MCDONALD'S MENU EXPLORATORY DATA ANALYSIS USING PYTHON

presented by

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Some of McDonald's Menu Items. Photo by Irene Jiang/Business Insider.

Ray Kroc (an American businessman) wanted to build a restaurant system that would be famous for providing food of consistently high quality and uniform methods of preparation. He wanted to serve burgers, buns, fries and beverages that tasted just the same in Alaska as they did in Alabama. To achieve this, he chose a unique path: persuading both franchisees and suppliers to buy into his vision, working not for McDonald's but for themselves, together with McDonald's. Many of McDonald's most famous menu items – like the Big Mac, Filet-O-Fish, and Egg McMuffin – were created by franchisees.

NUTRICION FACTS FOR MCDONALD'S MENU

HERE IS DATA CONTAINS NUTRITION FACT OF EACH MCDONALD'S MENU IN UNITED STATES IN 2017, INCLUDING BREAKFAST, BEEF BURGERS, CHICKEN AND FISH SANDWICHES, FRIES, SALADS, SODA, COFFEE AND TEA, MILKSHAKES, AND DESSERTS. IN THIS REPORT, WE'RE GOING TO WORK WITH THE DATA TO ANSWER QUESTIONS BELOW:

a) How many calories does the average McDonald's value meal contain?
b) How much do beverages, like soda or coffee, contribute to the overall caloric intake?
c) Does ordered grilled chicken instead of crispy increase a sandwich's nutritional value?
d) What about ordering Egg Whites instead of whole eggs?
e) What is the least number of items could you order from the menu to meet one day's nutritional requirements?

DATA PREPARATION

[1]:
```
# Mengimport library yang dibutuhkan
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
#Agar plots tampil inline
%matplotlib inline
```

[2]:
```
# Membaca dataset
menu = pd.read_csv('menu.csv')
```

[3]:
```
# Menampilkan 5 baris pertama dari dataset
menu.head()
```

[3]:

	Category	Item	Serving Size	Calories	Calories from Fat	Total Fat	Total Fat (% Daily Value)	Saturated Fat	Saturated Fat (% Daily Value)	Trans Fat	...	Carbohydrates	Carbohydrates (% Daily Value)	Dietary Fiber	Dietary Fiber (% Daily Value)	Sugars	Protein	Vitamin A (% Daily Value)	Vitamin C (% Daily Value)	Calcium (% Daily Value)	I...
0	Breakfast	Egg McMuffin	4.8 oz (136 g)	300	120	13.0	20	5.0	25	0.0	...	31	10	4	17	3	17	10	0	25	
1	Breakfast	Egg White Delight	4.8 oz (135 g)	250	70	8.0	12	3.0	15	0.0	...	30	10	4	17	3	18	6	0	25	
2	Breakfast	Sausage McMuffin	3.9 oz (111 g)	370	200	23.0	35	8.0	42	0.0	...	29	10	4	17	2	14	8	0	25	
3	Breakfast	Sausage McMuffin with Egg	5.7 oz (161 g)	450	250	28.0	43	10.0	52	0.0	...	30	10	4	17	2	21	15	0	30	
4	Breakfast	Sausage McMuffin with Egg Whites	5.7 oz (161 g)	400	210	23.0	35	8.0	42	0.0	...	30	10	4	17	2	21	6	0	25	

5 rows × 24 columns

[5]:
```
# Menampilkan nilai Null pada tiap kolom
menu.isnull().any()
```

[5]:
```
Category                        False
Item                            False
Serving Size                    False
Calories                        False
Calories from Fat               False
Total Fat                       False
Total Fat (% Daily Value)       False
Saturated Fat                   False
Saturated Fat (% Daily Value)   False
Trans Fat                       False
Cholesterol                     False
Cholesterol (% Daily Value)     False
Sodium                          False
Sodium (% Daily Value)          False
Carbohydrates                   False
Carbohydrates (% Daily Value)   False
Dietary Fiber                   False
Dietary Fiber (% Daily Value)   False
Sugars                          False
Protein                         False
Vitamin A (% Daily Value)       False
Vitamin C (% Daily Value)       False
Calcium (% Daily Value)         False
Iron (% Daily Value)            False
dtype: bool
```

The given Data from Kaggle has already in structured format. THERE IS NO missing value and any other problem so that we don't need to cleaning the data.

We can just go to the next step….

We want to find how many calories does the average McDonald's value meal contain.
As ‘Calories' column is already including data from 'Calories from Fat', so that we only need to count the average from 'Calories' column to find the answer.

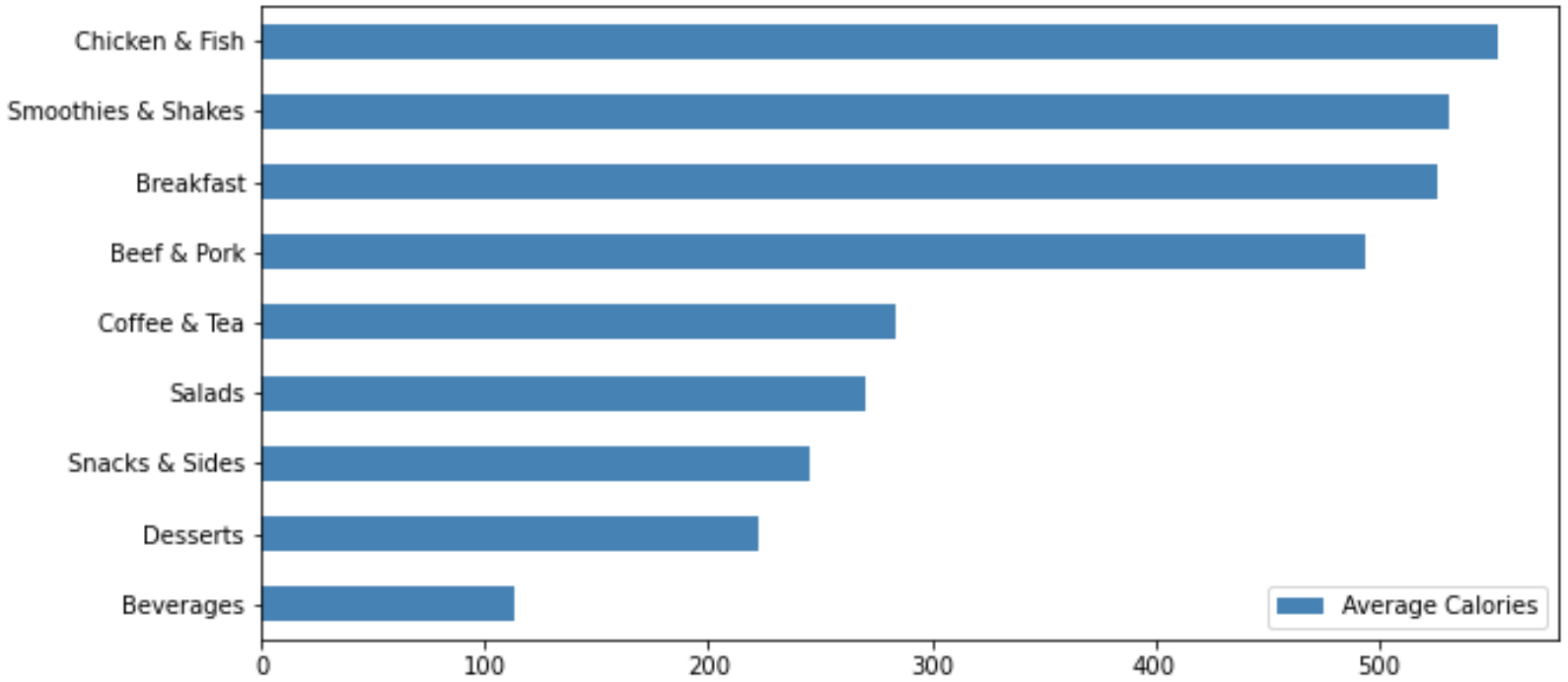

Fig 1. Bar Diagram of The Average Value of Calories in Different Category of Menu Dataset

	Average Calories
Beverages	113.70
Desserts	222.14
Snacks & Sides	245.77
Salads	270.00
Coffee & Tea	283.89
Beef & Pork	494.00
Breakfast	526.67
Smoothies & Shakes	531.43
Chicken & Fish	552.96

As we can see from Bar Diagram above, Chicken & Fish is the meal that contains the highest average value of calories, that is 552.96 Cal.
We also found that the average value calories of all McDonalds's meals, including **drink, contain**, is **368.27 Cal**.

Before we find out how much do Beverages, like soda and coffee, contribute to the overall caloric intake, we must to know that standards of caloric intake are different from one to another country. In the US, men are recommended to consume 2,700 calories per day and 2,200 calories per day for women.

[35]:
```
# Menampilkan kontribusi beverages dalam asupan kebutuhan kalori
bev_cal = pd.DataFrame({'Item': bev.Item, 'Calories': bev.Calories})
bev_cal['Men'] = bev_cal.Calories/2700
bev_cal['Women'] = bev_cal.Calories/2200
bev_cal.sort_values(by='Calories', ascending=False)
```

[35]:

	Item	Calories	Men	Women
128	Sprite (Large)	280	0.103704	0.127273
112	Coca-Cola Classic (Large)	280	0.103704	0.127273
135	Minute Maid Orange Juice (Large)	280	0.103704	0.127273
120	Dr Pepper (Large)	270	0.100000	0.122727
127	Sprite (Medium)	200	0.074074	0.090909
111	Coca-Cola Classic (Medium)	200	0.074074	0.090909
119	Dr Pepper (Medium)	190	0.070370	0.086364
134	Minute Maid Orange Juice (Medium)	190	0.070370	0.086364
133	Minute Maid Orange Juice (Small)	150	0.055556	0.068182
118	Dr Pepper (Small)	140	0.051852	0.063636
126	Sprite (Small)	140	0.051852	0.063636
110	Coca-Cola Classic (Small)	140	0.051852	0.063636
131	Fat Free Chocolate Milk Jug	130	0.048148	0.059091
121	Dr Pepper (Child)	100	0.037037	0.045455
124	Diet Dr Pepper (Large)	0	0.000000	0.000000
122	Diet Dr Pepper (Small)	0	0.000000	0.000000
117	Diet Coke (Child)	0	0.000000	0.000000
116	Diet Coke (Large)	0	0.000000	0.000000
115	Diet Coke (Medium)	0	0.000000	0.000000
114	Diet Coke (Small)	0	0.000000	0.000000
136	Dasani Water Bottle	0	0.000000	0.000000

[36]:
```
# Menampilkan nilai rata-rata kalori pada kategori 'Beverages'
avg_bev = bev['Calories'].mean(axis=0)
print("Average calories of 'Beverages' category is", round(avg_bev, 2))

# Menampilkan nilai rata-rata kalori pada kategori 'Beverages' yang mempengaruhi asupan kebutuhan kalori pria dan wanita di USA
avg_bev = pd.to_numeric(avg_bev)
bev_men = avg_bev/2700
print("'Beverages' contributes to caloric intake of men in USA averagely for", round(bev_men,2))

bev_wom = avg_bev/2200
print("'Beverages' contributes to caloric intake of women in USA averagely for", round(bev_wom, 2))
```

```
Average calories of 'Beverages' category is 113.7
'Beverages' contributes to caloric intake of men in USA averagely for 0.04
'Beverages' contributes to caloric intake of women in USA averagely for 0.05
```

From the table, we just know that the average calories of 'Beverages' category is 113.7 Cal

We also can see from the table Sprite, Coca-Cola Classic and Minute Maid Orange Juice in Large size has higher role to contribute to the overall caloric intake in 'Beverages' category, that is 0.103704 for men and 0.127273 for women.

And averagely 'Beverages' category contribute to the overall caloric intake for 0.04 to men and for 0.05 to women.

[37]:
```
# Menampilkan kontribusi coffe and tea dalam asupan kebutuhan kalori
cnt_cal = pd.DataFrame({'Item': cnt.Item, 'Calories': cnt.Calories})
cnt_cal['Men'] = cnt_cal.Calories/2700
cnt_cal['Women'] = cnt_cal.Calories/2200
cnt_cal.sort_values(by='Calories', ascending=False)
```

[37]:

	Item	Calories	Men	Women
231	Frappé Chocolate Chip (Large)	760	0.281481	0.345455
228	Frappé Caramel (Large)	670	0.248148	0.304545
225	Frappé Mocha (Large)	670	0.248148	0.304545
230	Frappé Chocolate Chip (Medium)	630	0.233333	0.286364
227	Frappé Caramel (Medium)	550	0.203704	0.250000
...	...	...	...	...
145	Coffee (Small)	0	0.000000	0.000000
138	Iced Tea (Medium)	0	0.000000	0.000000
140	Iced Tea (Child)	0	0.000000	0.000000
139	Iced Tea (Large)	0	0.000000	0.000000
137	Iced Tea (Small)	0	0.000000	0.000000

95 rows × 4 columns

[38]:
```
# Menampilkan nilai rata-rata kalori pada kategori 'Coffee & Tea'
avg_cnt = cnt['Calories'].mean(axis=0)
print("Average calories of 'Beverages' category is", round(avg_cnt, 2))

# Menampilkan nilai rata-rata kalori pada kategori 'Coffee & Tea' yang mempengaruhi asupan kebutuhan kalori pria dan wanita di USA
avg_cnt = pd.to_numeric(avg_cnt)
cnt_men = avg_cnt/2700
print("'Coffee & Tea' contributes to caloric intake of men in USA averagely for", round(cnt_men,2))

cnt_wom = avg_cnt/2200
print("'Coffee & Tea' contributes to caloric intake of women in USA averagely for", round(cnt_wom, 2))
```

```
Average calories of 'Beverages' category is 283.89
'Coffee & Tea' contributes to caloric intake of men in USA averagely for 0.11
'Coffee & Tea' contributes to caloric intake of women in USA averagely for 0.13
```

For ‘Coffee & Tea’ category, we found that its average calories is 283.89 Cal

We can see from the table that Frappe Chocolate Chip (Large size) has higher role to contribute to the overall caloric intake in ‘Coffee & Tea’ category, that is 0.281481 for men and 0.345455 for women.

The most important is averagely ‘Coffee & Tea’ category in contribute to the overall caloric intake for 0.11 to men and for 0.12 to women.

Next, we're going to find out does ordered Grilled Chicken instead of Crispy Chicken increase a sandwich's nutritional value.
Nutritional Value refers to contents of food and the impact of constituents on body. It relates to carbohydrates, salt intake, cholesterol, sugar intake, proteins, minerals, vitamins, and fat.
Let's see the comparison of the average value of the nutrients in both categories Chicken Grilled Sandwich and Crispy Chicken Sandwich below.

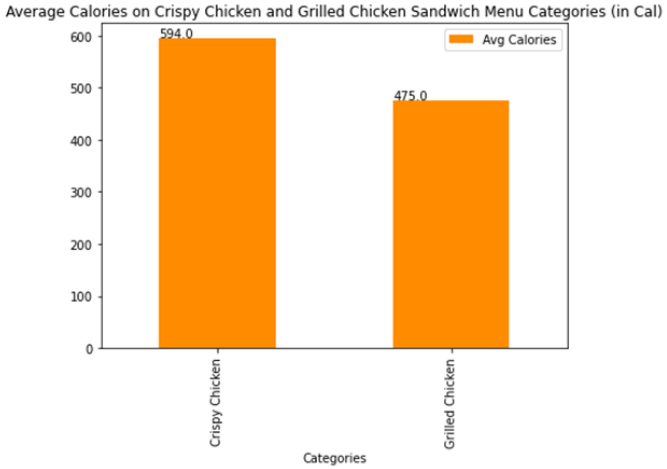

Fig 2.

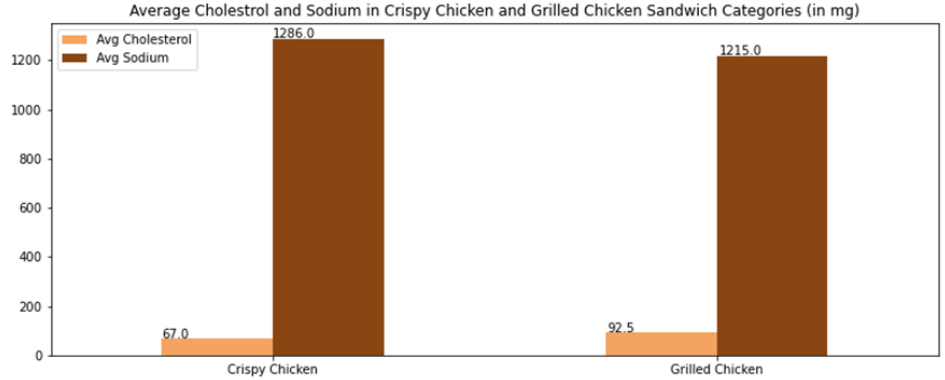

Fig 3.

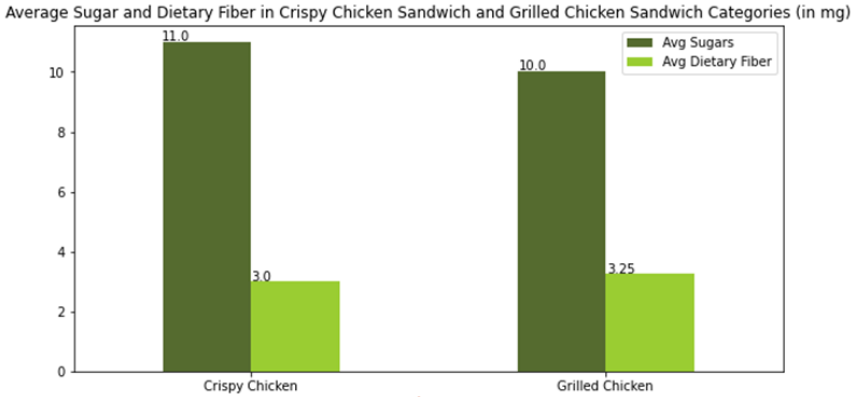

Fig 4.

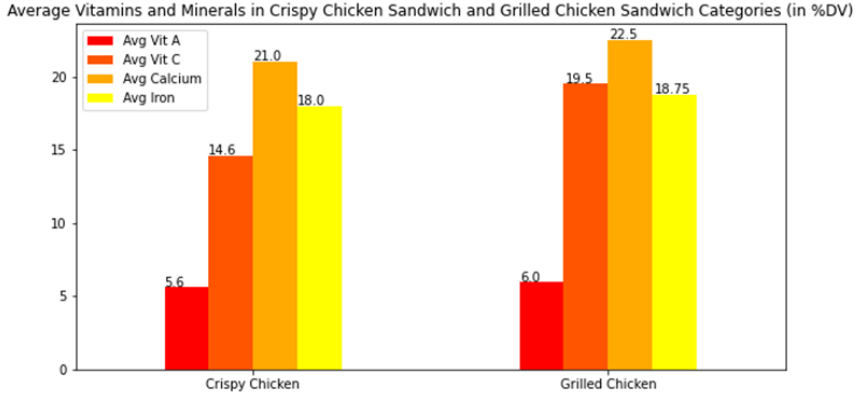

Fig 5.

As we can see from Fig 2.-5., we can conclude that:

1. Crispy Chicken category has higher average value of calories than Grilled Chicken category,
2. Crispy Chicken category has higher average value of sodium, but lower average value of cholesterol than Grilled Chicken category,
3. Crispy Chicken category has higher average value of sugar, but lower average value of dietary fiber than Grilled Chicken category,
4. Crispy Chicken category has lower average value of vitamin A, vitamin C, calcium and iron than Grilled Chicken category.

Grilled Chicken Sandwich category has more nutritional values since it contains dietary fiber, vitamin A & C, calcium, and iron richer than menu items in Crispy Chicken Sandwich category that only has higher average amount of calories, sodium, and sugar.

So that, Grilled Chicken increase a sandwich's nutritional value more than Crispy Chicken does.

And how about ordering Egg Whites instead of Whole Eggs?
Let's compare the average value of the nutrients in Egg Whites and Whole Eggs categories.

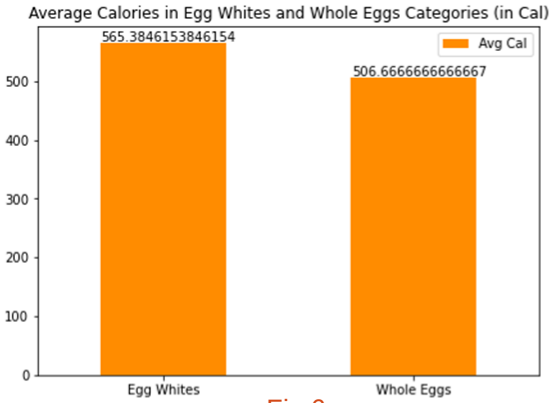

Fig 6.

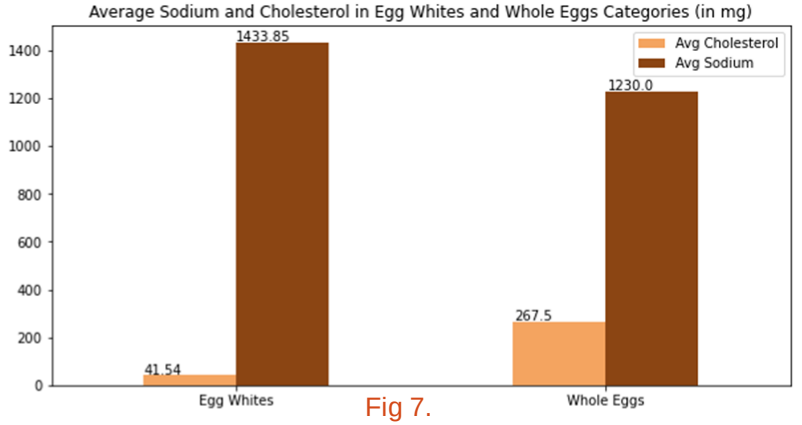

Fig 7.

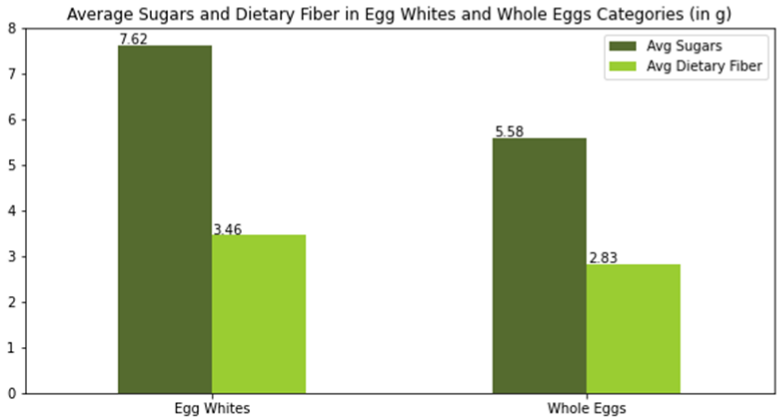

Fig 8.

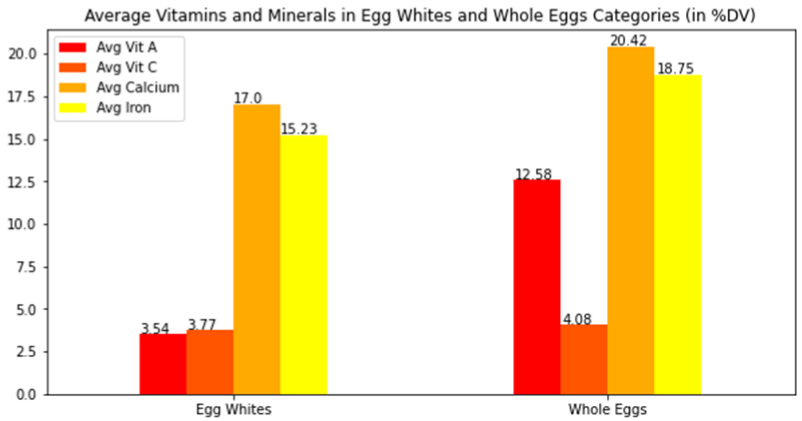

Fig 9.

From Fig 6.-9., we can conclude that:

1. Whole Eggs category has lower average value of calories than Egg Whites category,
2. Whole Eggs category has higher average value of cholesterol, but lower average value of sodium than Egg Whites category,
3. Whole Eggs category has lower average value of dietary fiber and sugar than Egg Whites category,
4. Whole Eggs category has higher average value of vitamin A, vitamin C, calcium and iron than Egg Whites category.

So, Whole Whites category has more nutritional values since it contains cholesterol, vitamin A, vitamin C, calcium and iron richer than menu items in Whole Eggs category. In other wise, Eggs White category has higher average amount of calories, sodium, dietary fiber and sugar only.

According to the NHS, the maximum amount of calories and nutrients you should eat on average in a day are:

- ✓ Calories: at least 2,000cal
- ✓ Total fat: less than 70g
- ✓ Carbohydrate: at least 260g
- ✓ Total sugars: 90g
- ✓ Protein: 50g
- ✓ Salt: less than 6g

We can use this reference to recommend the least number of items we could order from the menu of McDonald to meet one day's nutritional requirements.

By using Linier Programming, we can get a list recommendation of item that relevant to the NHS's reference.

	Item	Amount	Calories	Total Fat	Carbohydrates	Sugar	Protein	Sodium
0	Egg White Delight	1.0	250.0	8.0	30.0	3.0	18.0	770.0
1	Honey Mustard Snack Wrap (Grilled Chicken)	1.0	250.0	8.0	27.0	2.0	16.0	650.0
2	Hotcakes	1.0	350.0	9.0	60.0	14.0	8.0	590.0
3	Kids French Fries	9.0	990.0	45.0	135.0	0.0	9.0	585.0
4	Side Salad	2.0	40.0	0.0	8.0	4.0	2.0	20.0