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FACULTY OF APPLIED SCIENCES

SCIENTIFIC PROJECT COLLOQUIUM

2024



Final Year Project Colloquium 2024
Faculty of Applied Sciences,
Universiti Teknologi MARA,
Perak Branch Tapah Campus,
35400 Tapah Road, Perak, Malaysia.

Colloquium date 12 July 2024

Publication date 30 October 2024

Proceedings of Extended Abstracts

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e-I.S.B.N: 978-629-97630-4-8

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Preface

The Scientific Project Colloquium offers a platform for publishing Diploma Science final year projects (FYP). The objective is to effectively distribute research findings throughout all scientific disciplines. The primary objective of including final year projects into the course curriculum is to encourage students to put their theoretical knowledge into practical applications.

We would like to express our gratitude to our primary establishment, the Faculty of Applied Sciences and Universiti Teknologi MARA, Perak Branch, for their invaluable assistance.

Lastly, we would like to express our gratitude to all of the authors for the tremendous help in preparing the articles, without which this undertaking would not have been completed.

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October 2024

FORMULATION AND EVALUATION OF PAPAYA-FLAVORED GOAT MILK FOR EXPECTANT MOTHERS

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Abstract: This study aimed to reduce the gamey taste of goat milk and analyze its chemical composition after adding the papaya powder, using Fourier Transform Infrared Spectroscopy (FTIR). Goat milk from Suffly's Dairy Milk powdered milk and freeze-dried papaya powder had been used for the materials. FTIR analysis identified the functional groups present in the goat milk powder, papaya powder, and their new formulation. The spectra revealed that goat milk and papaya powder shared similar functional groups, including alcohols (O-H), alkanes (C-H), carbonyl (C=O), amines (N-H), and alcohols (C-O). In contrast, the new formulation goat milk papaya flavoured displayed a combination of the peak in papaya powder and goat milk powder. For the optimal formulation, a 4:6 ratio of goat milk to papaya powder was preferred. This ratio effectively reduced the gamey flavor and aroma of the goat milk, resulting in a more pleasant taste and a yellow-orange color. Additionally, the ideal temperature for dissolving the mixture was found to be 80°C.

Keywords: milk, powder goat milk, freeze dried papaya powder, pregnant women, FTIR

INTRODUCTION

Milk is a nutrient-dense liquid produced by mammals to nourish their young. When referring to milk in human diets, it typically denotes the liquid obtained from dairy animals such as cows, goats, and sheep. Milk serves as a versatile ingredient with various applications in everyday life. Nutritionally, it is regarded as a complete food source, providing proteins, vitamins, minerals, carbohydrates, and fats (Park, 2013). As a nutrient-rich option, goat milk is commonly included in daily diets, offering essential proteins, vitamins, minerals, carbohydrates, and fats that support a balanced diet and provide various health benefits. These benefits include easier digestion, a lower likelihood of milk allergies, reduced lactose levels, and enhanced heart health. Goat milk tends to be slightly sweeter than cow milk, although this can vary based on processing, packaging, and pasteurization methods. Its unique and subtle flavors contribute to its popularity in goat milk products (Turkmen, 2017). What sets goat milk apart from other types of milk is its thickness and creaminess. It also boasts several health advantages, such as improved digestibility, a lower risk of allergies, and better heart health. The sweetness of goat milk can vary depending on processing techniques. Goats are also more efficient at converting dietary carotene into vitamin A (Vasquez, 2023). Dry milk powder, or powdered milk, is a highly versatile and convenient product with numerous advantages. One key benefit is its extended shelf life compared to fresh milk, allowing it to be stored for long periods without spoiling or losing nutritional value. It is rich in essential nutrients like calcium, protein, and vitamins, making it a practical alternative for those who may lack regular access to fresh dairy (Nayik, 2021). Furthermore, dry milk powder is lightweight and compact, making it easy to transport and store, particularly beneficial for individuals or communities in remote areas with limited access to fresh milk. Its long shelf life and ease of transport also make it a practical solution for those without reliable refrigeration. (USDA,2021). Papaya, once considered an exotic fruit, is now readily available year-round. It is rich in potassium, beta-carotene, and vitamins A, B, and C, which support fetal neurological growth and development. The potential health benefits of papaya consumption include a reduced risk of heart disease, diabetes, and cancer, improved digestion, and enhanced skin health due to its antioxidant properties. The enzyme papain found in papaya is known for its digestive benefits, helping to break down proteins and improve overall digestion. Additionally, papaya is low in calories and high in fiber, making it a great addition to a balanced diet (Spritzler, 2018).

This study aims to explore the combination of goat milk powder and papaya powder to create a formula that minimizes the gamey taste of goat milk while maximizing the nutritional benefits of both ingredients. Through

taste tests and feedback, the goal is to produce the formula to achieve an optimal blend that enhances flavor and maintains the nutritional integrity of both powders.

METHODOLOGY

1.0 Materials Preparation

All necessary chemicals and apparatus, including acetone, water (H₂O), papaya powder, and Suffy Pure Goat (goat milk powder). Ensure you have a spoon, beaker, kettle, thermometer, digital scale, 10 small cups, tissues, a marker pen, and a small zip lock bag on hand.

2.0 Sample Preparation

Measure 250 mL of water and heat it in a beaker until it reaches temperature needed, then turn off the heat source. Pour the boiled water into a separate beaker and allow it to cool to 60°C, monitoring the temperature with a thermometer. Once the water reaches 60°C, add 10 g of powdered goat milk and stir the mixture with a glass rod until fully dissolved. Optionally, filter the mixture to remove any undissolved lumps. Pour the mixture into a cup, allow it to cool for 5 minutes, and then observe the taste and smell. Pour the prepared solution into the small cups for testing or further analysis. This procedure being repeated by adjusting the ratios 9:1, 8:2, 7:3, and 6:4. For temperature used are, room temperature 25°C, 60°C, 80°C and 100°C until the desired taste is achieved. Label each cup with the marker pen to identify different samples or variations if applicable.

Table 1. Table for ratio and temperature Mixture of Papaya and Goat Milk Ratio for S1, S2, S3, S4, S5

Sample No.	Ratio (10g)		Temperature
	Goat Milk	Papaya powder	
S1	10	0	25°C, 60°C, 80°C and 100°C
S2	9	1	25°C, 60°C, 80°C and 100°C
S3	8	2	25°C, 60°C, 80°C and 100°C
S4	7	3	25°C, 60°C, 80°C and 100°C
S5	6	4	25°C, 60°C, 80°C and 100°C

3.0 Infra-Red Analysis

Fourier-Transform Infrared Spectroscopy (FTIR) brand Perkin Elmer model Frontier had been used for the functional group detection by putting a small amount of goat milk powder onto the top plate of a Universal diamond ATR, ensuring the crystal area was fully covered with spread milk. The procedure was then repeated using papaya powder and a mixture of papaya and goat milk powders.

FINDINGS

Goat milk is white in color and has a stronger flavor than sheep milk. Goats' milk has smaller fat globules compared to cow milk, which provides a smoother texture. The flavor of goat's milk is more intense in comparison to cow's milk, which can restrict the acceptance of its derivatives by consumers. To overcome the smell of goat milk by treating goat milk with papaya in different ratios of milk and papaya powder at different temperatures. There was a significant improvement in taste and overall acceptability of goat milk containing papaya when compared to regular goat milk (control). Also, goat milk containing papaya presented a better smell than regular goat milk

The study investigated the solubility and flavor stability of papaya powder in goat milk across various temperature and ratio combinations. Using processed papaya powder, different ratios of goat milk powder to papaya powder (0:10, 1:9, 2:8, 3:7, and 4:6) were dissolved in water at room temperature, 60°C, 80°C, and 100°C. The results indicated that the addition of papaya powder significantly altered the color of the mixture, transitioning from white to bright orange. Among the tested ratios, the 4:6 ratio demonstrated the best solubility and flavor profile, dissolving quickly and effectively masking the strong taste of goat milk.

Taste tests conducted with participants revealed a clear preference for the 4:6 ratio, with 8 out of 10 testers describing it as delicious and noting the absence of goat flavor. This indicates that the combination of goat milk

and papaya powder at this specific ratio creates a harmonious blend that is both palatable and appealing. Overall, the findings suggest that the 4:6 ratio is the most successful combination for enhancing the flavor and solubility of goat milk with papaya powder, making it a suitable option for consumers seeking a pleasant taste experience.



Figure 1. Mixture of Papaya and Goat Milk Ratio for S1, S2, S3, S4, S5

The FTIR (Fourier Transform Infrared) spectrum analysis between papaya powder and goat milk provides valuable insights into the similarities and differences in their molecular compositions. Table 2 shows the comparison for Papaya powder, goat milk and mixture of both samples, it's exhibited absorption bands that suggest the presence of key functional groups such as O-H and C-O. These functional groups are commonly associated with alcohols, phenols, and esters, which contribute to the molecular structure and properties of organic substances.

Table 2 Assigned Infrared band of Papaya powder, Goat Milk Powder and Mixture Powder

Sample	Functional Group	Bond	Wavenumber (cm ⁻¹)
Papaya powder	alcohols	O-H	3303.97
	alkanes	C-H	-
	carbonyl	C=O	-
	amines	N-H	-
	alcohol	C-O	1000.57
Goat Milk Powder	alcohols	O-H	3290.26
	alkanes	C-H	2922.82
	carbonyl	C=O	1743.32
	amines	N-H	1635.79
	alcohol	C-O	1026.59
Mixture Powder	alcohols	O-H	3290.36
	alkanes	C-H	2921.77
	carbonyl	C=O	1742.87
	amines	N-H	1636.21
	alcohol	C-O	1023.06

The presence of an O-H stretch in both the papaya powder (3303.97 cm⁻¹) and goat milk (3290.26 cm⁻¹) suggests a hydroxyl group, indicative of the involvement of hydrogen bonding, possibly due to water content or other hydroxyl-containing compounds such as sugars or organic acids. The similar C-O functional group observed in both samples also points to common ester or alcohol linkages, further aligning their structural characteristics.

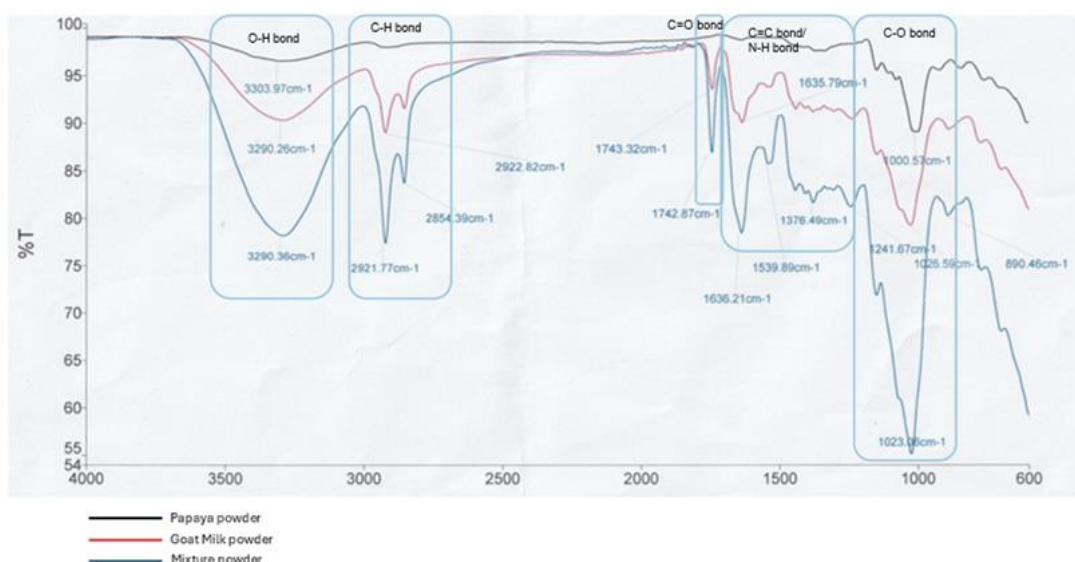


Figure 2. IR Spectra for Papaya powder, Goat Milk Powder and Mixture Powder

In Figure 2, goat milk shows additional absorption bands at 2922.82 cm^{-1} , 1743.32 cm^{-1} , 1635.79 cm^{-1} , and 1026.59 cm^{-1} , which correspond to functional groups not present in the papaya powder spectrum. These bands suggest the presence of C-H, C=O, and N-H bonds, likely related to fatty acids, proteins, and other bioactive compounds specific to animal-based products. The C=O stretch at 1743.32 cm^{-1} , for example, is characteristic of ester or carbonyl groups, commonly found in lipids and proteins. The diversity of functional groups in goat milk highlights its more complex biochemical composition compared to papaya powder, reflecting the presence of various macromolecules such as fats, proteins, and amino acids that are absent or minimal in the plant-based papaya powder. This comparison provides a deeper understanding of the distinct chemical properties of these two ingredients, which may be relevant in their functional or nutritional applications.

CONCLUSIONS

In conclusion, goat milk, known for its white color, smoother texture, and stronger flavor, can often face consumer resistance due to its intense taste and smell. The addition of papaya powder, however, has proven to be an effective strategy in improving both the flavor and aroma of goat milk. The study showed that treating goat milk with various ratios of papaya powder at different temperatures significantly enhanced its taste and overall acceptability. Among the tested combinations, the 4:6 ratio of goat milk to papaya powder at higher temperatures, particularly around 80°C and 100°C , provided the best results in terms of solubility and flavor masking. The combination of goat milk with papaya powder at this optimal ratio not only improved the color of the mixture, giving it an appealing orange hue, but also effectively masked the characteristic strong flavor of goat milk. Taste tests demonstrated a clear preference for this blend, with most participants finding the 4:6 mixture both delicious and free of the typical goat milk flavor. These findings highlight the potential for papaya powder to enhance the sensory qualities of goat milk, making it a more widely accepted and enjoyable product for consumers. This blend could open new opportunities for goat milk products in the market, offering a flavorful and healthier alternative. The objective to formulate Papaya flavored goat milk is successful with reducing the goaty taste and smell inside the milk with the ratio 6:4. FTIR had been used to show new formulate papaya goat milk powder shoe similar peak with the pure papaya powder and goat milk powder The spectra revealed that goat milk and papaya powder shared similar functional groups, including Alcohols (O-H), Alkanes (C-H), Carbonyl (C=O), Amines (N-H), and Alcohols (C-O).

COMPLIANCE OF ETHICAL STANDARDS

The study was approved by the Ethics Committee of Universiti Teknologi MARA and all participants provided written informed consent prior to enrolment in the study.

ACKNOWLEDGEMENT

The authors sincerely thank the experts in the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch Tapah Campus for commitment and contribution and Suffy Dairy Group Sdn Bhd for funding this study.

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Surat kami : 700-KPK (PRP.UP.1/20/1)

Tarikh : 20 Januari 2023

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Sekian, terima kasih.

“BERKHIDMAT UNTUK NEGARA”

Saya yang menjalankan amanah,

Setuju.

27.1.2023

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