

The background is a dark blue gradient. It is decorated with various geometric elements: small squares in white, pink, orange, and teal, and thin white vertical lines of varying lengths. The text is centered and reads:

TEAM 21: IMPROVING QUALITY OF LIFE THROUGH NUTRITION

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ABOUT TEAM 21

We are **current MS students** in the UMD Geographical Sciences Department pursuing our degrees in Geospatial Intelligence and are **very new** to **data science** concepts and tools!



INTRODUCTION

- The World Health Organization defines **Quality of Life** as an individual's perspective of his or her position in life.
- One way in which this quality of life is heavily impacted is **proper nutrition**.
- UN SDG 2 also highlights the importance of sustainably **achieving food security** and **proper nutrition** worldwide.



DATASET INTRODUCTION

- In the US, the USDA is also working to support improved nutrition.
- Americans rely now more than ever on the convenience of prepackaged foods.
- There have not been many studies about what ingredients are in these prepackaged meal, and what we can learn from these ingredients.



DATASET

- USDA FoodData Central repository
- The USDA released a **branded food product database** in 2018.
- 2020 branded food product database:
 - **Meals**
 - **Ingredients**
 - **Nutrient composition**

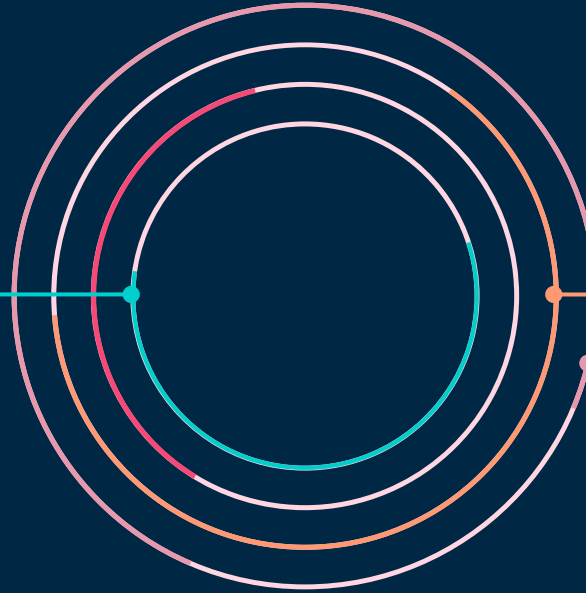


GOALS

Make suggestions about sourcing healthy ingredients, providing meal options in support of a balanced diet, and the cultivation of healthier and more sustainable living.

What ingredients are most commonly used?

INGREDIENTS



What nutrients appear together commonly?

NUTRITION

What key nutrients are lacking from common packaged meals?

OUR PROCESS

Develop goals and questions; explore the data

Researching
Topic

R Analysis

Clean and parse data
and perform statistical
analyses in R

Compare results and
create output
visualizations

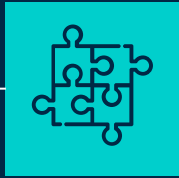
Analyzing
Results

Recommendations

Create recommendations for
promoting improved
nutrition in the US



PROJECT STEPS



01

DATA CLEANING

Parsing and unnesting ingredients from data set in R



02

INGREDIENTS

Counting most common ingredients and exploratory analysis



03

NUTRITION

Principal component analysis (PCA) of nutrients in packaged meals

01

DATA CLEANING

DATA CLEANING

- Tidyverse > stringr
- regex
- Mentor sample code
- <https://github.com/rstudio/cheatsheets/blob/master/strings.pdf>

```
15 meals_parsed <- meals_df %>%
16   mutate(ingredients = str_to_lower(ingredients),
17          ingredients = str_remove_all(ingredients, regex("less than 2% of?:?", ignore_case = T)), #remove non-ingredient strings
18          ingredients = str_remove_all(ingredients, regex("contains 2% or less of?:?", ignore_case = T)),
19          ingredients = str_remove_all(ingredients, regex("contains two percent or less of?:?")),
20          ingredients = str_remove_all(ingredients, regex("contains 2% or less?:?")),
21          ingredients = str_remove_all(ingredients, regex("and 2% or less?:?")),
22          ingredients = str_remove_all(ingredients, regex("and less than 2%?:?")),
23          ingredients = str_remove_all(ingredients, regex("2% or less of?:?")),
24          ingredients = str_remove_all(ingredients, regex("cured with?:?")),
25          ingredients = str_remove_all(ingredients, regex("contains the following?:?")),
26          ingredients = str_remove_all(ingredients, regex("each of the following?:?")),
27          ingredients = str_remove_all(ingredients, regex("the following?:?")),
28          ingredients = str_remove_all(ingredients, regex("dried")),
29          ingredients = str_remove_all(ingredients, regex("contains")),
30          ingredients = str_remove_all(ingredients, regex("anticaking agent")),
31          ingredients = str_remove_all(ingredients, regex("for anticaking")),
32          ingredients = str_remove_all(ingredients, regex("to prevent caking")),
33          ingredients = str_remove_all(ingredients, regex("a preservative")),
34          ingredients = str_remove_all(ingredients, regex("added")),
35          ingredients = str_remove_all(ingredients, regex("for color")),
36          ingredients = str_remove_all(ingredients, regex("added for color")),
37          ingredients = str_remove_all(ingredients, regex("a natural mold inhibitor")),
38          ingredients = str_remove_all(ingredients, regex("preserve freshness")),
39          ingredients = str_remove_all(ingredients, regex("to maintain freshness")),
40          ingredients = str_remove_all(ingredients, regex("ingredients")),
41          ingredients = str_remove_all(ingredients, regex("filling")),
42          ingredients = str_remove_all(ingredients, regex("crust")),
43          ingredients = str_remove_all(ingredients, regex("sauce")),
44          ingredients = str_remove_all(ingredients, regex("one or more of the following?:?")),
45          ingredients = str_remove_all(ingredients, regex(" to ")),
46          ingredients = str_remove_all(ingredients, regex("from")),
47          ingredients = str_remove_all(ingredients, "\\*"),
48          ingredients = str_remove_all(ingredients, "\\."),
49          ingredients = str_replace_all(ingredients, "and/or", " and "),
50          ingredients = str_replace_all(ingredients, " and ", " and "),
51          ingredients = str_replace_all(ingredients, "\\(", " ("), #replacing delimiters
52          ingredients = str_replace_all(ingredients, "\\)", " )"),
53          ingredients = str_replace_all(ingredients, "\\{", " {"),
54          ingredients = str_replace_all(ingredients, "\\}", " }"),
55          ingredients = str_replace_all(ingredients, ":", " :"),
56          ingredients = str_replace_all(ingredients, "\\[", " ["),
57          ingredients = str_replace_all(ingredients, "\\]", " ]"),
58          ingredients = str_replace_all(ingredients, "\\,", " ,"),
59          ingredients = str_replace_all(ingredients, " , ", " ,"),
60          ingredients = str_remove_all(ingredients, regex("\\&")),
61          ingredients = str_remove_all(ingredients, regex("\\-")),
62          ingredients = str_replace_all(ingredients, regex("[[:alnum:]]*%?", " %"),
63          ingredients = str_remove_all(ingredients, regex("b[[:digit:]]{1,2}")),
64          ingredients = str_remove_all(ingredients, regex("\\#")),
65          ingredients = str_remove_all(ingredients, regex("/")),
66          ingredients = str_remove_all(ingredients, regex("\\%")),
67          ingredients = str_remove_all(ingredients, regex("\\+")),
68          ingredients = str_remove_all(ingredients, regex("\\:")),
69          ingredients = str_remove_all(ingredients, regex("\\d")),
70          ingredients = str_remove_all(ingredients, regex("\\@")),
71          ingredients = str_remove_all(ingredients, regex("\\'")),
72          ingredients = str_remove_all(ingredients, regex("less than")),
73          ingredients = str_remove_all(ingredients, regex(" of ")),
74          ingredients = str_remove_all(ingredients, regex("or more")),
75          ingredients = str_remove_all(ingredients, regex(" one ")),
76          ingredients = str_remove_all(ingredients, regex("%& ")).
```

BEFORE

| ingredients |
|--|
| Cooked Whole Grain Brown Rice (Water, Brown Rice). |
| Cooked Thai Jasmine Rice (Water, Rice). |
| Vegetables and Fruit (Broccoli, Shiitake Mushrooms, Pineapple, Jalapeno Peppers, Red Bell Peppers), Sauce (Water, Hoisin Sa... |
| Vegetables (Broccoli, Carrots, Shiitake Mushrooms, Onions), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol... |
| SESAME SOY SAUCE (WATER, SOY SAUCE [WATER, WHEAT, SOYBEANS, SALT, ALCOHOL, VINEGAR, LACTIC ACID]), SUGAR, CO... |
| COOKED RICE: Water, White Rice, Soybean Oil. SAUCE: Water, Brown Sugar, Soy Sauce (Water, Wheat, Soybeans, Salt, Alcohol... |
| SAUCE: Water, Tomato Paste, Roasted Red Pepper Puree (Red Bell Pepper, Dried Cane Syrup, Sea Salt), Diced Tomatoes, Oliv... |
| COOKED JASMINE RICE: Water, White Rice >>> SEASONED COOKED ROASTED CHICKEN: Chicken, Water, Less than 2% of: M... |
| Broccoli, Sauce (Water, Soy Sauce [Water, Wheat, Soybean Oil], Sugar, Salt, Sodium Phosphates, Chicken Fat, Chicken Broth, Flavoring, Paprika... |
| Cooked Rice (Water, White Rice, Soybean Oil), Sweet & Sour Sauce (Water, White Rice, Soybean Oil, Sugar, Salt, Sodium Phosphates, Chicken Fat, Chicken Broth, Flavoring, Paprika... |
| Vegetables (Onions, Green Beans, Red Bell Peppers), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vinegar... |
| Cooked Thai Jasmine Rice (Water, Rice, Salt), Vegetables (Broccoli, Carrots, Shiitake Mushrooms, Onions), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vinegar... |
| CHEESY SAUCE: Water, Broccoli, Cheddar Club Cheese (Pasteurized Cultured Milk, Salt, Enzymes, Annatto), Onions, Maltodextrin, Soybean Oil, ... |
| Cooked Jasmine Rice (Water, Jasmine Rice), Vegetables (Broccoli, Carrots, Shiitake Mushrooms, Onions), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vinegar... |
| SWEET AND SOUR CHICKEN (CHICKEN NUGGETS) (CHICKEN BREAST, WATER, OLIVE OIL, CONTAINS 2% OR LESS OF: IS...) |
| Cooked Rice (Water, White Rice, Wild Rice), Water, Chicken Stock (Water, Chicken Stock Concentrate, Salt, Enzymes, Annatto), Onions, Maltodextrin, Soybean Oil, ... |
| Sauce (Water, Cheddar Club Cheese (Pasteurized Cultured Milk, Salt, Enzymes, Annatto), Onions, Maltodextrin, Soybean Oil, ... |
| Vegetables (Onions, Green Beans, Red Bell Peppers), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vinegar... |
| COOKED RICE (WATER, WHITE RICE), COOKED CHICKEN (CHICKEN BREAST, WATER, OLIVE OIL, CONTAINS 2% OR LESS OF: IS...) |
| COOKED RICE (WATER, WHITE RICE), SEASONED COOKED BEEF AND BINDER PRODUCT (BEEF, WATER, CONTAINS 2% OR LESS... |
| COOKED RICE (WATER, BROWN RICE). SESAME SAUCE (WATER, SOY SAUCE [WATER, WHEAT, SOYBEANS, SALT, ALCOHOL, VIN... |
| COOKED RICE (WATER, WHITE RICE), COOKED CHICKEN (CHICKEN BREAST, WATER, OLIVE OIL, CONTAINS 2% OR LESS OF: IS...) |
| VEGETABLES (BROCCOLI, CARROTS, EDAMAME, ONIONS, RED BELL PEPPERS). SEASONED COOKED CHICKEN (CHICKEN BREAST... |
| Battered Chicken (Chicken Breast, Water, Corn Starch, Wheat Flour, Yellow Corn Flour, Rice Starch, Less Than 2% Of: Salt, D... |
| Battered Chicken (Chicken Breast, Water, Corn Starch, Wheat Flour, Yellow Corn Flour, Rice Starch, Less Than 2% Of: Salt, D... |
| Vegetables (Broccoli, Onions), Sauce (Water, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vinegar], Sesame Seed Oil, S... |
| COOKED PASTA (WATER, PASTA [WHOLE GRAIN WHEAT FLOUR (ULTRAGRAIN®), DURUM WHEAT SEMOLINA, EGG W...] |
| Vegetables (Onions, Red Bell Peppers, Edamame), Sauce (Water, Garlic, Soy Sauce [Water, Wheat, Soybeans, Salt, Alcohol, Vi... |
| COOKED RICE (WATER, WHITE RICE), WATER, SEASONED COOKED BEEF STRIPS AND BINDER PRODUCT (BEEF, WATER, CONTAI... |
| VEGETABLES (EDAMAME, RED BELL PEPPERS, WATER CHESTNUTS). KUNG PAO SAUCE (WATER, SUGAR, RICE VINEGAR, SOY SA... |
| HEARTY VEGETABLE AND WHITE MEAT TURKEY STEW: Water, Cooked Turkey (Turkey Breast, Water, Isolated Soy Protein Pro... |

AFTER!

| ingredients |
|--|
| organic pasta ,organic wheat flour, organic whole grain wheat flour, organic nonfat milk, organic butter, organic whey, orga... |
| wheat flour, palm oil, cheese powder 5, raising agents ,ammonium hydrogen carbonate, potassium hydrogen carbonate, glu... |
| wheat flour, palm oil, glucose syrup, barley malt extract, salt, eggs, raising agents ,ammonium carbonates, sodium carbona... |
| wheat flour, palm oil, sugar, raising agents ,ammonium hydrogen carbonate, calcium phosphates, sodium hydrogen carbon... |
| wheat flour, palm oil, sugar, glucosefructose syrup, raising agents ,monocalcium phosphate, ammonium hydrogen carbonat... |
| wheat flour, palm oil, sugar, raising agents ,monocalcium orthophosphate, ammonium hydrogen carbonate, potassium hydr... |
| wheat flour, palm fat, barley malt extract, glucose syrup, eggs, raising agents ,ammonium carbonates, sodium carbonates, ... |
| wheat flour, palm oil, barley malt extract, glucose syrup, palm fat, raising agents ,ammonium carbonates, sodium carbonate... |
| wheat flour, palm oil, sugar, raising agents ,ammonium bicarbonate, monocalcium orthophosphate, sodium bicarbonate, po... |
| wheat flour, palm oil, sugar, raising agents ,ammonium hydrogen carbonate, monocalcium phosphate, potassium hydrogen... |
| buttermilk biscuit , enriched flour bleached ,wheat flour, malted barley flour, niacin, iron, thiamin mononitrate, riboflavin, f... |
| biscuit , unbleached enriched wheat flour ,flour, barley malt, niacin ,vitamin , iron, thiamin mononitrate , vitamin , riboflavin ... |
| biscuit, enriched bleached wheat flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| cooked pork sausage ,pork, water, salt, spices, corn syrup solids, dextrose, bha, propyl gallate, citric acid, hash brown pota... |
| flour tortilla ,unbleached enriched wheat flour ,unbleached enriched wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| flour tortilla ,enriched unbleached wheat flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| flour tortilla ,unbleached enriched wheat flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| cooked pork sausage ,pork, water, salt, spices, corn syrup solids, dextrose, bha, propyl gallate, citric acid, hash brown pota... |
| tortilla ,enriched unbleached flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| english muffin ,enriched wheat flour ,wheat flour enriched with niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| croissant ,enriched wheat flour ,unbleached wheat flour, malted barley flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| biscuit ,enriched flour ,bleached wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| chorizo sausage patty ,pork, seasoning ,spices, salt, paprika, onion powder, garlic powder, cayenne pepper, black pepper, white pepper, ... |
| tortilla bleached wheat flour ,enriched with niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, water, vegetabl... |
| honey butter biscuit ,enriched flour ,bleached wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| rice ,jasmine rice, rice oil, smoked salmon ,salmon, salt, celery extract, natural hardwood smoke, poke ,soy ,water, wheat, ... |
| biscuit, enriched bleached wheat flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| biscuit, bleached wheat flour ,enriched with niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzyme, water, ... |
| biscuit, enriched bleached wheat flour ,wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid, enzym... |
| bread, enriched wheat flour ,wheat flour, malted barley flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic aci... |

02

INGREDIENTS

COUNTING MOST COMMON INGREDIENTS

```
84 meals_unnested <- unnest_regex(meals_parsed, #un-nesting using comma as delimiter
85                               input= ingredients,
86                               output = ingredient,
87                               pattern = ",")
88
89 meals_tidy <- meals_unnested %>%
90   mutate(ingredient = str_trim(ingredient),
91          ingredient = case_when(str_detect(ingredient, "Flavor") ~ "flavoring", #fix some common issues/words with same meaning
92                                str_detect(ingredient, "salt") ~ "salt",
93                                str_detect(ingredient, "seasoning") ~ "spice",
94                                str_detect(ingredient, "oes$") ~ str_remove(ingredient, "es$"), #remove plural words
95                                str_detect(ingredient, "[Aa]s$") ~ str_remove(ingredient, "s$"),
96                                TRUE ~ ingredient))
97
98 ingredients_sorted <- meals_tidy %>%
99   count(ingredient, sort = T)
100
101 ingredient_summary<-as.vector(summary(ingredients_sorted$n))
102
103 ingredients_sorted <- meals_tidy %>%
104   count(ingredient, sort = T) %>%
105   filter(n > (ingredient_summary[4]))
106
107 write_csv(ingredients_sorted, "~/users//ktrdktrn/Desktop/top-ingredients.csv")
108
109 meals_tidy <- meals_tidy %>% #adding food description (name of food)
110   inner_join(food_names) %>%
111   select(description, everything(meals_tidy))
112
113 meals_tidy <- meals_tidy %>% #text cleaning with regular expressions to remove oz/lb and pack/count
114   mutate(description = str_to_title(description),
115          description = str_remove(description, regex(" [[[:alnum:]]{1,3}\\\\.?.?[[[:alnum:]]{0,2}[[[:blank:]]]?oz", ignore_case = T)),
116          description = str_remove(description, regex(" [[[:alnum:]]{1,3}\\\\.?.?[[[:alnum:]]{0,2}[[[:blank:]]]?ounce", ignore_case = T)),
117          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?ct", ignore_case = T)),
118          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?count", ignore_case = T)),
119          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?pack", ignore_case = T)),
120          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?pk", ignore_case = T)),
121          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?lb", ignore_case = T)),
122          description = str_remove(description, regex(" [[[:alnum:]]{1,3}[[[:blank:]]]?1b", ignore_case = T)))
123
124
```

- Unnesting word tokens using `unnest_regex()`
- Parsing ingredient text data using functions from tidyverse package and regular expressions
- Filtering and counting top ingredients

TOP INGREDIENTS IN PACKAGED MEALS

salt
water
flavoring
sugar
enzyme
spice
citric acid
soybean oil
sodium phosphate
cheese culture
riboflavin
folic acid
milk
niacin
wheat flour
dextrose
onion

xanthan gum
cream
maltodextrin
preservative
thiamine mononitrate
garlic
corn starch
soy lecithin
whey
modified corn starch
color
pasteurized milk
wheat
lactic acid
cheddar cheese
yeast extract
caramel color

soy
pork
modified food starch
soybean
reduced iron
yeast
annatto
whole egg
guar gum
butter
sodium acid
pyrophosphate
nonfat milk
canola oil
diglyceride
thiamin mononitrate

TOP INGREDIENTS RESOURCES

TOP INGREDIENTS LIST

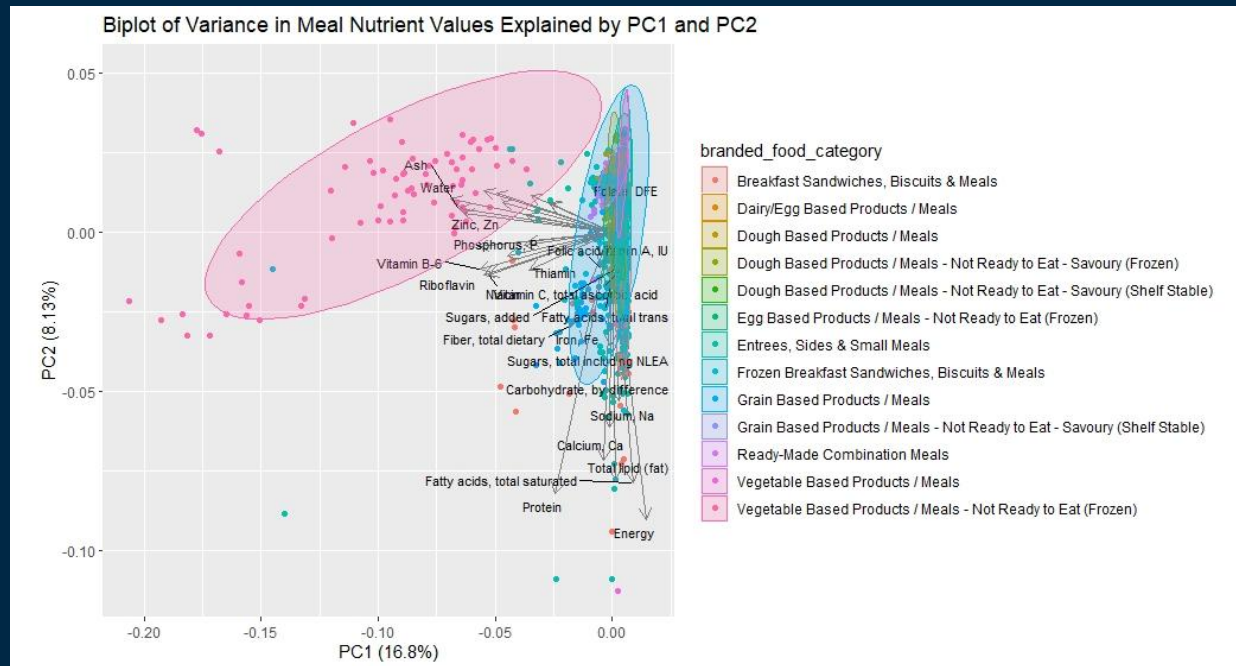
| Ingredient | Volume | Ingredient | Volume | Ingredient | Volume | Ingredient | Volume | Ingredient | Volume |
|----------------------|--------|---------------------------|--------|-------------------------------------|--------|------------------------------------|--------|--|--------|
| salt | 14,315 | turmeric | 339 | sunflower lecithin | 122 | chardonnay wine | 70 | apple cider vinegar | 48 |
| water | 7,804 | enriched wheat flour | 336 | organic pasta | 121 | egg patty | 70 | calcium phosphate | 48 |
| flavoring | 6,476 | paprika | 325 | organic wheat flour | 121 | mechanically separated turkey | 70 | green bean | 48 |
| sugar | 3,666 | sodium erythorbate | 318 | rice starch | 120 | turmeric extract | 70 | ham | 48 |
| enzyme | 3,480 | sodium bisulfite | 317 | chicken | 119 | coriander | 69 | low moisture part skim mozzarella cheese | 48 |
| spice | 3,206 | sodium nitrite | 316 | soy protein | 119 | lemon juice | 69 | milk protein concentrate | 48 |
| citric acid | 2,995 | high fructose corn syrup | 301 | blue cheese | 117 | organic canola oil | 69 | nisin preparation | 48 |
| soybean oil | 2,058 | bleached wheat flour | 299 | honey | 116 | ibhq | 69 | organic coconut oil | 48 |
| sodium phosphate | 1,949 | corn oil | 299 | romano cheese | 116 | cheddar | 68 | organic scallion | 48 |
| cheese culture | 1,916 | bht | 293 | tapioca starch | 116 | cooked black bean | 68 | organic sunflower oil | 48 |
| riboflavin | 1,868 | brown sugar | 290 | vital wheat gluten | 116 | cooked brown rice | 68 | organic white cheddar cheese | 48 |
| folic acid | 1,862 | sodium aluminum phosphate | 283 | bread crumb | 115 | red chili pepper | 68 | release agent | 48 |
| milk | 1,767 | whey protein concentrate | 283 | palm | 115 | textured vegetable protein | 68 | autolyzed yeast | 47 |
| niacin | 1,767 | beta carotene | 279 | isolated soy protein product | 114 | clove | 67 | chili powder | 47 |
| wheat flour | 1,729 | soy flour | 276 | acetic acid | 113 | ferric orthophosphate | 67 | dicalcium phosphate | 47 |
| dextrose | 1,626 | durum wheat semolina | 275 | pyridoxine hydrochloride | 113 | filtered water | 67 | fish | 47 |
| onion | 1,509 | tomato puree | 275 | extractivespaprika | 112 | nongmo corn starch | 67 | lecithin | 47 |
| xanthan gum | 1,472 | cornstarch | 272 | sunflower | 112 | calcium stearoyl lactylate | 66 | organic garlic | 47 |
| cream | 1,471 | annatto extract | 270 | vegetable | 112 | dehydrated potato with emulsifier | 66 | sweet potato | 47 |
| maltodextrin | 1,431 | beef | 267 | chicken breast with rib meat | 111 | maple syrup | 66 | vegetable color | 47 |
| preservative | 1,293 | monoglyceride | 262 | disodium dihydrogen pyrophosphate | 110 | organic garlic powder | 65 | vitamin e | 47 |
| thiamine mononitrate | 1,245 | cheese | 256 | tomato powder | 110 | parmesan | 65 | white rice | 47 |
| garlic | 1,234 | spice extractive | 248 | pasteurized process american cheese | 109 | pasteurized process cheddar cheese | 65 | buttermilk powder | 46 |
| corn starch | 1,221 | potato starch | 246 | scrambled egg | 109 | celery powder | 64 | cheese blend | 46 |
| soy lecithin | 1,199 | dehydrated onion | 244 | white wine | 106 | flour tortilla | 64 | extractivesturmeric | 46 |
| whey | 1,188 | disodium phosphate | 240 | contonseed | 105 | green chile | 64 | lime juice concentrate | 46 |
| modified corn starch | 1,182 | propyl gallate | 240 | black bean | 104 | mechanically separated chicken | 64 | organic cilantro | 46 |
| color | 1,163 | vitamin a palmitate | 238 | durum flour | 104 | organic tomato | 64 | organic spice | 46 |
| pasteurized milk | 1,098 | isolated soy protein | 235 | medium chain triglyceride | 104 | pasteurized cows milk | 64 | quinoa | 46 |
| wheat | 1,000 | datem | 232 | oat fiber | 104 | succinic acid | 64 | sodium silicoaluminate | 46 |
| lactic acid | 968 | dough conditioner | 230 | sausage | 104 | tocopherol | 64 | bacon fat | 45 |
| cheddar cheese | 962 | milkfat | 230 | chicken breast | 102 | cooked rice | 63 | beef tallow | 45 |
| yeast extract | 937 | contonseed oil | 224 | emulsifier | 102 | lactose | 62 | granulated garlic | 45 |
| caramel color | 936 | whole milk | 223 | partially hydrogenated soybean oil | 102 | sodium ascorbate | 62 | mixed tocopherol | 45 |
| soy | 931 | yellow corn flour | 216 | modified cornstarch | 101 | calcium carbonate | 61 | pasteurized cream | 45 |
| pork | 890 | baking powder | 215 | modified whey | 99 | lipolyzed butter oil | 61 | calcium pantothenate | 44 |
| modified food starch | 876 | wheat starch | 208 | natamycin | 98 | rolled oat | 61 | food starch | 44 |
| soybean | 865 | celery | 207 | potassium phosphate | 98 | sesame seed oil | 61 | organic diced tomato | 44 |
| reduced iron | 848 | distilled vinegar | 207 | egg yolk | 97 | tortilla | 61 | oyster | 44 |
| yeast | 846 | apapato color | 205 | mushroom | 97 | cooked beef | 60 | to | 44 |

- <https://github.com/allisoncahanin/packaged-meals-DC-21/blob/main/top-ingredients.pdf>
- <https://github.com/allisoncahanin/packaged-meals-DC-21/blob/main/top-ingredients.csv>

03

NUTRITION

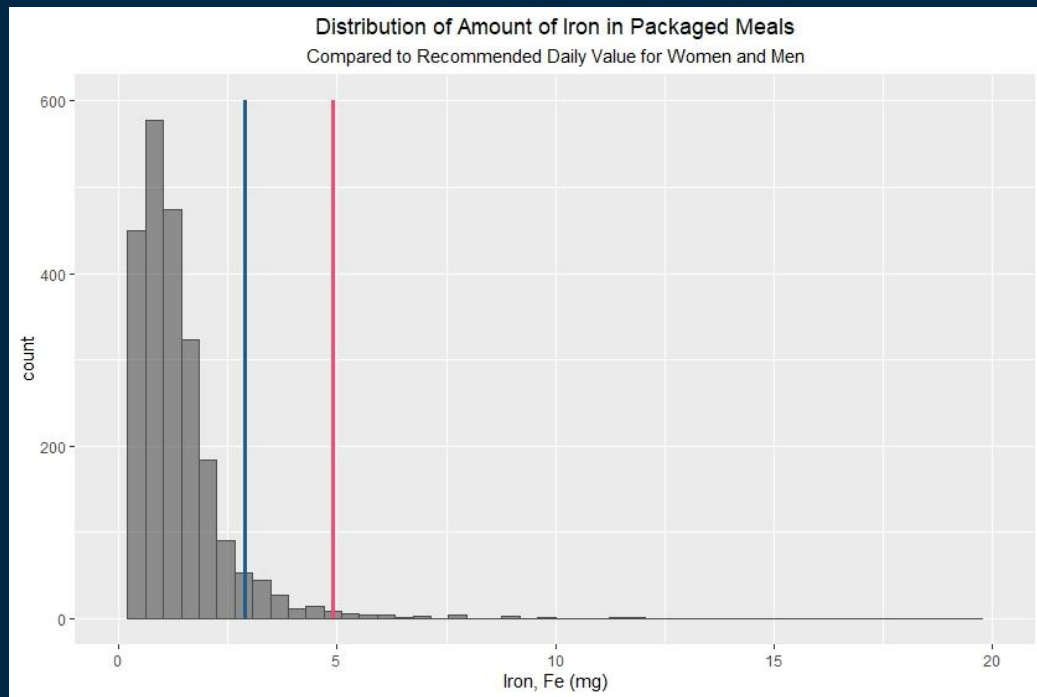
PRINCIPAL COMPONENT ANALYSIS (PCA)



- Exploratory data analysis that **reduces dimensionality** by projecting data using the first two components to view lower dimensional data
- The first component shows the direction in which the **most variation** can be explained

PC1 separates **Vegetable Based Products / Meals** from all other meals. So we can conclude that these meals are high in nutrients which have high scores on PC axis 1.

HISTOGRAM OF IRON IN MEALS



- PCA revealed some nutrients which contributed most to the overall variance in the data set which would have been difficult to otherwise identify given the 40 nutrient variables
- Iron was a key nutrient which contributed to some variance in PC1 and PC2

Most packaged meals will not meet the daily recommended amount of iron for men or women even if eaten 3 times a day!



Vitamin and Mineral Deficiencies

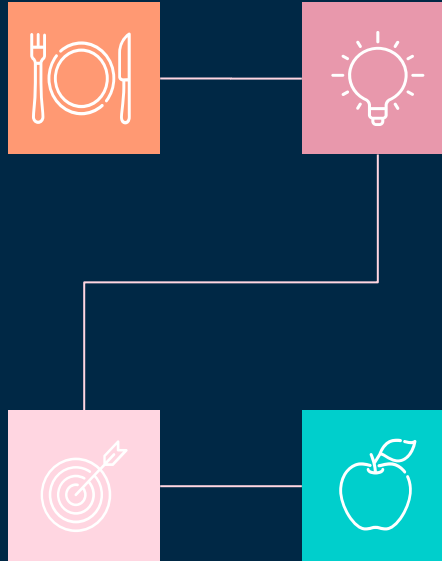
| Indicator | Info | Year | Value | Source |
|---|-------------------|------|-------|----------------------|
| Anaemia children <5 y (Hb<110 g/L) (%) | i | 2016 | 8.5 | View |
| Anaemia in women of reproductive age (%) | i | 2016 | 13.3 | View |
| Anaemia in non-pregnant women (Hb <120 g/L) (%) | i | 2016 | 13.2 | View |
| Anaemia in pregnant women (Hb <110 g/L) (%) | i | 2016 | 16.2 | View |

- WHO NLiS has identified **anaemia** as a public health issue in the United States among women and children
- Lack of packaged meals and accessibility to these meals from low income groups is likely contributing to widespread **mineral deficiency**

RECOMMENDATIONS

MOST COMMON INGREDIENTS

- Agencies can leverage this information to focus on sustainable food sourcing.
- Companies can modify supply chain to focus on these ingredients.



ACCESSIBILITY

- Increase amount of vegetable based meals available to food-insecure Americans using Supplemental Nutrition Assistance Program (SNAP).

NUTRIENT VARIABILITY

- Most packaged meals are lacking in nutrient variety.
- Additional research on ways to increase nutrient variety in packaged foods is recommended.

NUTRIENT DEFICIENT MEALS

- USDA can promote vegetable based meals to improve public health.
- USDA can inform companies about vitamin and mineral deficiency in Americans

THANK YOU, QUENTIN READ!

Shout out to our Team 21 mentor!



The background is a dark navy blue. It is decorated with various geometric elements: small squares in teal, orange, and pink, and thin white vertical lines of varying lengths. These elements are scattered across the frame, creating a modern, minimalist aesthetic.

THANK
YOU!