

Reduction of Acrylamide Content and Oil Absorption in Donuts, Using Antioxidant Properties and Unsaponifiable Components of Sesame Oil

Sareh Rashidi¹, Razieh Niazmand^{2*}, Akram Arianfar³

1- MSc. Student, Department of Food Science and Technology, Quchan Branch, Islamic Azad University, Quchan, Iran

2- Assistant Professor, Department of Food Chemistry, Research Institute of Food Science and Technology, Mashhad, Iran

* Corresponding author (r.niazmand@rifst.ac.ir)

3- Young Researchers and Elite Club, Quchan Branch, Islamic Azad University, Quchan, Iran

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Abstract

In this study, the effect of sesame oil mixture (1 and 2% w/w concentrations) and unsaponifiable components (0.02 and 0.04% w/w concentrations) was compared with frying oil in terms of acrylamide content, oil absorption and moisture in donuts during deep frying process at 180 °C. The data were analyzed in completely randomized design based on Turkey test. The results showed that considering the antioxidant role of sesame oil and its water barrier effect, the level of acrylamide and oil absorption were lower in all samples compared to control sample. Performance of fried samples containing 0.04% unsaponifiable compounds of sesame oil was much better than other fried samples. Samples lacking sesame oil had the least effect on acrylamide content and oil absorption compared with other samples. Samples fried in 2% sesame oil had 9.6 measure oil absorption and 45.20% acrylamide reduction compared with control sample. In addition, in samples fried in oil containing 0.04% unsaponifiable compounds, oil absorption, acrylamide content and moisture decreased 8.9 units, 58.64% and 13.33 units compared with the control sample, respectively.

Keywords: Acrylamide, Donuts, Oil Absorption, Sesame Oil, Unsaponifiable Compounds

Introduction

Frying process is one of the most significant methods in preparing foodstuffs, but the high temperature applied in the process may produce unfavorable ingredients which may not only affect food quality but also potential threats for human health and nutrition (Tokeoka, *et al.*, 1997). Acrylamides is an unfavourable component that is produced in deep frying process. So far, several methods have been used to reduce the formation and elimination of it. One the methods are the use of antioxidant compounds (Ghajarbeigi *et al.*, 2010). Due to the adverse effect of synthetic antioxidants on human health, application of natural antioxidants is necessary. Sesame oil is an edible oils with high content of natural antioxidant. In this study, the effect of sesame oil mixture (1 and 2% w/w concentrations) and unsaponifiable components (0.02 and 0.04% w/w concentrations) was compared with frying oil in terms of acrylamide content, oil absorption and moisture in donuts

during deep frying process at 1800 °C. Data were analyzed in completely randomized design based on Tukey test.

Methods

At first, unsaponifiable components of sesame oil was extracted. Frying oil was used as a control (Tavassoli-kofrani & Farhoosh, 2010). The ingredients of the dough, were mixed and the doughnut samples were formulated (Ajam *et al.*, 2012). The dough pieces were fried in a conventional fryer (Gosonic, 610-GDF, China) at a temperature of 180 ± 5 °C for 3 min (Zolfaghari *et al.*, 2011). Doughnut moisture was measured using the standard method AACC (1986). Doughnut acrylamide was measured based on Tareke *et al.*, (2002) and Lehotay & Mastovska, (2006) with some improvements. GC-MS analysis was performed on an Agilent HP 6890 gas chromatograph coupled to an Agilent HP 5973 mass spectrometer (Agilent Technologies, Santa Clara, California, USA), (Tareke, *et al.*, 2002; Lehotay & Mastovska, 2006). The fried doughnut cakes (at 1800 °C) were allowed to cool at room temperature and analyzed for oil uptake. The oil uptake was determined with Soxhlet extraction apparatus using hexan. 5 g of dried sample was weighed, and put into the machine for four hours after leaving our weight solvent. The percentage of the absorbed oil was calculated based on the dry weight (Zamani, 2012).

Results and discussions

Comparison results indicates the increasing of sesame oil and unsaponifiable components decreased the moisture content and oil absorption of samples in comparison to the frying oil was lacking ($P < 0.05$). Increasing of moisture content and reduction of oil absorption is due to because the presence of phenolic and antioxidant compounds as a naturally powerful antioxidant in sesame oil unsaponifiable components and its effect on the oxidative related interactions occurred (Barrera-Arellano *et al.*, 1999; Tavassoli-kofrani & Farhoosh, 2010; Mohammadi *et al.*, 2014).

Results of variance analysis showed (Figure 1) that increasing of sesame oil and unsaponifiable components had a significant effect on decreasing of acrylamide formation in doughnuts because of powerful antioxidant activity of sesamol, sesamolyn, sesamynol and lignin of sesame oil and presence of sterols and squalene in the unsaponifiable (Table 1) compounds (Kochhar & Stabilisation, 2000; Tavassoli-kofrani *et al.*, 2010).

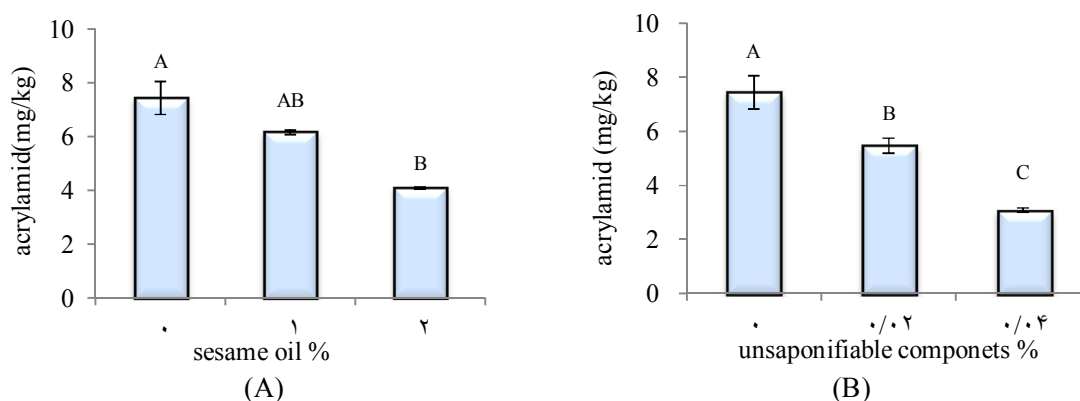


Figure 1. The effect of sesame oil and unsaponifiable components on acrylamid formaion in fried doughnut

Table 1. The effect of sesame oil and unsaponifiable components on the Moisture content and oil absorption in fried doughnut

Oil type	Concentration	Moisture content (%Wet weight)	Oil absorption (%Wet weight)
Frying oil	-	16.20±0.76 ^C	18.2±0.28 ^A
Frying oil + Sesame Oil	1	20.97±0.96 ^B	11.4±0.00 ^B
	2	16.25±0.97 ^A	8.6±0.00 ^C
Frying oil + Sesame oil Unsaponifiable compounds	0.02	24.83±0.40 ^B	11.5±0.42 ^B
	0.04	29.53±0.29 ^A	9.3±0.14 ^C

^a Means±SD with the same lowercase letters in each column are not significantly different at ($P < 0.05$).

Conclusion

According to the results, the impact of unsaponifiable components (0.04%) had a the best performance in reducing oil absorption, acrylamide formation and moisture content ($P < 0.05$). As compared to the other treatments. Vegetable oils such as sesame oil reduce the acrylamide formation due to powerful antioxidant activity of sesamol, sesamolyn, sesamynol and lignin of sesame oil and presence of sterols and squalene in the unsaponifiable compounds ultimately leads to the encouragement the use of oil type in catering industry provides.

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