

## Consumer acceptance and new business development of processed frog products in Chiang Mai province

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### Abstract

This research aimed to examine the consumer acceptance of four processed frog products, freshly skinned frog, herb-fermented frog, fried herb-fermented frog, and grilled herb-fermented frog. Data from a hundred random samples of consumers in Chiang Mai Province were collected through a direct questionnaire survey and analysed using descriptive and inferential statistics. Results of the study showed that most of the consumers were females, aged 41–50 years, bachelor's degree holders, and had a monthly income of 10,001-15,000 Thai baht. The 9-point hedonic scale was used to test the colour, odour, appearance, texture, and price or value for acceptance. Grilled herb-fermented frog had scores of  $8.44\pm 0.67$ ,  $8.45\pm 0.67$ ,  $8.06\pm 1.52$ ,  $8.45\pm 0.67$  and  $8.45\pm 0.67$  in colour preference, odour, texture characteristics, price or value, and overall acceptance, respectively. The ranking test showed that most consumers (85.50%) preferred grilled herb-fermented frog as the leading priority ( $3.86\pm 0.35$ , out of 4). Frog flesh is considered a healthy food because it is a low-calorie diet. Thus, the forms of food preparation and an increased market opportunity must be further explored.

## 1. Introduction

Frogs are one of the best alternative protein sources given their high protein content. It has also low-fat content and high digestibility and is a great source of vitamins A and B. They significantly contribute to the gastronomy of several cultures where frog legs are served as a delicacy. The edible frog flesh (frog legs) contains 83% protein, 5.8% fat, dry weight, and two important types of amino acids, namely, lysine and methionine (Dani *et al.*, 1966). Every 100 g of raw frog legs contains 16.40 g of protein, 0.076 g of saturated fatty acids, 18 mg of calcium, 50 mg of cholesterol, 285 mg of potassium, 1.50 mg of iron, and 50 IU of vitamin A (Wongtom, 2016). Frog culture is an important economic activity in Asian countries, with high demand in foreign markets. Farmed frogs in Thailand were worth up to 222.38 million baht in 2019 (Fisheries Statistics of Thailand, 2021). Frog legs have been used in French and Chinese cuisine for years. Thailand has exported frogs to Hong Kong with an export value of 141.67 million baht and to many other countries, such as Japan, Malaysia, Singapore, Germany, France, and the United States (Naksingh, 2003). Frog farming requires low capital investment and few spaces. It is also suitable for areas with dry climates as less water is needed during its culture. Therefore, frog farming is a potential enterprise

for farmers.

Frog culture in cages and small ponds could be a challenging and promising small business in the rural community. Marketing, value-added product development, and consumer acceptance must be considered to make profit viability. Sensory evaluation explains the acceptability of aquatic products based on organoleptic characteristics, such as physical appearance, consistency of the flesh, odour, texture, eye, gill, and colour (Mia *et al.*, 2021). Currently, easy Internet access connects everyone to everything worldwide, thus generating high tension in the business competition. New and improved products need to be continuously created. If a business stops inventing, developing, and improving products, its business sustainability will be affected in the long run (Pothong *et al.*, 2010). In addition to consuming freshly skinned frogs, a novel product, either ready-to-cook or ready-to-eat items, must be created to draw customers' attention. For example, the development of a chilli paste product made from frogs was to transform frog products' unappealing appearance for certain customers to create appetizing products. This frog chilli paste is a value-added product that can solve overproduction during the rainy season and could be a great choice for additional income for women in the local community.

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Therefore, this research aimed to determine the adoption behaviours and factors affecting consumer choice of purchasing processed frog products in Chiang Mai Province. Additionally, this study aimed to guide the creation of new businesses for processed frog products based on consumer behaviour, acceptance, and preference, which are vital keys to success in the development of processed frog products. Study results may aid entrepreneurs in developing frog farming, leading to a great expansion of the processed frog product market in Chiang Mai Province.

## 2. Materials and methods

### 2.1 Consumer acceptance test

A hundred Thai consumers who had eaten and had not eaten frogs were randomly selected from local farmer's markets, including Doi Saket Market GIS 18.873136, 99.137283, San Sai Luang Fresh Market GIS 18.874620, 99.051374, Aui Tha Market San Kamphaeng GIS 18.766202, 99.078674, and markets in Maejo University areas GIS 18.898094, 99.008036.

### 2.2 Research instrument

Data from respondents who bought processed frog products were collected using questionnaires. The questionnaire was divided into four parts: (1) demographic characteristics of the respondents, (2) data on consumer behaviour toward processed frog products, (3) sensory evaluation test, and (4) ranking preference test. For part 3, the 9-point hedonic scale was used to test the sensory quality in terms of colour, odour, texture, value for money, and market acceptance of four processed frog products: freshly skinned frog, herb-fermented frog, fried herb-fermented frog, and grilled herb-fermented frog. A scale of 1–9 was used (1 = extremely dislike, 5 = neutral, and 9 = extremely like). In part 4, after tasting all four processed frog products, the respondents sorted their preferences by setting a preference score for each product: Scores of 4, 3, 2, and 1 were assigned to their favourite (which they may purchase in the future), extremely liked, slightly liked, and least liked product, respectively.

### 2.3 Preparation of processed frog

In this study, four products were prepared, freshly skinned frog, herb-fermented frog, fried herb-fermented frog, and grilled herb-fermented frog. Frogs, about 3–4 months old, weighing 200–250 g were selected. They were skinned, cleaned, and processed using a specific method following animal welfare standards. Then, the processed frogs were packed in vacuum bags for storage in the freezer at  $-20^{\circ}\text{C}$ . Frog flesh was marinated in herbal ingredients to enhance its mellowness. Herb-

marinated frogs were deep-fried in hot oil, and others were grilled over low heat until cooked through. A vacuum sealer is used to seal off the products. The freshly skinned frog is packed in easy-open bags and can be cooked in various ways, such as curry frog, fried frog with garlic, and spicy stir-fried frog with red curry paste. The cooked products can be easily reheated in microwave ovens.

### 2.4 Data analysis

Data analysis, validation, and reliability of the questionnaire were conducted using SPSS 11.5 software package. The data were analyzed using descriptive statistics, and frequency, percentage, and standard deviation were presented for categorical data. In addition, hypothesis testing was performed to determine the difference between means. The t-test and F-test of the sample had statistical significance levels of 0.01 and 0.05, respectively, meeting the specified research framework.

## 3. Results

### 3.1 Demographic result

Responses to the questionnaires showed that 55.00% of the 100 respondents are female, aged 41–50 years, bachelor's degree holders, and have an average monthly income of 10,001–15,000 baht. Approximately 83% of the consumers had previously consumed processed frog products by purchasing them from fresh markets and cooking them at home. They often spend approximately 101–150 baht to buy the processed frog for consumption 2–3 times per week. Regarding purchase decisions, 67.5% of the consumers decided to buy processed frog products, and nearly 50.60% of them believed that they contained various nutritional values, such as high protein and low-fat contents. In contrast, 54.0% of the respondents did not choose to consume frogs mainly because of their horrible image and thus refused to eat.

### 3.2 Sensory evaluation: 9-point hedonic scale

Table 1 presents the sensory evaluation test results (9-point hedonic scale) of the acceptance and overall preferences of processed frog products. The mean preference scores of processed frog product features, including colour, smell, appearance, texture, cost-effectiveness, and overall acceptance, were within similar levels ranging from  $6.22 \pm 1.65$  to  $8.45 \pm 0.67$  (Table 2). These scores were classified as slight to highly favourable acceptance, where the consumer acceptance and preference test scores of 6 or higher indicate that consumers had recognized the products (Sukrod, 2012).

Table 1. Frequency distribution of sociodemographic characteristics (n = 100)

Characteristics	Factors	Percentage (%)
Gender	Male	45
	Female	55
Age	20 - 30 years old	20
	31 - 40 years old	22
	41 - 50 years old	41
	51 years old and above	17
Marital status	Single	56
	Married	44
Employment status	Private sector	17
	Government sector	36
	Freelance	40
	Self-employed/ Own business	7
Academic Qualification	Primary School / Elementary School	19
	High School Certificate / Vocational Certificate	11
	Diploma/High Vocational Certificate	31
	Bachelor's degrees	39
Income per month	< THB 10,000	30
	THB 10,001 – THB 15,000	57
	THB 15,001 – THB 20,000	13

Table 2. Consumer preference for the 4 processed frog products (n = 100)

Processed products from frog flesh	Attributes				
	Colour	Odour	Texture	The value of the price	Overall Acceptance
Fresh frog with skin peeling off	6.82±1.69 <sup>c</sup>	6.70±1.78 <sup>c</sup>	6.22±1.65 <sup>c</sup>	6.26±1.40 <sup>b</sup>	6.94±1.57 <sup>b</sup>
Frog fermented with herbs	7.21±1.03 <sup>bc</sup>	7.16±1.20 <sup>bc</sup>	6.37±1.47 <sup>bc</sup>	6.37±0.56 <sup>b</sup>	7.19±0.76 <sup>b</sup>
Fried frog fermented with herbs	7.30±1.04 <sup>b</sup>	7.23±1.41 <sup>b</sup>	6.87±0.88 <sup>b</sup>	6.51±0.56 <sup>b</sup>	7.30±0.67 <sup>b</sup>
Grilled frog fermented with herbs	8.44±0.67 <sup>a</sup>	8.45±0.67 <sup>a</sup>	8.06±1.52 <sup>a</sup>	8.45±0.67 <sup>a</sup>	8.45±0.67 <sup>a</sup>

Values are expressed as means±standard deviation. Values with the same superscript within the same column are not significantly different ( $p>0.05$ )

Table 3. Preference score and variations of acceptance and purchase decision of the four types of processed frog products (n = 83)

Processed products from frog flesh	Average preference score ( $\bar{x} \pm S.D$ )	Interpretation of acceptance results	Ranking of Preference Test
Fresh frog with skin peeling off	2.73±0.61	More liked	2
Frog fermented with herbs	1.20±0.41	The least liked	4
Fried frog fermented with herbs	2.16±0.79	Less liked	3
Grilled frog fermented with herbs	3.86±0.35	The most liked	1

### 3.3 Ranking preference test

The preference test ranking measured by mean preference score showed that the majority of respondents ranked the grilled herb-fermented frog first (3.86±0.35), translated as “most liked.” Then, fresh-skinned frog, fried herb-fermented frog, and herb-fermented frog ranked second, third, and fourth, with mean preference scores of 2.73±0.61 (“extremely liked”), 2.16±0.79 “slightly liked”), and 1.20±0.41 (“least liked”), respectively (Table 3).

### 3.4 Research hypothesis

Age, gender, education level, and income may affect

the acceptance and overall consumer preference of grilled herb-fermented frogs.

Table 4. Relationship between characteristics factors and consumer preferences for processed products grilled frog fermented with herbs (n = 83)

Relationship between characteristics factors and consumer preferences for processed products grilled frog fermented with herbs	Pearson	P-value
Gender	6.200	0.013*
Age	11.530	0.009**
Academic Qualification	13.320	0.004**
Employment status	10.635	0.014*
Income per month	2.506	0.286

\* and \*\* indicate 5% and 1% significance level, respectively.

#### 4. Discussion

This study investigated the consumer acceptance of four processed frog products. Product acceptance analysis is a method used to allow consumers to justify their product acceptance. Although the method is measurable, it may not be suitable for scientific application because the product acceptance data are based on human sensory processes (Anprung, 2004). Schiffman and Kanuk (2000) reported that cultural factors are the combined effects of learning between beliefs, values, and customs that could control the consumer behaviour of any member of society. Culture is crucial to consumer purchasing behaviour. Marketers must consider cultural dynamics and apply the nature of those changes in formulating a marketing plan to meet the overall consumer acceptance and liking of the products.

For example, fish consumption in Iran was inversely related to consumers' age, where youth and children preferred fish and fishery products more than elderly people (Shilat, 2008). Wiriyajaree (2002) reported that the acceptance test has been used to determine testers' satisfaction based on their feelings. Gender, age, education, and occupation are associated with fish product preference. Supphakitchanon *et al.* (2014) developed value-added products made from hybrid catfish, including emulsified sausage (Western style) and sai aua (Northern Thai spicy sausage), and found that most consumers were satisfied with the colour, odour, taste, and texture of the sausages. The emulsified sausage scored at the fourth level (good), whereas sai aua scored at the third level (medium). Moreover, different fish species may have different muscle textures that subsequently impact the quality and taste of processed fish products. Boonsoon *et al.* (2015) applied the sensory evaluation test using the 9-point hedonic scale to compare the quality of pounded fish products between short- and long-fibre fish fillets. They found that if both fish were cooked properly, sensory preferences would not significantly differ. Fish chips are one of the most popular products made from fish with bones, skin, and fats removed and then mixed with seasoning, followed by drying under the sun or using a hot air oven to grill, fry, or bake for easy consumption. Aedtem *et al.* (2018) investigated the suitable ratio of minced gold stripe Sardinella to minced yellowtail round scad and the drying conditions, nutrition, product acceptance from consumers, and shelf life of fish chips. They found that fish chips with a sardine-to-mackerel ratio of 80:20 received the highest overall sensory evaluation score of  $7.43 \pm 1.01$ . This finding implies that various ingredients and their ratio affect consumer preference.

In this study, the effects of different demographic

characteristics, including gender, age, education level, occupation, and average monthly income, on consumer preference were investigated. Findings showed that consumer preferences for processed herb-fermented frog products varied by gender, age, education level, and occupation (Table 4). Chuensamran and Kit-Karun (2013) and Trakulaksan and Khamdet (2013) reported a positive relationship between factors influencing consumer choice of frozen quick meals offered in convenience stores around Bangkok and consumer demographics. Both showed that gender, age, education level, and occupation were related to the consumer buying behaviour of different types of frozen ready-to-eat food products. In addition, compared with young consumers, older consumers had paid more money for each purchase of ready-to-eat frozen foods possibly due to higher income.

The savoury and unique flavour combinations of the frog food products chiefly contribute to their success with consumer acceptance. The incorporation of herb ingredients into frog flesh can increase their nutritional values and enhance their flavour. This study showed that grilled herb-fermented frogs were the most preferred. Therefore, in addition to spices, cooked food may captivate customer demand for a new normal lifestyle. However, the frog remains an unpleasant dish for certain people. Thus, its process can improve consumer purchase decisions. Like frogs, the preparation of other foods seems to trigger more dislike when insects are visible than when they are invisible, such as in cultures without entomophagy traditions (Megido *et al.* 2014, 2016). Negative tastes or unpleasantly visible experiences negatively influence the success of offering insects as food (Tan *et al.*, 2017). This finding is consistent with an earlier study claiming that people who are unfamiliar with eating insects, such as Western consumers, are more likely to eat processed rather than unprocessed insects, whereas people from cultures that are accustomed to eating insects exhibited no greater or less willingness (Hartmann *et al.*, 2015). Sobal *et al.* (2006) illustrated that the factors affecting food purchase were related to the person's way of living (environment and personal thoughts), influencing elements (mood-related products and family members), and personal food arrangement (convenience of buying and preparing food, price, and health-related factors). Grilled herb-fermented frog is a ready-to-eat product that is made convenient for consumption. An appropriate selling price consistent with the product quality and safety is preferable to the consumers. Proper preservation and handwashing practices should be encouraged among vendors and handlers to emphasize the benefits of safe practices that promote health (Mia *et al.*, 2021), especially during the COVID-19 pandemic.

## 5. Conclusion

The success of new processed food depends on consumers' acceptance and purchase. According to the survey conducted in Chiang Mai Province, the major reason for frog consumption was its source of omega-3 fatty acids, protein, potassium, vitamins and low-fat content. However, some consumers do not eat frog due to its unpleasant appearance. Nevertheless, the various ready-to-cook processed frogs may overcome the antipathy factors. The different personal factors significantly affected on purchasing behaviours of processed frogs. The grilled frog fermented with herbs was the most preferred selection since it might be compatible with a modern lifestyle with time limitations. The product should be advertised on various media platforms that can easily be accessed and should encourage consumers to feel the need to buy products.

## Conflict of interest

The authors declare no conflict of interest.

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