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Compliance of Malaysia Standard Dried Fish Crackers of Selected Fish Processor in Terengganu

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ABSTRACT

Fish cracker is a traditional food snack among Malaysians. Fish cracker was prepared from minced fish, a mix of tapioca and sago starch, salt and flavour enhancer. The mixture is then moulded into a cylinder or cubic, steamed or boiled, cooled, sliced and dried. The samples (17) of fish crackers were collected from four districts in Terengganu (Kemaman, Kuala Nerus, Kuala Terengganu and Marang) for their proximate analysis. The results showed that the protein content for all samples met the requirement of Malaysia Food law 1985 and complied according to the Malaysian standard (MS 1113:1998), in which the protein content is more than 12 % and moisture content below 14 %. The protein and moisture content analysis showed that the sample from the Kemaman district showed the highest protein content (21.9 ± 3.9 %) and moisture content (11.4 ± 1.68 %) respectively. The lowest protein content was found in the Kuala Nerus district sample (14.25 ± 1.48 %) and moisture content (10 ± 1.13 %). Hence, the difference in comparison between protein content to one another district is because of different ratios of minced fish used in the formulation. All the fish cracker samples had a protein content of more than 12 % met the food regulation (Food law 1985) and international standard (CODEX 222-2001) and can be an alternative ready-to-eat snack food with low calorie, healthy and high nutrition value.

1. Introduction

In Malaysia, the dried fish crackers industry, particularly in regions like Terengganu, embodies a crucial segment of the traditional food sector. Compliance with the Malaysian Standard (MS) is paramount for maintaining product quality, consumer health, and competitive advantage in both local and international markets. Recent research emphasizes the significance of adherence to these standards to bolster the industry's integrity and marketability.

Generally, a cracker can be categorized as a type of snack which is made of flavoured fish or shrimp. The quality of the cracker produced depends on the freshness of the fish, type of fish used, ratios of the ingredient and the processing parameter used. A good quality fish cracker is determined

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by its taste and flavour, its crispness, and the extent of the cracker once in deep frying or by microwave cooking [1].

The types of fish that are usually used to process these fish crackers are the wolf herring (Ikan parang), sardines (Ikan tamban), round scad (Ikan selayang), threadfin bream (Ikan kerisi), red bigeye (Ikan lolong bara), goatfish (Ikan biji nangka), lizard fish (Ikan conor) and many others [2]. Fish cracker was prepared from minced fish, a mix of tapioca and sago starch, salt and flavour enhancer. The mixture is then moulded into a cylinder or cubic, steamed or boiled, cooled, sliced and dried until 10% of moisture content was achieved. The sliced dried cracker was deep fried in cooking oil before being served with tea or coffee during a tea break in the evening. This favourite snack was served as a high protein snack especially in east coast Malaysian states.

In Terengganu, merely 200 small and medium food processors are involved in the fish cracker industry. The uniqueness of each cracker was based on their producing technique and the formulations of the crackers. Other characteristics that differ among the fish cracker producers are an uneven expansion and shape, different sizes and colours. This is due to the different ratios of ingredients used by the producers. Therefore, it is important to ensure that the crackers suit the best characteristics of good quality crackers in terms of their sufficient expansion from puffing, crispiness, low moisture content and less oil absorption [3]. According to the Food Act 1985, fish crackers should be prepared from fish and tapioca flour with a protein content of not less than 12 %. The main objective of this study was to determine the protein and moisture content of fish crackers collected in several districts in Terengganu processors involved in fish cracker production.

A study by Shahril *et al.,* [4] underscores the dietary relevance of traditional foods like fish crackers in the Malaysian diet and highlights the need for rigorous compliance to nutritional standards to address health concerns associated with high sodium and saturated fat contents. Moreover, compliance challenges linked to small-scale production have been analyzed in recent research, suggesting the need for tailored regulatory frameworks to support local industries while ensuring quality and safety [5]. Fish crackers are an integral part of Malaysia's gastronomic heritage, particularly prominent in coastal regions like Terengganu where fishing is a key industry. These crackers, derived from fish meat, are celebrated for their unique texture and flavor. As the demand for healthier snack options rises, the nutritional content of these traditional snacks, especially their crude protein levels, has come under scrutiny. Adherence to the Malaysian Standards (MS) for crude protein content is essential not only for health reasons but also for maintaining consumer trust and meeting export quality requirements.

In recent years, there has been an increasing focus on the compliance of food products with national and international food safety and quality standards. For dried fish crackers, the crude protein content is a significant indicator of quality, as protein is the primary nutritional component derived from the fish meat used in their production. A study by Baishak *et al.,* [6] have investigated the nutritional profiles of fish crackers, emphasizing the importance of standardized production processes to ensure consistent protein levels across batches.

Hamid *et al.,* [7] discuss the moisture content and drying cost implications for Malaysian Spratelloides Gracilis crackers, providing insight into the production efficiencies that can affect nutritional quality. Moreover, Bong *et al.,* [8] have applied life cycle assessment techniques to analyze the water-related impacts of traditional food production, including fish crackers, to ensure that sustainability standards are met alongside nutritional guidelines. This dual focus on nutritional content and environmental sustainability is critical as the global food market increasingly demands that products not only be nutritious and safe but also environmentally responsible.

This paper aimed to explore the compliance of selected fish processors in Terengganu with Malaysia's crude protein standards for dried fish crackers. By conducting comprehensive testing and

analysis, this study assessed the status of compliance, identified gaps, and proposed measures to improve adherence to these standards. The findings are expected to offer valuable insights for manufacturers to enhance the quality of their products, thereby boosting consumer confidence and expanding market reach. This research will also contribute to the broader discussions on food safety, quality assurance, and sustainable production within the food industry.

2. Methodology

2.1 Raw Samples

Fish crackers were bought from a few local businesses in the districts of Kemaman, Marang, Kuala Nerus and Kuala Terengganu which were in the southern and central regions of Terengganu, respectively (Table 1). For proximate analysis, 500 g samples of fish crackers were bought from each of the four Terengganu snack providers.

Table 1
Proximate composition of dried fish crackers (unfried) each snack producers of selected districts in Terengganu

No.	Fish snack producer	District	% Protein	% Fat	% Moisture
1	A	Kuala Nerus	13.2	0.9	10.8
2	B		15.3	0.5	9.2
3	C	Marang	19.0	0.2	8.7
4	D		19.3	0.4	9.6
5	E	Kuala Terengganu	18.1	0.3	10.6
6	F		17.9	0.3	10.1
7	G		14.8	0.2	10.4
8	H		11.6	0.3	14
9	I		17.1	1.0	11.1
10	J		20.2	1.1	11.9
11	K	Kemaman	20.8	0.3	13.9
12	L		22.0	0.8	11.9
13	M		26.5	1.2	12.9
14	N		17.4	1.0	11.5
15	O		21.9	0.8	9.8
16	P		19.3	1.1	10.9
17	Q		25.3	1.2	9.10

Note: Each snack manufacturers were labelled in alphabet to undisclosed confidentiality

2.2 Proximate Analysis

A total of seventeen samples of dried fish crackers (unfried) were purchased from fish snack producers, were collected from four districts in Terengganu (Kemaman, Kuala Nerus, Kuala Terengganu and Marang) for their proximate analysis. All samples were produced from round scads and sardines species. All samples were stored at room temperature in individual plastic bag pack by producers in laboratory cabinet prior to analyses. Proximate composition analyses were performed according to AOAC 2000 [9] procedures. Water content was determined by drying samples at 105 ± 2°C until a constant weight was obtained. Fresh samples were used for the determination of crude

fat, protein and mineral contents. Crude fat was measured by solvent extraction method in a Soxhlet system.

2.2.1 Determination of protein content

Determination of crude protein content was carried out using Kjeldahl method according [9]. Firstly, 1.0 g of sample was weighed and placed into the digestion tube. Two tablets of Kjeltabs catalyst, Cu 3.5 were added into the digestion tube containing the sample. Then, 12 ml of the concentrated sulphuric acid (H_2SO_4) was added and mixed gently to wet and mix the sample and is connected to the digester (2006 Digester, FOSS, Sweden 1998). The system will be stopped when the acid vapour appears at the top of the exhaust system. Digestion process will be continued until the green or light blue solution was formed, then the solution will be cooled vertically for 10 - 20 mins. After the solution was cooled, 75 ml of distilled water was carefully added into the cold tube and proceed to the distillation process. The receiving solution was prepared by adding 25 ml of 4 % boric acid and 5 drops of Green Bromocresol into a 250 ml conical flask. The receiving solution was then placed into the distillation unit (2100 Kjeltec Distillation Unit, FOSS, 2002). The 50 ml of 40 % NaOH will be flowed into the tube and the distillation process will be operated for 4 mins until a light green solution is formed. Then, the solution will be titrated with 0.1 N of standard HCL until the colour turns blue or grey and the volume of titration, recorded. Blank solution contained two tablets of Kjeltabs Cu 3.5 catalysts and 12 mL of concentrate H_2SO_4 without any sample was used to undergo similar processes which are digestion, distillation and titration. A protein factor (F) of 6.25 was used to convert the nitrogen value to crude protein content. The values obtained from the titration will be used to calculate the percentage of nitrogen and protein content using the following Eq. (1) and (2), respectively:

$$\text{Percentage of nitrogen (\%)} = [(T-B)\times N\times 14.007]) / (\text{Weight of sample (mg)}]\times 100 \quad (1)$$

$$\text{Protein}=\%\ N \times F \quad (2)$$

Where,
T = Volume of titration sample
B = Volume of titration for blank
N = Normality of acid (HCL)
F = Protein factor 6.25

2.3 Statistical Analysis

The data were analyzed and recorded by means ± standard deviation (SD) and all measurements were done in triplicate and the data were analyzed by SAS 9.1. The significant difference was considered at the level of $p < 0.05$.

3. Results

3.1 Proximate Analysis

Every sample of dried fish crackers met the requirements of the Malaysia Food Law of 1985 (MS 1113: 1998 Malaysia Standard Specification for Fish Crackers) [9], with a protein content exceeding 12 % and moisture content under 14 % for unfried crackers (Table 2). The proximate composition of

dried fish crackers (unfried) from different districts in Terengganu revealed significant variations in protein, moisture and fat content. The findings in Table 3 and Figure 1 show that Kemaman district has the highest mean protein content (21.9 ± 3.19 %), which is significantly greater than the other districts. This is followed by Marang (19.15 ± 0.21 %), Kuala Terengganu (16.62 ± 3.01 %) and Kuala Nerus (14.25 ± 1.48 %). The differences in protein content could be attributed to variations in the raw materials used, such as the type of fish, processing methods and drying techniques specific to each district.

Table 2
Standard of fish crackers based on local and international

Analysis	Malaysia Food Act (% protein)	Codex 222-2001 (% protein)	MS Standard 1998 (% protein)
Protein content	Minimum 12	gred 1: >12 gred 2: 8 gred 3: 5	Minimum 12
Moisture content	Maximum 14	8 to 14	Maximum 14

Table 3
Proximate composition of dried fish crackers (unfried) between all districts in Terengganu

District	Mean protein %	Mean moisture %	Mean fat %
Kuala Nerus	14.25 ± 1.48^{d}	10 ± 1.13^{b}	0.45 ± 0.21^{c}
Marang	19.15 ± 0.21^{b}	9.15 ± 0.64^{c}	0.70 ± 0.25^{b}
Kuala Terengganu	16.62 ± 3.01^{c}	11.35 ± 1.44^{a}	0.50 ± 0.23^{c}
Kemaman	21.9 ± 3.19^{a}	11.4 ± 1.68^{a}	0.95 ± 0.25^{a}

Note: Each value is presented as mean ± standard deviation (n = 3). Means with different letters differ significantly ($p < 0.05$)

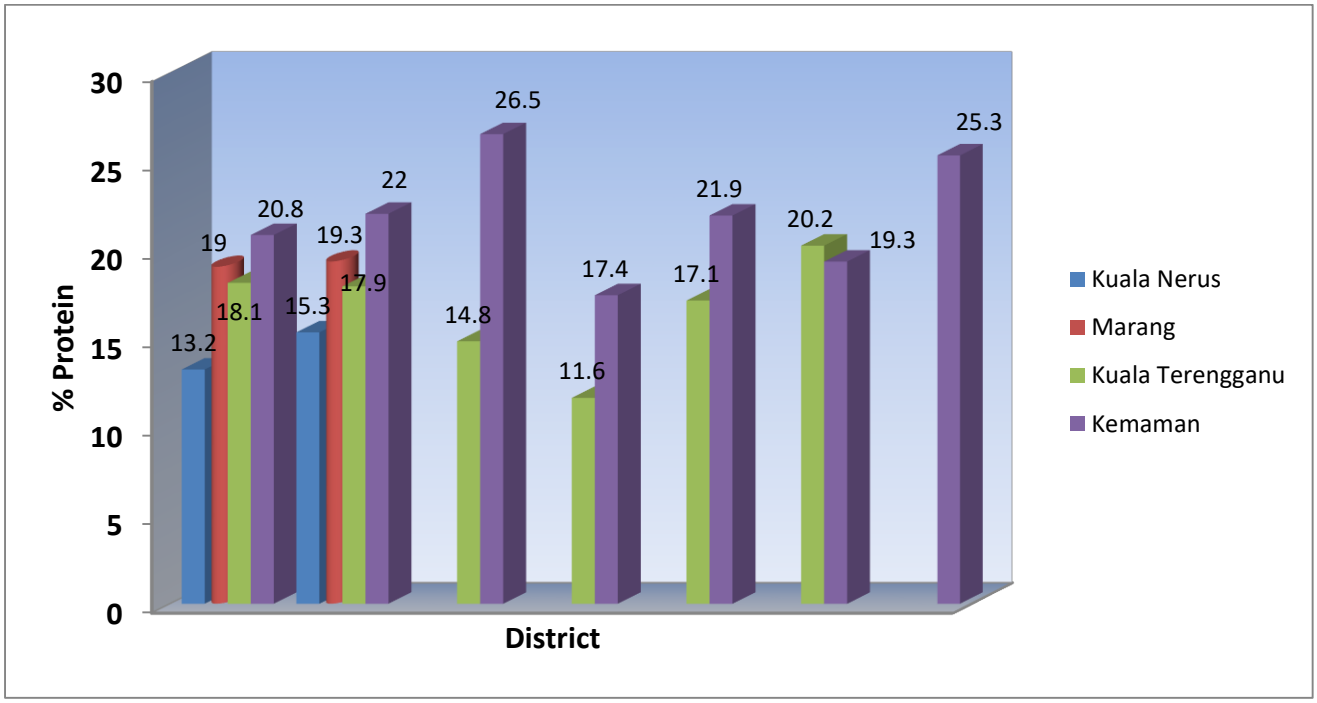

Fig. 1. Protein analysis of dried fish crackers among food producer in Terengganu

Moisture content varies across the districts, with Kuala Terengganu (11.35 ± 1.44 %) and Kemaman (11.4 ± 1.68 %) showing significantly higher moisture levels compared to Marang (9.15 ± 0.64 %) and Kuala Nerus (10 ± 1.13 %). The moisture content is crucial for determining the shelf life

and texture of the crackers. Higher moisture levels, as observed in Kuala Terengganu and Kemaman, may lead to a shorter shelf life due to the increased risk of microbial growth. In contrast, Marang and Kuala Nerus have relatively lower moisture contents, which could enhance the shelf stability of the crackers.

In terms of fat content, Kemaman also ranks highest (0.95 ± 0.25 %), followed by Marang (0.70 ± 0.25 %), Kuala Terengganu (0.50 ± 0.23 %), and Kuala Nerus (0.45 ± 0.21 %). The fat content in fish crackers is typically low, which aligns with the findings in this study. However, the variation in fat content might be influenced by the type of fish and the specific parts used in production, as well as differences in the drying process across districts.

For instance, in a study conducted by [11] shown that the proximate composition of dried fish crackers from different Malaysian regions indicated a similar range in protein content (14-22 %), which aligns with the findings from Terengganu. However, the moisture content reported by [11] was generally lower (8-10 %) compared to Kuala Terengganu and Kemaman districts in the current study. This discrepancy could be due to different drying techniques or environmental conditions during drying.

Similarly, the fat content reported by [11] was slightly higher (0.8-1.2 %) than what was observed in Kuala Nerus and Kuala Terengganu but aligns more closely with the fat content in Kemaman. This suggests that regional differences and local processing methods significantly impact the nutritional composition of dried fish products.

According to Huda *et al.,* [12] fish crackers was significantly different ($p < 0.05$) in their chemical composition, colour and linear expansion, the moisture content ranged between 9.37 and 13.83 %, whereas fat content ranged from 0.85 - 3.38 %, respectively. Variations in fat content in fish crackers can be attributed to differences in the type or parts of fish used, as well as the quantity of fish used in the keropok formulation inherent fat percentages.

These outcomes align with those reported by [13], which indicate that an increase in the ratio of fish meat correlates with a rise in the fat content of the fish crackers. Similarly, King [14] noted that fish meat comprising 40 – 60 % of the fish crackers formulation resulted in a protein content ranging from 10 - 19 % and a fat content between 0.5 - 1.9 %. Yu *et al.,* [13] also found that wheat flour-based keropok exhibited the highest protein levels, minimal linear expansion and received the lowest acceptance ratings. Additionally, the inclusion of greater amounts of minced fish or protein-rich ingredients in fish cracker recipes tends to elevate both protein and fat percentages in the end product. The study by Baishak *et al.,* [15] showed that the protein content in fish crackers varied significantly among three different carp species, emphasizing how fish type influences nutritional outcomes. High protein content is a desirable attribute for promoting fish crackers as nutritious snacks.

4. Conclusions

In conclusion, the fish cracker samples that protein content not less than 12 % meet the food regulation and international standard (codex 222-2001) [16] and can be an alternative ready-to-eat snack food to a high-calorie, healthy and high nutritional value. Regional variations in fish cracker formulations, such as those discussed in various studies, also reflect on protein and moisture content. Different regions may prefer varying textures and nutritional profiles, influencing how recipes are formulated to cater to these preferences. The adaptation of recipes to include different starches or flours as seen in the studies also speaks to how these ingredients affect the binding of water and the structural integrity of the crackers, thereby influencing both protein integration and moisture retention.

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