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Value added product development for oyster farmers' group in Kung Krabaen Bay Royal Development Study Center, Chanthaburi

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Abstract

This research aimed to survey consumer preference for oyster product development, developed new recipes as well as promoted oyster farmers' group in Kung Krabaen Bay Royal Development Study Center. The study asked 500 general consumers around Kung Krabaen Bay and tourists who had visited the area for feedback about oyster product. The majority of respondents preferred to Khaokriab, Numprikphao, and Todmonkrob products in 24.10, 23.40 and 18.57 frequency percentage, respectively. Three most prominent product ideas were developed in different product recipes, and tasted by 150 consumers in the study area. Each product recipe revealed that most respondents preferred Khaokriab, Numprikphao, and Todmonkrob with 10% oyster in each formula at 7.41, 6.90 and 7.43 average hedonic scale point (1-9), respectively. These confirmed a formula of each product recipe by 100 consumers in the study area. The acceptance hedonic scale point of three products: Khaokriab, Numprikphao, and Todmonkrob were 7.34, 6.70 and 6.31 average hedonic scale point (1-9), respectively. The three product prototypes were promoted to oyster farmers' group through a training process by the researcher. The training was continued until the group could reprocess products with the same quality as those made for trial. The group was preferred overall this development process at 4.61 (out of 5) average score point. Finally, the researcher assisted the farmer to apply FDA serial number for Khaokriab product until they had received the serial number.

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1. Introduction

Oyster is the common name for a number of different families of salt-water bivalve molluscs that live in marine or brackish habitats. In some species the valves are highly calcified, and many are somewhat irregular in shapes. Many, but not all, oysters are in the superfamily Ostreoidea. Oysters are effective filter feeders and can have large effects on the water columns in which they occur.[7] As filter feeders, oysters remove plankton and organic particles from the water column.[3] Some kinds of oysters are commonly consumed by humans, cooked or raw, and are regarded as a delicacy. Some kinds of pearl oysters are harvested for the pearl produced within the mantle. Windowpane oysters are harvested for their translucent shells, which are used to make various kinds of decorative objects. Oysters favor estuaries and embayments with low salinities and are intolerant of prolonged exposure to fresh water or marine conditions. They are found in shallow water of tidal to subtidal depth of fairly constant turbidity and salinity, but are able to withstand a wide range of temperatures. Oysters usually colonize in beds. Competition for space is an important source of mortality. Uncrowded, oysters can live to be 20 years old.[2]

However, many reports show that oysters are excellent source of zinc, iron, calcium, and selenium, as well as vitamin A and vitamin B_{12}. Oysters are low in food energy; one dozen raw oysters contains 110 kilocalories (460 kJ).[6] They are rich in protein (approximately 9 g in 100 g of Pacific oysters).[1] Traditionally, oysters are considered to be an aphrodisiac, partially because they resemble female sex organs.[10] A team of American and Italian researchers has analyzed bivalves and found they were rich in amino acids that trigger increased levels of sex hormones.[8] Their high zinc content aids the production of testosterone.[5]

The production of cultured oysters in Thailand has been approximately 2000 tons annually since 1986. Cultivation of

Crassostrea belcheri and *Saccostrea commercialis*

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were using wild seed has suffered from limitation of supply. These are mainly due to heavy exploitation of natural oyster and destruction of its habitats. Therefore, large-scale propagation of hatchery-produced seed was developed. Subsequently, the experimentation on C. *belcheri* has been carried out to support sustainable aquaculture of this species. [4]

200 members oyster farmers' group in Kung Krabaen Bay Royal Development Study Center were producing oyster in *Saccostrea commercialis* cultivar around 500 tons by natural cultivation in year 2010, and it was reduced to 100 tons since year 2015 because of the declination of visitors in tourism market. The raw oysters were sold to consumers, and faced problem in having no investment in their farm. Thus, an oyster farmers' group needed to find new opportunities to develop some good products to the market. The researcher should solve the problem of this group by using new product development method.[9][11] The type of products for development were selected by frequency percentage of consumer preferences to start making new oyster menu and recipe.

2. Material and Method

The studies were divided into 4 steps, (1) survey product ideas from consumers, (2) study composition in raw oyster, (3) develop the product and (4) promote development ideas to the oyster farmers' group in Kung Krabaen Bay area.

2.1. Consumer ideas survey

Oyster product is not widespread in the market because in past the people enjoy consuming raw oyster or cook oyster as main course menu. In order to find the suitable product from oyster, it is essential to learn what the market wants in which can lead to ideas to create new product to the market. Hence, this research started with market test with the survey on consumers' opinions in order to find product preference as well as other productions that are advantageous to the residents.

In this step, 500 local people and tourists in Kung Krabaen Bay area were collected. All of them needed to select the choice in a questionnaire regarding 1) personal detail 2) oyster product development ideas and 3) other personal opinions.

2.2. Chemical and physical composition in oyster

Composition analysis of raw oyster (*Saccostrea commercialis*) from Kung Krabean area focused on an element of moisture, fat, protein as well as ash employing AOAC method.

2.3. Oyster product development

This step can be made after the first step was completed, consumers' ideas were collected as frequency data. Then the product name was selected with the most duplicate data in order to develop prototype. The most popular three names were selected and designed recipes to develop in laboratory by making different formula, and tested step-by-step as shown below.

1. 3 types of oyster products were developed. Each product created by 5 different oyster levels with 5, 10, 15, 20 and 25% oyster in each recipe.

2. Sensory test was conducted in 9 point hedonic scale with 150 general consumers in Kung Krabaen area.

3. Selected the best sample from items with the highest average hedonic score.

4. Confirmed product recipe by reproducing the best sample version of each, and redid consumer test with 100 people in the same area.

5. Evaluated score of each recipe to confirm these product developments as fitted for market entry, suggestion average score is 6-9 points.

2.4. Promote oyster recipe to oyster farmers' group

Conducting a survey, after it could be confident that those focal formula can satisfy the market demand. The next step was to promote and to train oyster farmers'group; thus, they can provide with a standard quality. Lastly, the FDA serial number was applied.

3. Results

The results of this study comprised of 4 parts development process. The details of each part were shown as below.

3.1. Consumer detail and idea

According to a survey of 500 consumers, most respondents were 62.2% female, aged 15-25, followed by 26-35 years old. The majority had achieved a bachelor's degree (62.8%), followed by secondary school (19.4%).

The survey of consumer information related to oyster products, it was found that most consumer preferred to consume 3 products as followed: Khaokriab 24.10%, Numprikphao 23.4% and Todmonkrob 18.57%. The other inferential factors were product price, packaging and so on.

Table 1. Composition of raw oyster/100 g.

%**Moisture**	%**Fat**	%**Protein**	%**Ash**	%**Other**
73.22	19.08	6.49	1.21	0.08

Table 2. Average score of 3 oyster product samples.

%Oyster	Khoakriab	Numprik	Todmon
5	6.02[a]	6.35[a]	6.92[b]
10	7.41[c]	6.90[b]	7.43[c]
15	6.74[ab]	6.58[ab]	6.77[ab]
20	6.36[a]	6.21[a]	6.64[ab]
25	5.97[a]	6.59[ab]	6.39[a]

*Different letters in vertical means different significant ($p < 0.05$)

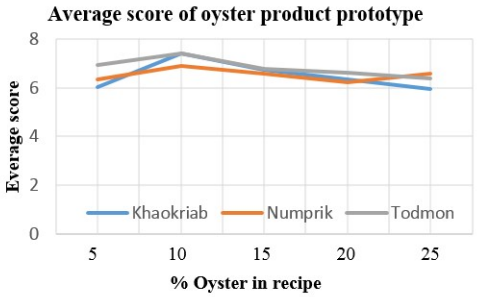

Figure 1: Trend of acceptance score with percentage of oyster in recipe.

3.2. Chemical and physical composition in oyster

The physical and chemical composition test of raw oyster (Saccostrea commercialis) revealed that moisture content was 73.22%, total fat was 19.00%, total protein was 6.49%, ash was 1.21% and other was 0.08% (Table 1)

3.3. Product development and prototype

1. Selected the best formula

The name of product from questionnaire was selected. Then, different level oyster ingredient were created at 5, 10, 15, 20 and 25% in recipe. The results of consumer test showed that Khaokriab, Numprikphao and Todmonkrob were the most preferred with 10% oyster in recipe at 7.41, 6.90 and 7.43 average score respectively (Table 2).

Trend of acceptance score showed that when oyster percentage was 5%, the score was low. When the recipe has more percentage oyster at 10%, the score was higher. When oyster percentage was higher than 10%, the score was lower (Fig. 1). The prototype products as Fig. 2.

2. Confirmation product prototype

After consumers' test in first step, the sample from most accepted score was reproduced with the same recipe again. The 3 prototype samples were re-tasted with respondents in the study area. For confirmation recipe 100 people tested different attributes of each prototype. Acceptance test was used for scoring points hedonic scale (9), in Central Location Test (CLT) method.

Figure 2: Oyster product prototype.

There were 54% female consumers and 46% were male consumers. The age of sample consumers ranged between 15 - 25 years old (57%) and 26-35 years old (28%). The majority of the consumers was under-graduated 61%, followed by diploma or under diploma 20%.

2.1) Khaokriab product confirmation

Khaokriab oyster product was taste for 4 attributes and overall acceptances. An average score from 100 people indicated that the appearance, smell, taste, texture and overall acceptance were 7.30, 6.76, 6.93, 6.27 and 6.70 score point, respectively (Table 3). The meanings of score were like, slightly-like, and very much

2.2) Numprikphao product confirmation

Numprikphao oyster product was tasted for 4 attributes and overall acceptance. An average score of 100 people unveiled that the appearance, smell, taste, texture and overall acceptance were 6.98, 6.97, 7.09, 6.93 and 7.34 score point, respectively (Table 3). The meanings of score were like, moderate-like, and very much.

2.3) Todmonkrob product confirmation

Todmonkrob oyster product was sensory 4 attributes and overall acceptance. An average score of 100 people revealed that the appearance, smell, taste, texture and overall acceptance were 7.58, 6.50, 6.00, 6.75 and 6.31 score point, respectively (Table 3). The meanings of score were like, slightly like, and very much.

3.4. Promote product prototype to oyster farmer group

After the development of all three oyster products, the results from the experiment were transferred to the oyster farmers' group. There were 15 participants, mostly aged between 45-55 years old, followed by 35-44 years old. Their educational levels were secondary and primary school. All participants had farming background, all of them were members of oyster farmers' group.

Activities included the training and demonstration. The average satisfaction was 4.61 points (from 5) or 92.20%, which means satisfaction was at the highest level. The participants who received knowledge and experience from the training satisfaction level was 4.87 points or 97.40%. The topic provided knowledge related to career satisfaction score was 4.87, or

Table 3. Average acceptance score.

Product sample	Average acceptance score				
	Appearance	**Smell**	**Taste**	**Texture**	**Overall**
Khaokriab	7.30	6.76	6.93	6.27	6.70
Numprikphao	6.98	6.97	7.09	6.93	7.34
Todmonkrob	7.58	6.50	6.00	6.75	6.31

97.40%. It was suggested by the participants that the training should be provided to villagers outside the project area in order to increase their options for processing oyster products. The facilitator will employ this suggestion to provide further trainings and academic services to the society at the next opportunity.

Moreover, researcher would help the group as a mentor to apply the good manufacturing practice standard (GMP), until passed the factory. Finally, a product Khaokriab received FDA approved with food serial number 22-2-00955-2-0001.

4. Conclusion

The results of the 3 oyster products development were shown as follows by the oyster content of product. All product would not contain more than 10% oyster in all ingredients, because consumers would not accept that. This may be due to the strong smell of oysters if the oyster mixed is too high. The color of the product is much darker, mixing of meat decreases welling. This study confirmed all three products have consistent results only with 10% oyster.

Assess the marketing potential to consumers by using the product teste results. It was found that consumers accept product prototype at like, slightly-like, and very much. This means that these three products can enter local market as well.

This research goals were to create new oyster product in order to add more choices for oyster farmers' group, to support the prices of fresh oysters as well as to create jobs and incomes for the community in the future.

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Thank you to the oyster farmers' group in Kung Krabaen Bay area who presented their problems in which inspired a researcher to develop research relevant to the needs of a community. Besides, the community can also use this research to develop their occupation and career streams of income.

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