

Addressing Food Insecurity: Using Web-Based Tools To Match Food Bank/Pantry Items To Recipes While Minimizing Cost

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Abstract

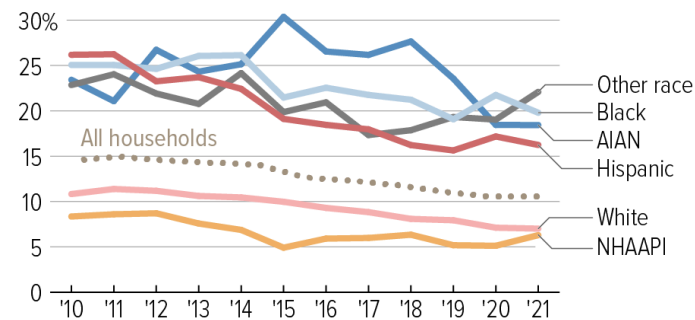
When individuals are uncertain of having, or unable to acquire, enough food to meet the nutritional needs of themselves and all members of their household they become part of the food insecure population. Food insecure families are going to food banks/pantries 2-3 times a week, but are concerned these institutions will not provide them with the amount and type of food they need. A prototype website was created to enhance the effectiveness of food programs for people affected by food insecurity that provides recipes utilizing the specific ingredients an individual already has available to them. This will allow an easier way to match the food received from a food bank/pantry to culturally relevant recipes that require limited additional ingredients.

1.0 Introduction

One in five people in LA are food insecure (L.A. Works, n.d.), meaning they have trouble providing enough food for themselves and their family. Food insecurity is exacerbated by a number of factors in a person's life, such as education, gender, race, age, and income. Food insecure adults in LA from April to July 2020 were 57% female, 59% 18-40 years old, 55% Latino, and 82% low-income (L.A. Works, n.d.). And by race, Black households (reported in 2021) have been the most food insecure because they have been lacking access to adequate food (Figure 1).

Food Insecurity by Race and Ethnicity Reveals Stark Disparities

Households that lacked access to adequate food at some point in the year



Note: Other race = people who are more than one race. AIAN = people who are American Indian or Alaskan Native. NHAAPI = people who are Asian, Hawaiian, or Pacific Islander. Hispanic people may be of any race. Race and ethnicity for the household are based on that of the household reference person (in whose name the housing unit is owned or rented).

Source: U.S. Department of Agriculture, Current Population Survey Food Security Supplement 2010-2021

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Figure 1: Food Insecurity Chart by Race and Ethnicity

Because these percentages combine to greater than 100%, it is clear that many people fall under more than one category.

Food insecurity can have life-long consequences for individuals, especially children growing up without healthy, stable meals. Food insecurity leads to higher levels of depression, anxiety, and stress, and obesity can be caused by prolonged food insecurity. Food insecure college students have chronic stress and unhealthy eating habits, leading to poor performance in school, which can make it difficult for students to become food secure even after graduation. Children who grow up in households with food insecurity have delayed motor skills due to iron deficiency and altered brain development due to stress (L.A. Works, n.d.).

Food insecure families are going to food banks/pantries 2-3 times a week, but people are afraid these institutions will not provide them with the amount and type of food they need. The

focus of this project is to provide low cost, culturally relevant, nutritional recipes to people impacted by food insecurity, which take advantage of food derived from food banks/pantries.

1.1 Food Insecurity

For this project, food insecurity will be defined as when individuals are uncertain of having, or unable to acquire, enough food to meet the nutritional needs of themselves and all members of their household. Food insecurity is often the result of insufficient money, lack of transportation, lack of access to healthy foods, high medical or housing costs, or systemic racism and discrimination.

1.2 Cultural Issues

Surveys show that immigrants living in LA have trouble cooking with the food they receive from food banks/pantries because the food items they may receive aren't part of their culture (B. Estudillo, personal communication, October 28, 2023). Traditional recipes in Asia, Africa, and Latin America are often healthier and more nutritious than the high-fat, high-sugar items to which Americans are accustomed (Iowa, 2021). But by going to food banks/pantries people are receiving mostly an excess amount of canned food, pasta, and milk, while most immigrants' dietary references include fresh fruit and vegetables, rice, and dried beans. It is even more difficult for food insecure immigrants because they cannot afford to go to shops specialized in ethnic foods to get ingredients they need to prepare their traditional dishes; they have to make use of any food they receive from food banks/pantries. It is hard for food insecure people to switch to cooking dishes that use ingredients they have never heard of before.

Regional food banks are working with local food pantries, homeless shelters, and other food donation charities. Food banks work with donors to find options nearby that accept perishables because many food banks are unable to accept perishable food, which people want to

receive from the banks. Food banks, such as the Los Angeles Regional Food Bank, have established nutrition policies that guide food solicitation efforts. Many food pantries and meal programs now offer balanced food packages, including fresh produce and other foods required to meet the nutritional requirements of food insecure people and families.

Families have also developed their own strategies to make the most of food banks and EBT cards, such as going to several food banks throughout the week to see what they can get, and then using EBT cards at the grocery store to fill in gaps in the food they have. Because families have no control over what is offered at food banks, they have to buy a lot of their food using EBT cards. Recipes are needed that optimize use of ingredients found at food banks, so families can save more money and use their EBT cards more efficiently.

1.5 Web Development Environment

Glitch is a web development site and its coding language is in javascript. Javascript is ideal for rapidly adding functionality. It is responsible for elements that the user can interact with, such as drop-down menus, modal windows, and contact forms. Also, by using Application Programming Interfaces (API) there is a way for two or more computer programs to communicate with each other. This is utilized in the website to do a deep search into databases to grab information from the provider site and send it back to the server to be displayed on the screen for the user to see.

Two API databases will be used for this project: Kroger, for price and location details, and Spoonacular, for recipes. The information from the Kroger API allows access to all Kroger stores in LA County, which include Food4Less, Ralphs, Foods Co., and QuickStop. API databases allow product developers to access all data made available by the company who created the database and to use the information to build new products. Establishing a connection

to an API through code opens up the database to searches and utilization of the data. Specific code is required for each type of search (searching for the location of a store vs the price of a product), and additional code is needed to display the results on a web page. Searches are conducted on the server side of a website, meaning individuals who use the final product are only shown the information for which the website creator has coded to be displayed.

1.6 Problem Statement

When people go to food banks/pantries they may receive an excess amount of one type of food that they don't know how to cook. People receiving low incomes and experiencing food insecurity in Los Angeles need a way to easily match the food they receive from a food bank/pantry to recipes culturally relevant to them that require limited additional ingredients. This project will address this problem by developing a website that uses the users zip code and ingredients they've received from the food bank/pantries to generate a recipe, along with the location to a store to purchase missing ingredients, and the total cost of making the recipe.

2.0 Methods

To address the problem statement, a method was developed to find recipes that use as many of the food bank ingredients as possible to help reduce waste and relieve stress for people facing food insecurity. A website has been created to allow people to enter the ingredients they have on hand, and return possible recipes that can be made with only these ingredients. There will likely be a few ingredients that the user does not already own, so those ingredients will be provided on the page to allow for easy comparison of recipes (Figure 2). To provide information regarding ingredients and recipes, the Spoonacular API will be implemented. The price of these additional ingredients will be shown, which requires a second API, the Kroger API. The zip code entered by the user will be used to find a nearby store, and the prices of the missing items will be

provided for that store. This data will help food insecure individuals make informed decisions about recipes they can easily make.



Figure 2: Display of Missing Ingredients and Price of them at the Kroger Store

During development the Kroger API and the Spoonacular API are implemented on separate websites so that any bugs in one program would not affect the functionality of the other, after which the two programs would be combined into a single web application. The combined single web application works where the user can input a zip code and an ingredient to display a recipe, store address, and cost of missing ingredients.

2.1 Validation

To ensure that the website meets these goals of having the recipe, store address, cost, and missing ingredients returned to the user, the project will be considered validated from the program side once one ingredient and zip code can be entered, and one recipe can be returned, along with the recipe's link and missing ingredient prices. All this information will be displayed on the web page.

3.0 Results

The prototype created during this experiment takes a single ingredient and zip code, both entered by the user, and returns one recipe that includes that ingredient. For all ingredients in the recipe other than the searched ingredient, the price at a local store is provided. The address of the store is also displayed so users know where the information is from.

The two databases were integrated to create a single website that provides the user with the store name, the store address, recipe title, recipe link, ingredients the user is missing, and the price of any missing ingredients.

3.1 Kroger API

The first function, titled “Locate”, takes a zip code provided by the user and searches for a Kroger Company store within five miles of that zip code. The response provides the name and address of the chosen store. The function retrieves the location’s store ID, so that it can be used to gather information about location specific prices.

The second function is called “getProduct,” and it provides the prices for specific items for which users search. The function takes the name of a product and the store ID found through the first function, and returns the cost of the item at that location. If the product is not in stock/not sold at that location, the message “Not Available” will appear instead of the price.

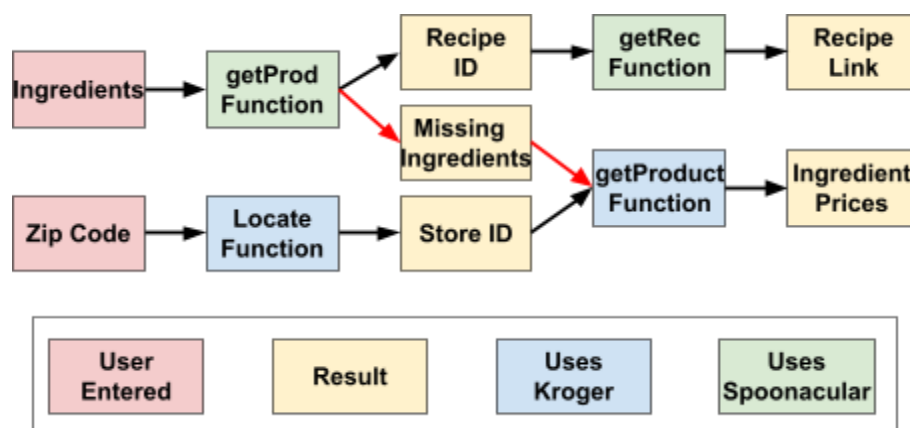


Figure 3: Spoonacular and Kroger Backend Flowchart

3.2 Spoonacular Recipe, Food and Nutrition API

The first Spoonacular function, “getProd,” takes a user entered ingredient and searches for recipes that contain the ingredient and as few additional ingredients as possible. It returns a list of missing ingredients and the ID for the recipe (excluding “pantry ingredients,” such as flour, salt, water). The Spoonacular API allows for searching of multiple ingredients simultaneously, but that feature is not implemented into the current version of the prototype.

The second function is “getRec,” which uses the recipe ID found through the first function to retrieve the link to the recipe instructions.

3.3 User Interface

Food Bank and Pantry Recipe Generator

The screenshot displays a web interface for a recipe generator. At the top, there is a search form with two input fields: "Enter a Food:" containing "canned green beans" and "Enter Your Zip Code:" containing "91030". A "Submit" button is located below the fields. Below the form, the results are displayed in a structured layout:

- Green Beans with Lemon**: A link to the recipe instructions.
- Missing Ingredients:** lemon zest, butter
- Store:** RALPHS
- Address:** 320 W Colorado Blvd, Pasadena, CA 91105, LOS ANGELES COUNTY
- Price of Missing Ingredients at Local Store:** Mr. Clean® Clean Freak Lemon Zest Mist Cleaning Products Value Pack: Not Available, Challenge® Unsalted Butter Sticks: \$6.49

Figure 4: Results for “canned green beans” in Zip Code “91030”

Figure 4 demonstrates what a user will receive if they search for the ingredient “canned green beans” and the zip code “91030.” The title of the recipe appears as a link to the recipe instructions, followed by a list of the missing ingredients. This list contains the general names of the items, rather than brand specific names (unless the original recipe only provides brand

specific names). The next section provides the name of the store and the address. The last section lists the price of each missing item at the chosen location. The prices correspond to brand specific items at that store.

The `getProduct` function searches for any product containing the name of the missing ingredient. In the above example, instead of showing results for the price of lemon zest, it displays the price of “Mr. Clean Freak Lemon Zest Cleaning Products.”

4.0 Discussion

The main feature of this prototype that is unique compared to other methods of finding recipes is that it finds the price of all ingredients a person does not already have. The combination of Spoonacular and Kroger allows a search to take place for the missing ingredients at a store near the user. The pathway for this search is shown in red in Figure 3. This feature allows for the easy comparison of recipes because users are aware of the full cost of each recipe.

Although Kroger was the chosen API for store and price information from the beginning of the project, several recipe APIs were tested before Spoonacular was chosen. Spoonacular was the easiest recipe API with which to work in terms of finding the information needed for this project (ingredient search, limited additional ingredients, missing ingredients list, and recipe link). Spoonacular offers four subscription levels, each with a different cost. The lowest subscription level is free for the first fifty requests made to the database each day, with a cost of \$0.007 for every additional request.

As seen in Figure 4, only the price of one brand at the chosen store is displayed for each ingredient. That brand may be out of stock, while another brand for the same ingredient is available at the store. The displayed brand may also be more expensive than other brands for the same ingredient at that store, making choosing a recipe more difficult because users do not have

all available information regarding cost. Additionally, the “getProduct” function searches for any item containing the name of the missing ingredient, so this may result in a product that is not a food, which happened in Figure 4. Instead of displaying the cost of “lemon zest,” the program displays “Mr. Clean Freak Lemon Zest Cleaning Products,” which is unrelated to the recipe.

Some of the links provided through the Spoonacular API are attached to web pages that no longer exist, meaning some ingredient searches are not useful, despite the fact that everything in the prototype worked correctly.

4.1 Validation

The validation goal planned from the beginning of the project has been completed. When a user enters a zip code and an ingredient, a recipe, store address, and the cost of the missing ingredients will be output on the screen. Client user validation is left to the future when a more robust prototype is complete. At that point, a client in the field of food insecurity or someone who is food insecure can give feedback for the team to identify the overall effect the website will have on addressing food insecurity.

The recipes available through the Spoonacular API are taken from food blogs, which are not targeted toward food insecure individuals, so many of the recipes are not applicable to real life situations. The prototype built in this experiment works as a proof of concept for a recipe website that minimizes additional ingredients, but the API currently implemented is likely not the best choice for a final product. More testing needs to be done of different recipe APIs before one can be chosen as the ideal source of recipes.

4.2 Future Work

As with any web development project, the "features to add" list can be endless. For this project, additional features could be included for:

Functionality-

1. Cultural parameters could be implemented using the Spoonacular API method to search within a particular culture. The Spoonacular API also has the ability to search for nutrition facts for a specific recipe.
2. There could be alternate suggestions for stores, either for price comparison or to provide a location that has the item in stock.
3. Parameters should be added for the quantity of an ingredient and the number of people the meal should serve. To solve the problem of recipe results not being relevant to the ingredients on hand, a system could be developed that allows users to indicate when a recipe is not helpful, and after a certain number of negative answers, that recipe will no longer show in the results for that ingredient.
4. Adding a parameter that will take into account the “health score” provided by Spoonacular. Recipes should only be displayed if they are above a certain health score (not yet found) so that the recipes are more relevant to people who need suggestions for their main diet.

Enhancements-

1. Boxes can be added next to each ingredient on the “Missing Ingredients” list that allows users to mark if they already have that ingredient (and may have forgotten to list it in the search), so it can be removed from any price calculations, allowing them to more accurately compare recipes.
2. Users should have the ability to choose if they want to ignore pantry ingredients (e.g. flour, salt, water) ingredients or not.

5.0 Conclusion

Food insecure people in Los Angeles who rely largely on food banks/pantries for food need a way to find recipes that use the ingredients they have been given, so a website has been developed to match ingredients to recipes. Any ingredients required by the recipe that the person does not already have will be listed along with the price of the item at a store in the person's zip code. The website combines two API databases, Kroger and Spoonacular, to provide users with the information they need to choose a recipe. Several adjustments need to be made to the program before it can be considered a final product, largely concerning allowing for more choices and specifications for users. The main aspect of the original problem statement that is not solved for in the current application is cultural parameters for recipe searches, which will need to be added in future iterations of the program.

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[9D](#)

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