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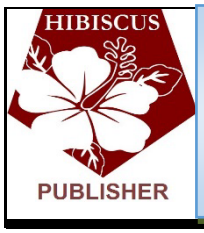

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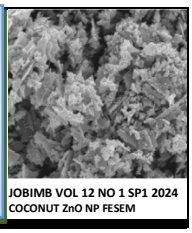

Physicochemical And Sensorial Properties of Fish Sausage Incorporated with Dorado Fish

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ABSTRACT

This study aimed to study the physicochemical properties and sensory acceptability of fish sausage incorporated with Dorado fish (*Coryphaena hippurus*). There are six different formulations with different ratios of surimi-to-Dorado fish, consisting of sample A (100:0), B (80:20), C (60:40), D (40:60), E (20:80) and F (0:100). Chemical properties include moisture (67.05-68.04%), ash (1.33-2.00%), fat (0.11-1.51%), protein (15.87-19.03%), and carbohydrate (10.40-14.64%) content, while texture profile analysis includes hardness (2426.0-2777.6 g), springiness (0.84-0.87 cm), cohesiveness (0.68-0.70), gumminess (1698.5-1876.5 g), and chewiness (1481.3-1698.5 g/cm). Colour profile, L*, a*, and b* was ranged from 80.56 to 82.17, -0.92 to 0.35, and 16.30 to 18.35, respectively. Sensory evaluation revealed no significant differences among samples, with sample B scoring the highest mean values in colour, tenderness, juiciness, and overall acceptability. The addition of Dorado fish percentage affects the physicochemical properties by increasing the fat, protein content, and a* value while decreasing the moisture, carbohydrate content, cohesiveness value, and L* value. Overall, incorporating Dorado fish into the sausage could contribute to cost reduction given its lower price compared to surimi and nutritional composition enhancement while maintaining a consistent preference level with the control sample.

INTRODUCTION

Sausages are seasoned meats including pork, beef, chicken, fish, and buffalo, that are pulverized, stuffed into casings, and may undergo processing including smoking, curing, fermentation, or heating [1]. It is a kind of fast-food meat product [2]. On average, individuals in the United States consume approximately 70 sausages per year [3]. Fish and fishery products are valuable sources of protein, essential fatty acids, vitamins, and minerals that are beneficial to human nutrition [4]. In addition, lean fish such as Dorado fish (DF) comprised higher polyunsaturated fatty acids as compared to fattier fish [5].

This research aims to see the possibility of producing a healthier food product, thus addressing the problem of chronic illnesses linked to fast food. Apart from that, it will also reduce the overdependence on specific fish species, and underutilization of DF in Malaysia. The goal is to develop a nutritional, wholesome, and cost-effective fish sausage from DF for commercialization in Malaysia. Utilizing DF can help alleviate stress on specific fish populations and provide a healthier option for frozen food products. The main objectives of this research are to determine the physiochemical properties of developed DF sausage and to determine the acceptability of the sausage via sensory evaluation.

MATERIALS AND METHODS

Fresh whole Dorado fish (DF) was purchased from a local Pulau Kambing, Kuala Terengganu supplier. The whole fish was filleted, skinned, and stored in a freezer (-18°C) until further utilization. Surimi was purchased at Maperow Sdn. Bhd., Terengganu. Each chemical and reagent applied were of analytical grade. How do you prepare your fish sausage? You prepared sample A-F, but you did not mention here the formulations for each of them. There are six different formulations with different ratios of surimi-to-Dorado fish, consisting of sample A (100:0), B (80:20), C (60:40), D (40:60), E (20:80) and F (0:100).

Proximate composition was determined following AOAC methods [6] in duplicates. Sausage formulations were subjected to texture analysis using a TA.XTplus Texture Analyser (Stable Microsystem USA) in triplicate. A compression plate (75mm)

with specified settings (5 kg load cell, 3.0 mm/s speed, 1.0 mm/s test speed, 3.0 mm/s post-test speed, 65% prefixed strain) was employed. In triplicate, sausage colour was measured using a Minolta spectrophotometer CM 3500d (Konica Minolta, USA). The sensory evaluation included 30 untrained panelists from UMT in acceptability tests. Results were analysed using one-way ANOVA and post hoc Tukey's Honest Significant Difference (Statistical Analysia Software -SAS), LSD at a 95% significance level, to identify differences between mean values.

RESULTS AND DISCUSSIONS

Chemical Properties

The proximate compositions of fish sausage in varying ratios are given in **Table 1**. There were some significant differences in moisture, fat, protein, and carbohydrate content among the samples ($p<0.05$). The decreasing trend of moisture content was due to the variation in the initial moisture content of surimi and DF [7]. Furthermore, a previous study revealed that the water-holding capacity of surimi surpasses that of minced fish [8]. The rising trend of fat and protein content was due to the variation in the initial fat and protein content of surimi and DF [8]. The fluctuations in moisture, ash, fat, and protein levels exerted a more pronounced influence on carbohydrate contents when compared to the relatively consistent impact of sugar and starch levels [9].

Texture Profile Analysis

The results of textural properties are presented in **Table 2**. There were some significant differences ($p<0.05$) found for cohesiveness. Amiza and Ng (2015) [7] attributed the elevated cohesiveness in samples to low-fat content. This aligns with another finding, indicating that increased oil content leads to reduced particle cohesion by introducing a lubricating effect, diminishing intermolecular friction among food particles [10].

Colour Analysis

The results of colour analysis are shown in **Table 3**. There were significant differences ($p<0.05$) among various sausage formulations. The decline in lightness and rise in redness were attributed to fish mince's darker colour compared to surimi, stemming from its higher myoglobin content [11]. Amiza and Ng (2015) [7] found yellowness is linked to starch levels instead of surimi-to-fish ratio.

Sensory Analysis

Table 4 displays the preferences of 30 panelists for different formulations, revealing significant differences ($p<0.05$) in juiciness acceptability. Juiciness is directly linked to fat content, while surimi's higher water-holding capacity plays a crucial role [7, 11]. In this study, moisture content outweighs fat content in contributing to juiciness. Sample B scored highest in overall acceptability. All formulations received favourable ratings (>5 on 7-point scale), indicating general preference among panelists with varying individual tastes.

Table 1. Overall chemical properties of fish sausage.

Sample	Surimi-to-DF Ratio	Moisture(%)	Ash(%)	Fat(%)	Protein(%)	Carbohydrate(%)
A	100:0	68.04±0.16^{a}	1.33±0.34^{a}	0.11±0.13^{c}	15.87±0.12^{b}	14.64±0.49^{a}
B	80:20	67.77±0.08^{ab}	1.39±0.11^{a}	0.13±0.10^{c}	16.72±0.05^{ab}	13.98±0.33^{a}
C	60:40	67.40±0.12^{bc}	1.49±0.37^{a}	0.39±0.13^{bc}	16.99±0.94^{ab}	13.73±1.33^{a}
D	40:60	67.31±0.02^{bc}	1.54±0.13^{a}	0.63±0.29 ^{abc}	17.34±0.95^{ab}	13.18±0.86^{ab}
E	20:80	67.24±0.17^{c}	1.88±0.07^{a}	1.06±0.07^{ab}	17.62±0.54^{ab}	12.20±0.23^{ab}
F	0:100	67.05±0.15^{c}	2.00±0.02^{a}	1.51±0.41^{a}	19.03±0.19^{a}	10.40±0.09^{b}

Value with the different superscripts is significantly different at ($p<0.05$).

Table 2. Overall texture profile of fish sausage.

Sample	Surimi-to-DF Ratio	Hardness(g)	Springiness (cm)	Cohesiveness (ratio)	Gumminess(g)	Chewiness (g/cm)
A	100:0	2426.0±185^{a}	0.87±0.03^{a}	0.70±0^{a}	1698.5±124.8^{a}	1481.3±70.1^{a}
B	80:20	2559.0±187^{a}	0.86±0.01^{a}	0.6967±0.01^{ab}	1784.1±141.3^{a}	1538.0±112.9^{a}
C	60:40	2658.0±39.8^{a}	0.86±0.02^{a}	0.6877±0.01^{ab}	1827.7±11.83^{a}	1566.8±34.4^{a}
D	40:60	2718.6±27.6^{a}	0.85±0.02^{a}	0.6767±0.01^{b}	1839.7±32.5^{a}	1570.6±30.2^{a}
E	20:80	2725.9±143.1^{a}	0.85±0.01^{a}	0.6780±0^{ab}	1847.6±93.3^{a}	1574.7±88.7^{a}
F	0:100	2777.6±164.3^{a}	0.84±0^{a}	0.6757±0.01^{b}	1876.5±117.4^{a}	1576.7±93.1^{a}

Value with the different superscripts is significantly different between column at ($p<0.05$).

Table 3. Colour profile properties (L*, a*, and b*) of fish sausage.

Sample	Surimi-to-DF Ratio	L*	a*	b*
A	100:0	82.17±0.13^{a}	-0.92±0.12^{d}	17.31±0.26^{ab}
B	80:20	82.03±0.45^{a}	-0.83±0.03^{d}	16.30±0.26^{b}
C	60:40	81.41±0.85^{ab}	-0.43±0.04^{c}	17.80±0.38^{a}
D	40:60	81.34±0.41^{ab}	-0.20±0.11^{b}	18.35±0.71^{a}
E	20:80	81.32±0.17^{ab}	-0.07±0.03^{b}	17.78±0.29^{a}
F	0:100	80.56±0.77^{b}	0.35±0.10^{a}	17.59±0.92^{ab}

Value with different superscripts is significantly different between column at ($p<0.05$).

Table 4. Overall sensory properties of fish sausage.

Sample	Surimi-to-DF Ratio	Colour	Tenderness	Juiciness	Fishy Flavour	Overall Acceptability
A	100:0	5.57±1.38^{a}	5.50±1.33^{a}	5.17±1.34^{ab}	4.43±1.65^{a}	5.100±1.21^{a}
B	80:20	5.80±1.10^{a}	5.60±1.19^{a}	5.43± 1.41^{a}	5.30±1.58^{a}	5.733±1.14^{a}
C	60:40	5.40±1.43^{a}	4.90±1.27^{a}	4.67± 1.37^{ab}	4.97±1.43^{a}	5.133±1.17^{a}
D	40:60	5.33±1.27^{a}	5.17±1.23^{a}	4.87± 1.36^{ab}	4.87±1.57^{a}	5.300±1.15^{a}
E	20:80	5.47±1.28^{a}	4.93±1.17^{a}	4.77± 1.46^{ab}	5.37±1.22^{a}	5.067±1.46^{a}
F	0:100	5.50±1.17^{a}	5.17±1.26^{a}	4.37± 1.43^{b}	5.20±1.23^{a}	5.100±1.21^{a}

Value with different superscripts is significantly different between column at ($p<0.05$).

CONCLUSION

The addition of Dorado fish percentage affects the physicochemical properties by increasing the fat, protein content, and a* value while decreasing the moisture, carbohydrate content, cohesiveness value, and L* value. Overall, incorporating Dorado fish into the sausage could contribute to cost reduction given its lower price compared to surimi and nutritional composition enhancement while maintaining a consistent preference level with the control sample.

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