

Proximate composition, texture analysis and sensory evaluation of keropok lekor formulated with herbs and spices

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Article history:

Received: 8 March 2019

Received in revised form: 6

April 2019

Accepted: 6 April 2019

Available Online: 5 May

2019

Keywords:

Keropok Lekor,
Product Development,
Sensory evaluation,
Proximate composition

DOI:

[https://doi.org/10.26656/fr.2017.3\(6\).050](https://doi.org/10.26656/fr.2017.3(6).050)

Abstract

Keropok lekor a fish-based sausage is a popular traditional food item in Terengganu state, Malaysia. This study aimed to develop a new flavor and taste of keropok lekor. Common spices such as cumin, coriander, cinnamon, cardamom, bay leaf, nutmeg, clove, onion, ginger, garlic were used to develop a new flavor of keropok lekor. A total of 5 samples, including two original and three developed keropok lekor samples were prepared. This study also evaluated the proximate composition of two raw samples (Original and developed). The results of the proximate analysis showed a significant difference ($p < 0.05$) in all parameters except the fiber content. Hardness, springiness, and chewiness of the samples were measured by using TA-XTplus texture analyzer. There was a significant difference in the hardness level between original and developed sample. Finally, sensory evaluation according to six attributes such as color, odors, texture, flavor, taste and overall acceptability was done by 39 panelists. A 7-point hedonic scale ranging from “dislike very much” to “like very much” was employed in sensory testing. There was a significant difference ($p < 0.05$) in all the sensory parameters evaluated. The results showed that most of the respondents preferred the developed samples over the original samples. Developed fried keropok lekor with bread crumb was the most acceptable one.

1. Introduction

Keropok lekor is one of the most popular and delicious fish-based snack food product in Malaysia. Keropok lekor is also a nutritious food item with high protein composition and high starch component (Mohamed *et al.*, 2008). Ikan parang (*Chirocentrus dorab*), ikan tamban beluru (*Clupea leiogaster*) and ikan selayang (*Decapterus russelli*) are the most commonly used fish in keropok lekor processing (Nor *et al.*, 2010). The types of fish used to make this product could affect the product characteristics (Kaewmanee *et al.*, 2015). Fresh fish, salt, sugar and sago flour are the main ingredients used to prepare keropok lekor (Omar *et al.*, 2011). Though keropok lekor resembles a sausage in texture, the production procedure is not that same (Bakar, 1983).

Due to lack of profit-making value, keropok lekor may need some form of modernization in order to extend its market in the future. A recent study showed young consumers' interest in having new flavor and taste of keropok lekor (Omar *et al.*, 2011). Food ingredients such

as herbs and spices are indispensable parts of various flavor and fragrance creations. The secrets of most great cuisine rely heavily on herbs and spices (Mookherjee *et al.*, 1989). Spices such as cloves, cinnamon, black pepper, turmeric, ginger, garlic, and onions also exhibit antioxidant properties in different food systems (Al-Jalay *et al.*, 1987).

Therefore, the main objective of this study was to develop keropok lekor by using common Bangladeshi spices in order to add some variety in taste and flavor. Moreover, people nowadays are getting conscious of the nutritional profile of a food product. That is why this study also analyzed the difference between the proximate composition of the developed keropok lekor and the original keropok lekor.

Furthermore, the acceptance level of consumers plays a pivotal role in the development of successful food products (Tuorila, 2007). Consumer's intention to buy food largely depends on the sensory profile of a food product (Wilkinson, 2000). So, the study also aimed to evaluate the sensory acceptability of the final products.

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In addition, hardness, springiness and chewiness level of the product was also analyzed as the quality of food is also depends on the texture (Kilcast and Lewis, 1990).

2. Materials and methods

2.1 Sample coding

The overall process of this research work has been shown in Figure 1. Five different samples were prepared for this study (Figure 2). Among them sample A: Boiled keropok lekor and sample B: Fried keropok lekor were prepared by using the original recipe (fish flesh, sago flour, sugar and salt). The other three samples; sample C: Developed boiled keropok lekor, sample D: Developed keropok lekor fried with bread crumbs, sample E: Developed keropok lekor curry were prepared by adding spices.

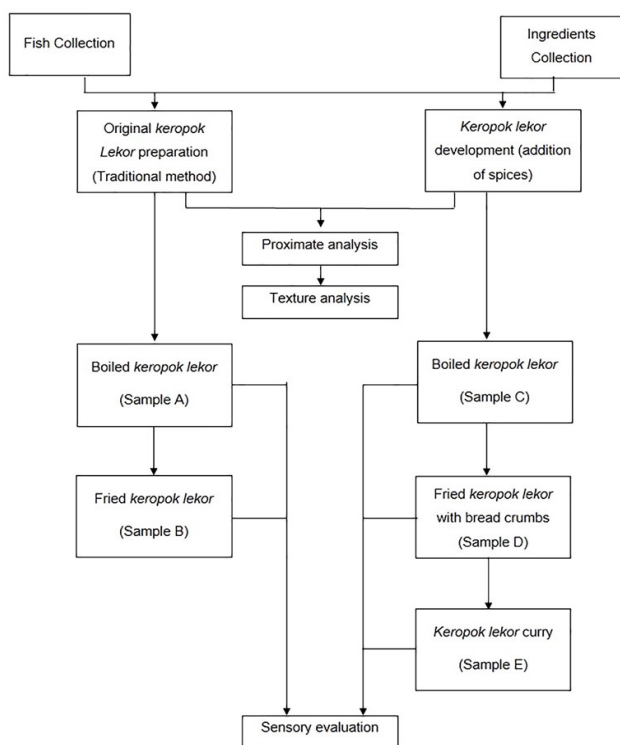


Figure 1. Flow chart of the overall process



Figure 2. Five samples of keropok lekor (Sample A= Boiled keropok lekor, Sample B= Fried keropok lekor, Sample C: Developed boiled keropok lekor, Sample D: Developed keropok lekor fried with bread crumb, Sample E: Developed keropok lekor curry.)

2.2 Traditional method of preparation

Ikan selayang (*Decapterus russelli*) Fish was collected from the local market of Gong badak, Kuala Terengganu. Then fishes were cleaned properly and passed through the fish deboner to prepare fish flesh. Then all ingredients (fish flesh, sago flour, salt, sugar) were mixed properly until it formed a dough. Next, the dough was shaped manually into the cylindrical roll. Each roll was shaped as 10-20 cm long and 2-3 cm in diameter. To work smoothly more flour was added from time to time. The rolls were then boiled until they are cooked. Then it was allowed to cool at room temperature. Before serving whether it was boiled (Sample A) or Fried (Sample B).

2.3 Product development

Product development was done by adding garlic paste, onion paste, ginger paste, green chilies and mixed spices (cumin, coriander, cinnamon, cardamom, bay leaf, nutmeg, and clove) on the dough. Roll preparation method and the amount of the main ingredients were the same as the traditional method.

2.3.1 Sample C (developed boiled keropok lekor) preparation

Keropok lekor rolls were immersed in the boiling water at 100°C. The floating of the keropok lekor indicated that boiling was done. This boiled keropok lekor was the first developed sample marked as sample C.

2.3.2 Sample D (developed keropok lekor fried with bread crumb) preparation

At first keropok lekor rolls were boiled properly. After cooling at room temperature prepared samples were dipped into egg mixture then covered with bread crumbs. Samples were then fried in hot oil.

2.3.3 Sample E (developed keropok lekor curry) preparation

Twenty Rolls were boiled at first. Then they were cut into small pieces. After that, shallow frying was done by cooking rolls in oil with a depth that reached about half of the thickness of the rolls. It created a crisp and browned crust in the upper surface of the rolls. Then, sliced onion, onion paste, ginger paste, garlic paste, salt, turmeric powder and the fried keropok lekor were taken into another pan. They were mixed thoroughly. Afterward, chili and tomato sauce were added. After mixing for some time coconut milk was added into it. Then it was cooked for approximately 20 mins. Before finishing the cooking process few mint leaves, tomato slices and green chilies were added for additional flavor.

The color of the final product was grayish yellow.

2.4 Proximate analysis

Proximate nutritional analysis, such as moisture, protein, fat and ash contents were determined according to the Association of Official Analytical Chemists' method (AOAC, 2012). Fiber content was determined by the fibrotherm fiber analyzer (Gerhardt analytical system, Germany). The carbohydrate content was determined by subtracting the other food value i.e. Protein, Fat, Moisture, Ash, fiber. Two raw samples (original and developed) were used for this analysis. Triplicate analysis of each sample was conducted.

2.5 Texture analysis

Textural analysis was done by using TA-XTplus (Stable Micro Systems, UK) texture analyzer. Samples were cut into 2 cm thick slices. A 30 kg load cell was used to determine the hardness, springiness, and chewiness (Bourne, 1978). The settings were: pre-test and post-test speed of 3 mm/s, distance at 10 mm and time at 5 s.

2.6 Sensory evaluation

Sensory evaluation of qualitative parameters (color, flavour, odor, texture, taste and overall acceptability) of the five samples was carried out using 9-point Hedonic scales (Larmond, 1977) adjusted to 7 point scale according to the following (7 = like very much, 6 = like moderately, 5 = like slightly, 4 = neither like nor dislike, 3 = dislike slightly, 2 = dislike moderately, 1 = dislike very much). The five samples were presented to 39 panelists in the food sensory lab of Universiti Malaysia Terengganu.

2.7 Statistical analysis

The data generated were analyzed using analysis of variance (ANOVA). Tukey's post hoc test was used for the separation of means, to determine which specific groups' means were different. In case of absence of homogeneity of variance Games-Howell post hoc test was done and the Welch test was used for understanding the significance.

3. Results and discussion

3.1 Proximate composition

Proximate composition of the keropok lekor made by the original and the developed recipe showed no significant difference ($p > 0.05$) in the fiber content (Table 1). However, there were significant differences ($p < 0.05$) in the moisture, protein, fat, ash and carbohydrate contents of the samples (Table 1). The mean moisture

content of developed keropok lekor (58.47%) was higher than that of original keropok lekor (56.33%). It may be due to the release of water from additional spices. Developed keropok lekor had slightly higher ash and fat contents with values of 8.90% and 1.38% as against 8.23% and 1.22% for original keropok lekor respectively. The slight increase in the ash content could be due to the addition of spices, as spices are a good source of minerals (Mehring, 1924). Besides, the low-fat content of the fish (*Decapterus russelli*) corroborates the lower amount of fat in both samples (Chrisanthi and Attygalle, 2013). However, the original keropok lekor had higher carbohydrate and protein contents with values of 20.81% and 12.61% as compared with 18.17% and 11.98% respectively. Protein percentage of products largely depends on the protein content of fish flesh. The amount of protein in both samples is almost similar to the study conducted by Edirisinghe *et al.* (2000) who showed 10.1% crude protein for *Decapterus russelli*. Edirisinghe *et al.* (2000) also reported that carbohydrate content is generally low in sea fish. Thus, it confirms that the main source of the carbohydrate was sago flour (Taewee, 2011). The fiber content varied slightly between the samples and was higher in developed keropok lekor (1.10%) compared to original keropok lekor (0.8%). This result indicates that the addition of spices can increase the fiber content.

Table 1. Proximate composition of keropok lekor

Parameter (%)	Type of Recipe	
	Original	Developed
Moisture	56.33±0.29 ^a	58.47±0.22 ^b
Protein	12.61±0.09 ^a	11.98±0.06 ^b
Fat	1.22±0.03 ^a	1.38±0.01 ^b
Ash	8.23±0.03 ^a	8.90±0.03 ^b
Fiber	0.8±0.01 ^a	1.10±0.20 ^a
Carbohydrate	20.81±0.02 ^a	18.17±0.02 ^b

Means ± SD within the row bearing different superscripts are significantly different ($p < 0.05$)

3.2 Texture

Changes in hardness, springiness, and chewiness between two samples were shown in Table 2. Springiness and chewiness were not significantly different ($p > 0.05$), whereas there was a significant difference ($p < 0.05$) in hardness level. From the data shown, hardness and chewiness were higher in the original keropok lekor sample than that of the developed sample. The opposite scenario was observed for the springiness. From the proximate analysis, it was found that moisture content was higher in the developed sample. This data validates the observation that higher moisture content can reduce the hardness and chewiness of a product (Huda *et al.*, 2012). Reduced hardness level of developed keropok lekor also proved that an inverse relationship exists between hardness level and the fat

Table 2. Texture analysis of keropok lekor

Parameters	Original keropok lekor	Developed keropok lekor
Hardness	5747.770±43.888 ^a	4801.710±219.578 ^b
Springiness	0.919±0.020 ^a	0.953±0.059 ^a
Chewiness	1445.632±124.579 ^a	1323.881±69.400 ^a

Means ± SD within the row bearing different superscripts are significantly different ($p < 0.05$)

content of a product (Pietrasik, 1999).

3.3 Sensory acceptability

There was a significant difference ($p < 0.05$) in all the sensory parameters assessed (Table 3). In all parameters, sample D had the highest acceptance rate. However, sample C scored least in all parameters, compared to the other samples. In terms of color, the highest acceptance was recorded (6.44) in sample D. It may be due to the orange color of bread crumb which made it unique among all samples. There was no significant difference between sample A and Sample C in terms of color, odor, texture, and taste. It indicates that boiled keropok lekor is almost the same whether or not spices are added. The analysis showed that sample A and sample B were significantly similar in terms of flavor. But, there was a significant difference between sample C, D and E. Likewise, the score of overall acceptance followed the same trend. This suggests that keropok lekor formulated with spices did affect the flavor and overall acceptance of the products. Furthermore, the higher sensory score of flavor and taste for sample D and sample E meets one of our objectives of this study to improve the taste and flavor of keropok lekor. Spices played a significant role in this regard (Pruthi, 1980). Moreover, the sensory score of overall acceptance of the samples made it obvious that sample D was the most preferred, sample E was liked moderately, sample A and B were liked slightly and sample C was neither liked or disliked. This is an agreement with the research conducted by Omar *et al.* (2011) which stated that people wanted to have new taste and flavor for keropok lekor.

4. Conclusion

Two potential innovative products were found in this

Table 3. Sensory evaluation and acceptability of keropok lekor

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Color	5.18±1.54 ^{ab}	5.08±0.96 ^a	4.90±1.50 ^a	6.44±1.05 ^c	5.82±1.02 ^{bc}
Odor	5.13±0.83 ^{ab}	5.26±0.64 ^b	4.64±0.71 ^a	6.59±0.88 ^c	6.26±0.94 ^c
Texture	5.10±0.64 ^{ab}	5.36±0.63 ^b	4.69±0.83 ^a	6.59±0.79 ^c	5.97±0.78 ^d
Flavor	5.18±0.76 ^b	5.54±0.85 ^b	4.64±0.67 ^a	6.74±0.61 ^c	6.23±0.81 ^d
Taste	5.13±1.08 ^{ab}	5.44±0.75 ^b	4.64±0.96 ^a	6.79±0.57 ^c	6.00±0.92 ^c
Overall Acceptance	5.21±0.66 ^b	5.59±0.72 ^b	4.67±0.48 ^a	6.90±0.38 ^c	6.18±0.94 ^d

Means ± SD within a row with different superscripts are significantly different ($p < 0.05$). Sample A= Boiled keropok lekor, Sample B= Fried keropok lekor, Sample C: Developed boiled keropok lekor, Sample D: Developed keropok lekor fried with bread crumb, Sample E: Developed keropok lekor curry.

study. One was keropok lekor fried with bread crumbs and the other was keropok lekor curry. People liked the spicy flavor of keropok lekor. The orange color of bread crumb used in the developed product was captivating. It was also cheap and convenient. Addition of spices made the developed keropok lekor as a good source of minerals. The knowledge received from this study can contribute to the development of other flavored keropok lekor. Further work could focus on improving the color of original keropok lekor as well as the developed keropok lekor curry. Moreover, the use of different fish type and its effect on the overall quality of the developed keropok lekor need to be studied.

Conflict of interest

None.

Acknowledgments

The authors would gratefully like to acknowledge the laboratory and monetary support given by the University Malaysia Terengganu, Malaysia.

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