

# Overripe Tempe Stock Prototype Development and Evaluation of Consumer Acceptance for Commercialization Preparation

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## ABSTRACT

Indonesia is experiencing a growth of sales in health and wellness packaged foods with more consumers aiming to adopt a healthy and balanced diet. Overripe tempe is traditionally used in Central Java as condiment, however it is not well known in other areas of Indonesia. Overripe tempe stock is a food product developed based on its practicality, flavor, and health benefit. In-depth-interview involving business, government, and user representative is used to evaluate the prototype readiness and required development. In accordance with the interview result, development of formula, brand, packaging label, and promotional material for commercialization preparation were conducted. The prototype was then evaluated for its acceptance to 126 women in Tangerang (Banten Province, Indonesia) using a home-use test. Questionnaires with the variable of sensory characters, packaging, and consumer characters are used to evaluate the defining factors that affect the consumer acceptance. More than 50% of respondents give “like” or “like very much” in response to the prototype. All variables affect the consumer acceptance, however the consumer character plays the most significant impact to the acceptance, especially knowledge about the overripe tempe usage in traditional culinary. The study shows promising potency of overripe tempe stock for further development toward commercialization.

**Keywords:** Consumer acceptance, Commercialization, Prototype, Overripe tempe, Tempe stock

## 1. INTRODUCTION

In Southeast Asia, including Indonesia, consumers are looking to adopt a healthy and balanced diet. Indonesia healthy food retail sales grew from US\$ 4.3 million in 2010 to US\$ 8.1 million in 2015 [1], while Forbes in 2021 forecast the food trend toward a healthier choice, especially amidst the pandemic covid-19 situation. Consumer study [2] pointed out that three out of four (75%) consumers in Indonesia, especially middle-income and high-income urban consumer, aim to have a healthier diet, placing a higher priority on convenience and on health and wellness products, in order to be able to enjoy a long and prosperous life free from illness. Euromonitor

International [3] also pointed out that the middle to upper-income groups are willing to pay a higher price for healthier products, while Tusso [4] directed plant based food diets as the potential consideration in healthy lifestyle trends among consumers.

In previous research, plant-based stocks have been developed from overripe tempe with the key value of natural and nutritious ingredients that enhance the umami taste [5-8]. Further prototype development is required according to consumer need and expectation as a plant-based healthy food product, to gain opportunity for commercialization [9].

## 2. MATERIALS AND METHOD

### 2.1. In-Depth Interview

In this study, an in-depth interview was done to three experts representing government, industry, and users from different fields to provide a wide range of answers that will provide various perceptions about what a product needs for consumer acceptance besides the sample itself [10]. The experts interviewed were the CEO from a national spice company, a chef that has concern in providing healthy and Indonesian authentic menu, and also a former head of communication and public relation division in one of the national agencies of drug and food control in Indonesia. The product samples were presented to the experts and questions were given about the product readiness for the commercialization, internal factors to be considered in the prototype development, and external factors to be considered in the commercialization.

### 2.2. Prototype Development

The products were developed according to the previous study [5] with slight modifications. Based on the in depth interview, oil was removed from the formula, while caramel syrup was replaced with a combination of white sugar and brown sugar with ratio 0:1, 1:1, 3:1, and 1:3. Sensory evaluation with discrimination test were conducted to evaluate whether oil removal give significant difference while sensory evaluation with acceptance test were conducted to select the best white sugar and brown sugar combination ration. The sensory evaluation is conducted employing 50 untrained panelists.

### 2.3. Consumer acceptance study

According to the result of an in-depth interview, a prototype was developed for formula adjustment, packaging, label, branding, and promotional material. The developed prototype was then tested for its sensory acceptance using panelist meeting below

criteria: women, live/work in Tangerang city (Indonesia), have interest in cooking their own food, and have interest in healthy food or healthy lifestyle. Further questions related to the packaging and respondents' characters were also collected to analyze whether factors that are not related to the prototype sensory characters also affect the acceptance. Design of the questionnaires questions and evaluation are as shown in Figure 1.

Prior to the market evaluation, pre-test using 30 participants were conducted to show the test validity and reliability. The questionnaire's validity as a reliable instrument was confirmed with the alpha value, or Alpha Cronbach ( $\alpha$ ) > 0.6 [11].

After passing the validity and reliability test, the questionnaires were passed to min 120 respondents that meet the requirement. The data was evaluated statistically using SPSS Statistical software for normality test with the p value limit of 0.05 [12]. Non-parametric correlation test was also applied in the case of data not being normally distributed ( $p < 0.05$ ). The correlation coefficient  $r$  was interpreted as the following: Correlation coefficient  $\pm .10 - .30$  indicated a weak linear relationship; correlation coefficient  $.30 - .50$  showed a moderate linear relationship; and correlation coefficient  $> .50$  characterized as a strong linear relationship [13]. Simple linear regression linear test was also used to examine the relationship between sensory, packaging, and people (independent variable) toward consumer acceptance (dependent variable). Null hypothesis is accepted if the significant coefficient is greater or equal. The linear regression model of this research is as shown in Equation (1).

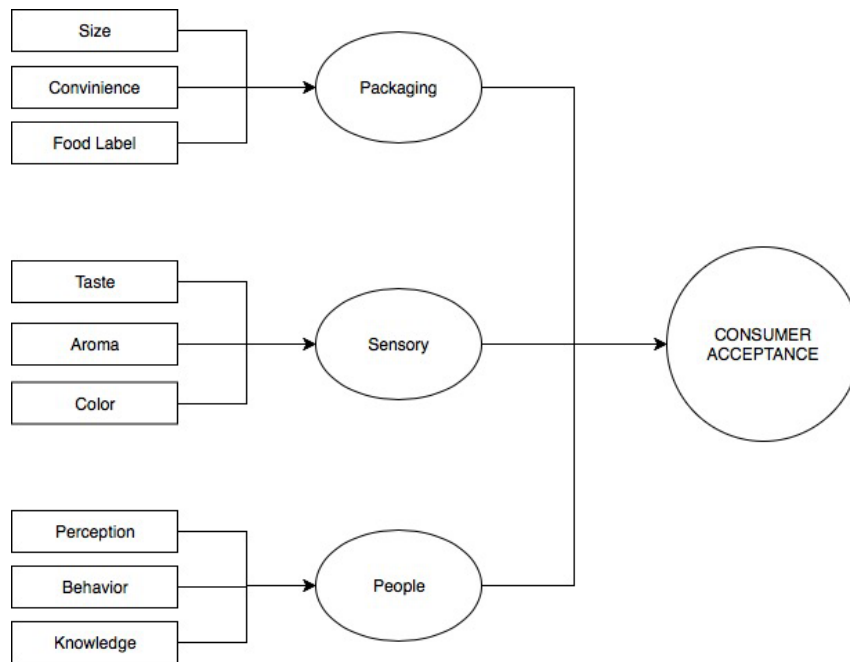
$$Y = a + bX \quad (1)$$

Y : Consumer Acceptance (Dependent Variable)

a : Constant

b : Regression Coefficient

X : Sensory / Packaging / People (Independent Variables)



**Figure 1** Questionnaire design and evaluation for the overripe tempe stock prototype’ consumer acceptance and its influencing factors

### 3. RESULTS AND DISCUSSION

#### 3.1. In-Depth Interview

Three experts that represent Indonesian spice company (Mr. A), culinary industry (Mr. B), and The National Agency for Drug and Food Control (BPOM) (Mrs. C) were presented with the initial prototype and interviewed using structured questionnaires. The prototype presented were stock paste that were diluted into liquid soup and presented in an unlabeled plastic cup. All of the experts agreed that the sensory characters of the presented samples meet the requirement for commercialization. However, several adjustments were suggested to develop the prototype (Table 1).

In consideration of holding time from production to the consumption, Mr. A suggested formula development to increase shelf life of the product while simplifying the production. Mr. A also pointed out the importance of branding and packaging to complement the product and win the initial customers. Packaging of a food product can be an added value for product commercialization [14]. Expectation in branding may often be combined with product appearance because it is uncommon to present the product without providing any visual stimulus either in the form of food appearance, packaging, or picture [15].

Mr. B suggested the point of view of users that are unfamiliar with the products. Since the stock can be directly diluted with water but also can be used as spices in various dishes, it will be better to provide instruction of usage and some recipe examples to win the initial customers. Consumer acceptance, especially on food products can be affected by many factors, including the sensory character of the food but also how the food is consumed [16]. as well as expectation and perception [17]. While the instant stock can be used for spices, the major usage will be for soup. The initial prototype is using dried overripe tempe and therefore the solid residue upon dilution is relatively high compared to the animal-based stock or stock made from plant/mushroom extract.

While both other respondents have more concern in adjustment that correlates to production and marketing factors, Mrs. C is providing the point of view of product compliance upon commercialization. Indonesia requires all food products in retail packaging, such as those of the overripe tempe stock, to obtain a distribution authorization before entering the retail market [18]. Public Health Office is authorized to issue distribution permit for food produced by the Home Industries, by issuing P-IRT (Produk-Industri Rumah Tangga) number [19], while BPOM issue a registration approval number for a larger business and products that meet the necessary requirements for distribution by

issuing a ML (Makanan Luar) number for imported products and a MD (Makanan Dalam) number for domestically produced products [18].

**Table 1** Key points suggestion from the experts' in-depth-interview for prototype development.

Experts	Adjustment correlation to		
	Production	Marketing	Regulation
A	Ingredient replacement to preserve odor and increase shelf life	Branding is required. Packaging design and label is required	
B	Development toward more clear soup is preferable. The initial prototype has many solid residue.	Usage instruction and simple recipe example will promote usage	-
C	Production location and facilities must consider the targeted type of distribution permit	Statement "free of..." shall not be used. Claims cannot be used for P-IRT type of permit	Ingredient list is important in the label. Information of the products must be completed in the packaging label. For P-IRT nutrition fact is not necessary.

The typical permit that will be targeted affects the production, e.g. MD permit will require the production facility to be located in the business area, and marketing factors, e.g. P-IRT permit do not give authority for producers to put any claim in the product label and promotional materials. Mrs. C pointed out that the current prototype is categorized as food with medium risk category as the past form will require a certain processing to extend the shelf life and therefore not suitable to be registered as P-IRT that was only meant for low and very low risk food product category. Mrs. C also pointed out that the label in food packaging should also comply with the type of permit.

### 3.2. Prototype Development

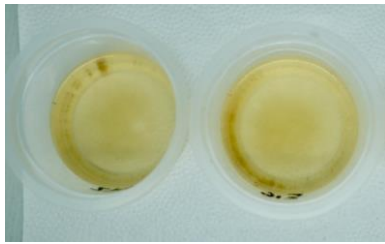
According to the consideration factors concluded in previous steps. Several adjustments were made on the product as well as the product attributes including packaging, branding, and promotional materials (Table 2). Two liquid ingredients used in the initial formula were oil and caramel syrup. The oil removal from the

formula did not provide a visually significant difference in the diluted stock (Figure 2).

**Table 2** Prototype product and product attributes development for commercialization preparation.

Component	Development	Target
Formula	Removal or replacement of liquid ingredients	Process practicality Extension of shelf life of ingredients and finished goods. Classification as low risk food product
Packaging	Selection of packaging materials using fiber pouch primary packaging and aluminium pouch for secondary packaging	Facilitate use of the stock to make clear soup. Improve usage practicality. Extension of shelf life of the finished good.
Packaging	Label design that provides information about the product name, ingredients, producer, weight, production date and code, as well as distribution permit number	Compliance to the regulation on Food by Indonesian Government (Act No 18 Year 2012) Improvement of consumer understanding and interest on the product
Brand	Logo and name that easy to remember and pronounce represent the product and company value	Building trust and track
Leaflet and Website	Provision of further information about the product information, benefit, company activities, suggestion for usage (including recipe)	Improvement of consumer understanding and interest on the product Promotional material

Confirmation of overall sensory difference with triangle test with (significance 0.05) using 32 trained panelists also showed that oil removal did not cause detectable difference in the overall sensory characters (Table 3). This is shown by only 15 panelists giving correct responses while a minimum of 16 out of 32 correct responses were required to conclude that two samples have significant difference in its overall sensory characteristic [20].



**Figure 2** Overripe tempe stock with oil (left) and without oil (right)

**Table 3** Responses in the overall sensory difference and preference tests of samples in the removal and replacement of liquid ingredient on the overripe tempe instant stock prototype development

Type of Evaluation	Samples with	Type of response	Number of response
Overall sensory difference (Method: Triangle Test)	Oil No Oil	Correct	15
		Incorrect	17
		Total Response	32
		Minimum correct response to be significant at p 0.05*	16 out of 32
Type of Evaluation	Overripe tempe stock samples with	Mean Rank**	
Overall sensory preference (Method: Ranking Test)	Caramel Syrup	3.67 ± 1.49	
	Brown Sugar	2.97 ± 1.51	
	Brown Sugar : White Sugar = 1:1	3.07 ± 1.31	
	Brown Sugar : White Sugar = 3:1	2.27 ± 1.22	
	Brown Sugar : White Sugar = 1:3	3.03 ± 1.24	

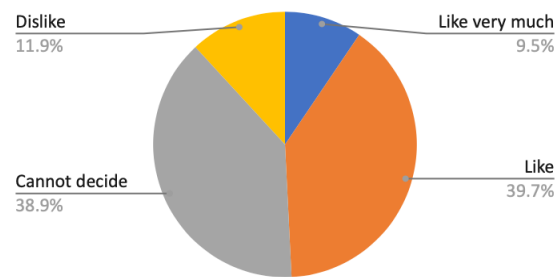
\*(Meilgaard et al., 2016)

\*\* Lowest number in the mean rank indicates higher preference. All means are significantly different at p < 0.05

Brown and white sugar in four ratio variations were tested in the formula as replacement of caramel syrup used in the initial prototype. Application of solid sugar to replace liquid caramel syrup was aimed to improve processing practicality and shelf life of the finished product. Interestingly, it was also found to increase the preference significantly (p 0.0184). Brown and white sugar in the ratio of 3 to 1 is selected to replace caramel syrup in the formula, as it resulted in the most preferred overripe tempe stock (Table 3). Brown sugar is known for its caramel-like aroma and sweetness [21] while white sugar is known for its high relative sweetness.

The combination of both solid sugars contributes to the caramel-like sweetness taste and aroma without masking the other ingredients taste and aroma.

Almost 50% of the respondents like or like the prototype very much (Figure 3). For a product and brand that are not yet known and available in the market, the acceptance level of the prototype is considered promising. The sensory acceptance was strongly correlated with sensory acceptance, packaging and people factors. The strong sensory character correlation was in conjunction with previous study stating that food acceptance must involve the sensory stimulus [22]. Hein and Ivens [23] mentioned that visual stimulus is important in the product presentation and therefore may correlate to how strong the packaging impacts the acceptance. The strong impact of respondent characters was in conjunction with the previous study mentioning that consumer acceptance was highly correlated with their lifestyle, perception, and knowledge [24].



**Figure 3** Acceptance of the adjusted prototype of overripe tempe instant stock

The R2 from linear regression test showed that people category were the most influencing factors, followed by packaging and then sensory character, as it explained 75.5% of the variance in the sensory acceptance, while the other two categories only explained 52.5% and 42.8% of the variance (Table 4). The linear regression test also resulted in the equation on the correlation of consumer acceptance with the three factors. The equation refers that for every one-point (1.0) increase in sensory, packaging, and people, the consumer acceptance will increase by 1.617, 2.262, and 1.499, consecutively (Table 4).

**Table 4** Linear regression analysis in the impact of sensory, packaging and people to overall sensory acceptance

Factors	R square	Beta	Equation*
Sensory (S)	0.428	0.654	CA = 50.902 + 1.617 S
Packaging (P)	0.525	0.724	CA = 28.394 + 2.262 P
People (Pe)	0.755	0.869	CA = 36.071 + 1.499 Pe

\*CA = Consumer Acceptance

#### 4. CONCLUSION

According to the experts input, the overripe tempe instant stock formula and product attributes were developed. The consumer acceptance test showed a promising rate of the prototype acceptability as a new product in a new brand. Sensory character, packaging, and respondents characters all play important roles in affecting the prototype acceptance. As people's categories play the most important impact on consumer acceptance it is important to characterize the type of the respondents as the consumer representatives.

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