

Sensory Characteristics of Thong Pha Phum GI Rambutan to Approach the Future Product Based on the Perceptions and Experiences of Various Consumer Groups

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Abstract

This study aims to investigate the conceptualizations of product development for Thong Pha Phum GI rambutan based on the perceptions and experiences of various consumer groups —culinary chefs (n=20), producers (n=20), academics (n=20), and general public (n=20), and to explore the emotional responses and wellness perceptions related to the future Thong Pha Phum GI rambutan product. The interview questions were designed to focus on the material's pain points, solutions, and overall concept as well as the emotional responses and wellness perceptions. According to the findings, four consumer groups can be distinguished, each with unique concepts to address their needs and produce novel products and uses of Thong Pha Phum GI rambutan. The generation of ideas is influenced by experience. The academic experts and producers discussed the production of the new products using high technology and innovation while the general public and the group of chefs focused on the ready-to-eat products. Exploring the emotional responses and wellness perceptions through corresponding analysis revealed that most people (from 4 different groups) appreciated and interpreted the Thong Pha Phum GI rambutan product as *healthy, relaxing, energetic, satisfying*, evoking *happy* and *joyful* emotional responses. This research offered consumer insights related to Thong Pha Phum GI rambutan material and unique products, which could be valuable for positioning and marketing of regional foods. It can also guide producers in the food industry.

Keywords: Thong Pha Phum GI rambutan, Idea product development, Experience, Perception of consumer

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Introduction

In today's world, significant changes have occurred through each era, driven by globalization. Human beings have evolved in countless ways to facilitate life, whether it is transportation, technology, innovation, or even important aspects of human life such as food production and consumption. When the world changes with the times, people's food choices also change. As the behavior in choosing food changes, manufacturers need to innovate and produce food that meets the needs of consumers. In food production, producers must fully understand the needs of the consumers.. (Guiné et al., 2020; Held et al., 1999)

Rambutan is a nutritious and tasty fruit that is beneficial to health. Many people enjoy it in various forms including fresh, frozen, canned, or processed into smoothies, and dishes like rambutan curry. (Jaki Mamat & Abdul Aziz, 2018). Interestingly, rambutan powder (Sunshine International Co., Ltd, 2020) which is a product manufacturing concept using the BCG Model. This economic model focuses on using biological resources to create added value by developing high-value products connected to the Circular economy. Rambutan powder products utilizes rambutan seeds to produce powder that can demonstrate the optimum use of materials. It is also one of the products aimed at reducing waste or achieving zero waste. (Cheok et al., 2016) In addition, rambutan

is also an important export product of Thailand, both in fresh and processed fruit form. It is mainly exported to Malaysia, China, and in other markets like the United States, Singapore, Taiwan, Australia, and the United Arab Emirates. In terms of economic value from exports, rambutan is a commodity that has about 8.5 times more processing value than the fresh fruit. (Salakpetch, 2005). In 2022, Thailand exported 21,599 tons of fresh rambutan, valued at 435 million baht to export markets including Vietnam (48%), Malaysia (38%), and Myanmar (7%). Processed rambutan exports were valued at 417.53 million baht. In 2023, Thailand exported 15,422 tons of rambutan, valued at 824 million baht. The export market was primarily Vietnam (approximately 72%), with 10-15% sold domestically in Thailand.

Based on marketing trends, fresh rambutan has emerged as the product type with the largest market share in 2022. (*Latest Business Trends & Insights, 2023*) In Thailand, approximately 3% of rambutan produced is exported to other countries, while the majority is consumed domestically. Thailand is also the world's leading producer and exporter of canned rambutan, along with other products such as rambutan juice, rambutan tea, and dried rambutan.

The *Department of Industrial Promotion* (2021) found that good product quality is essential for both producers and consumers. However, the perception of quality differs, as consumer demand often diverges from the goals of the manufacturers. Differences in producers' experiences also lead to varying demands and perspectives on the production of goods and services. Rambutan can be processed or distilled into new products beyond fresh fruit and beverages. Nevertheless, the global fruit juice beverage market is experiencing promising growth trends, driven by a rising consumer focus on health. This has led manufacturers to enhance the taste and incorporate beneficial ingredients such as vitamins, minerals, and collagen. It is predicted that the fruit juice beverage market will grow from approximately 141 billion US dollars in 2021 to 182 billion US dollars over the next five to six years (2022 to 2027), representing an average growth rate of 4.3%. This growth presents a significant opportunity for entrepreneurs in the fruit juice beverage industry. Additionally, rambutan seeds can be processed to develop a cocoa-like flavor compound through fermentation and roasting. This process significantly reduces rambutan seed waste, addressing a notable issue in the canning industry. (Febrianto et al., 2016) Another useful part of rambutan is its leaves, which contain moisturizing components and antioxidants. These extracts can be developed into various related products. (Afzaal et al., 2023) The most important part is the rambutan pulp, this can be used to produce rambutan fruit juice. This popular product is favored by consumers for its refreshing qualities. To enhance the texture, the product should include rambutan pulp in the fruit juice. Customer feedback overwhelmingly indicates a preference for this addition. (Sukasih & Setyadjit, 2015)

The Kanchanaburi Provincial Agriculture Office reports that Thong Pha Phum GI Rambutan is a renowned fruit from Kanchanaburi, officially recognized as a type of rambutan that qualifies as a geographically indicated (GI) intellectual property. GI is a label that certifies the specific geographical origin and quality of community products. It can be uniquely sourced and of high quality, affirming that Thong Pha Phum GI rambutan cannot be obtained from any other source. (Rujopakarn, 2018) Thong Pha Phum GI rambutan can generate significant income for local farmers. It has outstanding characteristics: the fruit is round, finely pubescent, with thin skin, small seeds, thick flesh, and is sweet, crunchy, and not juicy (Thonyim & Rojanatip, 2019). Its uniqueness stems from the fact that it is exclusively grown in Thong Pha Phum District, Kanchanaburi Province, Thailand. In terms of taste, Thong Pha Phum GI rambutan stands out from other varieties. While most people prefer rambutan with red skin for its sweetness, these often have bruised, overripe, or rotten flesh that diminishes the taste and appeal.

The general market indicates that options for consuming Thong Pha Phum GI rambutan are limited due to its seasonal nature. Thus, further processing or other innovation methods are used to prolong shelf-life of agricultural fruit products. Additionally, using innovative fruit processing technology allows the fruit to meet consumer requirements and extend its usability. Processing brings benefits in terms of shape, time, and taste. It provides consumers with diverse options, adds value to the product, stabilizes produce prices, and addresses surplus agricultural output demand during the season. (Mok et al., 2020)

Subsequently, research is being conducted to improve rambutan production through innovative methods to ensure the high-quality production of rambutan is beneficial. Processing or developing Thong Pha Phum GI

rambutan adds value to the product and help meet the needs of more consumers and increasing its market share in Thailand and the international market.

Objectives

This research aims to 1) investigate the consumer conceptualizations of product development for Thong Pha Phum GI rambutan based on the perceptions and experiences of various consumer groups and 2) explore the emotional responses and wellness perceptions related to the future Thong Pha Phum GI rambutan product.

Conceptual Framework



Figure 1 Conceptual Framework

Research Methodology

Sample

Thong Pha Phum GI rambutan (Substandard) was sent from Kanchanaburi province, Thailand and kept in a refrigerator at 0 to 4°C. until it was tested at the KKUIC laboratory of Khon Kaen University in Khon Kaen, Thailand (Figure 2).



Figure 2 Thong Pha Phum GI rambutan

Ethical Approval

The research procedure and questionnaires received ethical approval No. HE653266 from Khon Kaen University Ethics Committee for Human Research (KKUEC), Thailand.

Participants

To test consumer conceptualization for consistency and differences, the convenient sampling method was used; four different consumer groups were chosen based on their varying experiences and backgrounds related to fruits, fruit products, or operating a processed fruit business. The number of testers, totaling 20 individuals, was adjusted in accordance with the method of Wongthahan et al. (2020) for gathering qualitative data through targeted consumer interviews. Qualitative studies necessitate a minimum sample size of at least 12 participants to achieve data saturation ((Vasileiou et al., 2018). The first group – the academic experts (n=20) were from colleges, universities, other higher education institutions, and government officers in Thailand. The second group are the culinary chefs (n=20) who use materials in specific food industrial operations from Thailand (n=17) and abroad (n=3). Third are the producers (n=20) who are in the food and beverage business in Khon Kaen, Chaiyaphum, Bangkok, and Phetchabun province. Lastly, the general consumer (n=20) who prefer to buy fruits or fruit products. Since in-depth interviews will be performed to address the problems and explore the consumer need, the age range and product consumption experience of the informants are crucial for finding trends in the development of Thong Pha Phum GI rambutan products. All participants have familiarity with the rambutan fruit, and their products for more than five years. The age range was between 21 and 60 years old, covering the age range in each group studied, and people over 60 years old are considered to be a vulnerable group and may not provide accurate information.

Screening Concept Vocabulary

In this phase, the sensory team (n=10) was asked to evaluate the sample using sensory evaluation techniques to generate the descriptive vocabulary and explain the characteristics of Thong Pha Phum GI rambutan. According to the previous literature on sensory lexicon of food products adapted from Wongthahan et al. (2020), these attribute words from the sensory team were created independently. With a consensus from all panelists, any attributes generated by at least 30% of the group (or three panelists) were selected to represent the characteristics of Thong Pha Phum GI rambutan in the next step.

Data collection

There were two methods utilized for the data collection: face-to-face interview and online meeting interview. This research was conducted in Khon Kaen University International College, Thailand functioning as its central test location, where each group of participants was invited to be interviewed. Descriptive analysis and product design thinking were applied to evaluate specific sensory characteristics of Thong Pha Phum GI rambutan and to explain why consumers choose to purchase particular products. The perceptions, experiences, emotions, occupations, and social status can be of relative importance on consumer consumption, as seen in Figure 1. (Lewrick et al., 2020)

Upon arrival at the testing site, the test participants were given a broad overview of Thong Pha Phum rambutan tasting session and the scoring process. Following that, the participants were invited to individually complete the rambutan idea concept testing. Before starting the testing session, the participants were provided with general information about Thong Pha Phum rambutan including its outside shape, inside shape, texture, and taste based on finding from the screening process. This was necessary as the research was conducted off-season, preventing the use of real rambutan. Next, all participants were asked five question sets followed by Table 1.

Emotion and Wellness Perceptions Related to Thong Pha Phum GI Rambutan

From the EsSense Profile and WellSense Profile™ assessments, emotional and wellness-related phrases were chosen. A skilled group of linguists (n = 3) translated all the words into Thai, and another skilled group (n = 3) translated them back into English to confirm their meanings. (Hanmontree et al., 2022) All testers were asked to select the terms of emotion and wellness that were related to the product.

Table 1 Interview questions

Topics	Interview questions
1. Pain point	According to the characteristics of Thong Pha Phum GI rambutan, what pain points did you identify in producing/consuming new products?
2. Solution/ Innovation/Technology	Do you have any solutions, innovations or technologies to produce the new products?
3. Emotion and wellness perceptions	What emotion or wellness perceptions do you expect from Thong Pha Phum GI rambutan product?
4. Idea or future products	What new product from Thong Pha Phum GI rambutan are you looking for?
5. Marketing solution	In your opinion, how will the product you designed be marketed?

Emotion and Wellness Perceptions for Relevance to Thong Pha Phum GI rambutan

From the EsSense Profile and WellSense Profile™ assessments, emotional and wellness-related phrases were chosen. A skilled group of linguists (n = 3) translated all words into Thai, and another skilled group (n = 3) translated them back into English to confirm their meanings. (Hanmontree et al., 2022) All tester was asked to select the terms of emotion and wellness that were related to the product that their idea products.

Data Analysis

The lexicon of the Thong Pha Phum GI rambutan generated by the sensory team was quantified and presented as percentages. Qualitative data from the interview process (7 categories of pain point, PP1-7, 9 product groups G1-9, and emotion and wellness terms) were used to conduct correspondence analysis (CA). The analysis was performed using Statistical Package for the Social Sciences program (SPSS) 28.0 for Windows (SPSS, Inc., Chicago, IL, USA) to find correlations between the question set and the four participant groups. The CA is a multivariate statistical technique used with qualitative data. It provides a way to display or summarize a data set in a two-dimensional graphic.

Results

Characteristic screening of Thong Pha Phum GI rambutan

The sensory team (n=10) generated characteristics of Thong Pha Phum GI rambutan which are shown on Table 2. The researchers selected descriptive terms by the frequency of each word (more than 30%). All these descriptive terms were used to question all groups of consumers. Each group was asked about the concept to develop one or more products from Thong Pha Phum GI rambutan with the researcher explaining about the characteristic of Thong Pha Phum rambutan as outlined in Table 2.

Table 2 Preliminary list of the descriptive terms generated by the sensory team for Thong Pha Phum GI rambutan and their usage frequency.

Appearance	Percentages %	Flavor	Percentages %	Taste and Texture	Percentages %
30% above					
Firmness	80%	Less flavor	60%	Crispiness	60%
Juiciness	60%	Sweet flavor	50%	Sweet and sour	60%
Oval shape	50%			Less juiciness	40%

Transparent	50%			Less sweet	40%
Smooth (Outside)	50%				
30% below					
Circle Shape	20%	Coconut flavor	20%	Sour	20%
Small size	20%	Tasteless flavor	20%	Delicious	20%
Freshness	20%	Rambutan flavor	20%		

**Note the characteristics of Thong Pha Phum GI rambutan were counted based on the frequency of each word appearing more than 30%.

2. The Concept of Thong Pha Phum GI Rambutan

In line with the aim of the study—to investigate consumer conceptualizations of product development for Thong Pha Phum GI rambutan based on the perceptions and experiences of various customer groups—the question set was applied in interviews with all consumer groups. The results are explained as follows.

Pain Point Responses

Based on the responses from all groups of consumers including four different groups—chefs, producers, academic experts, and general consumers—correspondence analysis was used to explain the relationship between groups of consumer and pain points as shown in Figure 3. This relationship was described in two dimensions, which explained 96.2% of the data set: Dimension 1 accounted for 83.7% and Dimension 2 accounted for 12.5%. The interview results showed that each group had different pain point based on their experiences and behaviors.

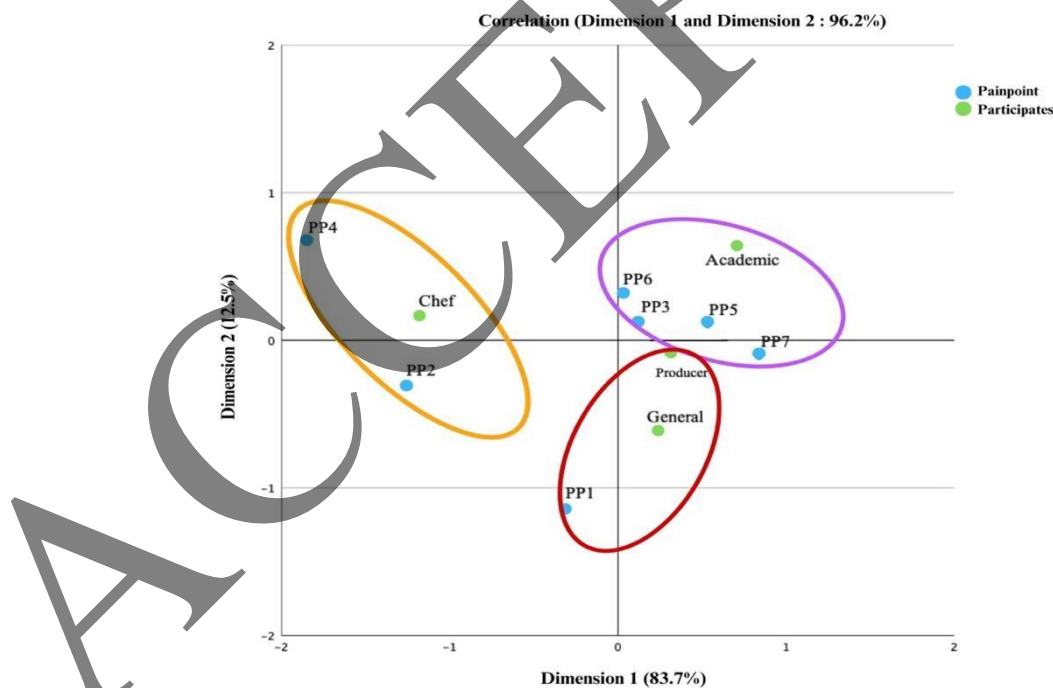


Figure 3. Correspondence analysis showed the relationship between each group of consumers and pain point issues. (PP1 = Not prefer the appearance, PP2 = Not well-known, PP3 = Short shelf life, PP4 = Low value, PP5 = Limitation of material, PP6 = Based on season and PP7 = Location)

The main pain point of chefs is that it is "not well-known" (PP2) which means that they are not familiar with the texture of this type of Thong Pha Phum GI rambutan. In addition, they thought that Thong Pha Phum GI rambutan is off "low value" (PP4). Additionally, general people and the producer group can be distinguished from other groups by the fact that their pain point was "not prefer appearance" (PP1), which was attributed to the

rambutan's unappealing exterior appearance. Furthermore, the results from the interviewed academic expert group has pain points in their respective dimensions. This group has concerns regarding Thong Pha Phum GI rambutan in terms of “short shelf life” (PP3), “material limitation” (PP5), “based on season” (PP6), and “location” (PP7)

Product Concept of Thong Pha Phum GI rambutan

The pain point responses can lead to solutions involving the following product concept ideas .. Figure 4 shows the summary results from different consumer groups regarding product concepts. It can be concluded that dimensions 1 and 2 were 87.3% with dimension 1 at 55.5% and dimension 2 at 31.8% from the grand total. It was found that a clear distinction of idea products in each group were based on their behaviors and experiences. Academic experts suggested using innovation and technology in product development and manufacturing to extend shelf life. For example, developing rambutan flour as a substitute for wheat flour or as a topping. Additionally, they proposed producing beverages using high-pressure processing (HPP). Interestingly, the same group also suggested snack innovations like freeze-dried rambutan.

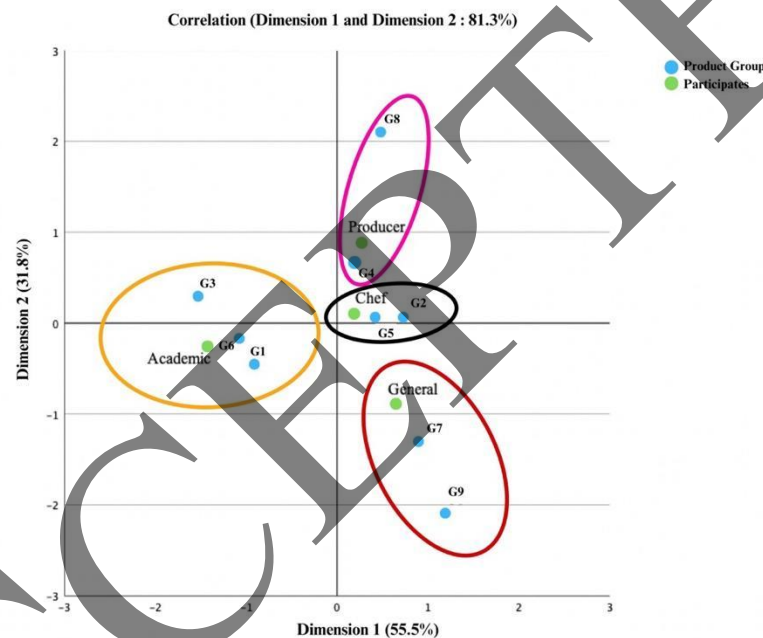


Figure 4 Correspondence analysis shows the relationship between each group of consumers product concept (G1 = Innovative snack, G2 = Application in snack, G3 = Innovative ingredients, G4 = Application in ingredients, G5 = Ready to eat, G6 = Innovative beverages, G7 = Application in beverages, G8 = feed and G9 = Fresh fruit)

Culinary chefs suggested developing ready-to-eat products and snacks while the producer group generated the idea to produce products available for purchase in the market. Therefore, they focused on solving pain points by developing applications like rambutan topping and rambutan jam. Most of the products that producers group generated can be used for adding on other food products or for business purposes. Additionally, two producers had the idea to process rambutan peel as animal feed. The products conceptualized by the general public group are application in normal beverages and be served as fresh fruit.

Emotion and Wellness Perceptions

The last aim of this study was to explore the emotional responses and wellness perceptions of the future Thong Pha Phum GI rambutan product. The results were explained as follows:

The correspondence analysis as the statistical technique was used to explain the relationship between consumer groups and their emotional and wellness responses. This analysis explained 86.2% of this data set, divided into two dimensions; Dimension 1 explained 54.5% and Dimension 2 explained 31.7% (The Figure was not shown). The results showed that the academic expert group and the general public were associated with the same emotion terms (*Energetic* (E2), *Active* (E11), *Happy* (E9) *Adventurous* (E12)) and wellness perceptions (*Stimulated* (W11) *Invigorated* (W5), *Energetic* (W7), *Comforted* (W8), *Relaxed* (W10), and *Joyful* (W13).

On the other hand, the producer group was more concerned about the wellness perception that can be *refreshed* (W6), make consumer feel more *active* (W3), *alert* (W4) and *secure* (W1)). and emotional response terms (*eager* (E1), *pleasant* (E3), and *joyful* (E8)). Producers are concerned more about emotion and wellness terms that can encourage customers. Culinary chefs also focused on creating *healthy*, (W2) products that *stimulate* (W11) appetite and makes customer feel *happy* (W9) and *satisfied* (E5), as seen in Figure 5.

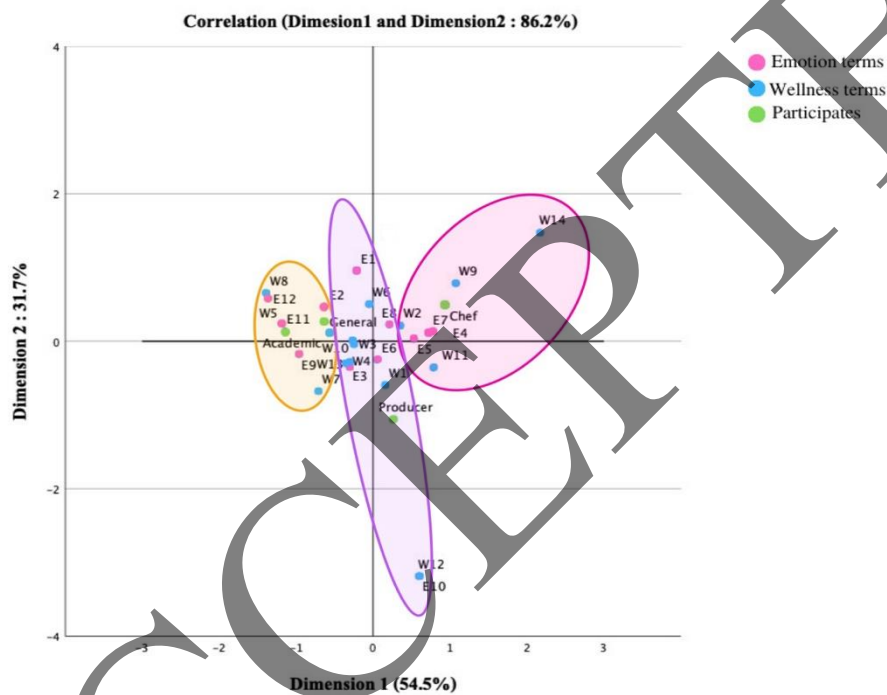


Figure 5: Correspondence analysis show the relationship between each group of consumer and emotion and wellness perceptions (W1 = *Secure*, W2 = *Healthy*, W3 = *Active*, W4 = *Alert*, W5 = *Invigorated*, W6 = *Refreshed*, W7 = *Energetic*, W8 = *Comforted*, W9 = *Happy*, W10 = *Relaxed*, W11 = *Stimulated*, W12 = *Satisfied*, W13 = *Joyful*, W14 = *Stressed*, E1 = *Eager*, E2 = *Energetic*, E3 = *Pleasant*, E4 = *Interested*, E5 = *Satisfied*, E6 = *Guilty*, E7 = *Worried*, E8 = *Joyful*, E9 = *Happy*, E10 = *Glad*, E11 = *Active*, and E12 = *Adventurous*).

Discussion

1. The Concept of Thong Pha Phum GI Rambutan

Pain Point Responses

Participants in each group presented different problems or pain points, depending on their experience and understanding of the raw material, namely Thong Pha Phum GI rambutan from Kanchanaburi Province. The chef was not familiar with the textures and types of Thong Pha Phum GI rambutan, and they thought that it had low value. Thus, they did not choose this ingredient for one of the elements in the dishes. It was possible that

they have never used the ingredient before. While the general public and the producer group focused on the physical aspect of the material considered appearance as a pain point. Other pain points of Thong Pha Phum GI rambutan were "short shelf life", "material limitation", "based on season", and "location" because Thong Pha Phum GI rambutan is a seasonal fruit and is grown only in the Kanchanaburi province, which can affect long-distance shipping distribution in the market all year round thus not being able to produce products for customers who want to use it as raw material for their production.

In marketing, transportation is one of the key factors in creating a competitive advantage (Guenzi & Troilo, 2006; Troilo et al., 2009). This explains marketability as one of the key components of entrepreneurs in building a business's competitive advantage. In addition, as Shamsuddoha & Yunus Ali (2006) described that the production capability, product design and packaging, product pricing capability, and distribution channel capability and freight are the factors that influence success in running a business. Thus, with the constraints of Thong Pha Phum GI rambutan it can cause delays in shipping and distribution that can cause manufacturers to lose market opportunities.

Product Concept of Thong Pha Phum GI rambutan

Based on their behaviors and experiences, each group can be discussed as follows. Academic experts focused on using innovation and technology in products. High-pressure processing (HPP), a non-thermal process, was highlighted for its ability to extend shelf life while having minimal effects on taste, texture, appearance, or nutritional values. However, HPP can inhibit or kill microorganisms that can cause diseases or spoil food. This process can be applied to several types of foods and beverages, including fruit, and vegetable juices (EFSA Panel on Biological Hazards (BIOHAZ Panel) et al., 2022). The Food and Drug Administration (FDA) of Thailand has now started to recognize HPP as an alternative to pasteurization. The products utilizing HPP include rambutan juice and rambutan jelly. In addition, the same group suggested producing freeze dried rambutan. because of Freeze-drying is the process that dries frozen food using sublimation of ice under vacuum. This method is very popular for fruits such as durian, mango, jackfruit, and banana, as well as vegetables, grains, nuts, seeds, and legumes. It maintains the aroma, taste, and nutritional value like that of fresh and crisp fruit. This quality makes the freeze-dried fruit so popular as a healthy snack. (Bhatta et al., 2020; K. Chen et al., 2021) The culinary chefs, producers, and general public considered it easy to buy and produce. The products that do not require complicated recipes or complicated processes are the rambutan juice, peeled rambutan, and fresh rambutan.

2. Emotion and Wellness Perceptions

The results show that the participants selected emotion and wellness perceptions based on their knowledge and consumption experiences and their awareness of the important benefits of the main raw material (Hanmontree et al., 2022). It is known that each group's characteristics affect the emotional profile of foods. Factors like personal preferences, prior experiences, consumption frequency, and cultural norms all play a significant role in shaping these perceptions. (Jiang et al., 2014)

For the marketing solution interviews with the four consumer groups, Business-to-Consumer (B2C) and Business-to-Business (B2B) models were used to categorize them. Each consumer focused on a particular model depending on the product idea aim at achieving the objectives. B2C involves a business selling products and providing services directly to customers. It was referenced by three groups, including the academics, chefs, and regular consumers. A form of business transaction (B2B), such as one involving a wholesaler and retailer or a manufacturer and wholesaler, was used by the producer (Bilro et al., 2023; L. Chen et al., 2021), which refers to the transactions that take place between corporations rather than between a company and a specific client. The manufacturer believed that selling products to retailers could generate greater profits than selling products directly to customers and utilizing connections to boost product opportunities. In conclusion, the opinions of four consumer groups about the use of the B2C and B2B marketing models revealed that while producers preferred to use the B2B model for marketing solutions, academics, chefs, and general consumers preferred the B2C model.

Conclusion

This research offered consumer concepts related to Thong Pha Phum GI rambutan ingredient and its unique products that could be helpful for the positioning and marketing regional foods and it can also be used as a guide for producers in the food industry. Each group's perceptions and experiences may have an impact on how new products are developed. It emerges from the Thong Pha Phum GI rambutan case study that consumers in the academic group consider the use of science, technology, and innovation in product development to be essential. The use of Thong Pha Phum GI rambutan as food remains expected by other consumer groups, including manufacturers, chefs, and general consumers. Additionally, not all consumers care about the distinctive texture of Thong Pha Phum GI rambutan; rather, they concentrate on the flavor and benefits of the product as expressed by their emotions as well as the wellness perception.

Recommendation

Although popular raw materials are available, the specific characteristics of these materials and guidelines for product development remain undetermined. This study explores consumer insights pertaining to the Thong Pha Phum GI rambutan material, identifying potential unique products that could enhance regional food positioning and marketing strategies. Additionally, it offers valuable guidance for manufacturers in the food industry.

For future research, products with potential, created by testers in each group, will be selected and developed into product prototypes. These prototypes will be used to inquire about consumer preferences and satisfaction. Physicochemical analysis and sensory testing will be studied to produce good quality products that meet the needs of consumers.

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