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Development of Fish Strip from Hybrid Clarias Catfish Surimi Fortified with Konjac Flour

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ABSTRACT

The hybrid catfish surimi was prepared and used as raw material for fish strip. Fish strip was processed by mixing hybrid catfish surimi, flour, salt, sugar, soy sauce and pepper for 10 minutes before rolling into a thin sheet, cooked at 80°C for 50 minutes in a hot air oven, then baked in a microwave oven at a high power level for 35 seconds to expand and dry before cutting into a strip. To increase fibre of fish strip, 1% of konjac flour could be added with moisture content of the mixture adjusted to 70% and 0.1-0.2% sodium bicarbonate added. Dietary fibre of product from this process could be increased for 1.65 folds. The developed fish strip was more accepted in taste, texture and overall likeliness than the market product.

Key words: fish strip, hybrid Clarias catfish, surimi, fibre, konjac flour

INTRODUCTION

In Thailand, at the present time, snacks become more influence to people who live in rural areas especially children. Many kinds of snacks have been produced; however, most of those snacks are made of starch and sugar, therefore, their nutritive values are rather low. Fish can be added to increase the protein content of snacks, e.g., in fish strip that is one of the popular snacks with a market share of about 10% (Boonyasirikul, 1998). In general, fish strip is made from marine fish or surimi. Freshwater fish has not yet been used as raw material. Since hybrid Clarias catfish (*Clarias macrocephalus x C. gariepinus*) is the second highest species raised, the price is sometimes low tremendously. Therefore new value added product development may create market demand and a way to assist the farmers. Surimi is stabilized myofibrillar proteins obtained from mechanically deboned fish flesh that is washed with water and blended with cryoprotectants (Park and Morrissey, 2000). Washing process help to removes compounds such as sarcoplasmic protein, inorganic salts, low-molecular weight substances, lipids, and blood components (Mireles DeWitt and Morrissey, 2002). The objectives of this study are to investigate the feasibility of using hybrid catfish surimi as raw material for fish strip and increasing dietary fibre in the product by fortification with konjac flour.

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MATERIALS AND METHODS

1. Preparation of hybrid catfish surimi

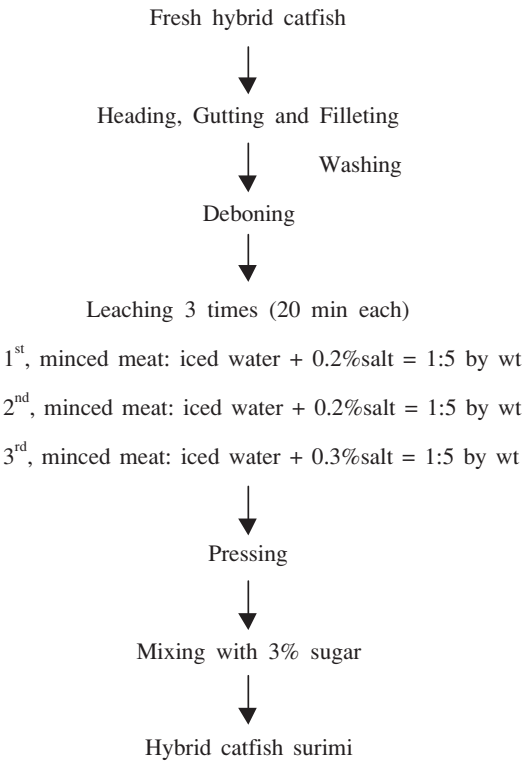

Figure 1 Preparation of hybrid catfish surimi. Source: Kongpun (1996)

2. Processing of fish strip

Ingredients for making fish strip comprised 74% hybrid catfish surimi, 10% corn starch, 2.5% wheat flour, 2.5% tapioca flour, 6% sugar, 2.5% soy sauce, 1.5% salt and 1% pepper.

Catfish meat was prepared into surimi according to Kongpun (1996). All ingredients were Kenwood mixed for 10 minutes and rolled on plastic film into a thin sheath of 1.0-1.5 mm thick. The fish sheath was dried in a hot air oven before cooking in a microwave oven at high level of energy for 35 seconds to reach 14-16% moisture content then cut into a strip of 2 mm width and 15 cm length.

3. Determination of appropriate drying temperature

An appropriate drying temperature was determined by varying drying temperatures at 60, 70, 80, 90, and 100°C for 50 minutes. The prepared fish sheath was dried in a hot air oven at the above temperature treatments before cooking in a microwave oven at high level energy for 35 seconds then cut into a strip of 2 mm width and 15 cm length.

Fish strip was sensory evaluated for appearance, color, flavor, taste, texture and overall acceptability by 15 panelists using hedonic scoring (1 - 9, 1 = dislike extremely, 9 = like extremely) to determine the appropriate drying temperature. The commercial sample with the ingredients of fish meat, tapioca flour, sugar, salt and soy sauce given full scores of 9 in all quality attributes was used to compare with the experimental samples. Experimental design was RCBD. Analysis of variance and DMRT were employed. TA-HD Texture Analyzer was used in measuring tensile strength (g) of the products. Linear expansion was calculated as:

$$\text{Expansion (fold)} = \frac{\text{Thickness of fish strip after cooking in microwave oven (mm)}}{\text{Thickness of fish strip before cooking in microwave oven (mm)}}$$

4. Fortification of konjac flour

Konjac flour of 0, 0.5, 1.0, 1.5 and 2.0% (w/w) of the total mixture were prepared by suspending small amount of water and added into the fish mixture. The moisture of the mixture was adjusted to 70% before thin sheath making as in 2. Sensory evaluation and physical properties were determined as in 3. Dietary fibre was analyzed according to AOAC (1995).

5. Effect of sodium bicarbonate addition

Sodium bicarbonate at 0, 0.1, 0.2 and 0.3 % (w/w) of fish mixture with 1% (result of 4) konjac flour was added and processed as in 2. Sensory evaluation and physical properties were

determined as in 3.

RESULTS AND DISCUSSION

Optimum conditions were considered from texture, linear expansion (fold), tensile strength (g) and acceptability. Sensory evaluation scores and physical characteristics of fish strip dried at different temperatures are shown in Table 1. It was found that drying temperature significantly affected physical properties of fish strip. Sample dried at 80°C got the highest sensory evaluation score for texture and linear expansion after cooking was also the highest but the tensile strength was the lowest among all treatments, although it was higher than that of the commercial sample.

Sensory evaluation scores and physical characteristics of fish strip fortified with different quantity of konjac flour are shown in Table 2. It was found that the linear expansion of fish strip decreased when concentration of konjac flour increased. It could be concluded that the maximum

Table 1 Sensory evaluation scores and physical characteristics of fish strip dried at different temperatures.

Attribute	Sensory evaluation scores at different drying temperature (°C)[1/]					
	60	70	80	90	100	Com. sample
Appearance	6.73±0.90b	6.83±0.84b	6.73±0.88b	7.00±0.91b	6.73±0.88b	9.00±0.00a
Color	6.73±1.03bc	6.53±0.83bcd	7.03±1.31b	6.47±0.99cd	6.03±0.85d	9.00±0.00a
Flavor	6.80±1.08b	7.13±0.74b	7.00±0.84b	7.00±0.92b	6.73±1.03b	9.00±0.00a
Taste	6.27±1.33c	6.20±1.32c	7.13±0.99b	7.15±0.99b	6.27±1.03c	9.00±0.00a
Texture	6.77±0.65c	6.73±0.96c	7.37±0.69b	6.93±0.59bc	6.57±0.49c	9.00±0.00a
Acceptability	7.27±0.67bc	7.07±0.70c	7.53±0.64b	7.30±0.59bc	7.27±0.64bc	9.00±0.00a
Expansion (fold)	1.28±0.11b	1.38±0.08a	1.33±0.10a	1.16±0.11c	1.03±0.14d	Not determined
Tensile strength (g)	332.3±42.7bc	325.5±36.8bc	312.2±23.2b	336.4±32.8bc	349.2±35.2c	276.8±11.3a

[1/] Values in the same row followed by different letters are significantly different (P≤0.05)

Table 2 Sensory evaluation scores and physical characteristics of fish strip fortified with different concentrations of konjac flour.

Attribute	Sensory evaluation scores of fish strip with different concentrations of konjac flour [1/]				
	0 (%)	0.5 (%)	1.0 (%)	1.5 (%)	2.0 (%)
Appearance	7.60±0.71a	7.40±0.54a	7.13±0.74ab	6.70±0.59b	5.93±0.80c
Color	7.23±0.90a	7.00±0.75a	7.43±0.90a	6.27±0.80b	6.03±0.85b
Flavor	7.47±0.83a	7.37±0.61ab	7.07±0.96abc	6.87±0.91bc	6.73±0.70c
Taste	7.60±0.74a	6.93±0.70a	7.10±0.85ab	6.60±0.51bc	6.10±0.95c
Texture	7.33±0.97a	7.20±0.80ab	7.10±0.54ab	6.53±1.35bc	5.93±1.10c
Acceptability	7.57±0.88a	7.23±0.56a	7.07±0.70a	6.37±0.67b	5.80±0.77c
Expansion (fold)	1.70±0.30a	1.62±0.09a	1.51±0.11ab	1.31±0.17c	0.87±0.13d
Tensile strength (g)	257.7±51.0a	269.4±32.7ab	282.9±26.9ab	301.2±46.1bc	334.8±34.2c

[1/] Values in the same row followed by different letters are significantly different (P≤0.05)

concentration of konjac flour used was 1.0 %. Increasing a concentration of konjac flour lowered sensory evaluation scores of the products. However, sensory evaluation scores of samples with 1 % konjac flour were not significantly different from the samples with 0 or 0.5 % konjac flour (P>0.05). Dietary fibre of the sample with 1 % konjac flour was 0.76% (AOAC, 1995) increased by 1.65 folds from sample with out konjac flour.

Sensory evaluation scores and physical characteristics of fish strip prepared with different concentrations of sodium bicarbonate compared with commercial sample are shown in Table 3. It was found that the higher the concentration of sodium bicarbonate used the increase in the expansion of fish strip was obtained. However, from the sensory evaluation scores on texture and overall acceptability, it was concluded that appropriate concentrations of sodium bicarbonate were 0.1 – 0.2 %.

Fish strip prepared at the most appropriate conditions of konjac flour and sodium bicarbonate was compared with commercial sample. The results were shown in Table 4. The sensory evaluation scores for all attributes except flavor of the prepared sample were higher than that of the commercial sample. The score for flavor of the prepared sample was lower, although not significant, due to the specific flavor of hybrid catfish. However, the scores for taste and overall acceptability were significantly higher (P≤0.05).

Table 3 Sensory evaluation scores and physical characteristics of fish strip prepared with different concentrations of sodium bicarbonate.

Attribute	Sensory evaluation scores of fish strip with different concentrations of $NaHCO_3$[1/]				
	0 (%)	0.1 (%)	0.2 (%)	0.3 (%)	Com. sample
Appearance	7.00±1.25cd	7.80±0.56b	7.37±0.48bc	6.57±0.59d	9.00±0.00a
Color	6.17±1.13d	7.20±0.56b	6.77±0.68bc	6.43±0.98cd	9.00±0.00a
Flavor	6.60±1.18b	7.20±0.62b	6.80±1.00b	6.67±1.11b	9.00±0.00a
Taste	6.87±0.91c	7.57±0.62b	7.27±0.53bc	7.00±1.19c	9.00±0.00a
Texture	6.27±1.28c	7.47±0.91b	7.00±0.38b	6.23±0.70c	9.00±0.00a
Acceptability	6.83±0.99b	7.37±0.58b	7.10±0.47b	6.20±1.58c	9.00±0.00a
Expansion (fold)	1.24±0.15c	1.58±0.11b	1.71±0.11b	2.08±0.57a	Not determined
Tensile strength (g)	324.1±28.9c	276.0±32.4b	277.7±42.0b	221.1±38.2a	271.0±19.4b

[1/] Values in the same row followed by different letters are significantly different (P≤0.05)

Table 4 Sensory evaluation scores of prepared fish strip and commercial sample.

Attribute	Appearance	Color	Flavor	Taste[1/]	Texture	Overall[1/] acceptability
Prepared sample	6.90±0.81	6.80±0.94	6.33±0.79	7.40±0.66a	7.10±0.91	7.17±0.75 a
Com. sample	6.70±0.75	6.83±1.25	6.80±0.70	6.60±0.95b	6.80±1.19	6.33±0.96 b

[1/] Values in the same column followed by different letters are significantly different (P≤ 0.05)

CONCLUSION

1. Sample dried at 80°C for 50 minutes then cooked in a microwave oven at high for 35 seconds contained 14-16 % moisture content.

2. The addition of konjac flour should not be higher than 1%.

3. Sodium bicarbonate increased the linear expansion of the sample and softened its texture. Therefore addition of 0.1 - 0.2% sodium bicarbonate in sample with 1% konjac flour was recommended.

4. Prepared fish strip has higher sensory evaluation score than the commercial sample in taste and overall acceptability ($P \leq 0.05$) but appearance, color, flavor and texture were not significantly different.

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