</b>	<b>I</b>
Appearance	6.51	2.16	LM
Color	6.78	1.73	LM
Aroma	7.11	2.01	LM
Taste	6.60	2.09	LM
Texture	6.60	2.06	LM
<b>Average</b>	<b>6.72</b>	<b>2.01</b>	<b>LM</b>

<i>Scale</i>	<i>Interval</i>	<i>Interpretation</i>
9	8.12 - 9.00	Like Extremely (LE)
8	7.23 - 8.11	Like Very Much (LVM)
7	6.34 - 7.22	Like Moderately (LM)
6	5.45 - 6.33	Like Slightly (LS)
5	4.56 - 5.44	Neither Like nor Dislike (NLD)
4	3.67 - 4.55	Dislike Slightly (DS)
3	2.78 - 3.66	Dislike Moderately (DM)
2	1.89 - 2.77	Dislike Very Much (DVM)
1	1.00 - 1.88	Dislike Extremely (DE)

**Table 5.** Level of Consumer Acceptability of Talisay (*Terminalia catappa*) Seeds as an Alternative Coffee

Table 5 presents the level of consumer acceptability of Talisay (*Terminalia catappa*) seed coffee as an alternative coffee. Using a structured hedonic scale, the sensory evaluation examined its appearance, color, aroma, taste, and texture. The findings indicate that the overall acceptability of Talisay seed coffee falls within the "Like Moderately" (LM) range, with an average score of 6.72 (SD = 2.01). Among the indicators, aroma (M = 7.11, SD = 2.01) received the highest rating, followed by color (M = 6.78, SD = 1.73), taste (M = 6.60, SD = 2.09), and texture (M = 6.60, SD = 2.06), while appearance (M = 6.51, SD = 2.16) had the lowest rating. These results suggest that while Talisay seed coffee is generally well-received, certain aspects such as taste, texture, and appearance may require further refinement to enhance consumer preference.

### Aroma

Aroma received the highest rating (M = 7.11, SD = 2.01), indicating that the scent of Talisay seed coffee is one of its strongest attributes. The high score suggests that the beverage emits a pleasant, coffee-like fragrance that appeals to consumers, likely due to the release of volatile compounds during roasting. According to Ashihara and Crozier (2001), the aroma of coffee is primarily attributed to volatile compounds such as furans, pyrazines, and phenols that develop during the roasting process. The agreement between this study and existing

literature indicates that Talisay seeds contain aromatic precursors that create desirable sensory characteristics upon roasting.

### Color

The color of Talisay seed coffee was rated slightly lower ( $M = 6.78$ ,  $SD = 1.73$ ) but still falls within the moderate acceptability range. This suggests that the coffee has a visually appealing hue that resembles traditional coffee but may have slight variations in shade or opacity. Studies by Mostafa et al. (2021) suggest that roasting plays a critical role in color development in coffee alternatives. Their research highlights that inconsistent roasting temperatures can lead to uneven browning, influencing consumer perception. The findings agree with this study, suggesting that improving roasting techniques could lead to a more visually consistent product.

### Taste

Taste was rated at  $M = 6.60$ ,  $SD = 2.09$ , indicating that while moderately liked, it may not fully replicate the traditional bitterness and richness of coffee. The relatively high standard deviation suggests individual differences in taste perception, possibly due to varying expectations regarding acidity, sweetness, or bitterness. Research by Poláková et al. (2023) found that many coffee alternatives lack the characteristic bitterness and umami found in traditional coffee due to differences in their chemical composition and caffeine content. The findings in this study align with that observation, suggesting that Talisay seed coffee may require additional roasting and flavor enhancement techniques to improve its taste profile.

### Texture

Texture was rated at  $M = 6.60$ ,  $SD = 2.06$ , similar to taste, suggesting moderate acceptability in terms of mouthfeel. Consumers may have perceived smoothness, body, or consistency variations, which could influence their overall experience. A study by Mostafa et al. (2021) found that the texture of coffee alternatives is heavily influenced by particle size, solubility, and extraction efficiency. The agreement with this study suggests that grind size and filtration techniques play a role in the textural perception of Talisay seed coffee.

### Appearance

The appearance of Talisay seed coffee received the lowest rating ( $M = 6.51$ ,  $SD = 2.16$ ), indicating that while it resembles traditional coffee, some variations in consistency, clarity, or surface texture may have affected its overall perception. The relatively higher standard deviation suggests that individual preferences varied, possibly due to differences in roasting or brewing methods. This result aligns with Poláková et al. (2023), who found that alternative coffee products often exhibit visual inconsistencies due to differences in processing and roasting techniques, affecting consumer acceptability. This supports the need for standardization in grinding size, roast color, and brewing clarity to improve visual appeal.

The findings suggest that Talisay seed coffee has strong potential as an alternative coffee, particularly due to its aromatic appeal and moderate acceptability across all attributes. However, further refinements in roasting, grinding, and brewing methods are necessary to enhance its taste, texture, and appearance to increase consumer satisfaction. Additionally, nutritional profiling and caffeine content analysis should be conducted to determine how it compares to traditional coffee in terms of health benefits and stimulant properties. Market studies focusing on consumer preference, branding, and pricing strategies could also help position Talisay seed coffee as a viable and competitive product in the alternative coffee industry.



<i>Indicators</i>	<b>M</b>	<b>SD</b>	<b>I</b>
Appearance	3.00	0.74	R
Color	2.87	0.79	R
Aroma	3.16	0.88	R
Taste	2.91	0.91	R
Texture	2.71	0.82	R
Average	<b>2.93</b>	<b>0.83</b>	<b>R</b>

<i>Scale</i>	<i>Interval</i>	<i>Qualitative Description</i>	<i>Verbal Interpretation</i>
4	3.25 – 4.00	Highly Recommendable	HR
3	2.50 - 3.24	Recommendable	R
2	1.75 - 2.49	Somewhat Recommendable	SR
1	1.00 - 1.74	Not Recommendable	NR

**Table 6.** Level of Product Recommendation of Talisay (*Terminalia catappa*) Seeds as an Alternative Coffee

Table 6 presents the product recommendation for Talisay seed coffee, which was evaluated based on key sensory attributes, including appearance, color, aroma, taste, and texture. Participants rated the product using a structured scale to determine its overall acceptability for consumer recommendation. The results indicate that Talisay seed coffee falls within the "Recommendable" (R) category, with an average score of 2.93 (SD = 0.83). Among the attributes, aroma (M = 3.16, SD = 0.88) received the highest recommendation, while texture (M = 2.71, SD = 0.82) had the lowest.

### Aroma

Gloss et al. (2013) emphasize that volatile compounds such as pyrazines, furans, and phenols contribute significantly to coffee aroma and affect consumer preferences. Their findings indicate that maintaining consistent roasting temperatures and proper storage conditions can preserve and enhance these desirable aromatic qualities. Similarly, Baggenstoss et al. (2008) highlight the role of roasting time and bean composition in developing coffee's characteristic aroma, reinforcing the need for controlled processing to optimize the fragrance of Talisay seed coffee.

### Appearance

The appearance of Talisay seed coffee received a mean score of 3.00 (SD = 0.74), placing it in the "Recommendable" (R) category. This suggests that while the beverage's visual aspect is generally acceptable to consumers, there is room for improvement to enhance its appeal. The moderate recommendation for appearance indicates that Talisay seed coffee possesses a satisfactory visual quality but lacks the refinement seen in traditional coffee. Factors such as color uniformity, clarity, and surface characteristics may have influenced this perception. Torma et al. (2019) support this finding, as their study on commercial coffee substitutes revealed that visual attributes significantly impact consumer acceptance. Their research suggests that optimizing processing techniques such as roasting and grinding could enhance the overall product appeal and make it more visually attractive to consumers (Torma et al., 2019). Similarly, Toci and Farah (2008) emphasize that inconsistencies in visual presentation can affect consumer preferences, reinforcing the importance of refining roasting and grinding parameters to improve appearance.

### Taste

The taste of Talisay seed coffee scored 2.91 (SD = 0.91), indicating moderate recommendation. While the flavor is acceptable, there is potential for improvement to better match consumer expectations. The moderate taste rating suggests that the beverage offers a palatable but slightly different profile from traditional coffee, possibly lacking some of the bitterness, acidity, or depth associated with conventional brews. Czerny and Schieberle (2002) identified key aroma-taste interactions that contribute to the complexity of coffee flavor, suggesting that enhancing the roasting profile and adjusting grind size could improve the sensory experience. Additionally, Toci and Farah (2008) highlight that non-traditional coffee sources often have a milder taste due to lower caffeine and chlorogenic acid content, which may explain the less pronounced bitterness in Talisay seed

coffee. Further refinement of roasting levels and potential natural additives could enhance its richness and complexity, making it more appealing to consumers.

### Color

The color of Talisay seed coffee was rated at 2.87 (SD = 0.79), also within the recommendable range. This indicates that while the beverage's hue is generally appealing, it may not fully match the deep, rich tones typically associated with traditional coffee. The color rating suggests that Talisay seed coffee has a visually pleasing shade but may exhibit slight variations in opacity or intensity compared to conventional coffee. Torma *et al.* (2019) highlights that color plays a crucial role in consumer perception, as deviations from expected coffee hues can influence acceptability. Their findings indicate that adjustments to roasting temperature and duration could improve color consistency. Similarly, Bicho *et al.* (2012) found that consumer preferences are closely linked to specific roasting profiles, which affect both visual appeal and taste expectations. Standardizing the roasting process could help achieve a more uniform color, potentially increasing consumer recommendation levels.

### Texture

Texture received the lowest mean score of 2.71 (SD = 0.82), though it still falls within the recommended category. This suggests that the mouthfeel of Talisay seed coffee is acceptable but may require refinement to improve smoothness and body. Fu *et al.* (2012) studied the impact of particle size distribution on coffee texture, finding that finer grinds enhance mouthfeel and extraction efficiency, leading to a smoother beverage. Their findings suggest that grind size adjustments and improved filtration techniques could positively influence consumer perception of Talisay seed coffee.

Similarly, Bicho *et al.* (2012) noted that solubility and viscosity play a crucial role in mouthfeel, emphasizing that optimizing extraction methods could enhance the drinking experience. With that, while Talisay seed coffee demonstrates moderate consumer acceptability, refinements in roasting, grinding, and extraction techniques could significantly improve its appearance, color, taste, and texture. Given the strong aroma profile, optimizing other sensory characteristics could position Talisay seed coffee as a competitive alternative to traditional coffee products.

## VI. CONCLUSIONS

The study confirmed that Talisay (*Terminalia catappa*) seed coffee is a viable alternative to conventional coffee, demonstrating favorable sensory acceptability and physicochemical properties. Evaluators found it acceptable in terms of appearance, aroma, texture, and taste, while laboratory analysis supported its suitable acidity, caffeine content, and nutritional value. The overall recommendability suggests its potential as a sustainable, locally sourced coffee substitute, warranting further research for optimization and commercial viability.

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