



USDA Packaged Meals by Team 22

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Background/Introduction

As time progresses, new technology and innovation progresses. The average person usually has a busy work or academic life that doesn't allow them to have the time to cook a nutritious meal. People nowadays either go to the grocery store or restaurant to get quick accessible food. These foods usually determine how a person life goes and it is a very important topic. The question that arises is that do these fast meals have the proper nutritional value that is recommended?

A doctor in a white lab coat is sitting at a desk, looking extremely stressed. Their head is buried in their hands, and they are slumped forward. The background is a blurred office setting with a window showing some foliage. The overall tone is somber and conveys a sense of frustration or despair.

The Problem

There is a rising issue with the United States regarding the topic of health. The US ranks first for diabetes and obesity and second for heart disease. A quote by the American Public Health Association states, "The U.S. spends more on health care but has worse health outcomes than comparable countries around the globe. This holds true across age and income groups." With poor insurance and a lack of knowledge, it adds an additional obstacle for Americans to maintain a healthy lifestyle. Are there popular food ingredients that can cause harm to these people, also, are there popular food ingredients that can benefit Americans?

What are we going to do about it?

There are several ways to combat the issue. We are mainly going to use the data set provided by the USDA that contains information of food ingredients and packages to find the most common ingredients in meals and packages to guide the US to a healthier diet. Using the USDA guidelines and the FDA guidelines will help our team to understand what specific ingredients are considered "healthy" and "unhealthy". We will then use all these factors and implement it to MATLAB, using an algorithm which allows us to piece out the popular ingredients in the data and piece together the popular healthy ingredients and the popular unhealthy ingredients.

USDA Guidelines

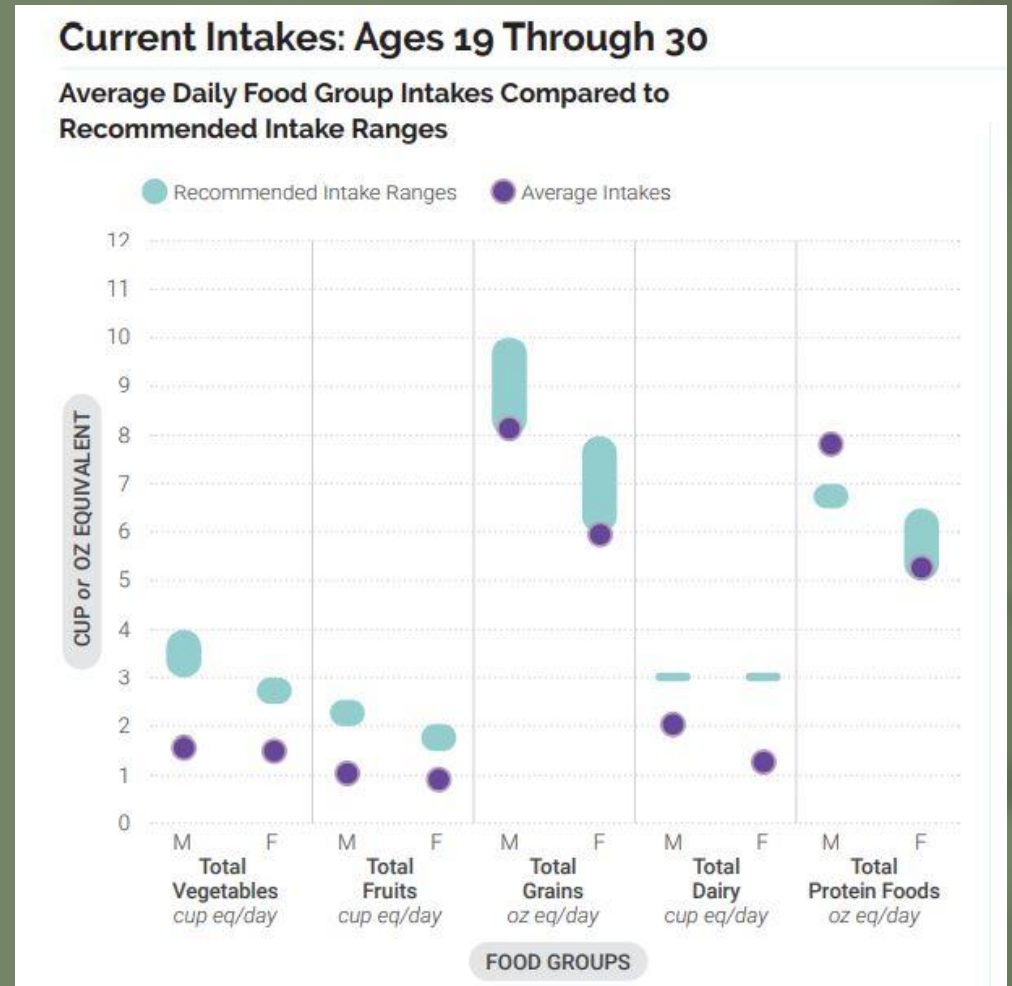
These USDA guidelines helps our group understand what should a healthy human eat to maintain a healthy lifestyle. This graph here shows the recommended amount of food from each food group in cups and grams.

Healthy U.S.-Style Dietary Pattern for Adults Ages 19 Through 59, With Daily or Weekly Amounts From Food Groups, Subgroups, and Components

CALORIE LEVEL OF PATTERN ^a	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000
FOOD GROUP OR SUBGROUP ^b	Daily Amount of Food From Each Group (Vegetable and protein foods subgroup amounts are per week.)							
Vegetables (cup eq/day)	2	2 ½	2 ½	3	3	3 ½	3 ½	4
	Vegetable Subgroups in Weekly Amounts							
Dark-Green Vegetables (cup eq/wk)	1 ½	1 ½	1 ½	2	2	2 ½	2 ½	2 ½
Red & Orange Vegetables (cup eq/wk)	4	5 ½	5 ½	6	6	7	7	7 ½
Beans, Peas, Lentils (cup eq/wk)	1	1 ½	1 ½	2	2	2 ½	2 ½	3
Starchy Vegetables (cup eq/wk)	4	5	5	6	6	7	7	8
Other Vegetables (cup eq/wk)	3 ½	4	4	5	5	5 ½	5 ½	7
Fruits (cup eq/day)	1 ½	1 ½	2	2	2	2	2 ½	2 ½
Grains (ounce eq/day)	5	6	6	7	8	9	10	10
Whole Grains (ounce eq/day)	3	3	3	3 ½	4	4 ½	5	5
Refined Grains (ounce eq/day)	2	3	3	3 ½	4	4 ½	5	5
Dairy (cup eq/day)	3	3	3	3	3	3	3	3
Protein Foods (ounce eq/day)	5	5	5 ½	6	6 ½	6 ½	7	7
	Protein Foods Subgroups in Weekly Amounts							
Meats, Poultry, Eggs (ounce eq/wk)	23	23	26	28	31	31	33	33
Seafood (ounce eq/wk)	8	8	8	9	10	10	10	10
Nuts, Seeds, Soy Products (ounce eq/wk)	4	4	5	5	5	5	6	6
Oils (grams/day)	22	24	27	29	31	34	36	44
Limit on Calories for Other Uses (kcal/day)^c	100	140	240	250	320	350	370	440
Limit on Calories for Other Uses (%/day)	6%	8%	12%	11%	13%	13%	13%	15%

USDA Guidelines (cont...)

This graph shows the recommended and actual food intake of each food sub-category. As you can see, the average American eats either under or over the recommended intake.



Food Additive, Fats, & Sugar

- One major difference between homemade and packaged food is the fact that it contains chemical additive during processing, packaging and storage. Are these food additives safe to consume?
- **Potassium Bromate:**
 - ❖ used for strengthen bread and cracker dough.
 - ❖ Listed as known carcinogen by state of California and International cancer agency
- **Aluminum Additives (Sodium Aluminum Sulfate and Sodium Aluminum phosphate) :**
 - ❖ Used as a stabilizer or preserver the food structure
 - ❖ Has a negative impact on neurological effects such as behavioral changes, learning and motor response.

Food Additive, Fats, & Sugar

- **Nitrate and Nitrites:**

- ❖ Used for curing meats products to retain their freshness and flavor.
- ❖ The additives reacts with amines(protein building block of the meat) and result in a carcinogenic chemical known as nitrosamines. That is a cause of stomach and esophagus cancer.

- **Natural and Artificial Flavor:**

- ❖ Used to increase the appeal and flavor of the food.
- ❖ No clues what chemical are added under the umbrella of this term. Therefore, it may become a serious concern for those who have uncommon food allergies and on restricted diets.

What the Data set looks like?

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	fdc_id	brand_owner	gtin_upc	ingredients	serving_size	serving	household_ser	branded_food_category	data_sc	modified_date	availabl	market	disconti	ed_d
2	344621	Kellogg Company US	1.00841E+13	COOKED BROWN RICE (LONG GRAIN	142	0.706468	1 Patty	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
3	344656	Kellogg Company US	84059000037	COOKED BROWN RICE (LONG GRAIN	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	12/20/2016	4/1/2019	United States		
4	344657	Kellogg Company US	84059100058	COOKED BROWN RICE (LONG GRAIN	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		
5	344744	Kellogg Company US	84059100089	COOKED BROWN RICE (WATER, BRO	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		
6	344921	Kellogg Company US	84059000426	COOKED BROWN RICE (WATER, LON	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	11/30/2016	4/1/2019	United States		
7	344922	Kellogg Company US	84059100010	WATER, COOKED BLACK BEANS (BLA	85	0.422886	1 Patty	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
8	344923	Kellogg Company US	84059100102	COOKED BROWN RICE (WATER, LON	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		
9	344924	Kellogg Company US	84059100003	COOKED BROWN RICE (WATER, LON	85	0.422886	1 Patty	Vegetable Based Products / Meals	GDSN	12/19/2016	4/1/2019	United States		
10	344943	Kellogg Company US	1.00841E+13	COOKED BROWN RICE (LONG GRAIN	96	0.477612	1 Patty	Vegetable Based Products / Meals	GDSN	11/30/2017	4/1/2019	United States		
11	344944	Kellogg Company US	1.00841E+13	WATER, COOKED BLACK BEANS (BLA	96	0.477612	1 Patty	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
12	344945	Kellogg Company US	1.00841E+13	SOY PROTEIN CONCENTRATE WITH	96	0.477612	1 Pattie	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
13	344946	Kellogg Company US	1.00841E+13	COOKED BROWN RICE (LONG GRAIN	96	0.477612	1 Patty	Vegetable Based Products / Meals	GDSN	11/30/2017	4/1/2019	United States		
14	344947	Kellogg Company US	1.00841E+13	WATER, SOY PROTEIN CONCENTRAT	71	0.353234	1 Patty	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
15	344948	Kellogg Company US	1.00841E+13	COOKED BROWN RICE (WATER, ORG	91	0.452736	1 Patty	Vegetable Based Products / Meals	GDSN	11/16/2017	4/1/2019	United States		
16	344956	Kashi US	18627100300	CRUST (WATER, WHEAT FLOUR, WH	149	0.741294	1 Pizza	Vegetable Based Products / Meals	GDSN	11/6/2017	4/1/2019	United States		
17	344958	Kashi US	18627102366	CRUST (WATER, WHEAT FLOUR, WH	156	0.776119	1 Pizza	Vegetable Based Products / Meals	GDSN	11/6/2017	4/1/2019	United States		
18	344959	Kashi US	18627102380	CRUST (WATER, WHEAT FLOUR, WH	152	0.756219	1 Pizza	Vegetable Based Products / Meals	GDSN	1/13/2017	4/1/2019	United States		
19	344960	Kashi US	18627102403	CRUST (WATER, WHEAT FLOUR, WH	147	0.731343	1 Pizza	Vegetable Based Products / Meals	GDSN	11/6/2017	4/1/2019	United States		
20	344961	Kashi US	18627102427	CRUST (WATER, WHEAT FLOUR, WH	153	0.761194	1 Pizza	Vegetable Based Products / Meals	GDSN	11/6/2017	4/1/2019	United States		
21	344968	Kellogg Company US	18627104414	Cooked red quinoa (water, red quino	255	1.268657	1 EntrÃ©e	Vegetable Based Products / Meals	GDSN	2/6/2018	4/1/2019	United States		
22	344976	Kellogg Company US	18627105480	Cooked red quinoa (water, red quino	255	1.268657	1 EntrÃ©e	Vegetable Based Products / Meals	GDSN	2/6/2018	4/1/2019	United States		
23	344998	Kellogg Company US	18627106067	Water, plantains (plantains, soybean	283	1.40796	1 EntrÃ©e	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		
24	344999	Kellogg Company US	18627106081	Water, cooked black beans, Kashi Se	283	1.40796	1 EntrÃ©e	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		
25	345001	Kashi US	18627329053	CRUST (CRUST MIX WITH KASHI SEVI	120	0.597015	1/3 pizza	Vegetable Based Products / Meals	GDSN	1/13/2017	4/1/2019	United States		
26	345039	Kellogg Company US	28989096685	TEXTURED VEGETABLE PROTEIN (WI	55	0.273632	2/3 cup	Vegetable Based Products / Meals	GDSN	11/7/2017	4/1/2019	United States		
27	345040	Kellogg Company US	28989100191	English muffin (water, whole wheat f	105	0.522388	1 Sandwich	Vegetable Based Products / Meals	GDSN	1/25/2018	4/1/2019	United States		

MATLAB

Popular Ingredients implementation

```
Editor - C:\Users\Asqr\Desktop\MathLab\USDAPackage.m
USDAPackage.m x +
43 - end
44 - Ingredientsnames(1:4437)
45 - Ingredientsnames = lower(Ingredientsnames);
46
47     % Popular Ingrdeant in the data set
48 - [words,~,idx] = unique(Ingredientsnames);
49 - numOccurrences = histcounts(idx,numel(words));
50 - [rankOfOccurrences,rankIndex] = sort(numOccurrences,'descend');
51 - wordsByFrequency = words(rankIndex);
52 - loglog(rankOfOccurrences);
53 - xlabel('Rank of word (most to least common)');
54 - ylabel('Number of Occurrences');
55 - wordsByFrequency(1:4185)
56 - numOccurrences = numOccurrences(rankIndex);
57 - numOccurrences = numOccurrences';
58 - numWords = length(Ingredientsnames);
59 - T = table;
60 - T.Words = wordsByFrequency;
61 - T.NumOccurrences = numOccurrences
62 - % popular ingredients ends here
```

ans = 400x4 table

	Words	NumOccurrences
1	"salt"	12724
2	"oil"	6679
3	"sodium"	6642
4	"water"	6419
5	"cheese"	6181
6	"milk"	6062
7	"flour"	5838
8	"acid"	5836
9	"corn"	5033

MATLAB (cont..)

```
%Additives
%potassium bromate
potassiumBromateBool = cellSplit.contains("potassium bromate");
potassiumBromateCol = length(potassiumBromateBool);

for i= 1:potassiumBromateCol
    if(potassiumBromateBool(1,i)==1)
        potassiumBromate= potassiumBromate+ 1;
    end
end

%nitrates and nitrites
nitratesBool = cellSplit.contains("nitrates");
nitratesCol = length(nitratesBool);
for i= 1:nitratesCol
    if(nitratesBool(1,i)==1)
        nitrates= nitrates + 1;
        nitrateIncludedFdcId =vertcat(string(fdcList),string(nitrateIncludedFdcId));
        % if(Data(m,1) == nitrateIncludedFdcId)
```

Food Additive implementation

Additive	Num of Occurrences
Nitrate and Nitrite	47
Natural and Artificial flavor	480
Phosphate	4891
Sodium Aluminum Phosphate	301
Sodium Aluminum Sulfate	42

MATLAB (cont..)

```
% Grain Comparson
```

```
grainValue = 3;
```

```
grainAccepted = 0;
```

```
sizeGrain = length(Grain);
```

```
for i = 1:sizeGrain
```

```
    if(Grain(i,6) < grainValue)
```

```
        grainAccepted= grainAccepted +1;
```

```
    end
```

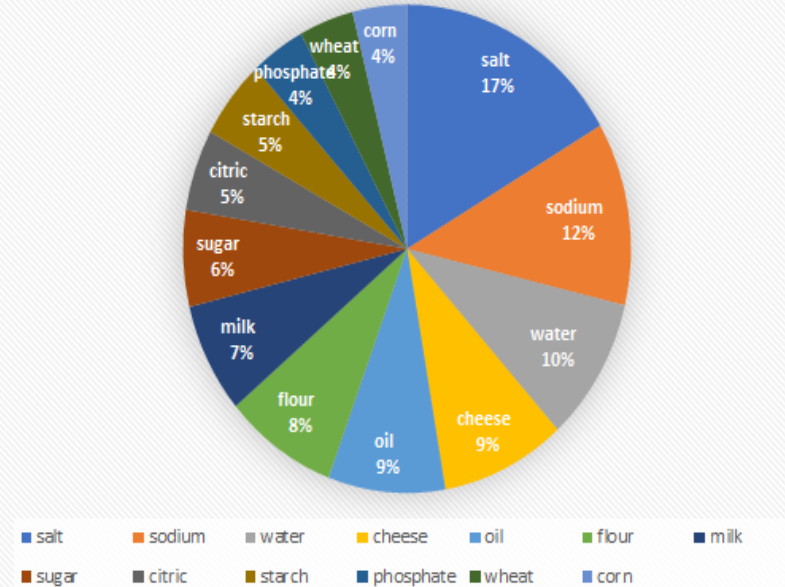
```
end
```

Nutrient dense food implementation

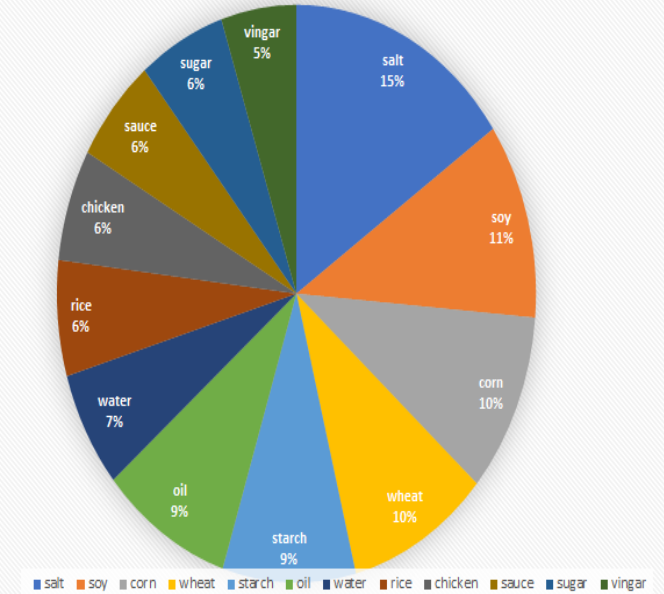
Food Category	Serving Size (cups)/day		Recommended(cups)/day
Frozen Breakfast Sandwiches	1.86108		6.5
Breakfast Sandwiches	1.87053		6.5
Dairy/Egg	2.61954		3
Grain	2.5563		9
Vegetable	1.6071		3.5
Dough Based products	2.73936		9
Entrees/sides	1.80258		6.5
Combinations	4.2246		4.8

Solution

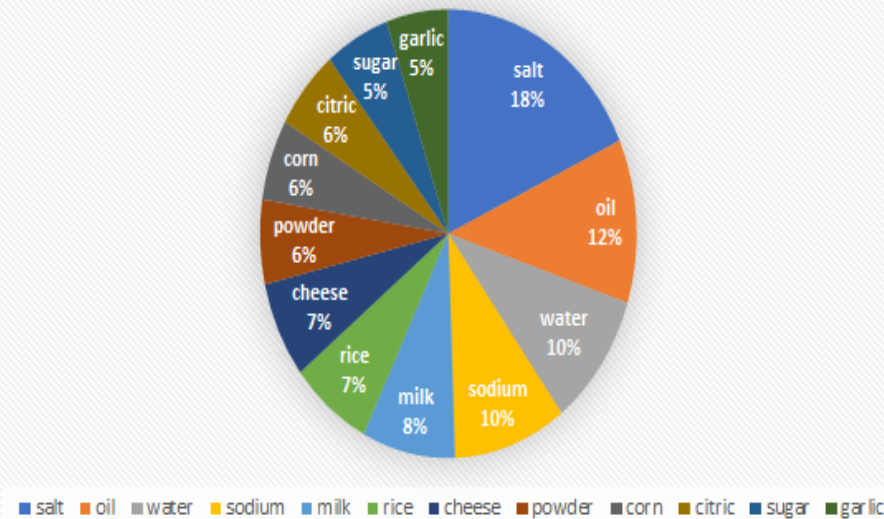
Popular Ingredients of Breakfast Sandwiches



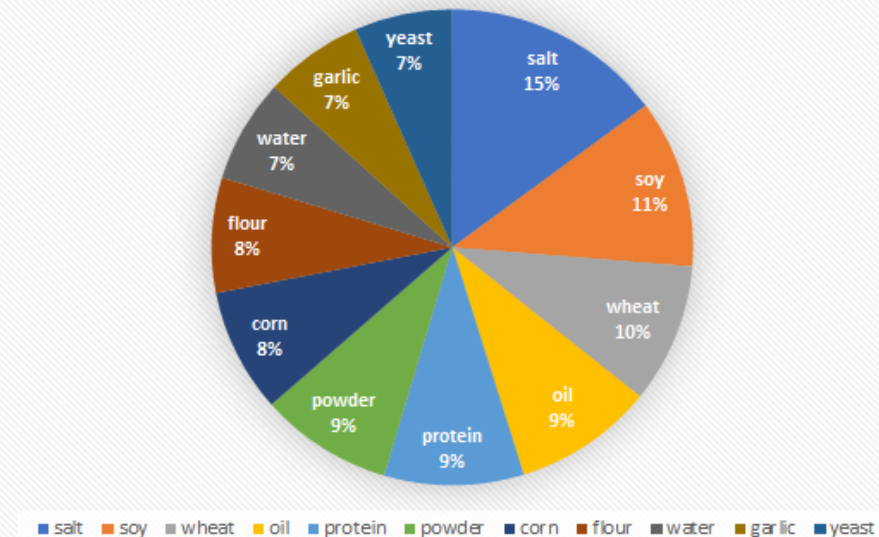
Popular Ingredient of Grain Based Products



Popular Ingredients of Entrees and sides meal category

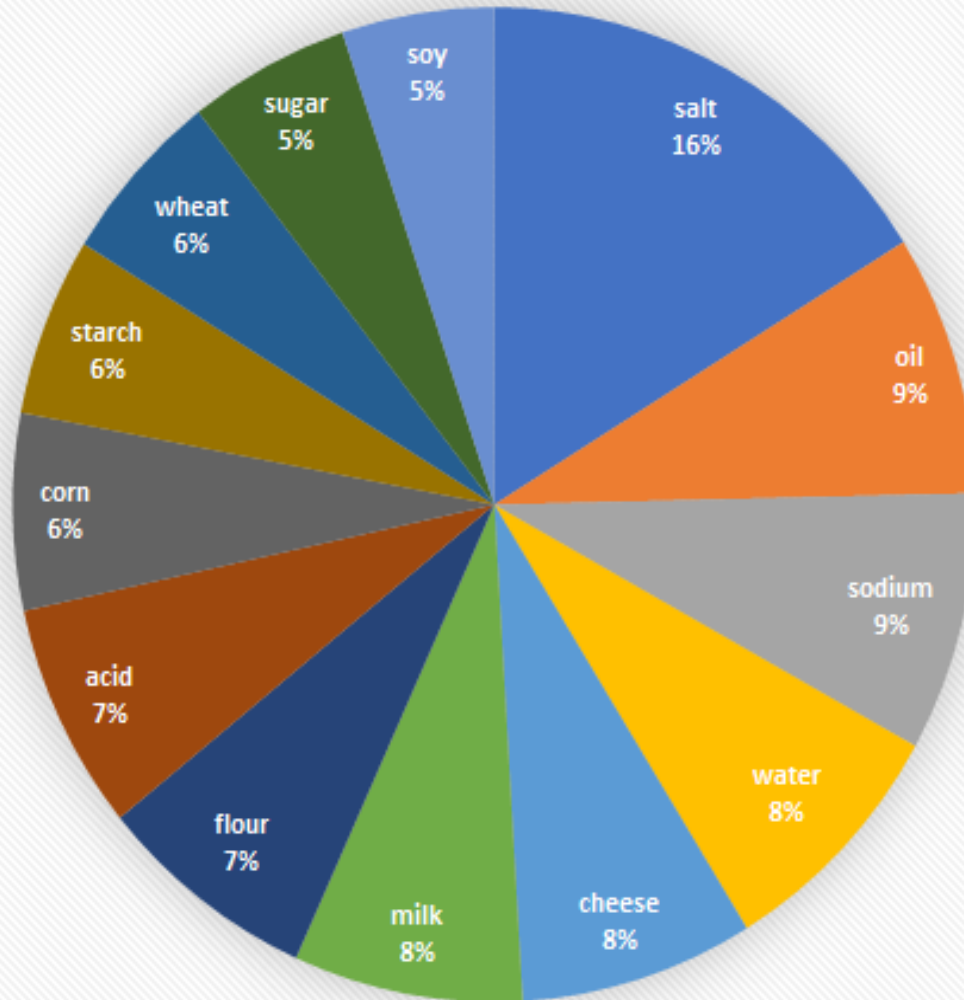


Popular Ingredients of Vegetable based Products



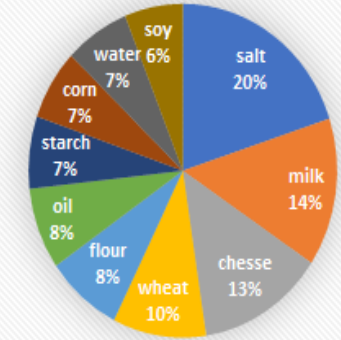
Solution cont..

POPULAR INGREDIENTS PRESENTED IN THE DATASET



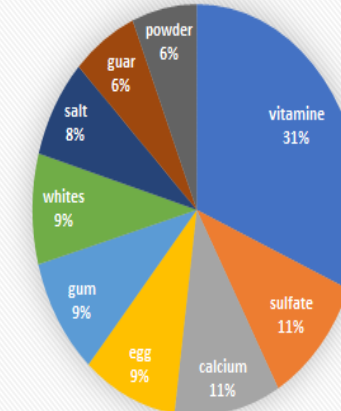
■ salt ■ oil ■ sodium ■ water ■ cheese ■ milk ■ flour ■ acid ■ corn ■ starch ■ wheat ■ sugar ■ soy

Popular Ingredients of Dough based products



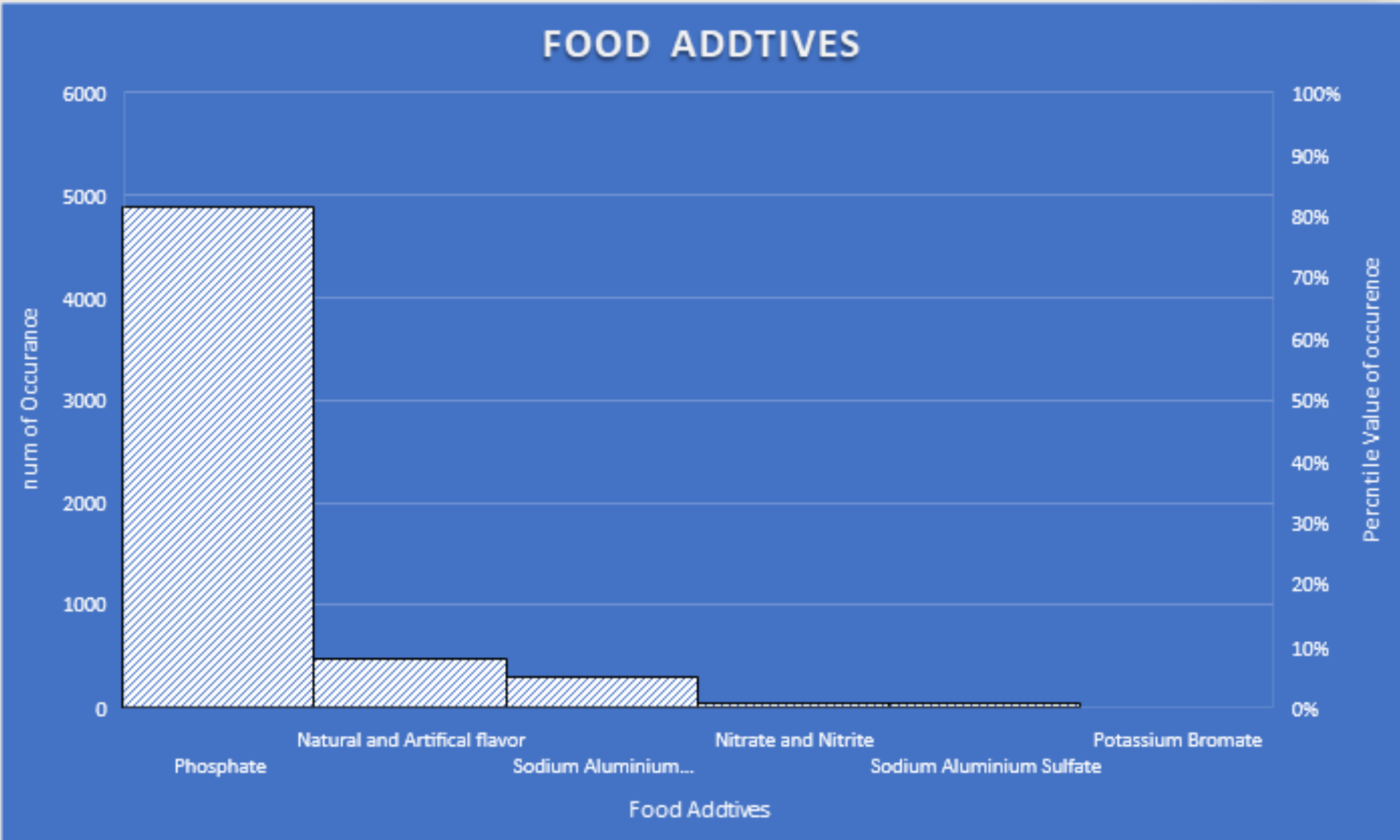
■ salt ■ milk ■ cheese ■ wheat ■ flour ■ oil ■ starch ■ corn ■ water ■ soy

Popular Ingredients of Egg based Products

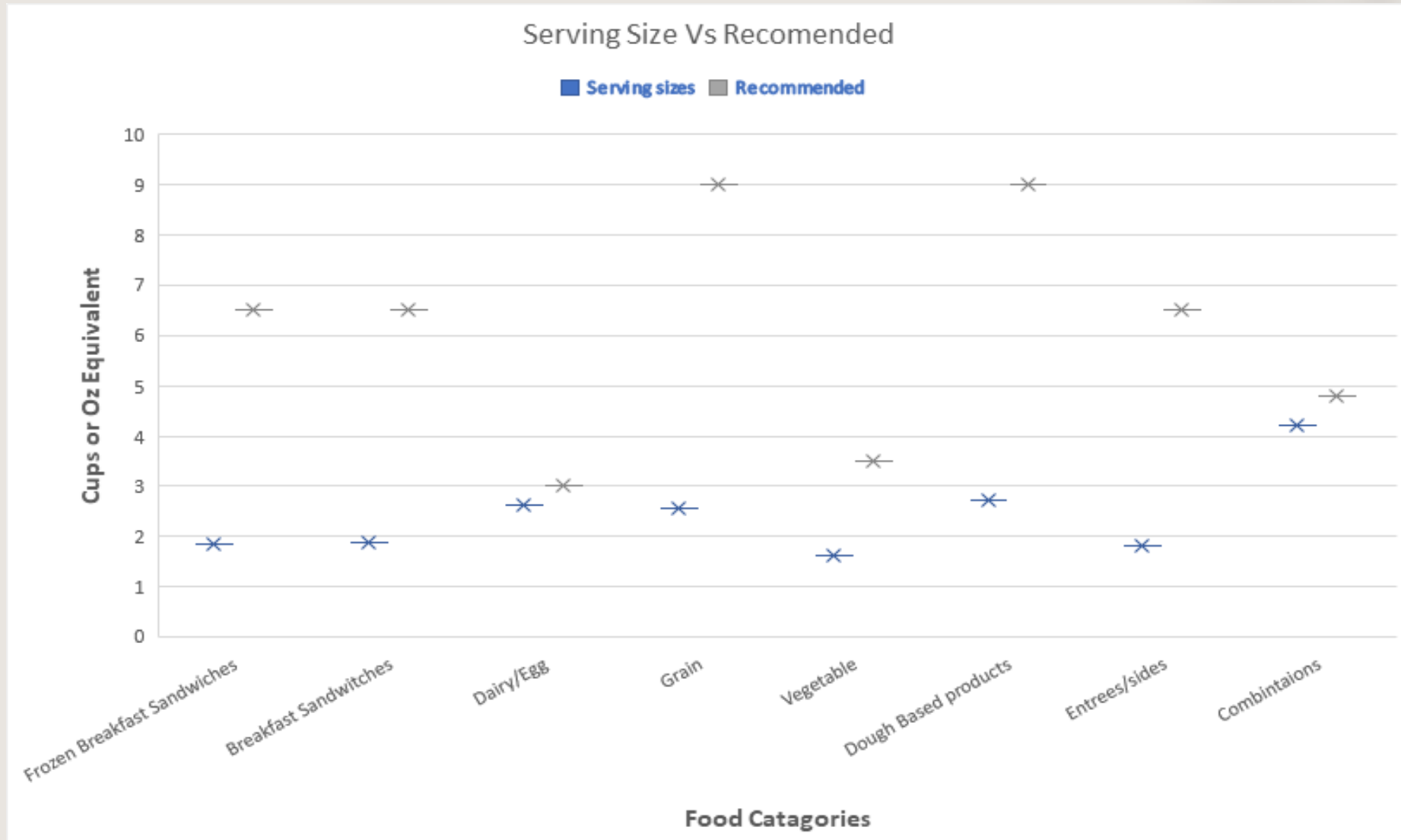


■ vitamine ■ sulfate ■ calcium ■ egg ■ gum ■ whites ■ salt ■ guar ■ powder

Food Additive Solutions..



Nutrient Dense Solution



Conclusion

According to the results we found:

- ❖ Most of the packaged meals contain salt, oil, cheese and milk.
- ❖ The most common combination of ingredients were salt and enzymes, corn and starch, soybean and oil ,milk and cheese.
- ❖ The nutritional values for most of the packaged meals fall less than what is recommended by the USDA and mostly contain phosphate which is considered toxic if taken in larger amount.
- After working on these data analysis, we were surprised to see how looking closely and exploring more about the foods we consume would help visualize how they affect our health and lifestyle and help companies make changes in levels of these nutrients of concern in the food supply and the potential to produce large health gains at relatively low cost.



Sources

- [office-workers-decided-to-take-break-eat-some-pizza-watching-something-computer-laughing-man-wheelchair-104292298.jpg \(800×534\) \(dreamstime.com\)](#)
- [SadDoctor-0003000.jpg \(600×400\) \(silverdoctors.com\)](#)
- [Health Rankings \(apha.org\)](#)
- [Dietary Guidelines for Americans, 2020-2025](#)
- [FoodData Central \(usda.gov\)](#)
- [EWG's Dirty Dozen Guide to Food Additives | EWG](#)