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Ingredients, Proximate Composition, Colour and Textural Properties of Commercial Malaysian Fish Balls

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Abstract: Fish balls are the popular value-added products in Malaysia. This study was carried out to determine quality characteristic associated with fish balls available in Malaysia markets. A total of six brands of Malaysian fish balls were collected, recorded and analyzed for list of ingredients and some physicochemical properties which include proximate composition, color and texture (folding test and Texture Profile Analysis). The results showed that there was a wide variation in the types of ingredients used in producing of fish balls. The study also reveals that there is a new trend of using surimi as substation for fish meat in Malaysian fish balls production. The price of currently fish balls varying from US$ 1.29-2.78/kg, respectively. The proximate composition from different brands of fish balls analyzed were found to be significantly different ($p<0.05$). The moisture, protein, fat, ash and carbohydrate contents of fish balls samples varied between 73.80-88.71%, 7.54-9.89%, 0.13-1.75%, 1.61-3.40% and 1.17-13.58%, respectively. The color value for lightness (L), redness (a) and yellowness (b) of the fish balls also significantly different ($p<0.05$), ranging from 69.61 - 77.96, -2.02 - 0.33 and 15.66 - 19.70, respectively. All of samples of fish balls showed AA grade of folding test which indicated that the texture of fish balls were acceptable for consumer preference. This result showed that Malaysian fish balls produced from different manufacturers were different in ingredient used, chemical composition and color, however these differences was not effect to the folding test of the samples.

Key words: Fish balls, commercial products, physicochemical properties, folding test

INTRODUCTION

Meatballs are among popular meat products in Malaysia. The types of meatballs can be found in Malaysia are including chicken ball, beef ball, fish ball, prawn ball and squid ball. However, the most popular and commonly consumed by Malaysian are fish ball, chicken ball and beef ball. As for fish ball, generally white fish ball is more preferred by Malaysian as it indicates the freshness of the fish ball. Chilled fish ball which appears glossy or little transparent is now becoming a popular among Malaysian.

Fish ball production in Malaysia is usually initiated by small family-based enterprises. However, in recent years many factories have invested in modern machinery to increase the production of fish balls. Fish ball production is the second largest processed fish-based production in Malaysia after fish cracker production. The contribution of fish ball production to the total fish-based processed food products in Malaysia has reached approximately 15-20%. Fish ball production increased from 7875 tonnes in 1996 to 16470 tonnes in 2008 (Department of Fisheries, 2010). Although fish balls are popular food among Malaysian, but there are increasing concerns among the consumer regarding the nutritive value of these fish balls. The consumers also prefer to have real meats than processed meat in the products. Many researchers had been conducted on the nutritional and quality aspects of fish balls. Yu and Yeang (1993) and Yamprayoon *et al*. (1991) conducted the effect of ingredient on quality of fish balls. Previously Huda *et al*. (2000) reported on chemical composition and quality of commercial Malaysian fish balls. The purpose of this study is to up date the information regarding the ingredients, proximate composition, colour and textural properties associated with fish ball available in Malaysia market.

MATERIALS AND METHODS

Sample collection: Samples 6 different brands of fish balls (FB1, FB2, FB3, FB4, FB5 and FB6) were collected and picked from local supermarket and wet market around Penang, Northern part of Malaysia. The label and information's on the package with the ingredient lists were recorded.

Proximate composition: The proximate composition was determined according to AOAC (2000) methods. Moisture content was determined by drying samples

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overnight at 100°C until constant weight was achieved (Memmert UL 40, Germany). Crude protein content was determined using the Kjeldahl method. Crude lipid content was determined by the Soxhlet Extraction method. Ash content was determined by ashing samples overnight at 550°C (Thermolyne Sybranm model: 6000, USA). The carbohydrate content was calculated by difference.

Colour: The colour of fish ball sample was measured using a colourimeter (Minolta spectrophotometer CM 3500d, Japan). The colour reading includes lightness (L), redness (a) and yellowness (b).

Folding test: Folding test was determined according to Lanier (1992). The fish ball samples were cut into a 3 mm thick round-shape slice at the middle of the ball and evaluated by a five-stage method, as follow: 1 (D) = Breaks by finger pressure, 2 © = Cracks immediately when folded in half, 3 (B) = Cracks gradually when folded in half, 4 (A) = No crack after folding in half and 5 (AA) = No crack after folding twice.

Textural properties: Texture measurement on meatballs was conducted by using a computer-assisted Stable Micro Systems TA-XT2i Texture Analyzer. The procedures to operate Texture Analyzer were stated in the Standard Operating Procedure (SOP).
Three types of test were carried out in order to compare texture profile of meatballs obtained from different test. First is Texture Profile Analysis (TPA) which was used to determine hardness, cohesiveness, chewiness, elasticity and gumminess (Bourne, 1978). This test was carried out by using compression platen with 75 mm diameter. TA-XT2i setting for TPA test was load cell 25 kg; pre-test speed 2.0 mm/s; test speed 2.0 mm/s; post-test speed 5.0 mm/s; distance 50% and trigger type Auto-30 g.
Second type of test is blade shear test which used knife blade to determined shear force required to cut through sample. TA-XT2i setting for this test was load cell 50 kg; pre-test speed 2.0 mm/s; test speed 2.0 mm/s; post-test speed 5.0 mm/s; distance 40 mm and trigger type Auto-30 g. Third test is penetration test which used a 2 mm diameter penetration probe to determine force required to penetrate through sample. TA-XT2i setting for this test was load cell 50 kg; pre-test speed 2.0 mm/s; test speed 2.0 mm/s; post-test speed 5.0 mm/s; distance 75% and trigger type Auto-10 g.

Statistical analysis: Data obtained is analyzed by using SPSS (Statistical Package for Social Science) software version 12.0 (SPSS Inc., Illinois, USA). Duncan test is used with significant level at $p<0.05$.

RESULTS AND DISCUSSION

Table 1 shows information's on fish ball samples collected for the analysis. Most of the fish ball samples were packaged and labeled with the ingredients used in the formulation, except two samples (FB5 and FB6) which purchased from traditional wet market. The retail prices for fish balls were ranged from US$ 1.29-2.78/kg, respectively. This retail price is lower compared with the retail price of fish balls reported by Huda *et al.* (2000) which ranged between US$ 1.97-3.47/kg. The decreasing of retail price maybe was related with the modernization of machinery and large-scale of fish balls production which will decrease the cost of production.
The ingredients used were also different for different brand names. The type and species of fish used was not mentioned. Based on the products labels, the main ingredients commonly used in Malaysian fish balls were quite similar which include fish or surimi, starch, sugar, salt, flavour enhancer and permitted food conditioner. The flavour and food conditioner used in fish balls were not clearly stated. Surimi is refers to stabilized myofibrillar proteins obtained from mechanically deboned fish meat that is washed with water and blended with cryoprotectants. Surimi is an intermediate product used in variety of products ranging from traditional product to shellfish substitutes (Park and Lin, 2005). The survey found that there is a new trend of using surimi as substitute to fish meat in Malaysian fish balls nowadays. Development of this trend is mainly because the price of surimi is more economical compared with fish meat which can cut down processing productions time. In addition, using surimi rather than whole fish can ensure standard quality supply in fish ball processing as well (Park, 2005).
The result of proximate composition of fish ball is showed in Table 2. All fish balls samples showed significant differences in protein, fat and ash content. The result were similar to the data reported by Huda *et al.* (2000), the moisture content of Malaysian fish balls ranged from 72.5-89.9%. This indicated that in term of moisture content, the Malaysian fish balls do not change much. Protein content of fish balls obtained in this project ranged from 7.54-9.89%. However, the results were in contrast with the report by Huda *et al.* (2000)

Table 1: Sample code and relevant information for fish ball samples

Code	Ingredients	Price ($US/kg)
FB 1	Surimi, water, modified starch, salt, monosodium glutamate (E621), flavour.	$US 2.04
FB 2	Fish meat (surimi), wheat flour, sugar, salt, MSG and vegetable oil.	$US 2.78
FB 3	Fish meat (surimi), water, starch, salt, sugar, vegetable oil and permitted flavour additive.	$US1.29
FB 4	Fish (surimi), starch, sugar, salt, sodium polyphosphate, flavour and flavour enhancer.	$US1.85
FB 5	N/A	$US 2.78
FB 6	N/A	$US 2.78

N/A-Not available

Table 2: Proximate composition of Malaysian fish balls (% wb)

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
FB 1	81.08^{c}±0.57	7.54^{a}±0.49	0.70^{bc}±0.09	2.27^{b}±0.03	8.59^{c}±0.31
FB 2	88.71^{e}±0.30	7.81^{ab}±0.08	0.13^{a}±0.07	2.12^{b}±0.05	1.17^{a}±0.14
FB 3	73.80^{a}±0.13	9.86^{d}±0.14	0.47^{ab}±0.10	2.28^{b}±0.10	13.58^{e}±0.21
FB 4	79.31^{b}±0.68	8.23^{b}±0.51	1.75^{d}±0.53	1.61^{a}±0.01	9.26^{d}±0.57
FB 5	81.50^{c}±0.26	9.89^{d}±0.15	1.06^{c}±0.08	3.18^{c}±0.10	4.31^{b}±0.08
FB 6	84.60^{d}±0.32	8.92^{c}±0.31	0.85^{bc}±0.44	1.63^{a}±0.18	3.98^{b}±0.17

Means in the same column with different superscripts are significantly different ($p<0.05$)

Table 3: Colour and folding test score for Malaysian fish balls

	Colour			Folding test	
Sample	L	a	b	Score	Grade
FB 1	75.94^{d}±0.34	-2.04^{d}±0.08	5.86^{c}±0.08	5.0^{b}±0.00	AA
FB 2	74.97^{c}±0.36	-3.87^{a}±0.04	-0.80^{a}±0.22	4.6^{a}±0.55	AA
FB 3	71.09^{b}±0.28	-0.37^{f}±0.12	11.21^{e}±0.17	5.0^{b}±0.00	AA
FB 4	79.19^{f}±0.79	-1.74^{e}±0.12	5.75^{c}±0.46	5.0^{b}±0.00	AA
FB 5	68.35^{a}±0.72	-2.58^{b}±0.09	6.98^{d}±0.29	5.0^{b}±0.00	AA
FB 6	78.06^{e}±0.23	-2.35^{c}±0.16	4.11^{b}±0.76	5.0^{b}±0.00	AA

Means in the same column with different superscripts are significantly different ($p<0.05$)

Table 4: Textural properties of Malaysian fish balls

	Texture profile analysis				Blade knife	Penetration
Sample	Hardness (kg)	Cohesiveness	Elasticity (mm)	Chewiness (kg mm)	Shear force (kg)	Force (kg)
FB 1	1.76^{a}±0.03	0.73^{c}±0.01	13.10^{c}±0.39	16.86^{c}±0.33	0.93^{b}±0.07	0.12^{b}±0.03
FB 2	3.01^{c}±0.13	0.80^{e}±0.00	8.25^{a}±0.14	19.77^{d}±0.76	1.29^{cd}±0.22	0.16^{b}±0.01
FB 3	1.84^{a}±0.16	0.70^{b}±0.01	11.40^{b}±0.14	14.66^{ab}±1.36	0.70^{b}±0.24	0.06^{a}±0.01
FB 4	1.71^{a}±0.12	0.66^{a}±0.01	11.53^{b}±1.01	13.09^{a}±1.63	0.24^{a}±0.18	0.07^{a}±0.03
FB 5	2.46^{b}±0.15	0.77^{d}±0.00	10.83^{b}±0.39	20.53^{d}±1.24	1.24^{c}±0.22	0.21^{c}±0.01
FB 6	1.77^{a}±0.11	0.76^{d}±0.03	11.50^{b}±0.61	15.42^{bc}±1.45	1.55^{d}±0.45	0.15^{b}±0.03

Means in the same column with different superscripts are significantly different ($p<0.05$)

where the protein content were higher, range from 8.3-14.6%. This might be due to some manufacturers had cut down production cost by reducing amount of fish meat and replace with other extenders such as starch. This also can be linked with the carbohydrate content of present fish balls (1.17-13.58%) which was higher than the result (0.2-11.7%) reported by Huda *et al*. (2000).

For the fat content the ranged was from 0.13-1.75%. This is similar to study reported by Huda *et al*. (2000) ranged from 0.1-1.9%. This showed that the amount of fat content in fish balls do not change much. Ash content determined in this project was ranged from 1.61-3.18%. This is slightly higher than values reported by Huda *et al*. (2000), which ranged from 1.1-2.7%.

Colour values of fish ball samples are given in Table 3. The L values of fish balls which analyzed in this project ranged from 68.35-79.19, a values were ranged from -3.87 - (-0.37) and b values were ranged from -0.80 - 11.21. These results were slightly different from previous report by Huda *et al*. (2000) where the commercial Malaysian fish balls L values were ranged from 62.1-76.8, a values were ranged from -3.4 - (-0.9) and b values were ranged from 2.7-10.7. The increasing of L value was related with utilization of surimi as raw material for current fish ball production in Malaysia. Washing treatment during surimi preparation resulting white fish meat which increasing the lightness of surimi-based product such as fish balls. Yu (1994) found similar result and concluded the washed treatment not only reduces fat content, but also improved the fish balls quality, including making it whiter in colour, more elastic and firm thus giving an improved mouth feel.

Overall, the texture quality of fish balls was higher. The folding test for fish balls samples were ranged from 4.6-5.0. Previous report by Huda *et al*. (2000) also mention that all of commercial fish ball samples tested showed AA grade for folding test which was point 5.0 in this analysis. According to Yu (1994), using washed minced fish meat in fish ball formulation will result higher grade of texture quality. Due to time constrain so far only simple texture analysis was performed on the fish balls samples. Texture profile analysis is more suitable to determine the detail information of textures qualities of fish ball.

Table 4 shows textural properties of commercial fish balls. Sample FB 2 was the hardest fish balls with hardness 3.01 kg. However, fish ball that required maximum shear force to cut through was FB 6 (1.55 kg) and fish ball that required maximum force to penetrate through was FB 5 (0.21 kg). All fish balls were different slightly in their hardness, shear force and force values as can be seen in table above. The cohesiveness of all fish balls were quite similar, ranged from 0.66-0.80. Elasticity of fish balls were quite different, the lowest was only 8.25 mm in FB 2 while the highest was 13.10 mm in FB 1. All fish balls also very different in chewiness where the highest was 20.53 kg mm in FB 5 but the lowest was only 13.09 kg mm in FB 4.

According to Serdaroglu *et al.* (2005), factors responsible for textural properties in comminuted meat proteins such as fish balls are degree of extraction myofibrillar proteins, stromal protein content, degree of comminuting and type and level of non-meat ingredients. Apart from amount of connective tissue, types and amount of extenders such as starch will play a decisive role on hardness of fish balls as well. As an example, addition of legumes flour can slightly increase toughness of meatballs (Serdaroglu *et al.*, 2005).

According to Yu and Yeang (1993), higher values for all the five parameters measured in TPA (hardness, cohesiveness, elasticity and chewiness) do not necessary mean better quality. There is a cut-off point above which the texture of meatballs would be unacceptable. Therefore, determination of good textural qualities of meatballs should be done together with sensory test in order to find out the most suitable range which is preferable by consumers.

Conclusion: The nutritional value in fish ball is consider as high because it has approximately quite high content of protein and carbohydrate although it has low content of fat. These compositions are desirable in human growth and in maintaining daily nutrient supplies for metabolism of body. The texture of all the fish balls samples are tender and gained AA grade for folding test.

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