



PUMPKIN PIE FILLING APPLICATION RESEARCH

COMPARING THE FUNCTIONALITY OF EGGS TO EGG REPLACERS IN PUMPKIN PIE FILLING FORMULATIONS

PUMPKIN PIE FILLING RESEARCH EXECUTIVE SUMMARY

For this study, eggs were reduced and/or removed from pumpkin pie filling formulas and replaced with commercial egg replacer products at the manufacturers' suggested rates. All the pie filling samples were evaluated quantitatively and qualitatively following industry-standard protocols. The changes to pie fillings with reduced egg content were noticeable. Overall, not a single product performed as well as or better than real eggs in all attributes assessed, but one blended ingredient product performed similarly to eggs.

Other blended ingredient egg replacers tested did not meet established targets, with some being firmer and others being looser in texture, and several having off vegetal flavors. Other replacers tested included fiber, algae and dairy-protein-based products, all of which varied in appearance, aroma and flavor, but were generally not as appealing as Control. The tests confirm pie fillings need eggs or egg replacers in formulation for optimal eating quality. Manufacturers must test egg replacing ingredients and spend time optimizing formulas for acceptable results.



OBJECTIVE

The purpose of the study was to provide research-based formulation and application information on the use of egg replacers in pie fillings for food manufacturers. Due to the known multi-functionalities of real whole eggs in pie fillings, it was hypothesized that no single ingredient would be able to replace the multiple functions provided by eggs in pie fillings without affecting product quality.

EGG REPLACING INGREDIENTS

After researching available egg replacers, eight egg replacer ingredient companies were selected, based on dollars spent on marketing and advertising in industry publications. A variety of egg replacing ingredients were selected based on their recommended use to reduce or replace eggs in pie fillings. Ingredient specifications, nutritionals, starting formulations and recommended usage rates were requested and compiled from the manufacturers and used to create test formulas. Egg replacers not recommended for this application were excluded from testing.

The recommended whole egg replacement for pie fillings ranged from 50 to 100 percent; almost all recommended keeping the ratio of wet to dry ingredients the same (when removing some or all the liquid eggs from a formula, moisture is also removed, therefore needing to be added back to balance the formula). Six of the eight manufacturers recommended removing 100 percent of the whole eggs from pie filling formulas.

FORMULAS

Control/Gold Standard Formulas

The Control formula consisted of pumpkin puree, evaporated milk, granulated sugar, whole eggs, salt and spices.

Negative Control

A test was conducted with the absence of whole eggs or egg replacers to demonstrate the need for the functionality of these ingredients.

Test Formulas

Eight egg replacer ingredients were tested in pie filling formulas. Those tested included:

- Blends of various ingredients, including starches, proteins, leaveners, emulsifiers, enzymes and hydrocolloids
- Citrus Fiber
- Algae
- Dairy Protein

Pie filling Test formulas were created using the Control gold standard formula, with the addition of egg replacing ingredients and any suggested changes to water content as recommended by the manufacturer. No further formula optimization was done. Formulation changes were based on the ingredient manufacturer's highest recommended usage rate in application and percentage of whole egg replacement, which varied widely among products.



PUMPKIN PIE FILLING VISUAL COMPARISON



TESTS

The raw pumpkin filling and Baked pumpkin pies were analyzed using industry standard, category-specific tests. The pies were all prepared in the same conditions, in the same model equipment and on the same day. Consistent batching, mixing, portioning and cooking procedures were used to limit variables. Baking times were neither adjusted nor optimized for each Test formula, instead a standardized time and temperature setting was used to ensure each Test saw the same conditions. The filling viscosity test was performed immediately after mixing, while all other tests were done after the pies were baked and cooled on the following day.

Testing was performed at the CuliNex Seattle Test Kitchen and Medallion Labs in Minneapolis, Minnesota.

Analytical Tests

Filling viscosity
Height & shape
Color
Texture

Subjective/Sensory Tests

Appearance
Interior color
Aroma
Texture
Flavor
Overall commentary

RESULTS & DISCUSSION

UNBAKED FILLING

Filling Viscosity

Some egg replacing ingredients provided similar filling viscosity as real eggs, while others were significantly less viscous. This suggests that egg replacer performance related to filling viscosity varies drastically, depending on the source material, functionality of the egg replacer and recommended liquid adjustments as recommended by the manufacturer.

BAKED PIES

Appearance

Only one egg-replacer had a similar exterior appearance to Control. All other egg-replacer Tests were described as having sunken, concave profiles, uneven browning, with many being overly browned.

Only one sample was similar to Control in all established interior appearance attributes. All other egg replacer Tests were described as having less structure, being softer and runnier than Control.

These results suggest that egg reduction and replacement may have a significant impact on pumpkin pie appearance.

Height

Three samples did not fully thicken upon baking and were too fluid to be measured for height and shape, and as such were excluded from this test. In center height, none of the remaining Tests were significantly different compared to Control. This suggests that the final pie shape is directly related to the degree of firmness after baking, and egg replacers function in various ways with some successfully recreating the proper final profile and others unsuccessful.



Color

The color of the exterior of the pie filling varied drastically among samples. Due to the inherent variations among pies, it was not possible to take accurate exterior color readings instead appearance commentary was recorded. There was little significant difference among the Hunter colorimeter values of the interior color of all Test pies, including the Negative Control. Since panelists were not in consensus, it can be concluded that egg replacers do not make a significant difference in the color of pumpkin pie filling.

Aroma

Most aroma commentary captured indicated that pie filling aroma quality was not significantly affected by egg reduction, however the intensity of aroma was impacted in many samples.

Texture

The results indicated egg replacement impacts pie filling firmness in different ways, with some of the differences being significant and some others that may not be perceptible to all consumers. Furthermore, egg replacement does not appear to impact perceived smoothness of the pie fillings.

Flavor

Overall, panelist commentary suggests pie fillings with reduced egg content may have reduced flavor intensity and may not meet established targets for flavor.

Overall Commentary

Panelists agreed Control was the best-tasting sample. None of the egg replacers tested performed as well as the Control pie made with eggs, although one egg replacer performed similarly.

CONCLUSIONS

The changes to pie fillings with reduced egg content were noticeable. The sensory evaluation results from panelists on the organoleptic attributes of the pie fillings tested were generally consistent with the findings of the objective analytical test results. The areas of pie filling quality most negatively affected when eggs are removed and/or replaced, included unbaked filling viscosity, baked pie appearance and firmness. Attributes where differences among Test samples were minimal included height, color, aroma and filling smoothness.

Tasters unanimously preferred the Control to the Test formulas. Its aroma and flavor won panelists' approval as the most acceptable pumpkin pie filling.

With neither eggs nor egg replacing ingredients, the pie filling was found to be different from Control in multiple ways: it was thinner both before and after baking, exemplifying that eggs function to thicken and set pie fillings. It was also muted in aroma and flavor, demonstrating eggs' ability to amplify flavor perception. These results imply that pie fillings made without eggs or egg replacers may be unappealing to consumers.



Unfortunately, few generalizations about egg replacers can be made, because they vary vastly among manufacturers. Even though ingredient manufacturers may have usage rate recommendations and starting formulations, many do not know how their product performs in a variety of applications. Their recommendations for incorporating egg replacers into formulas can be vague and hard to follow, making product optimization with egg replacers a time-consuming exercise.

Formulators must determine the best ingredients for pie fillings through hands-on testing on the bench and in the plant to achieve the desired results, balancing cost with functionality and flavor.

Ultimately, that may mean using real eggs in pie filling formulations.

COMPLETE RESEARCH REPORT & FINDINGS

For a copy of the complete 59-page research report with further study background and detailed findings, please contact Elisa Maloberti at info@RealEggs.org or call **847.296.7043**.





For additional application research summaries, go to RealEggs.org/Research



Research Conducted by **CuliNex**

Supported by **incredible!**
American Egg Board

RealEggs.org

©2017 REAL EGGS. All Rights Reserved.