COMPARISON OF PHYSICOCHEMICAL PROPERTIES OF DIACYLGLYCEROL PREPARED BY ULTRSOUND PRETREATMENT AND CONVENTIONAL METHOD

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I. INTRODUCTION

Diacylglycerol (DAG) is esters of glycerol in which two of the hydroxyl groups are esterified with fatty acids (FA). DAG oils have unique nutritional properties and health benefits, as well as specific physicochemical properties compared to TAG. Lard plays a crucial role in meat products due to its low cost and unique flavour and texture [1]. Ultrasonic pretreatment is an appropriate method for DAG production from lard. The objective of this study was to analyse physicochemical properties of lard-based DAG.

II. MATERIALS AND METHODS

The ultrasonic pretreatment was performed before the lipase-catalysed glycerolysis reactions. The ultrasonic pretreatment conditions were time 5 min, Lipozyme RMIM-to-lard ratio 4:100 (W/W), temperature 45 °C, and power 250 W. The lipase-catalysed glycerolysis reaction conditions were temperature 50 °C, agitation speed 180 r/min, and reaction time 4 h. The lard-based DAG samples after 4 h glycerolysis reactions with ultrasonic pretreatment (named DAG-U) and 11 h of glycerolysis reactions without ultrasonic pretreatment (named DAG-N) had similar DAG contents. The acylglycerol composition, fatty acid (FA) and iodine value analysed according to Long et al. [2] with a minor modification. The FA analysis was performed on an Agilent 7890A GC. The iodine value of oils indicates the degree of oil unsaturation and results are expressed in grams of iodine absorbed by 100 g of sample. The Fourier-transform infrared (FTIR) spectra were measured according to Diao et al. [1]. The X-ray diffraction and thermal properties were determined according to Zhou et al. [2]. The analysis of variance (ANOVA) was employed to analyze the significance. The Tukey procedures were performed to verify significant differences ($P < 0.05$).

Table 1 Fatty acid composition and iodine value of lard, DAG-U and DAG-N

		Lard	DAG-N	DAG-U
Fatty acid composition (g/100 g)	C14:0	0.96 ± 0.06[a]	0.99 ± 0.06[a]	0.98 ± 0.04[a]
	C16:0	20.25 ± 0.06[a]	20.41 ± 0.07[a]	20.36 ± 0.03[a]
	C16:1	1.25 ± 0.07[a]	1.21 ± 0.03[a]	1.20 ± 0.08[a]
	C17:0	0.33 ± 0.04[a]	0.34 ± 0.03[a]	0.36 ± 0.06[a]
	C17:1	0.15 ± 0.06[a]	0.12 ± 0.04[a]	0.12 ± 0.07[a]
	C18:0	11.15 ± 0.08[a]	11.42 ± 0.08[a]	11.47 ± 0.02[a]
	C18:1	36.12 ± 0.03[a]	36.05 ± 0.07[a]	36.08 ± 0.03[a]
	C18:2	25.12 ± 0.08[a]	25.05 ± 0.08[a]	25.09 ± 0.06[a]
	C18:3	1.40 ± 0.08[a]	1.36 ± 0.04[a]	1.37 ± 0.06[a]
	C20:0	0.18 ± 0.04[a]	0.19 ± 0.06[a]	0.19 ± 0.04[a]
	C20:1	0.72 ± 0.07[a]	0.70 ± 0.04[a]	0.69 ± 0.08[a]
	C20:2	1.22 ± 0.08[a]	1.14 ± 0.06[a]	1.15 ± 0.04[a]
	C20:3	0.21 ± 0.06[a]	0.18 ± 0.06[a]	0.19 ± 0.08[a]

	C20:4	0.27 ± 0.06[a]	0.26 ± 0.08[a]	0.26 ± 0.06[a]
	SFA	32.90 ± 0.01[a]	33.35 ± 0.16[a]	33.33 ± 0.18[a]
	USFA	66.42 ± 0.28[a]	65.81 ± 0.23[a]	66.15 ± 0.54[a]
Iodine value (g/100 g)		67.90 ± 0.60[a]	66.43 ± 0.67[a]	67.23 ± 0.32[a]

III. RESULTS AND DISCUSSION

The results showed that three types of oils had a similar FA composition and iodine values, which means that lipase-catalysed glycerolysis with and without ultrasonic pretreatment did not affect ($P > 0.05$) the FA compositions in samples. DAG-U had similar absorption peaks to DAG-N at 3381 cm^{-1} (I) and 1051 cm^{-1} (II), respectively, whereas lard had no absorption peaks in these wavelength ranges (Fig 1 A). X-ray diffraction results indicated that DAGs contained β′ crystal and a substantially lower amount of β crystal (Fig 1 B). The crystallization onsets of DAG-U and DAG-N were shifted to higher temperatures compared to lard, which indicated that DAG oils promoted the crystallization of lard (Fig 1 C). The DAG-U and DAG-N showed two major melting peaks, with a transition temperature in higher temperatures compared to lard (Fig 1 D). Results suggested that DAG-U and DAG-N had higher melting points compared to lard.

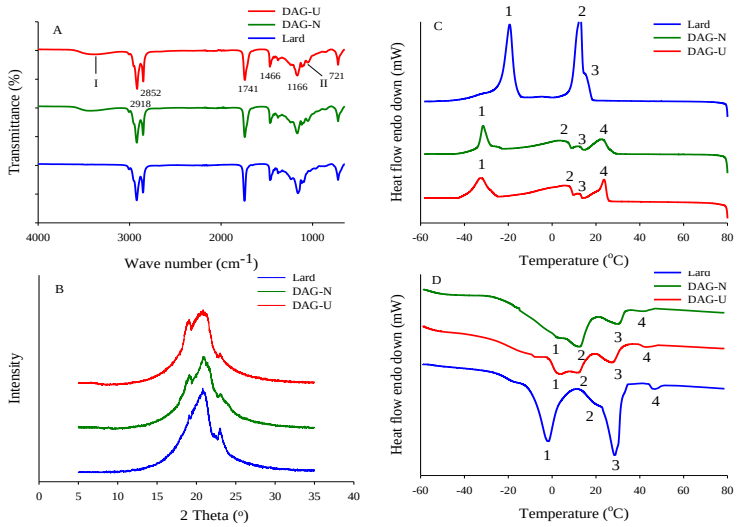

Fig. 1. Fourier-transform infrared (FTIR) spectra (A), X-ray spectra (B), differential scanning calorimetry crystallization (C) and melting (D) thermograms of lard, DAG-U and DAG-N.

IV. CONCLUSION

No remarkable variations were observed between DAG-U and DAG-N in the FA compositions, iodine value, FTIR spectra and thermal properties, while the physicochemical properties of DAGs differed somewhat from lard. Results revealed that DAGs produced with and without ultrasound pretreatment had similar physicochemical properties. In the future, sensory properties and flavor substances will be studied.

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