STM JOURNALS

Research & Reviews: A Journal of
Pharmacognosy

ISSN: 2394-7276
Volume 13, Issue 1, 2026
January–April
DOI (Journal): 10.37591/RRJoPC

https://journals.stmjournals.com/rrjopc

Review RRJoPC

# Development and Evaluation of a Coconut-Based Jam

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***Abstract***

*Conventional coconut jam formulations rely heavily on refined sucrose to achieve sweetness, texture, and preservation, limiting their suitability for individuals seeking reduced-sugar dietary options. The growing demand for nutritionally improved food products has encouraged the development of alternative formulations using natural sweet ingredients and polyol-based humectants. The present study aimed to develop and standardize a coconut-based reduced-sugar jam using coconut milk, dates, raisins, sorbitol, glycerin, citric acid, sodium chloride, and dry fruits, and to evaluate its sensory attributes, pH profile, and short-term storage stability. A reduced-sugar coconut jam was formulated through controlled heating and standardized processing. Dates and raisins were used as natural sweetening agents, while sorbitol and glycerin served as polyol-based humectants. Citric acid was incorporated for pH adjustment. The formulation was evaluated for organoleptic characteristics, pH, texture, spreadability, and storage stability under refrigerated conditions for 10 days. The developed formulation exhibited a balanced sweetness profile, desirable texture with added crunch from dry fruits, and good spreadability. The pH ranged from 3.3–3.6, indicating effective acidification. No visible spoilage, phase separation, or unacceptable sensory changes were observed during the storage period under refrigeration. A coconut-based reduced-sugar jam can be successfully developed using a combination of natural sweet ingredients and polyol-based humectants. The formulation demonstrated acceptable sensory quality and short-term stability, suggesting its potential as a nutritionally improved alternative to conventional sugar-rich coconut jams.*

**Keywords:** Coconut jam, dates, functional foods, glycerin, reduced-sugar formulation, sorbitol

## INTRODUCTION

Jam and jam-like fruit spreads are traditionally formulated using high concentrations of sucrose to achieve sweetness, gel formation, and microbial stability. Sugar contributes significantly to reduced water activity, texture development, and shelf-life extension [1]. However, excessive intake of added sugars has been strongly associated with metabolic disorders, including type 2 diabetes mellitus, obesity, and cardiovascular diseases, prompting global public health recommendations to reduce dietary sugar consumption [2, 3].

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Received Date: December 15, 2025
Accepted Date: January 23, 2026
Published Date: January 24, 2026

**Citation:** Ruhana Raffic, Paranjyothi Kanni, Shobha Rani R.H. Development and Evaluation of a Coconut-Based Jam. Research & Reviews: A Journal of Pharmacognosy. 2026; 13(1): 13–18p.

Coconut-based spreads are widely consumed in tropical regions due to their distinctive sensory properties and nutritional value. Coconut milk is rich in medium-chain triglycerides, which are rapidly metabolized and have been associated with potential metabolic benefits [4]. Nevertheless, conventional coconut jam formulations typically contain large quantities of refined sugar, limiting their suitability for individuals requiring glycemic control or calorie restriction.

In recent years, there has been growing interest in developing reduced-sugar and sugar-free food products using alternative sweetening and humectant systems. Naturally occurring sweet

 

ingredients such as dates and raisins provide intrinsic sugars, dietary fiber, minerals, and bioactive compounds, offering a more nutritionally favorable sweetness profile compared to refined sucrose [5, 6]. Additionally, polyols such as sorbitol and glycerin are commonly employed in food formulations to impart sweetness, improve mouthfeel, and maintain moisture while eliciting a lower glycemic response than sucrose [7, 8].

Citric acid plays a critical role in jam formulations by adjusting pH, enhancing flavor, and improving microbiological stability. Acidification is particularly important in low- or no-added-sugar systems, where the preservative effect of sucrose is diminished [9]. Sodium chloride, although used in minimal quantities, enhances flavor balance and overall palatability, while the incorporation of dry fruits contributes desirable texture, sensory complexity, and additional nutritional value, including unsaturated fatty acids and micronutrients [10].

Despite increasing consumer demand for healthier spreads, there is limited published literature describing standardized formulations of coconut-based, sugar-free or reduced-sugar jams utilizing a combination of natural sweeteners, polyols, and functional ingredients. Therefore, the present study aims to develop and standardize a coconut-based jam formulation using coconut milk, dates, raisins, glycerin, sorbitol, citric acid, sodium chloride, and dry fruits, and to evaluate its suitability as a nutritionally improved alternative to conventional coconut jam.

## MATERIALS AND METHODS

### Study Design

The present work was designed as a formulation and standardization study aimed at developing a reduced-sugar coconut-based jam using natural sweet ingredients and polyol-based humectants. The study focused on formulation development, process standardization, and preliminary physicochemical and sensory evaluation.

### Materials

Fresh coconut milk was prepared from mature coconuts procured from a local market. Dates (Phoenix dactylifera) and raisins (Vitis vinifera) were obtained from certified food-grade suppliers and used as natural sweetening agents, providing intrinsic sugars and bioactive components [5, 6]. Sorbitol and glycerin (food grade) were employed as polyol-based sweeteners and humectants due to their moisture-retaining properties, contribution to mouthfeel, and lower glycemic response compared to sucrose [7, 8]. Citric acid and sodium chloride were of food-grade quality and complied with relevant safety standards. A blend of dry fruits, including almonds and cashew nuts, was used to enhance texture, sensory appeal, and nutritional value [10]. All ingredients were stored under appropriate hygienic conditions prior to use.

### Formulation Composition

The composition of the developed coconut-based reduced-sugar jam formulation is presented in Table 1.

**Table 1.** Composition of coconut jam.

| Ingredient | Quantity |
|---|---|
| Coconut milk | 100 mL |
| Dates (paste) | q.s. |
| Raisins (paste) | q.s. |
| Sorbitol | q.s. |
| Glycerine | q.s. |
| Citric acid | 1–2 tsp |
| Sodium chloride | A pinch |
| Dry fruits (chopped) | 10–15 g |

 

### Preparation Procedure

Dates and raisins were soaked in warm water for 30 minutes and ground separately to obtain a smooth paste. Coconut milk was heated gently in a stainless-steel vessel under continuous stirring. The date and raisin pastes were added gradually and mixed uniformly. Sorbitol and glycerin were then incorporated slowly to achieve the desired sweetness and moisture retention, consistent with their established functional roles in reduced-sugar food systems [7, 8].

Citric acid was added to adjust the pH to an acidic range favorable for flavor enhancement and microbial stability [9]. Sodium chloride was incorporated in minimal quantity to balance sweetness and enhance overall palatability. Finely chopped dry fruits were added during the final stage of cooking to impart a crunchy texture. The mixture was cooked on low heat until a semi-solid, spreadable consistency was achieved. The final product was allowed to cool and stored in sterilized, airtight containers under refrigerated conditions, as reduced-sugar formulations lack sucrose-mediated preservation [1–9].

## EVALUATION PARAMETERS

### Organoleptic Evaluation

The prepared jam was evaluated for color, aroma, taste, texture, mouthfeel, and spreadability using subjective sensory assessment. Particular emphasis was placed on sweetness balance, aftertaste, and textural uniformity.

### pH Determination

The pH of the final formulation was measured using a calibrated digital pH meter at room temperature. Measurements were performed in triplicate and expressed as mean values.

### Storage Stability

The product was stored at 4–8 °C and observed for a period of 10 days. Physical changes such as phase separation, discoloration, off-odors, and visible spoilage were monitored visually and organoleptically. Refrigerated storage was considered essential due to the absence of sucrose-mediated reduction in water activity [1–9].

## RESULTS

### Organoleptic Characteristics

The developed coconut-based reduced-sugar jam exhibited a uniform, creamy appearance with evenly distributed dry fruit particles. The sweetness profile, contributed by dates, raisins, sorbitol, and glycerin, was balanced and acceptable, with no detectable bitter or metallic aftertaste. The inclusion of dry fruits imparted a desirable crunchy texture, improving overall sensory appeal. The aroma was characteristic of coconut milk with mild fruity notes, and the product demonstrated good spreadability under refrigerated conditions. Table 2 summarizes the qualitative organoleptic evaluation of the developed formulation.

**Table 2.** Organoleptic characteristics of the developed coconut-based reduced-sugar jam.

| Parameter | Observation |
|---|---|
| Appearance | Creamy, uniform, glossy |
| Color | Off-white to light beige |
| Aroma | Characteristic coconut with mild fruity notes |
| Taste | Mildly sweet, well-balanced |
| Texture | Smooth with crunchy dry fruit particles |
| Spreadability | Good at 4–8 °C |
| Aftertaste | None undesirable |

The pH of the final formulation values ranged within the 3.3–3.6, confirming effective acidification following citric acid incorporation. This acidic range is favorable for flavor enhancement and contributes to microbial safety in reduced-sugar formulations [9].

 

Table 3. presents the pH values observed during the evaluation period.

**Table 3.** pH values of the coconut-based reduced-sugar jam.

| Observation | pH (Mean ± SD) |
|---|---|
| Initial (Day 0) | 3.4 ± 0.1 |
| Day 5 (Refrigerated) | 3.5 ± 0.1 |
| Day 10 (Refrigerated) | 3.6 ± 0.1 |

### Texture and Consistency

The formulation exhibited a semi-solid, cohesive consistency suitable for use as a spread. Glycerin contributed to moisture retention and softness, while sorbitol aided in maintaining structural integrity without crystallization. No syneresis or phase separation was observed during the study period, indicating adequate formulation stability.

### Storage Stability

During refrigerated storage (4–8 °C) for 10 days, the product showed no visible signs of spoilage, discoloration, or off-odors. Sensory attributes, including taste, aroma, and texture, remained stable throughout the observation period. Refrigeration effectively compensated for the absence of sucrose-mediated preservation, maintaining acceptable product quality [1–9].

Storage stability observations are summarized in Table 4.

**Table 4.** Storage stability of coconut-based reduced-sugar jam under refrigerated conditions.

| Parameter | Day 0 | Day 5 | Day 10 |
|---|---|---|---|
| Color change | Absent | Absent | Absent |
| Phase separation | Absent | Absent | Absent |
| Off-odour | Absent | Absent | Absent |
| Visible spoilage | Absent | Absent | Absent |
| Sensory acceptability | Acceptable | Acceptable | Acceptable |

## DISCUSSION

The present study demonstrates the feasibility of developing a coconut-based reduced-sugar jam using a combination of natural sweet ingredients (dates and raisins) and polyol-based humectants (sorbitol and glycerin), without the addition of refined sucrose. The formulation achieved acceptable sensory characteristics, appropriate acidity, and short-term refrigerated stability, addressing key technological challenges associated with sugar reduction in jam-like products.

Sugar traditionally serves as a multifunctional ingredient in jam formulations, contributing to sweetness, gel structure, reduced water activity, and microbial stability [1]. Its removal necessitates alternative strategies to maintain product quality. In the present formulation, dates, and raisins provided intrinsic sugars along with dietary fiber and bioactive compounds, resulting in a more nutritionally favorable sweetness profile compared to refined sucrose [5, 6]. The absence of undesirable aftertaste suggests effective masking of polyol-related sensory effects through the use of natural fruit matrices.

Sorbitol and glycerin played a critical role in maintaining moisture content and mouthfeel. Polyols are known to act as humectants, reducing water loss and preventing excessive firmness in reduced-sugar systems [7, 8]. Glycerin, in particular, contributed to softness and cohesiveness, while sorbitol supported sweetness and structural stability without crystallization. These findings are consistent with previous reports highlighting the utility of polyols in sugar-reduced food formulations [7].

The incorporation of citric acid resulted in a final pH range of 3.3–3.6, which is considered optimal for flavor enhancement and for limiting microbial growth in fruit-based spreads [9]. Acidification is

 

especially important in reduced-sugar products, where the preservative effect of sucrose is diminished. The stable pH observed during refrigerated storage indicates adequate buffering capacity of the formulation components.

Texture and sensory complexity were further enhanced by the inclusion of dry fruits, which provided a desirable crunchy element and improved consumer appeal. Nuts are also recognized for their nutritional benefits, including healthy fats, protein, and micronutrients, which may contribute to the functional value of the product [10]. Importantly, the even distribution of dry fruit particles and absence of phase separation indicate good formulation homogeneity.

The product remained organoleptically stable for 10 days under refrigerated conditions, with no visible spoilage or sensory deterioration. This limited shelf life aligns with existing literature, as reduced-sugar formulations lack sucrose-mediated reduction in water activity and therefore require refrigeration for quality maintenance [1–9]. While the current stability period is suitable for fresh or small-batch preparation, future studies may explore natural preservatives or hurdle technologies to extend shelf life.

Overall, the findings suggest that a coconut-based reduced-sugar jam can be successfully formulated using a combination of natural sweeteners and polyols, offering a nutritionally improved alternative to conventional sugar-rich products.

## CONCLUSION

The present study successfully developed and standardized a coconut-based reduced-sugar jam using coconut milk, dates, raisins, sorbitol, glycerin, citric acid, sodium chloride, and dry fruits, without the addition of refined sucrose. The formulation demonstrated acceptable sensory attributes, balanced sweetness, desirable texture, and short-term refrigerated stability.

The combined use of natural sweet ingredients and polyol-based humectants effectively compensated for the functional roles traditionally performed by sucrose, particularly with respect to sweetness, mouthfeel, and moisture retention. Acidification using citric acid achieved a pH range favorable for flavor enhancement and microbial safety, while the inclusion of dry fruits improved textural complexity and nutritional value.

Although the product exhibited stability for up to 10 days under refrigerated conditions, its limited shelf life underscores the need for appropriate storage and highlights opportunities for future optimization. Further studies may focus on extending shelf life through natural preservatives, evaluating microbiological parameters, and conducting structured sensory analysis with larger panels.

Overall, this formulation offers a nutritionally improved alternative to conventional coconut jam and demonstrates potential for application in reduced-sugar and functional food product development.

### Limitations and Future Scope

The present study was limited by its preliminary nature and small-scale formulation approach. Microbiological analysis was not performed, and storage stability was assessed only under refrigerated conditions for a short duration. Sensory evaluation was qualitative and subjective, without the use of a trained sensory panel or scoring system. These factors limit the findings' generalizability. Future research should focus on conducting detailed microbiological and shelf-life studies under varied storage conditions to better establish product safety and stability. Quantitative sensory evaluation using validated scales and a larger panel would provide more robust insights into consumer acceptability. Further optimization may include the incorporation of natural preservatives or the application of hurdle technologies to extend shelf life. Nutritional profiling and glycemic response evaluation would also strengthen the clinical and functional relevance of the formulation, particularly for populations requiring reduced-sugar dietary options.

 

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