GCMS_Identification_of_Volatile.pdf

by

Submission date: 25-Jun-2020 03:31PM (UTC+0800)
Submission ID: 1349423538
File name: GCMS_Identification_of_Volatile.pdf (540.37K)
Word count: 2633
Character count: 14077

Asian Journal of Applied Research for Community Development and Empowerment. Vol 4 (2020), No.1

AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

GCMS Identification of Volatile Compounds in Indonesia's Specific Traditional "Kalio" and Dried Rendang

*Rini *, Daimon Syukri and Fauzan Azima*

Department of Agricultural Product Technology, Faculty of Agricultural University, Andalas University, Indonesia Pampanga. Email: rinibahar59@yahoo.com

ARTICLE INFO

Article History:
Received: 12 February 20
Final Revision: 29 March 20
Accepted: 01 April 20
Online Publication: 19 April 2020

KEYWORDS

rendang, cooking process, heating treatment, specific food, qualitative

CORRESPONDING AUTHOR

E-mail: rinibahar59@yahoo.com

A B S T R A C T

Rendang is a traditional-specific food in Indonesia. Rendang is generally made with beef, coconut milk, and spices. There are two types of rendang according to its time processing. Rendang "kalio" is a final product of rendang that needs a short heating period while dried rendang is produced by the longer heating period. In the present study, the profile of the volatile compounds that most obtained from spices was analyzed by gas chromatography-mass spectrometry (GC-MS) to characterize the influence of the cooking period on the flavor characteristic of two available types of rendang. There were dozens of volatile compounds identified including carboxylic, aromatic, carbonyl, and alcohols where carboxylic and aromatics were the predominant volatile fractions. The results indicated that the cooking period affected the profile of volatile compounds between "kalio" rendang and dried rendang. Carboxylic and aromatics were less in the dried rendang compared to the rendang "kalio" where others were opposites. The increase of carbonyls and alcohol during the cooking process has suggested can play a crucial role in the flavor of dried rendang.

1. INTRODUCTION

1.1. Research Background

Spices are one of the most valuable commodities and have been extensively used over the years as a compound to add flavor in food preparation. In addition, spices are a good source of several health promoting compounds, such as flavonoids, carotenoids, vitamin C, and terpenoids. Especially in Indonesia, the utilization of spices are widely used as ingredient in the traditional foods such as rendang. Rendang is a traditional Minangkabau food which recognized as one of the most delicious foods in the world. The basic ingredients of rendang are beef, coconut milk and spices. The process of rendang's production took certain period of cooking around 6 to 7 hours at the medium high temperature 80-95ºC [1].

Spices in production of rendang will contribute to the presence of volatile compounds. Volatile compounds in foods create odors/aromas, and their types and concentrations dictate olfactory and taste perception [2]. Since the production of rendang took a quite long period of heating process, this condition may affect to volatile compounds that derived for the spices. Moreover, since the main material on the production of rendang consist of meat and coconut milk that rich on carbohydrates and proteins, the heating process condition might also influence the chemical reaction among ingredients of rendang. The Volatile compounds, including pyrazines, pryidines, and furans, are readily generated by Maillard reactions of reducing sugar with amino compounds [3].

There are two type of rendang according its time processing. Rendang kalio is a final product of rendang that need short heating period while dried rendang is produced by the longer heating period. In common dried rendang has famous compare to kalio rendang. According to the length of heating period during the production of rendang, the profile of its volatile compounds may be different. There is no information regarding the differences of volatile compounds in two types processed rendang available yet.

1.2. Research Objective

This study aims to identify the volatiles in two types of rendang relating to the heating process during its production.

2. MATERIALS AND METHODS

2.1. Materials

The basic material in this experiment were beef, coconut milk and related spices such as red chili, onion, garlic, ginger, galangal,

https://doi.org/10.29165/ajarcde.v4i1.34

coriander, nutmeg, clove, white pepper, caraway, cardamom, lemon grass, turmeric leaf, lime leaf, and bay leaf. The traditional cooking equipments were used for the production of rendang. A gas –chromatography coupled with mass spectrometer detection was used for identification of volatile compounds.

2.2. *The Production of Rendang*

All of the spices grounded except galangal and leafs and mix together with coconut milk and then were heated at temperature around 90 – 93 °C for 90 minutes until the sauce become thick. The beef was added into the sauce and keep in the heat at temperature around 90 – 93 °C for 90 minute until the sauce more thick and the color has changed to brown where this product was named as Kalio. The process was further continue at the lower temperature around 80 - 85 °C until dryness and the color has changed to dark brown or black, this product was named as dried rendang.

2.3. *Extraction of volatile compounds in rendang and its analysis by using gas chromatography-mass spectrometer (GC-MS)*

Three grams of extracted oil of rendang kalio and rendang kering were extracted using aceton for three times (15 minutes each time) with the assistance of ultrasonic. The obtained turbid solution was filtrated and the excess solvent was removed by rotavapor. Then the extractum was diluted with 1mL of ethylalcohol: *n*-acetone (1:1,v/v) and was filtered through a 0.22 μm membrane filter. 1 μL of subsequent filtrate was injected to GCMS for analysis.

The GSMS identification was set up according to the method the described by Ref. [4]. Shimadzu GCMS-QP-2010 plus system Series gas chromatograph (Shimadzu, Kyoto, Japan) was used to carry out the identification of contained volatile compound in the extracted samples. The Gas Chromatographic columns were used for separation of matrix in samples as follows as DB-5MS and DB-1MS (30 m 0.25 mm 0.25 m) column that was supplied by Agilent (Agilent Technologies, Santa Clara, CA, USA). The injector temperature was 250 ˚C. The injection mode was split-less, and the injection volume 2µL. Helium was the carrier gas at a flow of 1 mL/min. The transfer line and source temperature were set at 300 ˚C. The oven temperature was initially at 50 ˚C for 2 min, then increased at a rate of 10 ˚C/min until 250 ˚C and held at 250 ˚C for 3 min. The chromatograms were acquired in full scan mode (m/z 35-500). The mass spectral libraries NIST47 was used for identification purposes.

3. RESULT AND DISCUSSION

3.1. *Volatile compound in rendang kalio and dried rendang*

In this experiment, the volatile compounds were extracted by using acetone as a semi-polar solvent. The basic difference between rendang kalio and dried rendang is by its moisture contents. Therefore, prior to volatile compounds extraction, both of samples were dried in vacuum condition to reduce and equalize the moisture. The volatile compounds were then extracted from the samples as the form of oil, and finally the volatile compounds in the oil were extracted by acetone to further identification by using GC-MS. The selection of acetone as the extraction solvent was to emphasize the volatile compounds that contain in the spices since the main concern of this study was to evaluate the changes of volatile compounds in rendang relating to the presence of spices. Ref. [5] indicated that the main compounds of spices was suggested as carbonyls which classify as semi-polar compound.

Table 1 indicates the identified volatile compounds both in rendang kalio and dried rendang. As the results, it can be noticed that there were 38 volatile compounds detected in rendang kalio and 31 compounds in dried rendang. The detected compounds in both samples can be identified as carboxylic, aromatics, esters, alkenes, carbonyls, alcohols, sulfides and alkynes (data not shown). Among those compounds, carboxylics aromatics and carbonyls were observed as the major components. There were different profile of volatile compounds between rendang kalio and dried rendang. Carboxylics and aromatics were less in the dried rendang compared to the rendang kalio where others were opposites. It can be suggested that the degradation of carboxylic might contribute to the formation of other volatile compounds during long period of heating. Moreover, it can also be suggested that the addition of spices has contributed to the profile of volatile compounds in the processed rendang.

Table 1. The percentage of detected volatile compound in rendang kalio and dried rendang according to its functional groups

No	Functional groups	Volatile compounds (%)	
		Kalio	Dried
1	carboxylics	75.88	65.15
2	Aromatics	9.57	14.07
3	Alcohols	11.33	16.99
4	Carbonyls	3.06	6.59

3.2. *Carboxylic in rendang kalio and dried rendang*

Table 2 indicates the specific identified carboxylics both in rendang kalio and dried rendang. The data shows that most of detected carboxylics in rendang both in kalio form and dried form presence as carboxylic acids. It can be suggested that the detected carboxylics were originated from the coconut milk as the main material of rendang. The period of cooking was affected the the stability of carboxylics.

Table 2. The percentage of identified of carboxylics in rendang kalio and dried rendang

No	Name of carboxylics	Kalio (%)	Dried (%)
1	n-Hexadecanoid acid	-	7.75
2	Tetradecanoid acid	32.62	14.22
3	Dodecanoid acid	18.73	28.39
4	Oleic acid	-	-
5	Acetic acid, (22-propenylthiol)	0.14	-
6	N- decanoic acid	-	0.44

3.3. *Identified aromatic in rendang*

Table 3 indicates the specific identified aromatics both in rendang kalio and dried rendang. Aromatics has been suggested as the main of flavor compounds. The data indicates there were ten aromatics that detected both in rendang kalio and dried rendang. Similar profile as carboxylics, the aromatics was observed in the higher amount in rendang kalio compared to dried rendang therefore it also can be suggested that the duration period the cooking has decreased the volatile compound in processed rendang. Ref [6] has mentioned that during heat treatment of food, poly aromatic hydrocarbon (PAH) migt be produced, however on the production of rendang both of kalio or dried rendang, PAH was not observed. The utilization of medium-high temperature such as ± 90 °C during certain length time of cooking was confirmedly not produce any PAH on production of rendang.

Table 3. The percentage of identified of aromatics in rendang kalio and dried rendang

No	Name of aromatics	Kalio (%)	Dried (%)
1	3-Allyl-6-methoxyphenol	8.34	3.53
2	Phenol, 2-methoxy-4-(2-propenyl)-, acetate	4.99	2.06
3	4-Chromanol	3.47	1.71
4	p-Xylene	0.10	0.19
5	Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-	0.51	0.35
6	Butan-2-one, 4-(3-hydroxyphenyl)	2.63	-
7	4-Hydroxy-2-methylacetophenone	0.08	0.13
8	Benzene, 1-methyl-4-(1-methylethyl)-	0.02	-
9	Benzeneacetaldehyde	0.01	0.02
10	Butan-2-one, 4-(3-hydroxy-2-methoxyphenyl)	-	1.77

3.4. *Carbonyl of Rendang*

Table 4 indicates the specific identified carbonyl both in rendang kalio and dried rendang. Carbonyls has also been suggested as the flavor compounds of the foods. The data indicates there were eighteen carbonyls that detected both in rendang kalio and dried rendang. Quite different with carboxylics and aromatics, the trend of carbonyls in processed rendang was increasing on the long period of cooking. The production of carbonyls might relate to the degradation of carboxylics. Ref. [7] explained that carbonyl can be produced from carboxylic degradation, which phonomene is very common in the lipid degradation process.

3.5. *Alcohols in rendang*

Table 5 indicates the specific identified alcohols both in rendang kalio and dried rendang. Alcohols has also been suggested as the flavor compounds of the foods. The data indicates there were twenty alcohols that detected both in rendang kalio and dried rendang. Quite different with carboxylics and aromatics, the trend of alcohol in processed rendang was unique. There were some compounds have degraded while on the other hands some others were produced. This data might indicate the different flavor between rendang kalio and dried rendang.

Table 4. Carbonyl both in rendang kalio and dried rending

No	Name of carbonyls	Kalio (%)	Dried (%)
1	2,6-Octadienal, 3,7-dimethyl-, (E)-		
2	Dodecanal	1.16	2.28
3	2,6-Octadienal, 3,7-dimethyl-, (Z)-	1.44	0.40
4	2-Hexanone, 3,3-dimethyl-;		
5	6-Octenal, 3,7-dimethyl-, (R)-	0.48	0.08
6	4-Butoxy-2-butanone;		
7	3-Hexen-2-one		
8	Hexadecenal		
9	Decanal	0.67	0.95
10	2,6-Octadienal, 3,7-dimethyl-,	1.90	0.67
11	2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (E)-	0.23	0.19
12	2-Hexanone		
13	Decanoic acid, ethyl ester	0.08	
14	Hexanal;	0.08	0.49
15	2H-Inden-2-one, octahydro-3a-methyl-, trans-	0.03	
16	Octadecanal		2.17
17	Octanal		0.15
18	5-Hepten-2-one, 6-methyl-		0.01

Table 5. The percentage of identified of alcohols in rendang kalio and dried rendang

No	Name of alcohols	Kalio (%)	Dried (%)
1	2,6-Octadien-1-ol, 3,7-dimethyl-	0.3	-
2	1,6-Octadien-3-ol, 3,7-dimethyl-	0.09	0.02
3	2-Pentanone, 4-hydroxy-4-methyl-	10.14	8.42
4	2-Pentanone, 4-hydroxy-	0.2	-
5	Carotol	0.19	-
6	6-Octen-1-ol, 3,7-dimethyl-, (R)-	0.15	-
7	3-Cyclohexene-1-methanol, .alpha.,.alpha.4-trimethyl-	0.14	-
8	Borneol	0.05	-
9	3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)- (R)	0.05	-
10	2-Oxabicyclo[2.2.2]octan-6-ol, 1,3,3-trimethyl-	0.01	-
11	3-Octyn-2-ol	0.01	-
12	1-hentetracontanol	-	7.53
13	1-decanol, 2methyl	-	0.47
14	2-Pentanone, 4-hydroxy-	-	0.19
15	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	-	0.15
16	2,6-Octadien-1-ol, 3,7-dimethyl-, (E)-	-	0.10
17	6-Octen-1-ol, 3,7-dimethyl-, (R)-	-	0.05
18	2-Hexenoic acid, 5-hydroxy-3,4,4-trimethyl-	-	0.04
19	3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)-	-	0.01
20	Isoborneol	-	0.01

https://doi.org/10.29165/ajarcde.v4i1.34

4. CONCLUSION

This study investigated the volatile compounds in processed rendang that made as kalio rendang and dried rendang.. The data collected from the present study provide qualitative information concerning the profile of volatile compounds during the cooking process of the rendang. Most of the volatiles identified in the rendang showed that the contents of carboxylics, carbonyls and aromatics aromatics deceased as the cooking period extended and that the carbonyls and alcohols were increased. Our results therefore suggested that carbonyls and alcohols can play a crucial role in the flavor of dried rendang..

REFERENCE

[1] Rini, Azima, F., Sayuti,K., Novelina,. (2016). The Evaluation of Nutritional Value of Rendang Minangkabau. Agriculture and Agricultural Science Procedia. 9. 335-341. 10.1016/j.aaspro.2016.02.146.

[2] Zhou, M., Robards, K., Glennie-Holmes, M., Helliwell, S., (1999). Analysis of volatile compounds and their contribution to flavor in cereals. J. Agric. Food Chem. 47, 3941-3953.

[3] BeMiller, J.N., 2007. Carbohydrate Chemistry for Food Scientists, second ed. AACC International, St. Paul, MN.

[4] Kasim, A and Syukri, D. (2016). HPLC-DAD and GC-MS identification of pesticides compound from diethyl ether extract of mangosteen peel. Res J. Chem. Environ. Sci., 5: 56-61.

[5] Hao, Chao-Yun, Fan, R., Qin, X., Hu, L., Tan, L., Xu, Fe & Wu, B. (2018) Characterization of volatile compounds in ten Piper species cultivated in Hainan Island, South China, International Journal of Food Properties, 21:1, 633-644

[6] Eldaly, E., Hafez, A., Darwish, W., El-Hamid, R., Elmalt, D. (2016). Effect of Heat Treatments on Polycyclic [6] Aromatic Hydrocarbons Formation in Meat. Zagazig Veterinary Journal Volume 44, Number 3, p. 263-272, December, 2016. 44. 10.21608/zvjz.2016.7880.

[7] Syukri, D, Thammawong, M., Naznin, H.A., Kuroki, S., Tsuta, M., Yoshida, M., Nakano, K. (2018). Identification of a freshness marker metabolite in stored soybean sprouts by comprehensive mass-spectrometric analysis of carbonyl compounds. Food Chemistry. 269. 10.1016/j.foodchem.2018.07.036.

GCMS_Identification_of_Volatile.pdf

ORIGINALITY REPORT

16%	9%	14%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	media.neliti.com Internet Source	5%
2	Jingjing Wang, Rongrong Wang, Qian Xiao, Chengguo Liu, Fangming Deng, Hui Zhou. "SPME/GC-MS characterization of volatile compounds of Chinese traditional-chopped pepper during fermentation", International Journal of Food Properties, 2019 Publication	4%
3	www.mdpi.com Internet Source	4%
4	Submitted to Universitas Jember Student Paper	3%

Exclude quotes	On	Exclude matches	< 3%
Exclude bibliography	On		