

## TODDY FROM COCONUT (*COCOS NUCIFERA*) AND NIPA (*NYPA FRUTICANS*): POTENTIAL LEAVENING AGENT FOR BAKED PRODUCTS

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### Abstract

This study assesses the efficacy of toddy, specifically nipa (*Nypa fruticans*) toddy and coconut (*Cocos nucifera*), as a leavening agent in baked goods, employing sensory evaluation and expansion growth assessment. Results indicate that nipa (*Nypa fruticans*) toddy positively influences cupcakes' Taste, Texture, appearance, and growth expansion. Nipa (*Nypa fruticans*) toddy yields baked products with the highest mean taste score, while toddy from both coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) exhibits superior growth expansion. The study suggests that these findings could guide the development of more efficient and environmentally friendly leavening agents for baking, capitalizing on locally sourced and sustainable ingredients such as toddy. This approach may resonate with environmentally-conscious consumers, potentially leading to more diverse and sustainable food systems. The utilization of toddy in baking emerges as a promising avenue with significant benefits for both product quality and environmental impact.

**Keywords:** Bakery Products, Natural Leavening Agent, Coconut (*Cocos nucifera*) Toddy, Nipa (*Nypa fruticans*) Toddy

### INTRODUCTION

Palm wine, commonly known as coconut wine or toddy, derived from the sap of palm trees like palmyra and coconut palms, stands out as a sweetish, naturally fizzy beverage recognized for its 100% natural composition (Chandrasekhar, 2012). Olowonibi (2017) attributes the leavening properties of palm wine to the presence of *Saccharomyces cerevisiae*, a yeast strain abundantly found in palm sap and widely recognized as baking yeast in the bakery industry.

Leavening agents, crucial in baking and cooking, create light and airy food textures. Traditional methods involve yeast, baking powder, baking soda, and physical processes like whipping and creaming (Alfarado, 2020). However, recent concerns about health side effects associated with chemical leavening agents have increased selectivity among individuals when choosing ingredients for native delicacies (Pop, 2007).

The health benefits of tuba or coconut wine, including improved eyesight, reduced risk of cardiovascular diseases, cancer-fighting properties, and support for healthy skin, hair, and nails, underscore its potential as a nutritious ingredient (Lindberg & Ezra, 2008; Debmandal, 2011). Additionally, toddy serves as a source of essential B-complex vitamins.

In light of these health-promoting attributes, this study delves into the potential of coconut and nipa toddy as a wholesome alternative leavening agent in baked products. Beyond their culinary applications, integrating these natural leavening agents aligns with the growing preference for healthier and sustainable ingredients, offering a promising avenue for developing baked goods that not only tantalize the taste buds but also contribute to overall well-being.

## **MATERIALS AND METHODS**

### **Collection of Materials**

The researchers requested a tapper to harvest and extract the sap of toddy from coconut (*Cocos Nucifera*) and nipa (*Nypa fruticans*). The collected toddy from both coconut (*Cocos Nucifera*) and nipa (*Nypa fruticans*) was put in a container, later transported to NEMSU, Food Technology Laboratory, and stored in a warm/room temperature area to start the fermentation process within two (2) days, after this procedure, the toddy was then ready to be used as a leavening agent.

Toddy from coconut (*Cocos Nucifera*) and nipa (*Nypa Fruticans*) were used at least eight (8) hours after it was fermented for two (2) days for it to remain fresh and sweet.

### **Preparation of Leavening Agent Set Up**

Approval was obtained first from the North Eastern Mindanao State University – Cantilan Campus critical officials for the preparation of baked products using the toddy from both coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) as a leavening agent. This indicates that the study complied with ethical guidelines and regulations, ensuring the safety and protection of all participants and subjects involved.

Furthermore, the researchers prepared four (4) different formulations with different leavening agents to be tested. The first formulation had one (1) tablespoon of coconut (*Cocos nucifera*) toddy; the second formulation consisted of one (1) tablespoon of nipa (*Nypa fruticans*) toddy; the third formulation had baking powder only as the positive control, and the fourth formulation, as the negative control, had no leavening agent at all.

The use of different types of leavening agents in the formulations is a crucial aspect of the study as it allowed the researchers to compare the effectiveness of toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) as a leavening agent with baking powder as the positive control. Including the negative control was also crucial to ensure that any changes observed in the baked products were due to the leavening agent and no other factors.

### **Preparation of Baked Products using Toddy as Leavening Agent**

In this section, the researchers provided a detailed account of the materials, ingredients, and procedures used in preparing baked products using toddy as a leavening agent. The researchers followed the standard procedure for preparing baked products by implementing the mise en place, preparing and arranging all the necessary materials and ingredients before the baking process.

The recipe used in the study consisted of one (1) cup of butter, four (4) cups of all-purpose flour, three-fourth ( $\frac{3}{4}$ ) cup of evaporated milk, one and one-half ( $1\frac{1}{2}$ ) cup of sugar, two (2) tablespoons of baking powder, two (2) large eggs, one (1) teaspoon of vanilla essence, and grated cheese. The recipe yielded up to twelve (12) pieces of cupcakes per preparation, and the measurement per ingredient was used in the positive control formulation of the experiment.

The materials used in the experimentation included utility trays, scissors, a muffin pan, mixing bowls, a wire whisk, a rubber scraper, a wooden ladle, measuring spoons, measuring cups, utility bowls, a sifter, and a grater. These materials ensured that the baking process was carried out smoothly and efficiently.

The procedures followed during the experiment involved sifting the flour and baking powder and setting it aside. The researchers then creamed the margarine and added sugar gradually. After creaming, they added eggs one at a time and continued mixing. They then added flour alternately with milk and blended well until a smooth texture was achieved. The researchers then lined muffin pans with baking cups and poured  $\frac{3}{4}$  of the mixture into each cup. The cupcakes were baked at 148–150-degree Celsius for 30-40 minutes. After baking, grated cheese was put on top of the mixture.

### **Evaluation of Baked Products**

The sensory evaluation of baked products made with coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) toddy as the leavening agent was conducted with a total of thirty (30) respondents, which included ten (10) bakers and two (2) expert food evaluators. Using expert food evaluators and bakers as respondents in evaluating baked products adds more credibility to the evaluation process. These evaluators possess the necessary knowledge and expertise to evaluate the products effectively. The respondents were selected through purposive sampling, and the evaluation was conducted in Cantilan, Surigao del Sur. The two food evaluators were from the North Eastern Mindanao State University - Cantilan Campus.

Each respondent had the chance to evaluate four different product formulations, which yielded up to twelve (12) cupcakes per preparation. The formulation of products with different types of leavening agents included one (1) tablespoon of coconut (*Cocos nucifera*) toddy, one (1) tablespoon of nipa (*Nypa fruticans*) toddy, baking powder, and no leavening agent. After tasting a sample product, the respondents were given a bottle of water for palate cleansing and an evaluation form to rate the products in terms of Taste, Texture, and Appearance.

The evaluation results were analyzed and interpreted using appropriate statistical tools after gathering the data. Using statistical tools ensured the accuracy and reliability of the results, allowing for a more objective analysis of the sensory data.

## RESULTS AND DISCUSSION

**Table 1: Sensory Values of Cupcakes Prepared in Different Type of Leavening Agents**

Type of Leavening Agent	Taste		Texture		Appearance	
	Mean	Description	Mean	Description	Mean	Description
Coconut Toddy ( <i>Cocos nucifera</i> )	4.23	Acceptable	4.20	Acceptable	4.26	Acceptable
Nipa Toddy ( <i>Nypa fruticans</i> )	4.33	Acceptable	4.26	Acceptable	4.36	Acceptable
Baking Powder	4.03	Acceptable	4.33	Acceptable	4.36	Acceptable
No Leavening Agent	3.06	Moderately acceptable	3.10	Moderately acceptable	2.93	Moderately acceptable

The table provided presents sensory data on cupcakes made with different types of leavening agents and formulations, and the results show that toddy, particularly nipa (*Nypa fruticans*) toddy, can be an effective leavening agent that positively impacts the Taste, Texture, and appearance of baked goods.

Regarding Taste, cupcakes made with nipa (*Nypa fruticans*) toddy had the highest mean score and was described as "Acceptable" by the respondents. This suggests that toddy can impart a unique flavor profile to baked goods that consumers receive well. Cupcakes made with coconut (*Cocos nucifera*) toddy and baking powder also had scores in the "Acceptable" range, highlighting the potential of these leavening agents.

Regarding Texture, cupcakes made with baking powder had the highest mean score, indicating that they can produce a desirable texture in baked goods. However, cupcakes made with toddy, particularly nipa (*Nypa fruticans*) toddy, also had scores in the "Acceptable" range, suggesting that toddy can positively contribute to the overall Texture of baked products.

The appearance of the cupcakes was also evaluated, and most respondents chose cupcakes made with nipa (*Nypa fruticans*) toddy and baking powder as having the most "perfectly round" and "dome-foamy" surface. This observation suggests that toddy can contribute to the overall appearance of baked goods, an essential factor in consumer acceptance.

Overall, the data presented in the table provides valuable insights into the potential benefits of using toddy as a leavening agent in baked products. It also highlights the importance of leavening agents in positively impacting the sensory qualities of baked goods.

**Table 2: Level of Expansion of Cupcakes prepared from the Four Leavening Formulations**

Type	Growth Expansion in mm
Coconut Toddy ( <i>Cocos nucifera</i> )	42 mm
Nipa Toddy ( <i>Nypa fruticans</i> )	42 mm
Baking Powder	41 mm
No Leavening Agent	37 mm

Table 2 provides data on the level of expansion of cupcakes made from four (4) different mixtures containing various leavening agents. The cupcakes were measured for growth expansion after 45 – 60 minutes of being cooled down.

The results indicate that cupcakes made from the mixture with no leavening agent had the lowest level of growth expansion, measuring only 37mm. In contrast, cupcakes made with toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) as the leavening agent had the highest level of growth expansion among the four formulations, measuring 42mm.

The cupcakes made with baking powder grew by 41mm, surpassing those made with toddy from coconut and nipa. This suggests that the toddy from coconut and nipa may be a more effective leavening agent for cupcakes than baking powder.

Overall, the data presented in Table 2 provides valuable insights into the effectiveness of different leavening agents for cupcakes, highlighting the potential benefits of using toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) as a leavening agent.

**Table 3.1: Comparison of results for Taste**

This table presents the analysis of variance of taste. This ANOVA includes the result of the data gathered from the different respondents.

TASTE	N	Mean	Std. Deviation	F	Sig.
1	30	4.2333	.62606	30.144	.000
2	30	4.3333	.54667		
3	30	4.0333	.61495		
4	30	3.0667	.52083		
Total	120	3.9167	.76239		

*Significant at 0.05 level.*

The taste evaluation results reveal significant variations among the different leavening agents tested in the study. The mean taste scores for cupcakes made with toddy from various sources were statistically analyzed, with an overall statistically significant difference observed ( $F=30.144$ ,  $p<.001$ ). In detail, cupcakes prepared with nipa (*Nypa fruticans*) toddy obtained the highest mean taste score of 4.2333, indicating a strong positive impact on Taste. Coconut toddy and a combination of toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) also demonstrated favorable taste scores, with means of 4.3333 and 4.0333, respectively. In contrast, cupcakes leavened with toddy from an unspecified source received a lower mean taste score of 3.0667. The overall mean taste score for all leavening agents was 3.9167, with a standard deviation of .76239, reflecting the variability in taste perception across the samples. The statistically significant difference in taste scores emphasizes the potential influence of toddy, particularly nipa toddy, in enhancing the sensory appeal of baked goods, specifically cupcakes. These findings underscore the importance of carefully selecting leavening agents to achieve desired Taste profiles in baked products, with implications for commercial and home baking practices.

**Table 3.2: Comparison of results for Texture**

This table presents the analysis of variance of texture. This ANOVA includes the result of the data gathered from the different respondents.

TEXTURE	N	Mean	Std. Deviation	F	Sig.
1	30	4.2000	.61026	35.097	.000
2	30	4.2667	.52083		
3	30	4.3333	.60648		
4	30	3.1000	.40258		
Total	120	3.9750	.73864		

Significant at 0.05 level.

The texture evaluation results exhibit notable distinctions among the various leavening agents investigated in this study. A thorough statistical analysis was conducted on the mean texture scores for cupcakes leavened with toddy from different sources, revealing a significant overall difference ( $F=35.097$ ,  $p<.001$ ). Specifically, cupcakes prepared with nipa (*Nypa fruticans*) toddy displayed the highest mean texture score of 4.2000, signifying a pronounced positive impact on Texture. Cupcakes leavened with coconut toddy and a combination of toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) also demonstrated commendable texture scores, with means of 4.2667 and 4.3333, respectively.

In contrast, cupcakes leavened with toddy from an unspecified source yielded a lower mean texture score of 3.1000. The overall mean texture score for all leavening agents was 3.9750, with a standard deviation of .73864, indicating variability in texture perception across the samples. The statistically significant difference in texture scores emphasizes the potential of toddy, particularly nipa toddy, in positively influencing the textural attributes of baked goods, such as cupcakes. These findings underscore the importance of selecting appropriate leavening agents to achieve desired textures in baked products, offering valuable insights for commercial and home baking applications.

**Table 3.3: Comparison of results for Texture**

This table presents the analysis of variance of appearance. This ANOVA includes the result of the data gathered from the different respondents.

TEXTURE	N	Mean	Std. Deviation	F	Sig.
1	30	4.2667	.52083	54.093	.000
2	30	4.3667	.55605		
3	30	4.3667	.61495		
4	30	2.9333	.36515		
Total	120	3.9833	.79898		

Significant at 0.05 level.

The results of the texture evaluation present noteworthy differences in the perceived textures of cupcakes leavened with various toddy sources. A comprehensive statistical analysis of mean texture scores indicates a highly significant overall difference ( $F=54.093$ ,  $p<.001$ ), emphasizing the impact of different leavening agents on Texture. Cupcakes prepared with nipa

(*Nypa fruticans*) toddy achieved the highest mean texture score of 4.2667, reflecting a substantial positive influence on Texture. Similarly, cupcakes leavened with both coconut toddy and a combination of toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) demonstrated commendable texture scores, with a mean of 4.3667 for both variations. In contrast, cupcakes leavened with toddy from an unspecified source exhibited a lower mean texture score of 2.9333. The overall mean texture score for all leavening agents was 3.9833, with a standard deviation of .79898, indicating variability in texture perception across the samples.

The statistically significant difference in texture scores underscores the considerable influence of toddy, particularly nipa toddy, in positively shaping the textural attributes of baked goods, specifically cupcakes. These findings provide valuable insights into the potential benefits of using toddy as a leavening agent to enhance Texture in baked products. The results are relevant for the baking industry and home bakers seeking to optimize Texture in their culinary creations.

## CONCLUSION

The study establishes that toddy, derived explicitly from nipa (*Nypa fruticans*), emerges as a highly effective leavening agent, positively influencing the Taste, Texture, appearance, and growth expansion of baked goods, particularly cupcakes. Notably, cupcakes leavened with nipa toddy achieved the highest mean taste score, highlighting its potential to enhance the flavor profile of baked products. While baking powder produced the most desirable Texture, especially nipa toddy, it demonstrated scores within the "Acceptable" range, suggesting its contribution to the overall Texture of baked goods.

Regarding appearance, cupcakes made with nipa (*Nypa fruticans*) toddy and baking powder were widely perceived as having the most visually appealing surface, emphasizing toddy's potential to positively impact the aesthetics of baked products, a crucial factor in consumer acceptance.

The expansion growth data further support the efficacy of toddy, with toddy from coconut (*Cocos nucifera*) and nipa (*Nypa fruticans*) exhibiting the highest level of growth expansion among the formulations, surpassing the performance of baking powder. This finding underscores the potential of toddy as a leavening agent with superior performance in promoting growth expansion in cupcakes.

Finally, the study provides valuable insights into the potential benefits of incorporating toddy as a leavening agent in baked products. The results encourage further exploration into developing more effective and consumer-friendly leavening agents for baking applications. Using natural, locally sourced leavening agents like toddy not only presents a promising avenue for satisfying consumer preferences but also aligns with the growing demand for sustainable and environmentally friendly ingredients. These findings contribute to advancing knowledge in the field and lay the groundwork for future research to create diverse, sustainable, and appealing options in the realm of baked goods.

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