How to Choose Food in a Healthy and Balanced Way

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Introduction

A healthy and balanced diet style has become the pursuit of more and more modern people. In addition to relying on the intake of food to obtain a sense of satiety, people are beginning to care about the nutrition and health benefits that different foods can bring to the human body. Sugar, as a pleasant and exciting seasoning, brings a richer taste to many foods; but at the same time, sugar can also accelerate human skin aging, and excessive intake can cause serious diseases such as hyperlipidemia and diabetes. Some food would full of one kind of nutrition that benefit our body, but can lead to the unbalanced diet at the same time. This project would focus on [1] the relation between sugar level and food energy; [2]the relation between water and dietary fiber; [3] finding out the beef or chicken, which one is a better source as calcium supply for human body. This analysis would help people to form a healthier diet by choosing food with proper sugar level, have an understanding about how to balance the intake of dietary fibers and and find out ideal food to ensure their daily nutrition intake.

Data

The data used in the project is from the National Nutrient Database of the United States Department of Agriculture (USDA). For different types of food (description), the energy and nutrients are collected. In the database, there are following quantitative data: [1] the energy per 100 grams of a certain food in kcal; [2] the protein per 100 grams a certain food contain in grams; [3] the total lipids (fat) per 100 grams of a certain food contain in grams; [4] the total calcium per 100 grams a certain food contain in milligrams (mg); [5] the total potassium per 100 grams a certain food contain in milligrams (mg); [6] the total sodium per 100 grams a certain food contain in milligrams (mg).

In the database, there are following categorical data: [1] the level of total sugar per 100 grams a certain food contain in grams (g) from 1 to 10 (1: 0-10g; 2: 10-20g; 3: 20-30g; 4: 30-40g; 5: 40-50g; 6: 50-60g; 7: 60-70g; 8:70-80g; 9: 80-90g; 10: 90-100g). [2] the level of total water per 100 grams a certain food contain in grams (g) from 1 to 4 (1: 0-25g; 2: 25-50g; 3: 50-75g; 4: 75-100g). [3] total dietary fiber of a certain food, use 0 and 1 to represent (0: no; 1: yes).

Relation Between Energy and Sugar

Most snacks and fried foods contain a lot of sugar. Therefore, consuming large amounts of sugar is considered to be one of the causes of obesity. The following test will focus on whether there is a relationship between sugar content and high calories.

Figure1 shows the distribution of of the energy of food with sugar level 1-5. There are 4164 food with a sugar level from 1-5 in the sample. The distribution of energy of food with sugar level 1-5 is skewed to the right with a mean energy of 220.728 and a standard deviation of 172.118.

Figure1:Energy for food with sugar level 1-5

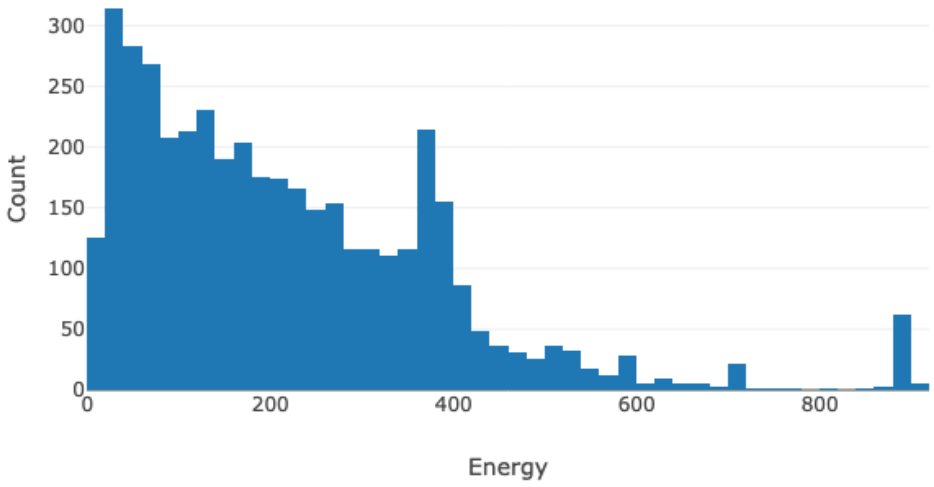
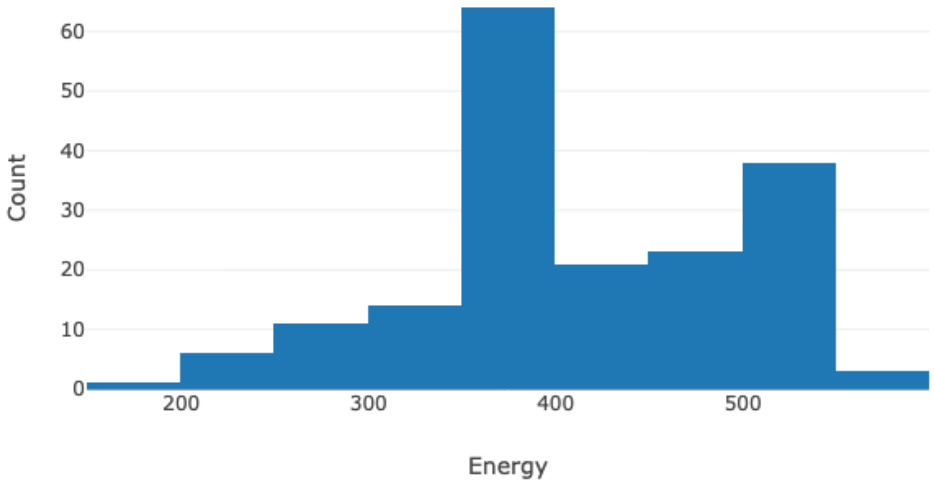


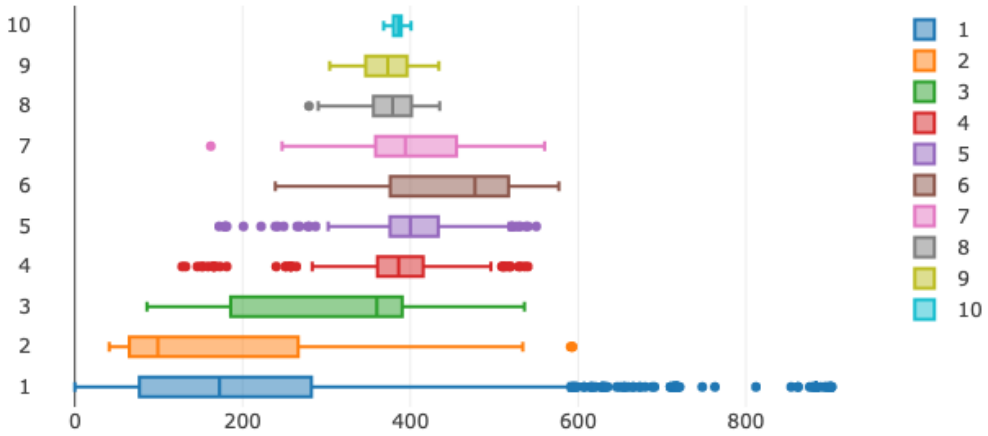
Figure2 shows the distribution of of the energy of food with sugar level 6-10. The total amount of food with sugar level 6-10 is 181.
The distribution of energy of food with sugar level 1-5 is skewed to the left with a mean energy of 413.155 and a standard deviation of 83.303.

Figure2: Energy for food with sugar level 6-10



Based on the data, a histogram of energy blocked by the sugar level is generated. By observing the range of energy of most of the food in a sugar level is, we see there is obvious difference. The box plot below (figure3) shows the distribution of energy of food of different sugar level. There is a clear difference between the energy of food in different sugar level, especially by observing the minimum and median. So we would like to test to see if the food with high sugar level have a higher chance of having more energy.

Figure3:Energy given Sugar



We divid the food into to two groups: one is the food with sugar level from 1-5, the other is food with sugar level from 6-10. We collect the data of how many foods in each group has energy more than about 500 calories per 100 grams. Based on our total 4345 samples, there are a number of 4051 food have a sugar level from 1 to 5. Among them, 140 out of 4051 have energy above 500 calories per 100 gram. There are a number of 294 food have a sugar level from 6-10. Among them, 39 out of 294 have energy above 500 calories per 100 gram. By employing 2-proportion z test and 2-proportion z interval, we gain the conclusion about whether the proportion of food with a sugar level from 1- 5 has energy over 500 calories per 100 grams is lower than the proportion of food with a sugar level from 6-10 has energy over 500 calories per 100 grams and a fair 95% confidence level interval of the difference between these two proportions.

The following table shows that sample data:

	Sugar Level 1-5	Sugar Level 6-10	
Energy below 500 calories	3911	140	4051
Energy above 500 calories	255	39	294
			4345

State:

p1: the proportion of food with a sugar level from 1- 5 has energy over 500 calories per 100 grams

p2: the proportion of food with a sugar level from 6-10 has energy over 500 calories per 100 grams

H0 (null hypothesis) : p1 = p2

Ha (alternative hypothesis) : p1 < p2

p-hat1 = 140/4051= 0.0346

p-hat2 = 39/294 = 0.133

Plan:

We are infer about 2 independent population

Samples are reasonably random

4051 < 1/10 * (the total number of food with a sugar level from 1 to 5)

294 < 1/10 * (the total number of food with a sugar level from 6 to 10)

4051 * 0.0346 > 30

4164 * (1-0.0346) > 30

294 * 0.133 > 30

294 *(1- 0.133) > 30

sample standard deviation for p-hat1

Variable:	Standard Deviation	N
Energy	64.704	140

sample standard deviation for p-hat1

Variable:	Standard Deviation	N
Energy	16.134	41

Do:

From the result of 2-proportion z test, we gain the result of p-value = 0

From the result of 2-proportion z interval, we gain the 95% level confidence interval of (-0.137, -0.059)

Conclude:

Since p-value < 0.05, we reject the null hypothesis. We have sufficient evidence that the proportion of food with a sugar level from 1- 5 has energy over 500 calories per 100 grams is lower than that of food with sugar level of 6-10.

And we are 95% confidence that the true difference in proportion between food with a sugar level from 1- 5 has energy over 500 calories per 100 grams and food with a sugar level from 6-10 has energy over 500 calories per 100 grams lies between -0.137 and -0.059.

Based on this analysis, we can tell that food with high sugar level (6-10) have a higher chance of high calories. Sometimes it can be a necessary and ideal supplement for our body especially after sports. However, we need to care about the intake of sugar in order to have a healthy eating style.

Relation Between Water and Fiber

Dietary fiber is one of the most important element our body need and we intake them mostly from the food we eat everyday. This study would focus on finding if there is an association between dietary fiber and water in food by conducting chi-square test for independence.

Figure4 is the pie chart shows the distribution of water level of food. 35.3% of the food in the sample have a water level of 3, 29.3% of the food have a water level of 4, 26% of the food in the sample have a water level 1, and the rest 9.44% have a water level of 2.

Figure 4 :Water

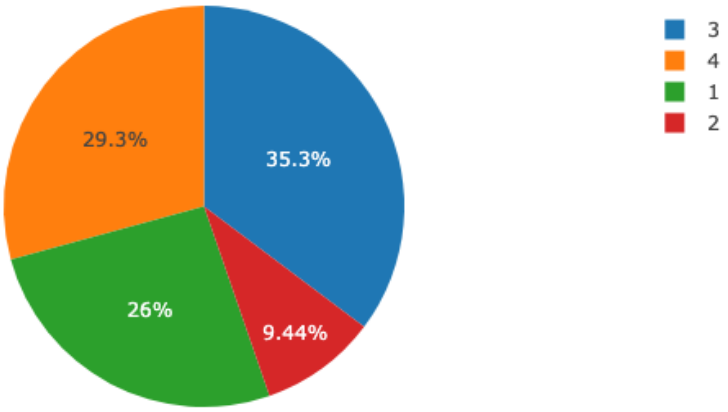
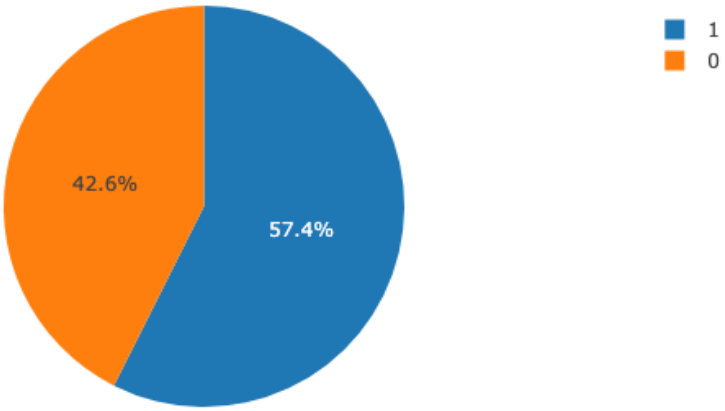


Figure5 is the pie chart showing the food distribution based on whether it contain dietary fiber. 42.6% of the food do not contain dietary fiber while the rest 56.4 have.

Figure 5: Fiber



State:

H0: There is no association between water and dietary fiber

Ha: There is an association between water and sugar fiber

Plan:

observed value:

water fiber	1	2	3	4
0	223	133	1156	338
1	908	277	376	934

expected value:

water fiber	1	2	3	4
0	481.55	174.57	652.29	541.59

1	694.45	235.43	879.71	730.41

All the count is grater than 5.

Do:

Based on the chi-square independence test, we gain a p-value smaller than2.2*10^16.

Conclude:

Since p-value < 0.05, we reject the null hypothesis. We have sufficient evidence to prove that there is an association between fiber and water.

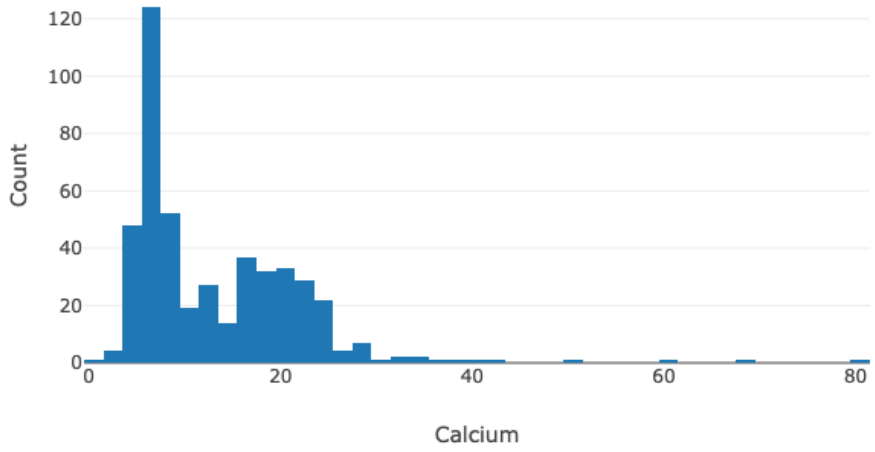
Relation Between Food and Calcium

Beef or Chicken?

Some people find it is hard to decide between fried chicken sandwich and cheese beef burger. This analysis would focus on chicken or beef, can they provide same amount of calcium to our body.

Figure6 is the histogram the mass of calcium in milligrams (mg) of all the food in our sample that contain beef. There are a total of 466 food in the database contain beef. The sample mean for food contain beef is 13.208 mg per 100 grams with a standard deviation of 9.005.

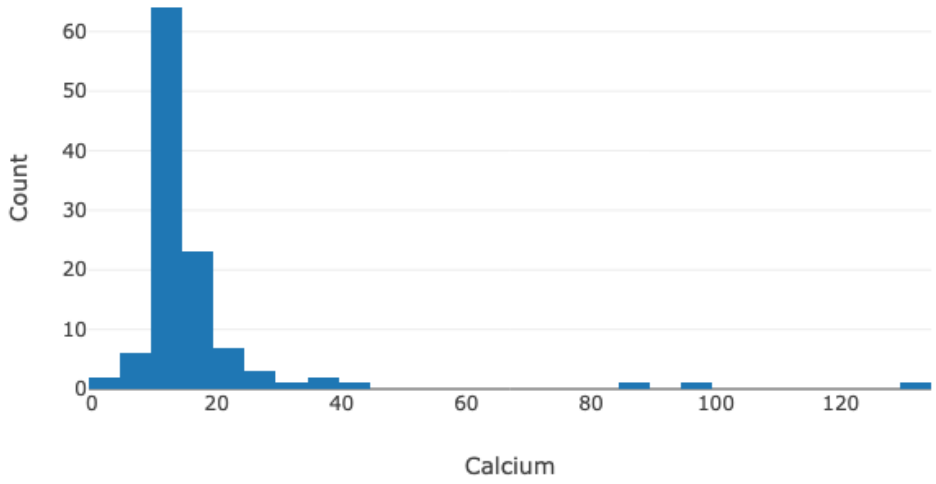
Figure 6:Calcium of beef



Variable:	Mean	Standard Deviation	N
Calcium	13.208	9.005	466

Figure7 is the histogram the mass of calcium in milligrams (mg) of all the food in our sample that contain chicken. There are a total of 112 food in the database contain beef. The sample mean for food contain cheese is 16.661 mg per 100 grams with a standard deviation of 16.156.

Figure7: Calcium of Chicken



Variable:	Mean	Standard Deviation	N
Calcium	16.661	16.156	112

State:

mu0: the true mean mass of calcium in food made with beef

mu1: the true mean mass of calcium in food made with chicken

H0: mu0 = mu1

Ha: mu0 ≠ mu1

Plan:

random sample

466< 1/10*(the number of food contain beef in the world)

112< 1/10*(the number of food contain chicken in the world)

466>10

112>10

Do:

From the result of conducting 2-sample t test, we get the p-value= 0.031

From the result of 2-sample t interval, we obtain the 95% confidence interval as (-6.584, -0.322)

Conclude:

Since p-value = = 2.59*10^22 < 0.05, we reject the null hypothesis. We have sufficient evidence that the the true mean mass of calcium in food made with beef is different from the true mean mass of calcium in food made with cheese.

Since 0 is not include in 95% confidence interval, there is an difference between the calcium that chicken and beef can bring to our body when taking the same amount.

Discussion:

Based on these study, we can obtain some basic facts that [1] the food with higher sugar level have a higher chance of with higher energy; [2] the dietary fiber that contain in the food has an association with water; [3] different kinds of meat—chicken and beef, can provide our body with different amount of calcium. These can be some reminder for us when picking everyday food and start to pay attention to the sugar amount, water amount and other elements of single ingredient.

However, the study is limited that the ingredient itself is not the only factor may affect the nutrition of food. We also need to consider the way of cooking the food. For example, over frying may lead to cancerization of nutrition and also bring some extra unsaturated fat to our body. At the same time, another misconception is that if sugar may lead to disease, we should avoid having it; if a kind of food is full of benefits, we have to eat a lot of it. What we should pursue is a balanced diet. While taking in various trace elements, we should eat more natural things that can bring more beneficial substances.

Reference:

[1] National Nutrient Database for Standard Reference from the United States Department of Agriculture (USDA)