



USING

# RAISIN INGREDIENTS

AS A PLANT-BASED FAT SUBSTITUTE



## RESEARCH REVIEW & SUMMARY

In this paper, we'll explore the functional benefits and opportunities for California-grown raisins and raisin ingredients as a fat substitute in baked goods, using Fudgy Brownie Bites as a model system.

For the application selected, we'll showcase the benefits of using raisins in food manufacturing and foodservice applications, determining the optimum raisin ingredient and percent utilization. When applicable, the California Raisin formulas were compared to commercial benchmarks and control formulas.

# KEY BENEFITS

## KEY BENEFITS OF USING CALIFORNIA RAISINS IN FUDGY BROWNIE BITES

- Worked well as a butter/egg yolk substitute in brownies due to sugar and fiber content
- Imperceptible impact on flavor at 25% and 50%, noticeable change in flavor at 75% and 100% with fruity notes that complemented the chocolate
- Retained moisture and crumb texture typical for brownies in varying percentages

## FUNCTIONALITY AND SUMMARY OF FINDINGS

To ascertain the fat substitution potential that raisin paste may have, we ran a series of experiments with a basic fudge brownie formula (see page 3). After determining the total fat content in the formula contributed from the egg yolks and butter, we then used raisin paste to substitute that fat at the following percentages: 25%, 50%, 75%, and 100%. After adjusting the formulas accordingly, the experiments resulted in a final product very similar to control. The substitutions at 75% and 100% were particularly interesting, as the texture and flavor of the brownies were very slightly affected. At the higher raisin paste usage rate, the baked brownies were a bit stickier. However, the gooey texture of the brownie was a good fit for the chewiness of the raisin. Additionally, the increased flavor of the raisin was a natural complement to the bitter chocolate.

The brownie formulas on page 3 (excluding the control) can be marketed as containing fruit sugar and fiber, having fewer calories, less total fat, lower saturated fat, less or no cholesterol, and made with real California Raisins.

As seen in the photo, substitution of butter/egg yolk fat with 25%, 50%, 75%, and 100% raisin paste resulted in very little change in visible crumb and texture. The internal moisture of the brownie is unaffected by the substitution. Raisin paste is shown to be a viable plant-based fat alternative in the brownie.

Brownies Baked with Differing Percentages of Raisin Paste



Table 1: Fat Substitution with Raisin Paste

| SAMPLE  | OBSERVATIONS  |
|---|---|
| <b>0% Raisin Paste</b><br>(100% Fat from Butter and Egg Yolk) Control | <ul style="list-style-type: none"> <li>• Traditional soft baked and rich chocolate brownie</li> </ul>   |
| <b>25% Raisin Paste</b><br>(75% Fat from Butter and Egg Yolk)         | <ul style="list-style-type: none"> <li>• The typical crumb of the brownie is unaffected at 25% substitution of butter/egg yolks with raisin paste</li> <li>• The flavor of the raisin paste is indiscernible</li> </ul>                   |
| <b>50% Raisin Paste</b><br>(50% Fat from Butter and Egg Yolk)         | <ul style="list-style-type: none"> <li>• The typical crumb of the brownie is unaffected at 50% substitution of butter/egg yolks with raisin paste</li> <li>• The flavor of the raisin paste is almost indiscernible</li> </ul>            |
| <b>75% Raisin Paste</b><br>(25% Fat from Butter and Egg Yolk)         | <ul style="list-style-type: none"> <li>• The raisin flavor begins to be more detectable</li> <li>• The fruitiness and sweetness pair well with the bitter chocolate</li> <li>• A slightly more soft-baked texture than control</li> </ul> |
| <b>100% Raisin Paste</b><br>(0% Fat from Butter and Egg Yolk)         | <ul style="list-style-type: none"> <li>• The raisin flavor is moderately perceptible but pairs well with the chocolate</li> <li>• Brownie retains positive and decadent texture and is more soft-baked than control</li> </ul>            |

# FORMULAS

Actual totals may differ from 100% due to rounding.

## CONTROL FORMULA

| Ingredients                | % Total by Weight |
|----------------------------|-------------------|
| Sugar                      | 28.6              |
| Bittersweet Chocolate      | 20.35             |
| Butter                     | 16.3              |
| Flour                      | 13.3              |
| Egg White                  | 10.7              |
| Yolks, Large               | 5.3               |
| Semi-Sweet Chocolate Chips | 5.1               |
| Vanilla Extract            | 0.3               |
| Salt, Kosher               | 0.05              |
| <b>TOTAL</b>               | <b>100.00</b>     |

## 25% Butter/Egg Yolk Substitution

| Ingredients                | % Total by Weight |
|----------------------------|-------------------|
| Sugar                      | 28.4              |
| Bittersweet Chocolate      | 20.35             |
| Butter                     | 12.3              |
| Flour                      | 13.2              |
| Egg White                  | 10.6              |
| Yolks, Large               | 4.0               |
| Semi-Sweet Chocolate Chips | 5.1               |
| California Raisin Paste    | 4.1               |
| Water                      | 1.6               |
| Vanilla Extract            | 0.3               |
| Salt, Kosher               | 0.05              |
| <b>TOTAL</b>               | <b>100.00</b>     |

## 50% Butter/Egg Yolk Substitution

| Ingredients                | % Total by Weight |
|----------------------------|-------------------|
| Sugar                      | 28.3              |
| Bittersweet Chocolate      | 20.25             |
| Flour                      | 13.2              |
| Egg White                  | 10.6              |
| Butter                     | 8.3               |
| California Raisin Paste    | 7.7               |
| Semi-Sweet Chocolate Chips | 5.0               |
| Yolks, Large               | 2.7               |
| Water                      | 3.6               |
| Vanilla Extract            | 0.3               |
| Salt, Kosher               | 0.05              |
| <b>TOTAL</b>               | <b>100.00</b>     |

## 75% Butter/Egg Yolk Substitution

| Ingredients                | % Total by Weight |
|----------------------------|-------------------|
| Sugar                      | 28.4              |
| Bittersweet Chocolate      | 20.25             |
| Flour                      | 13.2              |
| Egg White                  | 10.6              |
| California Raisin Paste    | 11.8              |
| Butter                     | 4.2               |
| Semi-Sweet Chocolate Chips | 5.0               |
| Water                      | 4.8               |
| Yolks, Large               | 1.4               |
| Vanilla Extract            | 0.3               |
| Salt, Kosher               | 0.05              |
| <b>TOTAL</b>               | <b>100.00</b>     |

## 100% Butter/Egg Yolk Substitution

| Ingredients                | % Total by Weight |
|----------------------------|-------------------|
| Sugar                      | 28.4              |
| Bittersweet Chocolate      | 20.25             |
| California Raisin Paste    | 16.7              |
| Flour                      | 13.2              |
| Egg White                  | 10.6              |
| Water                      | 5.5               |
| Semi-Sweet Chocolate Chips | 5.0               |
| Vanilla Extract            | 0.3               |
| Salt, Kosher               | 0.05              |
| <b>TOTAL</b>               | <b>100.00</b>     |

## BENCHTOP PROCESSING METHOD

### PREPARE

- 1 Melt the chocolate and butter in a bain-marie (double boiler).
- 2 Soften raisin paste very briefly in a microwave (about 20 seconds on full power).
- 3 Mix the warmed raisin paste into the butter and chocolate combination.
- 4 After the mixture is homogenous, allow to cool for about 10 minutes.
- 5 Whisk sugar, vanilla and salt into the butter, chocolate and raisin paste mixture until fully incorporated.
- 6 Add egg whites and yolks until fully incorporated.
- 7 Fold in flour and chocolate chips.
- 8 Pour batter into an oiled pan lined with parchment paper.
- 9 Bake in a standard oven at 350°F for 20 minutes. Check the middle for doneness. It should be gooey.



# NUTRITIONAL FACTS PANEL

A decrease in overall calories, total fat, saturated fat, and cholesterol can be observed in the panels below as the fat is substituted by raisin paste at increasing rates.

## CONTROL

| Nutrition Facts               |                        |
|-------------------------------|------------------------|
| TBD servings per container    |                        |
| <b>Serving size</b>           | <b>1 Brownie (40g)</b> |
| <b>Amount per serving</b>     |                        |
| <b>Calories</b>               | <b>210</b>             |
|                               | <b>% Daily Value*</b>  |
| <b>Total Fat</b> 12g          | <b>15%</b>             |
| Saturated Fat 7g              | <b>35%</b>             |
| Trans Fat 0g                  |                        |
| <b>Cholesterol</b> 45mg       | <b>15%</b>             |
| <b>Sodium</b> 20mg            | <b>1%</b>              |
| <b>Total Carbohydrate</b> 25g | <b>9%</b>              |
| Dietary Fiber 0g              | <b>0%</b>              |
| Total Sugars 18g              |                        |
| Includes 15g Added Sugars     | <b>30%</b>             |
| <b>Protein</b> 2g             |                        |
| Vitamin D 0mcg                | 0%                     |
| Calcium 13mg                  | 2%                     |
| Iron 1mg                      | 6%                     |
| Potassium 29mg                | 0%                     |

\*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

## 50% Butter/Egg Yolk Substitute

| Nutrition Facts               |                        |
|-------------------------------|------------------------|
| TBD servings per container    |                        |
| <b>Serving size</b>           | <b>1 Brownie (40g)</b> |
| <b>Amount per serving</b>     |                        |
| <b>Calories</b>               | <b>190</b>             |
|                               | <b>% Daily Value*</b>  |
| <b>Total Fat</b> 9g           | <b>12%</b>             |
| Saturated Fat 5g              | <b>25%</b>             |
| Trans Fat 0g                  |                        |
| <b>Cholesterol</b> 30mg       | <b>10%</b>             |
| <b>Sodium</b> 20mg            | <b>1%</b>              |
| <b>Total Carbohydrate</b> 28g | <b>10%</b>             |
| Dietary Fiber 0g              | <b>0%</b>              |
| Total Sugars 20g              |                        |
| Includes 15g Added Sugars     | <b>30%</b>             |
| <b>Protein</b> 2g             |                        |
| Vitamin D 0mcg                | 0%                     |
| Calcium 13mg                  | 2%                     |
| Iron 1mg                      | 6%                     |
| Potassium 51mg                | 2%                     |

\*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

## 100% Butter/Egg Yolk Substitute

| Nutrition Facts               |                        |
|-------------------------------|------------------------|
| TBD servings per container    |                        |
| <b>Serving size</b>           | <b>1 Brownie (40g)</b> |
| <b>Amount per serving</b>     |                        |
| <b>Calories</b>               | <b>160</b>             |
|                               | <b>% Daily Value*</b>  |
| <b>Total Fat</b> 5g           | <b>6%</b>              |
| Saturated Fat 3g              | <b>15%</b>             |
| Trans Fat 0g                  |                        |
| <b>Cholesterol</b> 0mg        | <b>0%</b>              |
| <b>Sodium</b> 20mg            | <b>1%</b>              |
| <b>Total Carbohydrate</b> 31g | <b>11%</b>             |
| Dietary Fiber 1g              | <b>4%</b>              |
| Total Sugars 23g              |                        |
| Includes 15g Added Sugars     | <b>30%</b>             |
| <b>Protein</b> 2g             |                        |
| Vitamin D 0mcg                | 0%                     |
| Calcium 12mg                  | 0%                     |
| Iron 1mg                      | 6%                     |
| Potassium 85mg                | 2%                     |

\*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

### 100% Fat Substitution Ingredient Declaration

Sugar, Bittersweet Chocolate (Unsweetened Chocolate, Sugar, Cocoa Butter, Soy Lecithin, Vanilla Extract), Raisin Paste, Enriched Flour (Wheat Flour, Niacin, Iron, Thiamin Mononitrate, Riboflavin, Folic Acid), Egg Whites, Water, Semi-Sweet Chocolate Chips (Sugar, Unsweetened Chocolate, Cocoa Butter, Milkfat, Soy Lecithin, Natural Flavor), Vanilla Extract, Salt.

**CONTAINS:** Wheat, Milk, Eggs, Soy.

## INGREDIENT INSIGHTS AND FUNCTIONAL BENEFITS SUMMARY

California Raisins are a viable fat substitute in this fudgy brownie application. 100% substitution of butter and egg yolks with raisin paste yielded a desirable flavor and texture outcome.

California Raisins as a fat substitution in more complicated recipes, such as cakes or cookies, should be evaluated to determine if it is as successful as in brownies. Brownies, by nature, are best slightly undercooked, and the gooey texture of raisin paste works well. However, the desirability and efficacy in more complex, or more cooked, recipes would require more testing.

# CALIFORNIA RAISINS OVERVIEW

## PRODUCTS AND PROCESSING

California Raisins are simply grapes that have been cleaned, dried, de-stemmed, and washed. The majority of California-grown raisins are the *Vitis vinifera* varietal and are typically either sun-dried on trays or dried on the vine.<sup>1</sup> Other California Raisin varietals and cultivars include Zante Currant, Muscat, Monukka, Sultana, Thompson Seedless, Fiesta, Selma, and DOVine.<sup>1</sup>

The California Raisin industry offers a variety of raisins and raisin ingredients that are suitable for food manufacturing and foodservice applications. Raisins feature in a variety of applications ranging from bakery, breads, cereals, condiments, confectionery, dairy, and snacks, just to name a few.

California-grown raisins are available in a multitude of forms such as whole raisins (various sizes and varieties), raisin paste (made from whole, ground raisins), and raisin juice concentrate that make them ideal for many applications.

## PROCESSING

California Raisins are grown in the sunny fields of California and can take three full years from initial planting before bearing fruit that is subsequently dried.<sup>1</sup> Raisins are harvested either by the traditional hand method or with a mechanical harvester, which became widely available in the 1990s.<sup>1</sup>

After harvesting and drying, raisins are evaluated by government inspectors to ensure that they meet strict quality standards.<sup>1</sup> Next, any remaining stems are removed, and the raisins are packaged or further processed to create raisin paste or raisin juice concentrate.<sup>1</sup> Thanks to these high-quality standards, California Raisins have never been linked to any cases of foodborne illness according to the CDC.<sup>1</sup>

Golden raisins are produced when fresh grapes are harvested and dried using drying tunnels to preserve the golden color.<sup>1</sup>

For more in-depth information on raisin processing and harvesting, please refer to the [California Raisins Industry Brochure](#).

### NEED PRODUCT DEVELOPMENT INSPIRATION?

Visit the [California Raisins website](#) or download our [INNOVATION BROCHURE](#).

## COMPOSITION AND NUTRITION

Table 2, below, shows average values of the commonly tested physical and chemical properties of California Raisins. The chemical and physical properties of raisins contribute greatly to the functional properties in the next section.

Table 2: Physical & Chemical Properties of California Raisins<sup>2</sup> (Average Values)

| Product                                     | PH      | Water Activity                      | Moisture Content            | Sugar Content (g/100g)  |
|---|---------|-------------------------------------|-----------------------------|---|
| California Raisins, Whole (Mixed Varieties) | 3.5-4.0 | 0.51-0.56 (13-15% Moisture at 25°C) | Varies, Based on Processing | Total: 68-70g Glucose, Fructose, Sucrose, and Fructose/ Glucose |

## NUTRITIONAL FACTS PER SERVING

California Raisins are naturally low in fat and sodium, and as whole fruit, raisins contain unrefined sugars and dietary fiber, making them a nutritious additive with numerous uses in product development and culinary applications.

Nutritional Facts of Raisins per 40g Serving<sup>3</sup>

| Nutrition Facts   |               |
|---|---------------|
| 1 serving per container   |               |
| Serving size  | 1/4 cup (40g) |
| Amount per serving  |               |
| <b>Calories</b>   | <b>120</b>    |
| % Daily Value*  |               |
| Total Fat 0g  | 0 %           |
| Saturated Fat 0g  | 0 %           |
| Trans Fat 0g  |               |
| Cholesterol 0mg   | 0 %           |
| Sodium 10mg   | 0 %           |
| Total Carbohydrate 32g  | 12 %          |
| Dietary Fiber 2g  | 7 %           |
| Total Sugars 26g  |               |
| Includes 0 Added Sugars   | 0 %           |
| Protein 1g  |               |
| Vitamin D 0mcg  | 0 %           |
| Calcium 25mg  | 2 %           |
| Iron 0.7mg  | 4 %           |
| Potassium 298mg   | 6 %           |
| * The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice. |               |
| Ingredients: California Raisins   |               |

## FUNCTIONAL PROPERTIES

The table below is a brief overview of a few functional properties that raisins can provide in a formula, either to substitute an ingredient or to provide a specific attribute to a product. Raisins retain their flavor for an extended period, can enhance a food's flavor without overwhelming the overall taste, and can function as a substitution for sugar or fat in baking scenarios.

Table 3: Functional Properties of Raisins and Raisin Ingredients

| Functional Property  | Description   | Uses and Purpose  |
|--|---|---|
| Added Sugar Reduction  | Raisins are a dried fruit full of natural sugars. As a whole fruit, the sugars in raisins do not need to be declared as "added sugar" on nutritional fact panels.   | <ul style="list-style-type: none"> <li>Substitute refined and other added sugar with plant-based source, such as raisins, to claim "no added sugar"</li> <li>The Dietary Guidelines recommends consumers should limit their calories from added sugars to less than 10% of total calories daily.</li> </ul> |
| Plant-Based Fat Substitution                                     | Fibers and sugars in raisins, along with the soft, chewy texture, mimic fat and richness <sup>2</sup>   | <ul style="list-style-type: none"> <li>Natural fat substitute for baked goods</li> <li>Substitute high-fat animal products with plant-based products</li> <li>Overall calorie reduction</li> </ul>  |
| Binding/Texture and Enhancer/Bulking Agent                       | Texture and low moisture content of raisins aid in creating chewy textures and binding dry ingredients <sup>2</sup>   | <ul style="list-style-type: none"> <li>Optimal for use in baked goods, bars, and other products that use a liquid or paste binder</li> <li>Manipulate textures of products to become chewier without adding liquid</li> <li>Prevents case hardening</li> </ul>  |
| Shelf-Life Extension<br>Inhibit Mold Growth/Natural Preservative | Flavor stability, low water activity, antioxidants, and acids like propionic, glutamic, and tartaric acids inhibit mold growth <sup>2</sup> High percentages of natural sugars and fiber bind free water. | <ul style="list-style-type: none"> <li>Alternative to chemical-sounding and artificial preservatives</li> </ul>   |
| Limit Water Activity   | Raisins have a lower water activity due to their intact skin, glucose, and fructose content <sup>2</sup>  | <ul style="list-style-type: none"> <li>Prevent microbial growth</li> <li>Reduce overall water activity in final products</li> </ul>   |
| Flavor Stability   | Sweetness and fruity flavor of raisins can be stable for up to 15 months when stored in optimal conditions <sup>2</sup>   | <ul style="list-style-type: none"> <li>Stable sweetness and flavor in products</li> <li>Flavors not affected by manufacturing</li> <li>Natural alternative to refined sugars and sweeteners</li> </ul>  |
| Flavor Enhancement   | Raisins contain about 2% tartaric acid, a known flavor enhancer, as well as precursors to the Maillard reaction from the drying process <sup>2</sup>  | <ul style="list-style-type: none"> <li>Able to improve or intensify added flavors (including natural flavors)</li> </ul>  |
| Flavor Compatibility   | Raisins have a naturally sweet and mild flavor that pairs well with other sweet flavors and spices <sup>2</sup>   | <ul style="list-style-type: none"> <li>Able to carry flavors well with underlying sweetness</li> <li>Add complexity and balance</li> </ul>  |

## REFERENCES

1. Raisins, C. (n.d.), Industry Brochure. Retrieved from California Raisins: [https://calraisins.org/wp-content/uploads/2021/09/FinalRAC\\_Industry\\_Brochureweb-9\\_9\\_21.pdf](https://calraisins.org/wp-content/uploads/2021/09/FinalRAC_Industry_Brochureweb-9_9_21.pdf)
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