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Physicochemical Properties of Malaysian Fish Balls

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A total of 10 brands of Malaysian fish balls were analyzed for physiochemical properties like colour, cooking effect, proximate composition and texture (folding test). Results showed that there was a wide variation in the amount and types of ingredients used in producing the different kinds of fish balls. The weight of samples analyzed ranged between 6.25 - 15.14 g with price varying from US $ 1.97-3.62/kg. The colour value for lightness (L) of fish ball varied significantly ($p<0.05$), ranging from 62.14-76.85. Different brands of fish balls exhibited different cooking effect, which ranged between -11.06% and +8.21%. All samples showed AA grade in folding test, which indicated that the texture of fish balls was acceptable to consumer.

Key words: Fish balls, proximate composition, folding test

Fish ball is a popular fish based processed product, commonly consumed with noodles in the Southeast Asian region. Fish balls are also popular in many Southeast Asian countries in different local names such as *Bebola* in Malaysia and Brunei, *Bakso* in Indonesia, *Bola-bola* in Philippines, *Jbi-ei* in Singapore and *Luk-chin pla* in Thailand (Chng *et al.*, 1991). Fish ball production used to be usually a small, family-based enterprise. But in recent years, many factories have invested in modern machinery to increase the production of fish balls. The annual production in Malaysia increased from 4,381 t in 1990 to 7,874 t in 1996 (Department of Fisheries, 1996).

The basic ingredients of fish balls are fish meat, starch, salt, sugar and water. The ingredients are usually mixed together thoroughly using mixer, transformed into the shape of balls and then allowed to set in water at 40°C for 20 min, followed at 90°C for 20 min. The fish balls are normally sold fresh or as chilled/frozen in supermarkets (Yu & Yeang, 1993). Attributes such as white colour, absence of fish smell and soft but elastic texture are the desirable qualities of fish balls (Yamprayoon *et al.*, 1991). This study is aimed at providing more information on the physicochemical properties of fish balls, which are produced and marketed in Malaysia.

Materials and Methods

Fish balls from ten producers (Sajimas, Kuantan, Top 1, Armiya, Parang AA, DFI, SIA Parang, GAN, SIA Putih and without brand) from different regions of Malaysia were obtained from local markets and supermarkets. Samples were randomly labelled as A,B,C,D,E,F,G,H,I and J (not according to the brand's order). Two packets of each brand were obtained for analysis. Label information on the package with ingredient lists was recorded.

Cooking effect was measured as percentage of gain or loss of weight of the fish balls after immersion in boiling water for 4 min. The colour of fish balls was measured for lightness (L), redness (a) and yellowness (b) using colourmeter (Minolta CR 300, Japan). Five fish ball samples from each packet were used for colour measurement by cutting to a thickness of 4 mm (Yu, 1994). Moisture, protein, fat and ash contents of the samples were determined using the method described by AOAC (1990). Carbohydrate content was calculated by the difference.

Table 1. Ingredient used and price for Malaysian fish balls

Sample	Ingredients	Price (US$/kg)
A	Fish, wheat flour, potato flour, baking powder, MSG	2.18
B	Fish, modified corn starch, vegetable oil, ISP, salt, sugar, sodium pyrophosphate, MSG, permitted flavour enhancers	3.47
C	Fish, corn starch, salt, MSG	1.97
D	Surimi (Fish) wheat flour, salt, sugar, MSG, vegetable oil	2.37
E	Fish, salt, sago flour, wheat flour, ajinomoto	3.21
F	Fish, salt, sago flour, wheat flour, ajinomoto	3.21
G	Fish, wolf-herring fish, tapioca starch, sugar, salt	3.62
H	Fish, tapioca starch, sugar, salt	3.29
I	Not available	2.89
J	Fish, corn flour, salt	1.97

Folding test was carried out according to Lanier (1992). The fish ball samples were cut into 3 mm thick round slice at the middle of the ball and evaluated by a five stage method, as follows:

Grade	Condition
D	Breaks by finger pressure.
C	Cracks immediately when folded in half.
B	Cracks gradually when folded in half.
A	No crack after folding in half.
AA	No crack after folding twice.

A completely random design was used for the study. Data were analyzed using General Linear Model procedures of Statistical Analysis Systems (SAS) version 6.11 (SAS, 1994). Treatment showing significant differences ($p<05$) were subjected to Duncan's New Multiple Range Test.

Results and Discussion

Most of the fish ball samples were packaged and labelled with the ingredients used in the formulation. The ingredients used were different for different brand names. The type and species of fish used was not mentioned. The price of fish balls varied between US$ 1.97 and 3.47/kg, depending on the brand. In 1991, the price of fish balls in Thailand was US$ 1.18-3.54 and in Brunei it was US$ 3.72 (Chng *et al.*, 1991). The ingredients used and price for Malaysian fish balls are shown in Table 1.

The individual weight of each fish ball sample was significantly different ($p<0.05$). (Table 2) The individual weight varied between 6.25 and 15.14 g. However, the average weight of fish ball was about 10 g. There was a significant difference ($p<0.05$) in cooking effects on the weight of fish balls (Table 2). The weight of five fish ball samples increased from 0.83 to 8.21% after the cooking period while in the other samples, the weight decreased by 1.74-11.06%. The wide range of weight gain or loss may be correlated to the freshness of the fish balls, moisture content and other ingredients. The gain in weight after cooking was shown by the samples which was marketed at chilled/frozen temperature while the loss in weight were shown by samples which were marketed at room temperature (traditional markets). The different results may also be correlated to the amount of starch used in formulation. Higher content of starch resulted in an increase in the capacity to retain water since the starch molecules are attached to the myofibrillar protein after heating process (Yamprayoon *et al.*, 1991). The high moisture content and positive cooking effect in the case of sample D may be due to the water retaining capacity of the added surimi.

Since good quality fish balls are also represented by its whiteness, the colour of fish balls is an important factor which influences the consumers' preference. Results showed that the color of Malaysian commercial fish balls of different brands was significantly different ($p<0.05$) (Table 2). The L value varied between 62.14 and 76.85. The different L values may be correlated to the washing treatment used on the fish meat and

Table 2. Weight, cooking effects and colour values of Malaysian fish balls

Sample	Weight (g)	Cooking effects (%)	Lightness (L)	Redness (a)	Yellowness(b)
A	8.54±0.35^{f}	-5.70±4.20^{d}	66.71±0.99^{h}	-0.88±0.11^{a}	10.42±1.48^{a}
B	15.14±0.88^{a}	8.21±4.84^{a}	74.13±0.61^{b}	-2.15±0.07^{e}	5.96±0.35^{d}
C	9.27±0.67^{ed}	-3.46±2.41^{c}	76.85±0.57^{a}	-2.29±0.14^{f}	5.15±0.88^{d}
D	9.34±0.43^{ed}	1.30±0.95^{b}	72.99±0.51^{c}	-1.84±0.06^{d}	7.74±0.79^{c}
E	9.95±0.58^{bc}	1.62±1.59^{b}	67.44±0.49^{gh}	-1.20±0.11^{b}	9.40±0.78^{b}
F	10.42±0.62^{b}	0.83±0.53^{b}	67.70±0.35^{gf}	-1.55±0.21^{c}	9.21±0.35^{b}
G	9.88±0.71^{bc}	-7.12±2.69^{d}	71.57±0.79^{d}	-2.54±0.16^{g}	5.06±0.92^{d}
H	8.84±0.20^{ef}	-1.74±0.76^{e}	69.73±0.26^{e}	-2.37±0.07^{f}	5.20±0.57^{d}
I	9.80±0.57^{cd}	-11.06±1.22^{e}	68.35±1.09^{f}	-3.35±0.27^{h}	2.69±0.32^{e}
J	6.25±0.41^{g}	2.37±1.75^{b}	62.14±0.89^{i}	-0.75±0.19^{a}	10.73±1.94^{a}

* Value is the mean of five samples. Means in the same column with different superscripts are significantly different ($p<0.05$)

the starch used in the formulation. Yu (1994) reported that the colour of fish balls made from fish meat washed twice or thrice was significantly whiter than that made from unwashed and once washed fish meat. Starch used also influenced the L value. Yu & Yeang (1993) found that balls which were made from tapioca starch, showed higher L value followed by formulations using waxy maize, potato and corn starch. The redness 'a' and yellowness 'b' values of each fish ball sample were also significantly different ($p<0.05$) and varied between -3.35 and -0.75 and 2.69 and 10.73, respectively. The 'a' and 'b' values tend to decrease with increasing L value. Yu (1994) reported that the fish balls with higher L value tend to have lower 'a' and 'b' values.

The proximate composition of different brands of fish balls was significantly different ($p<0.05$) among all samples analyzed (Table 3). In Thailand, moisture and protein content of threadfin bream fish balls was about 80.13-80.58% and 11.09-11.25% respectively (Yamprayoon *et al.*, 1991). The shark fish balls from Indonesia showed different proximate composition. The moisture, protein and fat varied between 60 to 73%, 17 to 19%, 0.6 to 0.9%, respectively (Fawzya, 1992).

Table 3. Proximate composition of Malaysian fish balls

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
A	82.50±0.33^{e}	14.57±0.29^{a}	0.21±0.05^{de}	1.17±0.06^{f}	1.54±0.24^{g}
B	72.50±0.64^{1}	14.15±0.36^{b}	0.87±0.13^{b}	2.37±0.04^{bc}	10.10±0.34^{b}
C	83.38±0.16^{d}	11.14±0.17^{d}	0.11±0.06^{ef}	1.13±0.09^{f}	4.24±0.15^{e}
D	84.32±0.21^{e}	9.88±0.37^{g}	0.05±0.02^{f}	2.29±0.05^{e}	3.45±0.28^{f}
E	81.50±0.26^{f}	8.92±0.18^{1}	0.15±0.04^{def}	2.65±0.11^{a}	6.76±0.32^{d}
F	74.45±0.26^{h}	11.88±0.37^{c}	0.38±0.09^{c}	1.58±0.16^{e}	11.71±0.42^{a}
G	86.41±0.40^{b}	10.26±0.16^{f}	0.89±0.07^{bh}	2.10±0.19^{d}	0.34±0.16^{h}
H	83.41±0.12^{d}	10.61±0.14^{e}	1.95±0.31^{a}	2.46±0.04^{b}	1.58±0.33^{g}
I	89.92±0.17^{a}	8.30±0.17^{i}	0.08±0.03^{ef}	1.53±0.07^{e}	0.17±0.03^{h}
J	80.54±0.26^{g}	9.55±0.15^{h}	0.29±0.05^{cd}	2.25±0.04^{c}	7.36±0.14^{c}

* Value is the mean of triplicate analysis. Means in the same column with different superscripts are significantly different ($p<0.05$)

The varying proximate compositions of fish balls are mainly due to the different formulations used for fish balls production. Fish species and types of starch used also influenced the proximate composition. To minimize the varying protein content, the Malaysian Government has proposed that the minimum amount of fish meat to be used in fish balls formulation be not less than 50% (Laws of Malaysia, 1996).

Carbohydrate content of fish balls varied with the amount of starches used. In the past, starch was used in fish balls as a source of carbohydrate and to thicken the texture, but now they are used extensively as stabilizers, texturizers, water or fat binders and emulsifiers. Carbohydrate or starch also increases gel strength and freeze-thaw stability of the products if appropriately modified starches are added at proper level (Luallon, 1985). Generally, about 0 - 10% of starch is used for fish balls formulation (Yamprayoon *et al.*, 1991; Fawzya, 1992; Yu & Yeang, 1993).

Folding test is one of the simple methods used to measure the quality of fish balls. All the fish ball samples showed AA grade of folding test. Yu (1994) showed that AA grade of folding tests could be obtained by using washed minced fish in fish balls formulation. Unwashed minced fish will result in lower grade of folding test score. The AA grade of folding test indicated that the fish species, source of starch, storage method and ingredients used for fish balls formulation were acceptable for consumer preference on texture attribute.

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