

Keropok Lekor — Boiling and Steaming Methods of Processing

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RINGKASAN

Keropok lekor daripada ikan kembong (Rastrelliger kanagurta) dimasak dengan cara direbus dan dikukus. Kemudian digoreng, dibungkus dan dianalisis. Dua rumusan yang berbeza telah dicuba. Pertama, rumusan asas tanpa sebarang bahan pengawet dan kedua, rumusan asas bercampur bahan pengawet. Telah didapati bahawa tidak ada perbezaan yang bererti di antara sampel-sampel yang dianalisis di dalam kandungan kelembapan, 'total plate count' dan nilai asid tiobarbiturik (TBA). Walau bagaimanapun, perbezaan yang sangat bererti ($P < .01$) didapati di dalam perubahan-perubahan pH sampel-sampel. Sampel-sampel yang dikukus mempunyai pH yang lebih rendah ($P < .05$). Sampel yang dikukus dan berbahan pengawet didapati paling stabil.

Pengkukusan sampel buat masa ini tidak terbukti berfaedah. Tetapi, kemungkinan pengkukusan boleh diubahsuai untuk pemerosesan oleh kerana pada keseluruhannya bilangan mikroorganisma pada sampel tersebut lebih rendah ($\times 10^2$ lebih rendah daripada yang direbus).

SUMMARY

'Keropok lekor' from Chubb Mackerel (Rastrelliger kanagurta) was precooked by boiling and steaming. They were fried, packed, and then analyzed. Two different formulations were used. They were (i) basic formulation without any preservative and (ii) basic formulation with preservatives added. It was found that the samples tested did not have any significant differences in moisture content, total plate count and thiobarbituric acid value (TBA). However, a significant difference ($P < .01$) was observed in the pH changes of samples. Samples which were steamed had significantly lower pH ($P < .05$). The formulation with preservatives gave the most stable product.

Steaming of samples presently did not prove to be feasible. However, it is suggested that steaming can be adopted in the precooking process due to the overall lower microbial count of steamed samples ($\times 10^2$ less than the boiled).

INTRODUCTION

'Keropok lekor' as it is called in Trengganu is basically the same as 'Keropok Batang' in Kelantan and 'Keropok Tongkol' in Pahang. It resembles a sausage in texture, but it does not undergo the same final processing as does a sausage. Sausages are smoked or cured to give the required flavour, while the precooked 'keropok lekor' is deep fried prior to eating.

Traditionally, the 'keropok' is precooked by boiling in water. Problems such as bacterial

activities resulting in surface slime development and mould growth are encountered the next day. Fried 'keropok' also tends to become stale and rancid after a few days.

Steaming 'the keropok' could be an alternative method to precooking by boiling in water. In this way the product is not totally immersed in water and thus excessive softening of the outer 'keropok' layer might be prevented. This experiment assesses the merits of steaming as an alternative precooking method on the basis of TBA value, pH, moisture content and TPC (total plate count).

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MATERIALS AND METHODS

I. Keropok preparation

'Ikan kembong' (*Rastrelliger kanagurta*) was bought at a local market. It was washed and the flesh was scraped off using a scoop. The flesh was then minced with a manual mincer. The minced fish was chilled at 4°C before mixing with the dry ingredients to form the final dough.

The dough was prepared in the following basic proportions: fish flesh 242.60 g; sago 121.30 g; tapioca starch 121.30 g; salt 16.90 g; monosodium glutamate 2.40 g; crushed ice 66.50 g.

A formulation with predetermined amounts of preservatives was also prepared. It consisted of the following preservatives and the percentages were proportional to the total weight of basic formulation in the following order:

BHT	0.01%
BHA	0.01%
Tocopherol	0.01%
Sodium pyrophosphate	0.02%
Sorbic acid	0.03%
EDTA	0.005%
Propylene glycol	0.05%

The preservatives were added to the basic dough before boiling or steaming. The prepared dough was mixed in a Kenwood Chef Mixer at medium speed for about 20 minutes or until a uniform distribution of ingredients was achieved. It was then manually extruded and cut to a length of approximately 5cm. and a diameter of 3.7cm. The portions were then steamed or heated until all the starch in the dough gelatinized. The dough was pricked with a sharp object to check its interior. Completely gelatinized dough did not show a whitish interior. They were then deep fried at 120°C, for 15 min., cooked and air packed in two's in low density polyethylene bags. The bags were kept at ambient temperature for a seven-day storage study.

II. Methods of analysis

The moisture content was measured by using the infra red lamp (OHAUS) method. A 10g of the minced sample was spread thinly on the heating plate and was subjected to 10 watts for 10 minutes (Pomeranz and Meloan, 1978).

pH was determined using a Metrohm Herisau pH - meter (Type E516). A 10g sample was blended in 50ml of distilled water until a uniform suspension was obtained.

TBA (thiobarbituric acid) analysis was carried out according to Pearson (1976). A 10g of the minced fish keropok was blended with 50ml of distilled water. The mixture was then washed into a distillation flask (250ml) with 47.5ml of distilled water. Then 2.5ml of 4N HCl was added to bring the mixture to pH 1.5. Antifoam and anti-bumping (glass) granules were added. Distillation was then carried out so that 59ml of the distillate was collected in 10min. 50ml of the distillate was mixed with 5ml of TBA reagent and boiled in boiling water for 35 minutes. The tubes were then cooled for 10 minutes before the absorbance was read at 538nm using Spectrophotometer 20.

The total plate count (TPC) was obtained by the spread plate method. One g of sample was mashed finely in 100ml of sterile distilled water. Then 1ml of the former was pipetted into a dilution bottle containing 9ml of presterilized distilled water. A series of dilutions was prepared. Each dilution was plated by taking 1ml of the diluent which was mixed thoroughly with sterile nutrient agar in the petri dish. Plates, in triplicates, were incubated for 18 hours at 38°C.

Statistical Analysis:

The data obtained were analyzed by the analysis of variance according to Larmond (1977).

Any further difference in a parameter of the sample was further analyzed by Tukey's test (Snedecor, 1956).

RESULTS

pH: The pH values of both the steamed samples were lower than the boiled samples on the first day of the experiment (Table 1). Progressive changes in the pH values of the samples are shown in the table. Statistical analysis indicated a highly significant difference in the pH changes of all samples ($P < .01$). Differences were noted between samples on the same day and in the sample itself on a different day. By the least significant difference method, it was found that all the boiled samples had significantly higher pH values than the steamed samples ($P < .05$) (Table 7).

Moisture Content: Very little change of moisture content was observed (Table 2). Generally, the samples had moisture content of above 43.0% \pm 2.0%. No significant difference was obtained in the changes of moisture content upon storage (Table 5).

TPC: The initial plate count was in the vicinity of $\times 10^4 - \times 10^5$. The final plate counts

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TABLE 1
pH of Keropok Lekor¹

Day/Sample+	K1	K2	K3	K4
1	5.73	5.70	6.15	6.15
3	5.75	6.65	6.10	6.15
5	6.02	5.95	6.30	6.35
6	6.18	6.15	6.58	6.25
7	5.95	6.13	6.30	6.35

¹ Means of samples done in duplicates

- +K1 – No preservatives, steamed and fried
- K2 – With preservatives, steamed and fried
- K3 – No preservatives, boiled and fried
- K4 – With preservatives, boiled and fried

TABLE 2
Moisture Content of Keropok Lekor¹ (% W/W)

Day/Sample	K1	K2	K3	K4
1	40.50	39.50	48.09	44.99
3	45.50	43.00	44.25	42.25
5	47.50	40.75	41.65	45.15
6	49.50	46.00	41.40	42.10
7	46.75	45.50	44.00	46.87

¹ Means of samples done in duplicates

generally did not double that of the initial count with the exception of boiled 'keropok'. The total plate counts were mainly contributed by growth on the surface of the packed 'keropok'. Hardly any spoilage due to microbial propagation was obtained from the interior of the samples. No significant difference was obtained in all the microbial counts (Table 3).

TBA: No significant difference was obtained among *TBA* values of samples (Table 4).

DISCUSSION

The stability of this product can be predicted from its moisture content. A moisture content of above 40% is not sufficient to discourage microbiological and biochemical activity and consequently deterioration and spoilage can occur under most ambient conditions (Robson, 1976). However, a progress has been made in the keeping quality of this item. It is normally free from

TABLE 4
TBA of Keropok Lekor¹ (mg malonaldehyde/kg sample)

Day/Sample	K1	K2	K3	K4
1	6.11	1.31	4.34	4.50
3	6.23	2.38	3.38	3.53
5	3.48	3.27	6.54	4.22
6	3.89	1.94	4.20	4.78
7	1.81	3.48	3.56	4.68

¹ Means of samples done in triplicates

TABLE 3
Total Plate Count of Keropok Lekor¹ (/g sample)

Day/Sample	K1	K2	K3	K4
1	1.34 × 10 ⁵	7.07 × 10 ⁴	3.27 × 10 ⁴	8.71 × 10 ⁴
2	2.16 × 10 ⁵	6.33 × 10 ⁵	7.21 × 10 ⁵	3.49 × 10 ⁵
5	1.41 × 10 ⁵	7.43 × 10 ⁵	2.22 × 10 ⁷	1.51 × 10 ⁵
6	1.12 × 10 ⁶	1.20 × 10 ⁶	3.77 × 10 ⁹	4.35 × 10 ⁵
7	1.72 × 10 ⁶	1.57 × 10 ⁶	2.30 × 10 ⁸	1.98 × 10 ⁸

¹ Means of samples done in triplicates

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TABLE 5
Analysis of Variance of pH of Keropok Lekor

Source of variation	df	ss	ms	F value
Samples	3	0.735	0.245	27.2**
days	4	0.558	0.140	15.56**
Error	12	0.102	0.009	
Total	19			

**highly significant at (P < .01)

TABLE 6
Least Significant Different for pH Values of Keropok¹

K1	K2	K3	K4	SE ²
2.962c	2.958c	3.143a	3.125b	.03
LSD 0.126				

¹ Any two values not followed by the same subscript are significantly different (P < .05)

² standard error of the mean

microbial growth on the first day of processing. On the 7th day of the storage study, the first appearance of microbial growth (mainly moulds) was noted.

Though a significant difference was observed in the pH values of samples, it cannot be concluded here that the steaming method of pre-cooking has any great advantage over boiling. It was observed that only 15 minutes of boiling is required to achieve complete cooking of the product. For the same purpose it took three hours for steaming. Steaming is time consuming and is excessive in terms of energy input.

The TBA values of K2, K3 and K4 are still within acceptable limit. According to Bello and Pigott, (1980), the initial TBA value for dried fish patties was 3.1mg malonaldehyde/kg sample which had a slightly rancid flavor, but acceptable. Rancidity is mainly due to the frying oil used. A change in the TBA values of K1 can be possibly due to extreme rancidity.

Spoilage of this 'keropok' can be safely attributed to rapid microbial propagation. From

the results, it can be concluded that steamed samples had an average of $\times 10^2$ lower counts than those boiled. Steaming of the product may prove to be more effective in terms of storage if cross-contamination during the entire processing time can be minimized.

CONCLUSION

The steaming method may prove to be feasible if the time of steaming can be cut down to that nearing the boiling method. This could be achieved, for example, by reducing the thickness of the extruded keropok. Indicators of pH, moisture content, TBA and above all the microbial count indicate the possibility of its use. It is suggested that some modification in the processing steps in the 'keropok' preparation will however, be necessary.

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