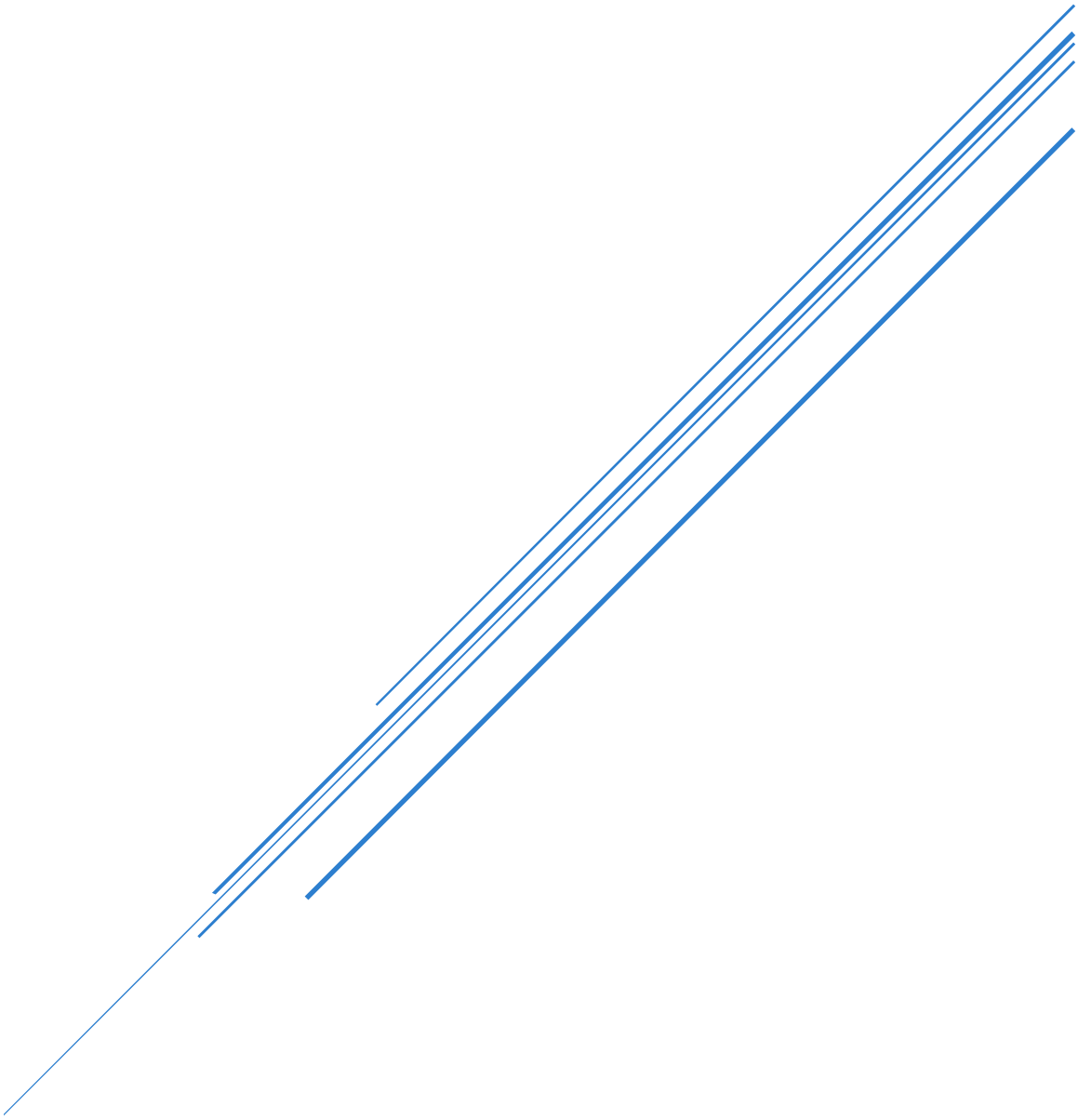
MCDONALD'S MENU NUTRITIONAL ANALYSIS

Leveraging data analytics to recommend healthier fast-food options



Manthan Pandey

Problem Statement & Background

According to the National Health and Nutrition Examination Survey, over 40% of adults and almost 20% of children in the United States are classified as obese. Nineteen states now have obesity rates exceeding 35%, up from 16 states the previous year. Obesity is linked to chronic diseases such as diabetes, heart disease, stroke, and cancers including breast and colorectal cancer. In 2019, obesity-related medical expenses reached nearly $173 billion.

Given these alarming trends, this project leverages data analytics to assess McDonald's menu items and recommend healthier choices. The aim is to empower consumers to make informed nutritional decisions, reducing their risk of obesity-related conditions**.**

Objectives

1. Analyze nutritional data from McDonald's US menu.
2. Identify high-risk items exceeding daily recommended nutrient values.
3. Calculate nutrient densities and portion size effects.
4. Provide actionable recommendations for consumers and McDonald's.

Dataset Overview

- The dataset contains 260 items with 24 columns, covering nutritional facts like calories, fats, sodium, carbohydrates, sugars, protein, and micronutrients.
- Key variables include Category, Item, Serving Size, Calories, Total Fat, Sodium, Carbohydrates, Sugars, Protein, Vitamins & Minerals.
- Data quality issues: mixed units (g/ml/fl oz) and zero-nutrient entries in beverages. Serving sizes were standardized to grams for uniform analysis.

Methodology

1. Data Cleaning: Removed zero-nutrient beverages, standardized serving sizes.
2. Analysis: Applied nutrient thresholds, validated calorie counts, calculated nutrient densities, assessed category calorie ranges.
3. Visualization: Used histograms, bar charts, scatter plots, and heatmaps to interpret patterns.

Exploratory Data Analysis (EDA)

The exploratory data analysis phase was carried out to understand the nutritional composition of McDonald's US menu items, detect patterns across categories, and identify items posing higher health risks. This section combines descriptive statistics with visual analytics to uncover meaningful insights for both consumers and decision-makers.

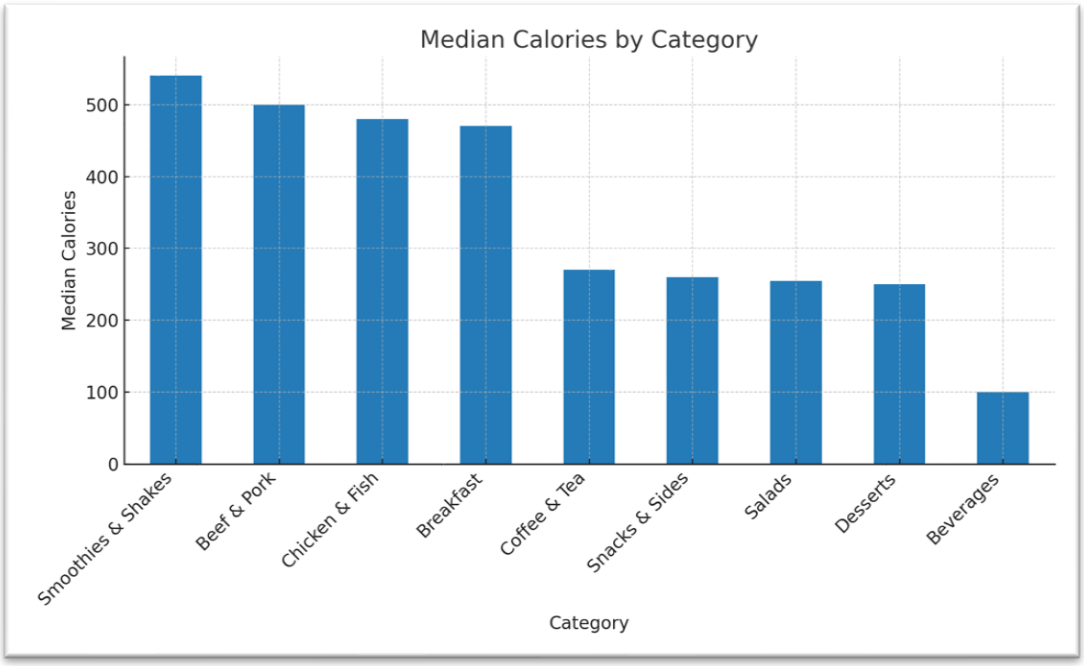


Fig-5.1:- Median Calories by Category

This bar chart compares the median calorie content of menu items across different categories such as Desserts, Breakfast, Beef & Pork, Chicken & Fish, Salads, and Beverages.

Key Insights:

- Desserts have the highest median calorie values, followed closely by Breakfast and Beef & Pork items.
- Categories such as Salads and Beverages (excluding sugary drinks) show lower median calories, making them potential lower-risk choices.
- The wide gap between high and low categories suggests that switching categories can significantly reduce calorie intake.

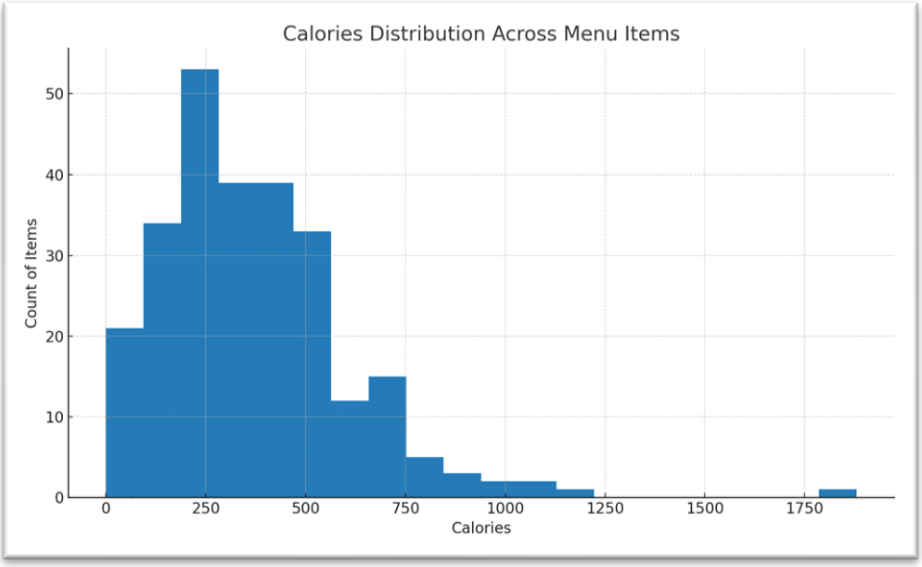


Fig-5.2:- Calories Distribution Histogram

This histogram shows how calories are distributed across all menu items.

Key Insights:

- The distribution is right-skewed, with most items falling between 200–500 calories, but a notable tail extending past 800 calories.
- The tail represents high-calorie items like large breakfast platters, premium burgers, and indulgent desserts.
- Consumers frequently ordering from this upper range may exceed their daily calorie requirements in just one meal.

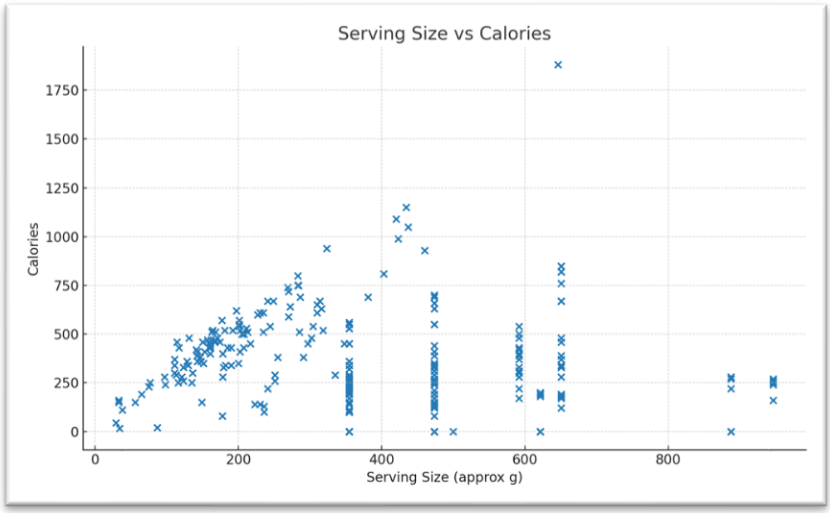


Fig-5.3:- Serving Size VS Calories Scatter Plot

This scatter plot examines the relationship between serving size (in grams) and calories.

Key Insights:

- There is a general upward trend, indicating that larger portions tend to have more calories.
- Certain categories (like Breakfast and Beef & Pork) show steeper slopes, meaning that upsizing portions in these categories leads to disproportionate calorie increases.
- Outliers, such as diet beverages and salads, show larger serving sizes but low calories, highlighting good low-calorie volume options.

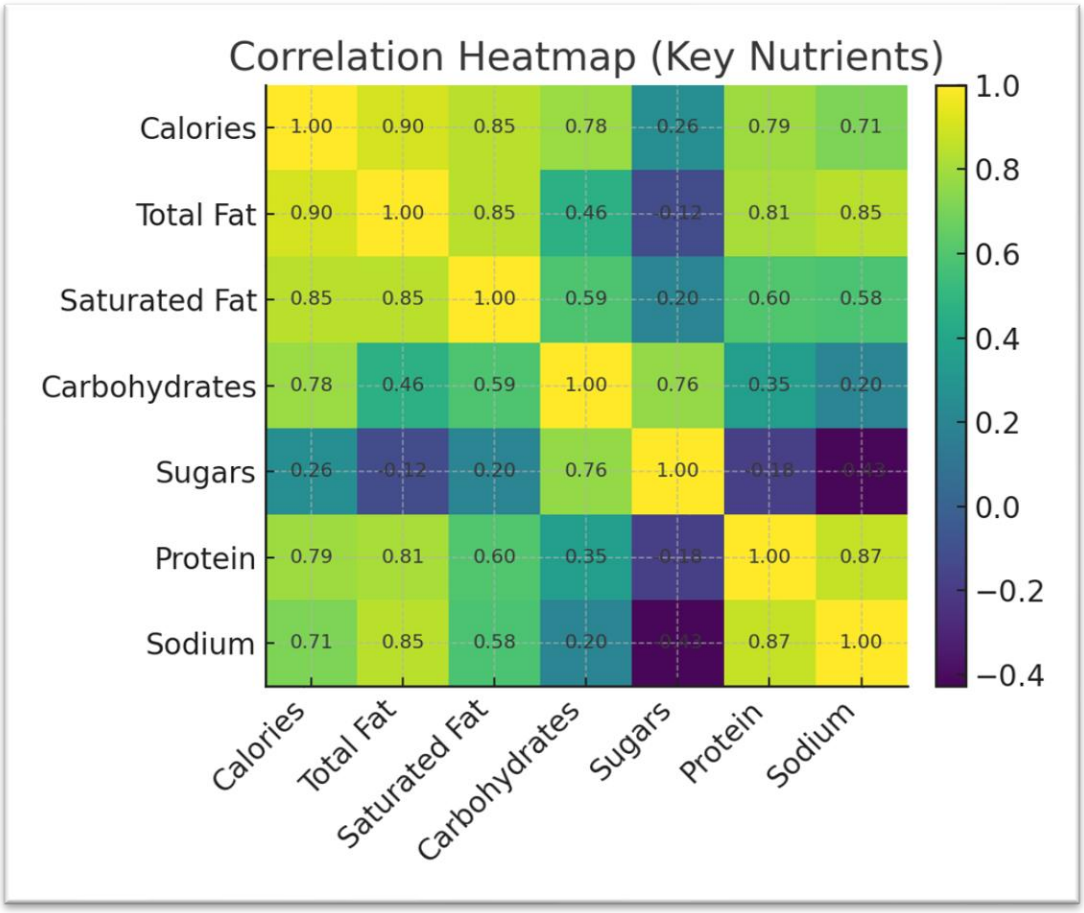


Fig-5.4:- Serving Size VS Calories Scatter Plot

This heatmap visualizes correlations between calories, macronutrients, and key micronutrients.

Key Insights:

- Calories are strongly correlated with saturated fat (0.85), protein (0.79), and carbohydrates (0.78), confirming that these macronutrients drive calorie counts.
- Sodium and protein are also positively correlated, reflecting the high sodium levels in meat-based menu items.
- Sodium and sugar are negatively correlated (-0.42), indicating that items high in sugar (desserts, shakes) tend to be lower in sodium, and vice versa.
- Vitamin C has a weak negative correlation with calories (-0.07), with sources like apple slices and side salads providing micronutrients without excess calories.

Knowledge Gained from EDA:-

- Category choice matters: Choosing lower-calorie categories can significantly reduce overall calorie intake
- Portion control is key: Upsizing in certain categories can disproportionately increase calories.
- Nutrient trade-offs exist: Items high in one nutrient (e.g., protein) may also be high in sodium or saturated fat.
- Target for reformulation: Desserts and certain breakfast items could be reformulated to lower calorie density without sacrificing portion size.

Key Findings

The exploratory analysis of McDonald's menu data reveals several important patterns and health-related risks. These findings highlight how nutritional composition varies across categories, how portion sizes affect caloric intake, and which nutrients are most problematic for consumers.

1. High-Risk Nutrient Items

- Out of 260 items, 121 menu items (≈47%) exceed 100% of the recommended daily value (DV) for at least one nutrient.
- Sugar: 108 items exceed 30.5 grams of sugar in a single serving—the recommended daily maximum (based on WHO guidelines for men and women). Many of these are desserts, shakes, and flavored beverages.

- Saturated Fat: 3 items exceed 100% DV for saturated fat, primarily found in premium burgers and desserts containing cream.
- Sodium: 1 item exceeds 100% DV for sodium, but many items fall in the 60–90% DV range, making combinations (like meal bundles) dangerous for exceeding limits.
- Implication: Consumers can unknowingly exceed their daily nutrient intake with just one meal, increasing the risk of obesity, hypertension, and heart disease.

2. Calorie Density by Category

- Desserts have the highest median calorie density, followed by Breakfast items and Beef & Pork dishes.
- Salads, beverages, and sides represent the lowest-calorie-density categories, but beverages can be misleading since sugary options (shakes, smoothies) spike calorie counts.
- Some categories (like desserts) show wide ranges, meaning there are both relatively safe options (e.g., fruit-based desserts) and extremely high-risk items (e.g., McFlurries and shakes).
- Implication: Category selection significantly impacts calorie intake; even within the same category, choosing wisely can reduce excess calories.

3. Portion Size Impact

- The scatter plot analysis confirms a positive correlation between serving size and calories overall. However, the relationship strength varies by category:
- Breakfast, Beef & Pork, Chicken & Fish: Steeper slopes, meaning upsizing in these categories disproportionately increases calories.
- Beverages: Some beverages (diet drinks, water, black coffee) remain at zero calories despite larger sizes.
- Salads: Larger salads increase volume without extreme calorie jumps, making them safer upsizing options.
- This aligns with global trends: U.S. portion sizes are much larger than those in countries like Japan, and this cultural difference directly correlates with obesity prevalence (40% obesity in U.S. vs <4% in Japan).

- Implication: Consumers should be cautious with portion upsizing in calorie-dense categories, but can safely upsize low-calorie-density items like salads and unsweetened beverages.

4. Nutrient Correlations

- Calories are strongly correlated with:
  - Saturated Fat (0.85)
  - Protein (0.79)
  - Carbohydrates (0.78)

  This confirms that calorie content is primarily driven by macronutrients.
- Sodium and Protein are strongly correlated, reflecting the high salt content in meat-heavy menu items (burgers, nuggets, chicken).
- Sodium and Sugar show the strongest negative correlation (-0.42), indicating that sweet items (desserts, shakes) are generally low in sodium, while savory items (burgers, fries) are high in sodium but low in sugar.
- Micronutrients: Vitamin C shows a slight negative correlation with calories (-0.07), driven by items like apple slices and salads.
- Implication: Reformulating high-sodium and high-saturated-fat items could significantly reduce overall calorie risk. Consumers should recognize that "protein-rich" often means "sodium-rich" in the fast-food context.

5. Overall Menu Health Risks

- Nearly half the menu poses nutritional risks in isolation, and risks compound when items are combined into meal bundles.
- Desserts and breakfast items stand out as "nutrient traps"—tasty but disproportionately high in sugar, saturated fat, and calories.
- Some healthier alternatives exist (apple slices, side salads, grilled chicken items), but they are underrepresented compared to calorie-dense choices.

Recommendations

For Consumers

1. **Avoid Upsizing in High-Calorie-Density Categories**
   - Analysis shows that upsizing in categories such as breakfast, beef & pork, and chicken/fish leads to disproportionately large increases in calories, sodium, and saturated fat.
   - Consumers should resist promotional upsizing (e.g., "large meal upgrades") unless choosing low-calorie-density items like salads or zero-calorie beverages.

2. **Choose Lower-Calorie-Density Items**
   - Items such as apple slices, side salads, grilled chicken sandwiches, and unsweetened beverages provide satiety with significantly fewer calories.
   - Substituting these options reduces risks of exceeding daily intake limits and helps maintain balanced diets without eliminating fast food entirely.

3. **Monitor Sugar and Sodium Intake Proactively**
   - Many desserts and shakes exceed the recommended daily sugar intake in a single serving, while burgers and fried items often provide 60–90% of daily sodium limits.
   - Consumers should plan meals by checking available nutritional information, ensuring that individual choices do not collectively surpass daily thresholds for sugars, sodium, and saturated fats.

4. **Adopt a Balanced Meal Strategy**
   - When choosing calorie-dense items (e.g., a burger), pair them with low-calorie sides (salads, fruit) and water instead of sugary drinks.
   - This balance allows indulgence without dramatically exceeding recommended nutritional limits.

For McDonald's

1. **Introduce More Portion-Controlled Options**
   - Offer "mini" or "half-size" versions of high-calorie items, especially in desserts and breakfast categories, to reduce overconsumption.

- Portion-controlled products can appeal to health-conscious consumers while retaining brand loyalty among traditional customers.

2. **Display Nutrient Densities Clearly on Menus**
   - Instead of only listing calorie counts, menus could highlight nutrient density scores (calories per 100g/ml).
   - Visual cues such as “High Sugar” or “Low Sodium” icons would simplify consumer decision-making and demonstrate corporate responsibility.

3. **Reformulate High-Sugar Desserts and Beverages**
   - Develop reduced-sugar alternatives (e.g., shakes with 30% less sugar, desserts with natural sweeteners) without compromising taste.
   - Reformulation aligns with industry trends toward “better-for-you” products and could open opportunities to market healthier options without losing dessert category revenue.

4. **Expand Healthy Menu Variety**
   - Increase availability of nutrient-rich options (salads with lean proteins, fruit cups, whole-grain buns).
   - Position these products as affordable and accessible alternatives rather than premium-priced niche items, encouraging adoption by a broader customer base.

5. **Leverage Consumer Data for Personalized Health Recommendations**
   - Use loyalty apps or digital ordering platforms to provide real-time suggestions (e.g., recommending a side salad instead of fries when sodium intake is already high).
   - Personalized nudges could enhance both customer satisfaction and brand image as a health-conscious fast-food leader.