

# Consumer Sensory Evaluation and Validation of Baking Time Using Various Heating Methods on Frozen Ready-to-Bake Peach Pastries

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## Introduction

- In 2012, the convenience food channel, including ready-to-bake desserts, outperformed other channels (Sloan, 2013).
- Consumer practices and the heating medium may have a significant effect on the sensory qualities of the final product; however, little research has been done on heat transfer of domestic ovens (Cernela and others 2014).
- Various baking ovens though are now available for domestic use such as forced air convection, conventional deck, infrared, and microwaves (Heist and Cremer 1990) in addition to their countertop counterparts.
- Different ovens produce different energy inputs into the product, which consequently affects the sensory characteristics of bakery products. Prior to releasing new products, proper consumer handling instructions must be determined to address safety and quality concerns.
- This study evaluated a new ready-to-bake frozen peach pastry, approaching product launch, in order to determine appropriate baking parameters for package labeling.

## Objectives

- To evaluate the effects of oven type and baking time (determined by the manufacturer) on the final baked peach pastry
- To validate the appropriate baking times for each oven type
- To identify and recommend optimum baking conditions based on colorimetry and consumer evaluation

## Materials and Methods

### Baking Time Validation

- Frozen peach filled pastries were baked using five types of ovens, two separate bake sheets and three different predetermined bake times (Figure 1).
- Prior to baking at 400°F, the peach pastries were removed from the freezer and the tops were dipped in white granulated sugar as per manufacturer directions. The bake sheets were rotated half way through the baking process.

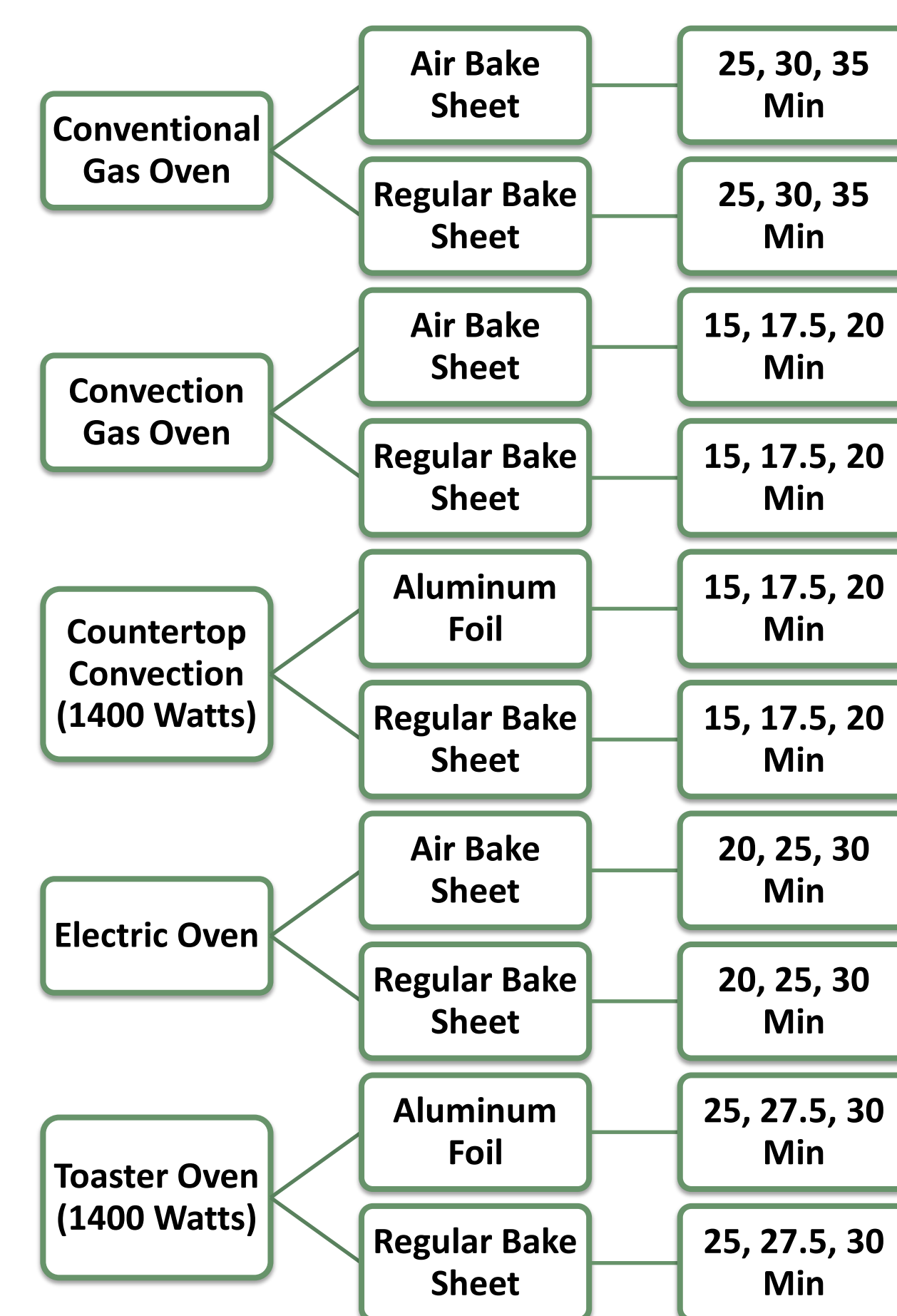


Figure 1. Experimental protocol used to validate bake times for the peach pastries . The three tested bake times were chosen based on the manufacturer's hypothesized bake times.

### Colorimetry/Photography

- Colorimetry measurements (data not shown) were taken using the Minolta Chroma Meter CR-300 (Minolta Co. Ltd, Japan).
- Digital pictures were taken using an 8-megapixel iSight camera.

### Consumer Acceptance Testing

- Two separate consumer tests were conducted with selected users (Table 1).
- Five Peach Jewel samples were tested: Convection (18 min), Conventional Gas (25 min), Countertop Convection (25 min), Electric (25 min) and Toaster Oven (18 min).
- Attributes measured:
  - 9-point hedonic scale: overall liking, appearance, crust appearance, crust texture, flavor and aftertaste.
  - Just About Right (JAR) scale: crust appearance and crust texture.
- Compusense® Five software was used for data collection and analysis.
- Analysis of variance (ANOVA) was performed for consumer data followed by means separation using Fisher's LSD.

Table 1. Panelist demographics for consumer acceptance testing sessions

	Test 1	Test 2
Gender	Male	18
	Female	55
Age	22 ± 4.6	45 ± 11

## Results

### Baking Time Validation

- Baking times were determined based on visual appearance and validated using colorimetry values and photographs (Table 2).
- Figure 2 illustrates an example of the photographs taken for one set of samples.

Table 2. Specific bake times chosen for each oven type for consumer acceptance testing

Baking Method	Bake Time (Min)
Convection	18
Conventional Gas	25
Countertop Convection	25
Electric	25
Toaster	18

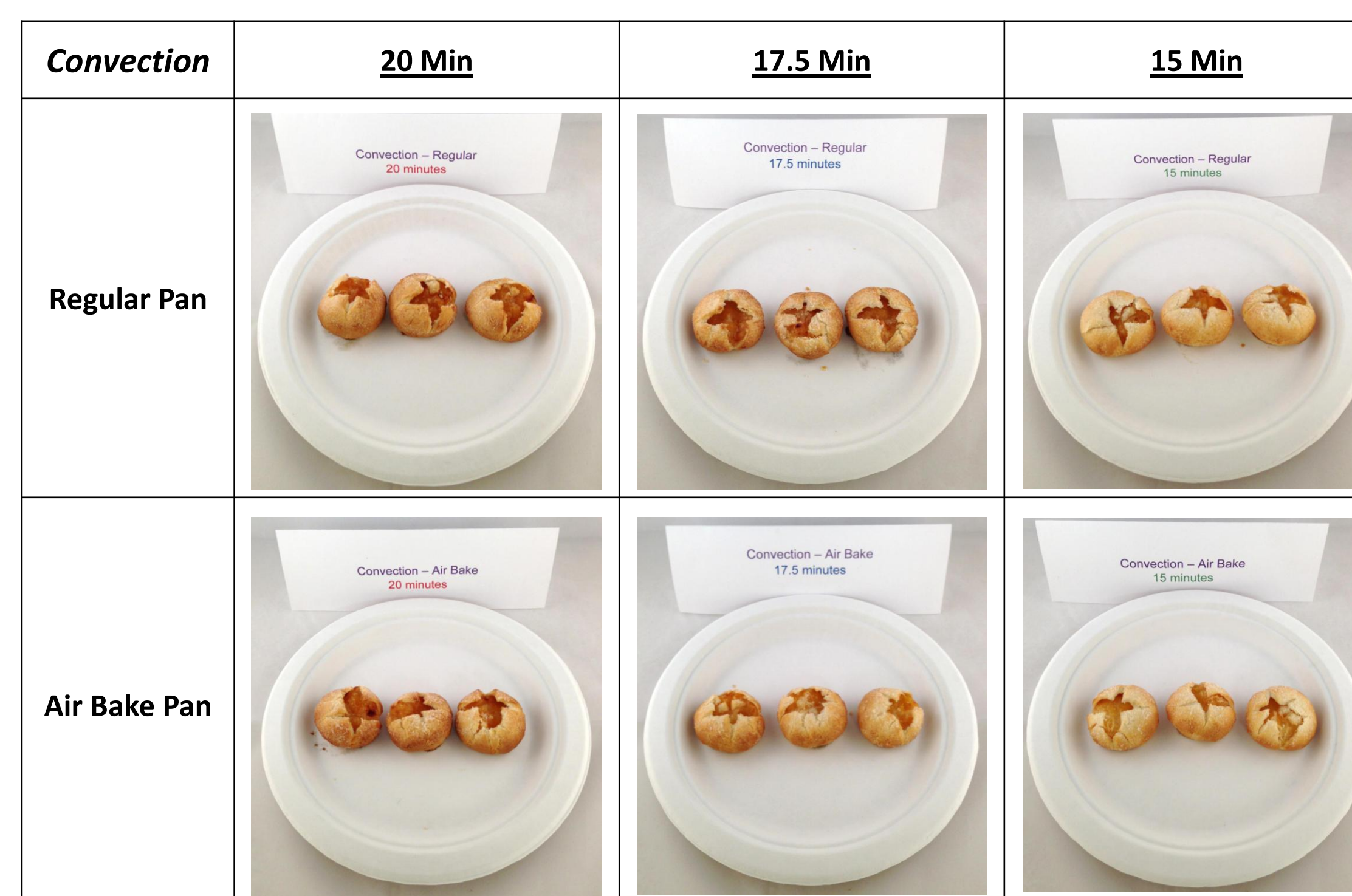


Figure 2. Photographs for peach pastries baked using the convection oven.

### Consumer Acceptance Testing

- All cooking methods resulted in overall liking hedonic scores ranging from 6 to 7 (Table 3), indicative of positive consumer acceptability.
- Hedonic scores for flavor and aftertaste were not found to be significantly different across baking methods (Table 3).
- Based on the JAR scores (Table 4), the countertop convection and electric oven baking times may be at the upper limit of consumer acceptability and could be decreased as these products had lower hedonic scores than the conventional gas and convection ovens.

Table 3. Consumer liking scores for peach pastries over two testing sessions (n=73 and n=64 respectively). The two testing sessions were conducted independently of each other (mean ± standard deviation)\*

Baking Method	Overall Liking	Appearance	Crust Appearance	Crust Texture	Flavor	Aftertaste
Test 1						
Convection	6.92 ± 1.288 <sup>a</sup>	7.04 ± 1.550 <sup>ab</sup>	7.00 ± 1.462 <sup>ab</sup>	6.89 ± 1.560 <sup>a</sup>	-	-
Conventional Gas	7.01 ± 1.349 <sup>a</sup>	7.32 ± 1.311 <sup>a</sup>	7.11 ± 1.468 <sup>a</sup>	6.67 ± 1.537 <sup>a</sup>	-	-
Countertop Convection	6.62 ± 1.569 <sup>ab</sup>	6.63 ± 1.704 <sup>bc</sup>	6.49 ± 1.827 <sup>bc</sup>	6.63 ± 1.791 <sup>ab</sup>	-	-
Electric	6.29 ± 1.611 <sup>b</sup>	6.37 ± 1.799 <sup>c</sup>	6.05 ± 1.899 <sup>c</sup>	6.16 ± 1.795 <sup>b</sup>	-	-
Toaster	6.66 ± 1.377 <sup>ab</sup>	6.73 ± 1.644 <sup>bc</sup>	6.44 ± 1.810 <sup>c</sup>	6.48 ± 1.625 <sup>ab</sup>	-	-
Test 2						
Convection	6.64 ± 1.429 <sup>a</sup>	7.08 ± 1.276 <sup>a</sup>	6.97 ± 1.436 <sup>a</sup>	6.89 ± 1.524 <sup>a</sup>	6.58 ± 1.572 <sup>a</sup>	5.50 ± 1.852 <sup>a</sup>
Conventional Gas	6.16 ± 1.775 <sup>b</sup>	6.64 ± 1.473 <sup>b</sup>	6.66 ± 1.596 <sup>ab</sup>	6.58 ± 1.789 <sup>a</sup>	6.16 ± 1.801 <sup>a</sup>	5.19 ± 1.943 <sup>a</sup>
Countertop Convection	6.67 ± 1.261 <sup>a</sup>	6.88 ± 1.507 <sup>ab</sup>	6.67 ± 1.728 <sup>ab</sup>	6.77 ± 1.530 <sup>a</sup>	6.39 ± 1.432 <sup>a</sup>	5.20 ± 1.801 <sup>a</sup>
Electric	6.20 ± 1.635 <sup>b</sup>	6.78 ± 1.618 <sup>ab</sup>	6.53 ± 1.736 <sup>ab</sup>	6.66 ± 1.472 <sup>a</sup>	6.23 ± 1.591 <sup>a</sup>	5.34 ± 1.819 <sup>a</sup>
Toaster	6.36 ± 1.567 <sup>ab</sup>	6.52 ± 1.633 <sup>b</sup>	6.42 ± 1.726 <sup>b</sup>	5.94 ± 1.763 <sup>b</sup>	6.34 ± 1.711 <sup>a</sup>	5.19 ± 1.885 <sup>a</sup>

\*For each test, different letters in the same column indicate significant differences between samples as evaluated by Fisher's LSD (P<0.05) . Attributes were evaluated on a 9-pt hedonic scale with 1 = dislike extremely and 9 = like extremely.

Table 4. Just About Right (JAR) scores for peach pastries over two testing sessions (n=73 and n=64 respectively) (mean ± standard deviation)\*

Baking Method	Crust Appearance	Crust Texture
Test 1		
Convection	2.18 ± 0.509 <sup>bc</sup>	1.86 ± 0.509 <sup>b</sup>
Conventional Gas	1.81 ± 0.569 <sup>d</sup>	1.86 ± 0.608 <sup>b</sup>
Countertop Convection	2.32 ± 0.574 <sup>b</sup>	2.00 ± 0.553 <sup>b</sup>
Electric	2.56 ± 0.552 <sup>a</sup>	2.23 ± 0.590 <sup>a</sup>
Toaster	2.00 ± 0.667 <sup>c</sup>	1.84 ± 0.601 <sup>b</sup>
Test 2		
Convection	2.09 ± 0.462 <sup>b</sup>	1.91 ± 0.387 <sup>bc</sup>
Conventional Gas	1.80 ± 0.568 <sup>c</sup>	1.80 ± 0.443 <sup>c</sup>
Countertop Convection	2.27 ± 0.479 <sup>a</sup>	2.03 ± 0.397 <sup>ab</sup>
Electric	2.28 ± 0.548 <sup>a</sup>	2.06 ± 0.432 <sup>a</sup>
Toaster	1.64 ± 0.515 <sup>c</sup>	1.48 ± 0.534 <sup>d</sup>

\*For each test, different letters in the same column indicate significant differences between samples as evaluated by Fisher's LSD (P<0.05) (1 = too light/soft, 2 = JAR, 3 = too dark/crunchy).

## Conclusions

- Peach pastries from the convection ovens, conventional gas ovens, and counter top convection ovens received the highest hedonic scores .
  - The manufacturer's recommended bake times are within an appropriate consumer acceptable range.
- Peach pastries from the electric oven had the lowest hedonic scores for all attributes tested.
  - Product was too dark and too crunchy for consumers.
  - Baking time should be reduced by about two minutes, from 25 to 23 minutes.
- Due to the variability of the toaster oven, a wider range of bake times should be suggested for the toaster oven to account for heat variability.
- Most successful baking methods:
  - Convection oven (18 min), conventional gas oven (25 min), and countertop convection oven (25 min).

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