



Baked Cheese Stick: Analysis of Nutrient Content and Halal Authentication

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ABSTRACT

Halal food market is increasing in the past decades which eventually leads to the halal as a food branding in the marketing strategy. One of the issues of halal authentication in the bakery product industry is the potential adulteration of the butter from lard. This study aims to investigate the halal status as well as nutritional aspects of baked cheese stick fortified with chia seed flour (*Salvia hispanica*). As for the halal authentication, the butter with halal and non-halal logo were compared in this study. For the nutritional aspects, this study identified the content of essential fatty acids as well as the trans fat. The fatty acid profile was analysed using GC (Gas Chromatography) and FT-IR (Fourier-Transform Infrared Spectroscopy). Principal Component Analysis (PCA) was applied for data interpretation. From the GC analysis, it was found that the most abundant fatty acid in margarine and butter sample are palmitic acid (C16:0) and oleic acid (C18:1cis). The chia seed flour consists of linolenic acid (C18:3n3) and linoleic acid (C18:2cis). The findings also showed that the baked cheese stick also contain slight amount of linolenic acid showed by both GC and FT-IR. The result from FT-IR showed that further confirmation to identify the peak at wavelength 668.1 cm⁻¹ and 2950– 2990 cm⁻¹. No trans fatty acid detected in the products. From the result of the 3D PCA score plot, it could be shown that there is grouping between the samples with a Q2 coefficient value of 0.411. Halal logo butter is grouped with non-halal logo butter, and neither of them is grouped with lard oil. Untreated baked cheese stick (without chia seed flour) is grouped with the both treated baked cheese stick (added with: 1) chia seed flour and halal logo butter; 2) chia seed flour and non-halal logo butter) and all baked cheese sticks are not in the same group with lard oil. The originality and value of this research lie in the holistic approach to halal authentication for bakery products. More research with a greater number of samples—including butter with lard—is necessary to confirm these results.

Keywords: chia seed flour; fatty acid; halal authentication

BACKGROUND

20.4% death primarily attributed to **CVD**

Halal branding strategy and the increase of halal food market



Baked cheese stick

- Savory snack
- Kepok flour substitution → Local food source, fiber, gluten-free
- Chia seed → contain omega-3 fatty acid

Ratio of omega-3 and omega-6 consumption
Unhealthy snacking habit

This study aims to analyze fatty acid profile of developed baked cheese stick product fortified with chia seed flour (*Salvia hispanica*).

METHODS

Development of baked cheese stick

Fatty acid analysis

FTIR Measurement

Statistical analysis

Ingredients:
Mocaf flour, Banana flour, Tapioca flour, chia seed flour, edam cheese, parmesan cheese, margarine, butter, low fat milk, baking powder

Gas chromatography (GC) using a flame ionization detector

FTIR spectrometer equipped with a detector of deuterated triglycine sulphate (DTGS) and KBr beam splitter.

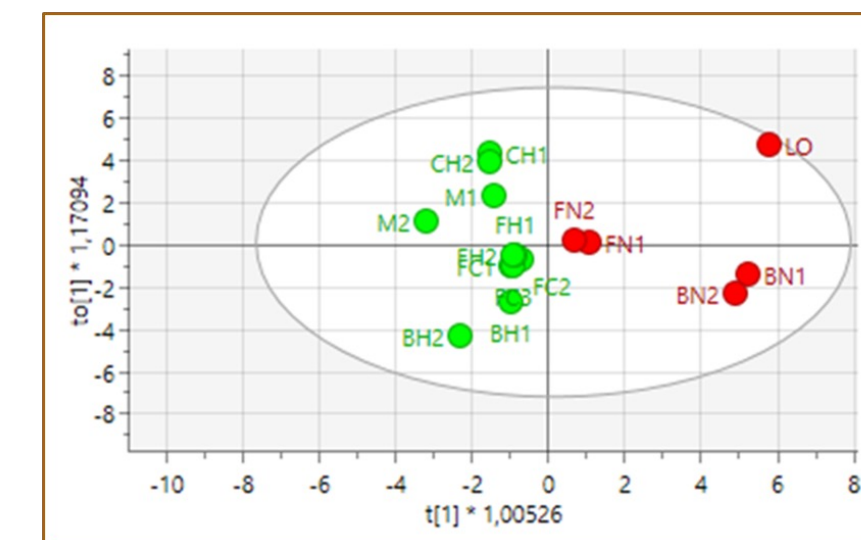
Principal Component Analysis (PCA) was applied for data interpretation.

RESULTS AND DISCUSSION

Table 1. Fatty acid composition of lard and sample

Fatty acid	Sample							
	FC	FH	FN	CH	BH	BN	M	LO
C4:0	0,9745	0,8199	1,0492	-	1,2462	2,3163	0,0613	-
C6:0	0,7676	0,6674	0,9743	0,0309	0,9566	2,2164	0,0720	-
Caprylic acid (C8:0)	0,5948	0,5189	0,6613	0,0237	0,8839	1,4933	0,0966	0,0731
Capric acid (C10:0)	1,1693	1,0467	1,5991	0,0515	1,4035	3,7319	0,1163	0,0701
Lauric acid (C12:0)	2,6974	2,4557	2,2016	0,0768	5,2298	4,4033	0,2815	0,1141
Miristic acid (C14:0)	5,7508	5,4501	6,9825	0,2814	7,8584	13,9898	1,0838	1,2651
Myristoleic acid (C14:1)	0,3663	0,3538	0,5273	-	0,4253	1,1184	-	-
C16:0	41,7818	41,3222	41,1796	8,6358	38,5171	36,2806	45,8194	24,046
C16:1	0,6645	0,6660	0,7946	0,0946	0,9220	1,5612	0,1996	1,8331
C17:0	0,3198	0,3179	0,3513	0,0623	0,4139	0,6105	0,1427	0,216
C18:0	6,7620	6,7777	6,6476	3,5359	8,7901	9,7573	4,3775	10,264
C18:1cis	30,5631	29,8343	28,0922	6,8767	29,1888	20,1015	37,3758	45,427
C18:2cis	6,6809	6,4013	6,0983	19,5183	3,4106	1,7363	9,2073	14,426
C18:3n3	0,3178	2,5180	2,3297	60,1509	0,3010	0,4952	0,2446	0,5831
C20:0	0,2717	0,2785	0,2042	0,2626	0,3825	0,1107	0,4037	0,1991
C20:1	0,1011	0,1059	0,0686	0,1236	0,1282	2,3163	0,1587	0,7451

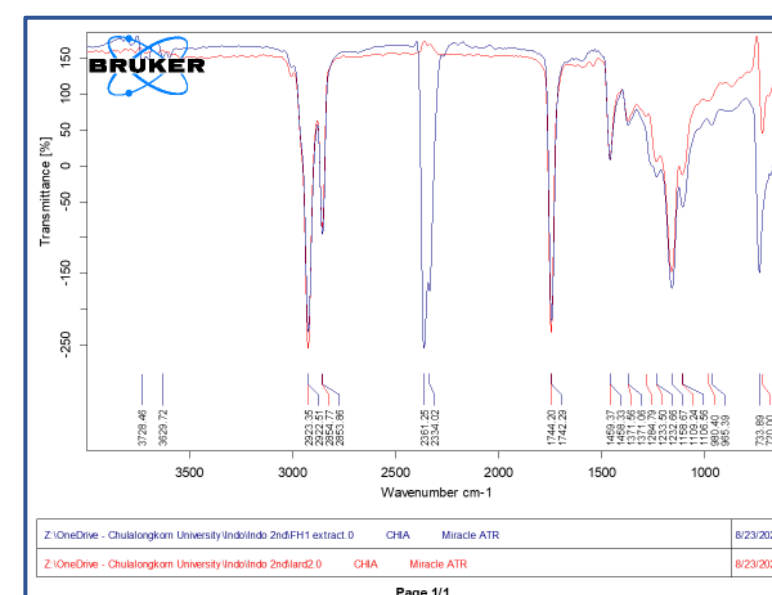
FC Cheese stick (control formula), FH Cheese stick (substituted with chia seed flour, use butter with halal logo), FN Cheese stick (substituted with chia seed flour, use butter without halal logo), CH (chia seed flour), BH (butter with halal logo), BN (butter without halal logo), M (margarine), LO (lard oil)



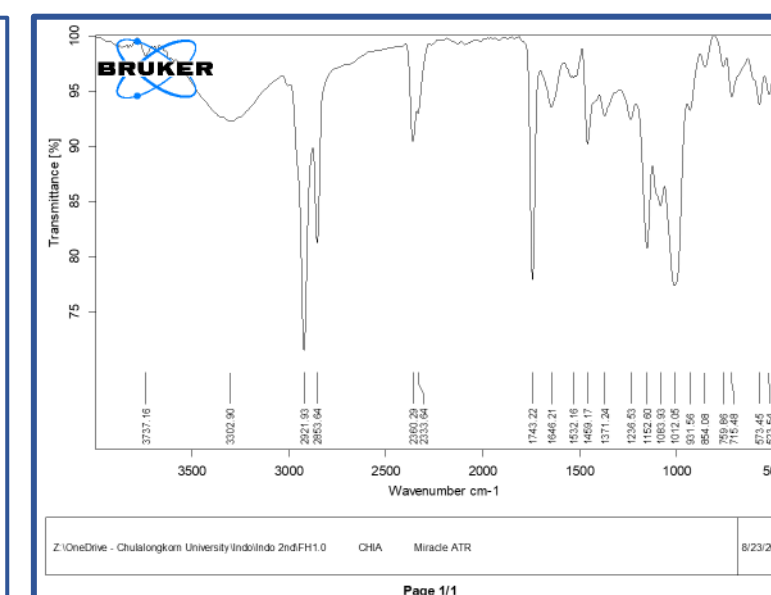
3D PCA score plot (Q2 coefficient value of 0.411) and OPLS-DA with Q2 coefficient value 0,716

Grouping between the samples. BH is grouped with BN, neither of them is grouped with LO. FC is grouped with FH and FN. All baked cheese sticks are not in the same group with LO.

Most abundant fatty acid in margarine and butter sample are palmitic acid (C16:0) and oleic acid (C18:1cis). The chia seed flour consists of linolenic acid (C18:3n3) and linoleic acid (C18:2cis). The findings also showed that the baked cheese stick also contain slight amount of linolenic acid showed by both GC and FT-IR.



FH



FN

The result from FT-IR showed that further confirmation to identify the peak at wavelength 668.1 cm⁻¹ and 2950– 2990 cm⁻¹. No trans fatty acid detected in the products.

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