

Abstract

Background: Fats behave differently based on their fatty acid compositions, leading to their unique applications in food preparation. **Methods:** Bread “doughnuts” were either air fried or deep fried in a given amount of fat or oil at four different temperatures: 325, 350, 375, and 400 degrees F. Total frying time and % absorption were also calculated.

Results: The most fat absorbed by the “doughnuts” occurred at ~400 degrees F, except when deep frying in shortening. Air frying time was the lowest at ~400 degrees F, except for olive oil, while deep frying time was the lowest at ~375 degrees F (except for shortening). **Discussion and Conclusions:** Varying fats and frying methods impact “doughnut” greasiness, aroma, and % absorption of fat, among other factors, differently.

Introduction

This lab explored the sensory characteristics of fried bread “doughnuts” using three different types of fats (corn oil, olive oil, and shortening) and two different heating methods (deep frying and air frying).

Fats have different traits related to their fatty acid composition, which also dictates fats’ varying applications in food preparation. For example, a given fat’s smoke point is determined based on these (and other) factors, and this plays an important role in determining if and when a fat will start deteriorating and will no longer produce an acceptable product when used to cook food. (1) The cooking technique and fat source chosen can impact frying time, as well as sensory and nutritional qualities of the final product. This lab report will cover how some of these concepts came into play when deep or air frying bread “doughnuts.”

Materials and Methods

Materials:

- 4 slices of white bread (1 slice for each oil at each temperature).
- 454 g fat OR 472 mL oil listed.

Methods:

1. With a doughnut or biscuit cutter, create a doughnut from each slice of bread. Weigh each doughnut (prior to frying).
2. Using the Deep Fryer, heat the assigned fat to the temperature assigned (163°C / 325°F), and transfer the doughnuts into the hot fat, being careful not to splash the fat.
3. Begin timing immediately.
4. Maintain frying temp (fryer will do this for you) at 163 C.
5. As soon as doughnut is a pleasing brown color, use a chopstick to turn to other side.
6. When second side is a pleasing brown, remove doughnut.
7. Note total fry time.
8. Weigh doughnut and calculate difference between initial and fried weight.
9. While heating the fat to the next frying temperature of 177°C (350°F), weigh the next doughnut to be fried.
10. Follow the frying procedures in steps 2-8. Repeat process at temps 190°C (375°F) and 204°C (400°F).

Lab #5: Fats and Oils - Deep Frying and Air Frying

Results



- Aroma scores were the highest at ~375 degrees F for both oils under deep frying conditions. “Doughnuts” air-fried in the two oils were the greasiest at this temperature as well.
- The most oil absorbed under both deep frying and air frying conditions was at ~400 degrees F for all fats tested, except for shortening used for deep frying and olive oil used for air frying.
- Air frying time was the lowest at ~400 degrees F, except for olive oil. Deep frying time was the lowest at ~375 degrees F, except for shortening.
- Taste was ranked the highest at ~375 degrees F when “doughnuts” were deep fried in olive and corn oil; this was not the same for shortening. When air fried, olive oil continued this trend, whereas shortening and corn oil were ranked the highest at ~325 degrees F.

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Summary and Conclusions

- Air-fried foods and deep-fried foods exhibit similar patterns in relation to aroma and temperature.
- “Doughnuts” air-fried and deep-fried at ~400 degrees F were the greasiest when fried in corn and olive oils. Shortening-fried “doughnuts” were the greasiest when deep fried at the lowest temperature tested, and maintained a stable, low level of greasiness when air fried.
 - The latter finding relates to the amount of fat being absorbed by the “doughnuts,” and can be explained, in part, by shortening’s higher melting point than both corn and olive oil. (2)
- Percent absorption is also dependent upon frying method. “Doughnuts” deep fried in shortening absorbed the most fat but absorbed the least fat when air fried.
 - This has to do with full submersion in fat versus a light fat coating that is not as readily absorbed into the “doughnut” pores. (2)
- Generally speaking, frying time decreases with increasing temperature, but there are exceptions. Often, these depend on the type of fat used.
- Taste perceptions likely depend on the type of fat used, cooking time, cooking temperature, and the interactions between these, rather than each factor alone.

References

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2. Ghaitaranpour A, Mohebbi M, Koocheki A. Characterizing the cellular structure of air and deep fat fried doughnut using image analysis techniques. *J Food Eng.* 2018;237:231-239. doi:10.1016/j.jfoodeng.2018.06.006