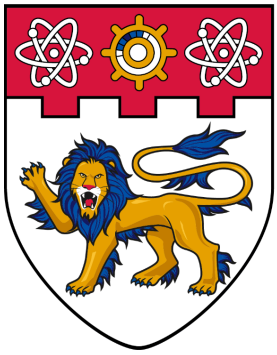

NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

BC2402: DESIGNING & DEVELOPING DATABASE

GROUP PROJECT REPORT

Seminar 4 Group 1

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Executive Summary

This report analyzes the complex intersection between national dietary patterns, fast-food consumption, and national happiness. Utilizing country-level data on macronutrient intake (1961–2020), happiness scores, and fast-food menu nutrition, this project investigates whether a nation's diet correlates with its collective well-being. The main result of this report is that socioeconomic development—namely, national wealth—is the leading determinant of happiness, with dietary patterns largely reflecting this wealth rather than being the cause of happiness.

Key insights:

1. **Wealth as a Confounding Variable**
   The analysis repeatedly finds that metrics seemingly linking “unhealthy” diets to “positive” outcomes are misleading.
   - There is a strong statistical correlation between higher long-term average fat intake and higher national happiness.
   - Countries with the highest levels of processed-food consumption (e.g., the US, UK) also tend to record high happiness, better health outcomes, and longer life expectancy than lower-intake countries.
   - The report concludes this is not because these diets are beneficial. Instead, national wealth enables both an industrialized, high-fat/processed food system and the real drivers of well-being: advanced healthcare, strong social safety nets, and higher GDP per capita.
2. **Weak Links Between Diet Stability and Happiness**
   - The link between low nutrient variation—a stable food supply—and happiness is weak. A consistent food supply does not guarantee happiness, nor does high variation rule it out, indicating that social and economic factors carry more weight.
   - Similarly, analysis of fat and protein intake during winter months showed inconsistent connections with happiness, again suggesting these patterns reflect economic capacity rather than any direct dietary influence.
3. **Fast Food and National Diets**
   - The nutritional profile of fast food, high in carbohydrates and fats, low in protein, closely resembles the broader dietary trends of countries with high processed-food intake.
   - This pattern suggests that in developed economies, national diets are increasingly mirroring the macronutrient makeup of fast food.

In conclusion, diet is a poor indicator of national happiness. While it remains essential for individual physical health, national dietary patterns are more symptomatic of industrialization and economic development than drivers of happiness themselves. These findings suggest that policies aimed at boosting national well-being should prioritize core socioeconomic factors over dietary stability alone.

1. Introduction

In recent decades, what people eat and how they feel about their lives have both become major public concerns. Many countries are seeing rising rates of obesity, diabetes and cardiovascular disease, while at the same time investing in policies to improve citizens' overall well-being and happiness. Global nutrition and happiness are closely linked to issues such as economic development, food security, healthcare costs and social cohesion. Understanding how these two areas interact can help governments, health agencies and food industries design more effective interventions that support both physical health and life satisfaction.

This project focuses on the intersection between food intake, fast-food consumption and happiness. Diets in many countries are shifting towards higher calorie intake and more processed or fast-food options. These changes may affect not only physical health outcomes, but also how satisfied people feel with their lives through factors such as energy levels, long-term health risks, and cultural preferences. Analysing these patterns with data allows us to move beyond assumptions and explore whether there are consistent relationships between what people eat, their reliance on fast food, and their reported happiness.

In this report, we use country-level food intake data (calories and macronutrients across months and years), country-level happiness scores and fast-food nutrition information from major international chains. Together, these datasets allow us to connect national dietary patterns with reported happiness and the nutritional profile of common fast-food items. Our goal is to use these data to answer Questions 16 to 23 by extracting key patterns and drawing practical insights about how food intake and fast-food consumption might relate to happiness and health.

2. Insights and Findings

2.1 Insights for Q16 - Q18 (Open-Ended Questions)

Q16. Winter protein & fat intake vs happiness

The combined nutrient intake and happiness data reveals a consistent pattern across 5 countries (US, Brazil, Germany, Japan and India). Countries with higher average winter fat and protein intakes generally also report higher Happiness Scores. In contrast, India, which has the lowest winter fat and total protein intake, records the lowest Happiness Score.

The data below was tabulated by defining winter months as based on the countries hemisphere location. Out of the 5, only Brazil falls under the Southern hemisphere.

Hemisphere	**Northern**	**Southern**
Winter Months	December, January, February	June, July, August

Figure 16-1: Winter Period Definition

Country	**US**	**Brazil**	**Germany**	**Japan**	**India**
Happiness Rank	15	16	26	46	117
Happiness Score	7.119	6.983	6.75	5.987	4.565
Fat Calories	1328.00	1083.20	1284.60	1179.48	714.08
Protein Calories	559.10	469.25	554.01	530.47	405.36
Animal Protein	304.86	195.58	286.53	254.77	81.76
Vegetal Protein	254.24	273.67	267.49	275.70	323.59

Figure 16-2: Countries Happiness Score, Rank & Calorie Intake

Figure 16-3: Happiness vs Protein Intake

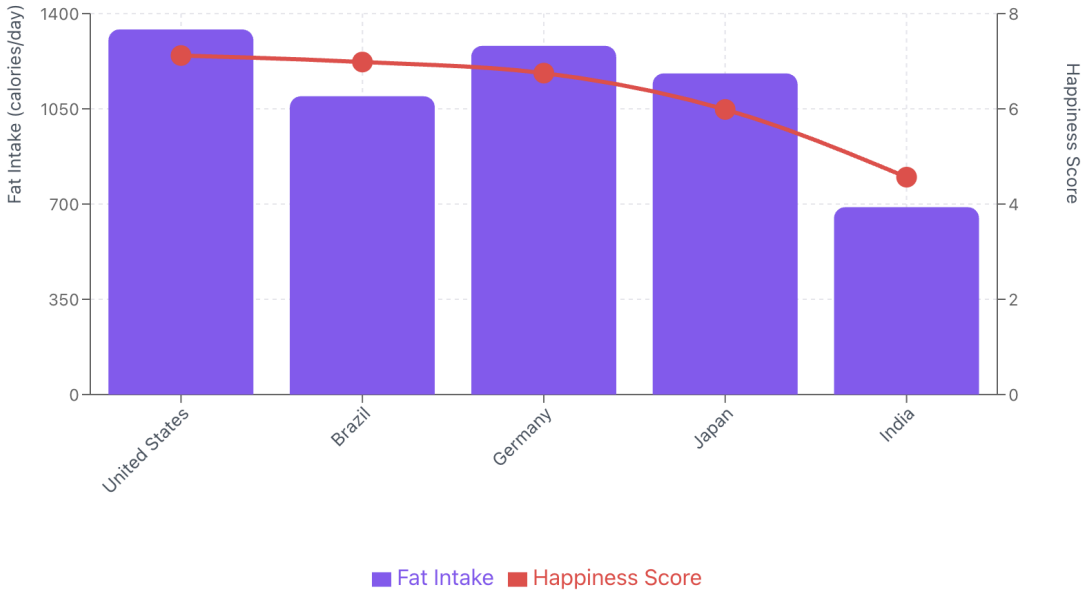


Figure 16-4: Happiness vs Fat Intake

Analysis:

Protein Intake Patterns:

The United States and Germany have the highest total protein intake (559 and 554 calories/day respectively) and also rank among the top two happiest nations in this group. However, Brazil, with significantly lower protein intake (469 calories/day), ranks second in happiness, suggesting protein alone is not a determining factor.

India stands out with dramatically lower animal protein (82 calories/day) compared to other countries, but compensates with higher vegetable protein (324 calories/day). Despite having the lowest total protein intake, the gap in happiness appears disproportionately large, indicating other socioeconomic factors play a more significant role.

Fat Intake Patterns:

All countries except India consume over 1,000 calories from fat daily during winter. The United States leads in fat consumption (1,328 calories/day) and also has the highest happiness score. However, Germany, with nearly identical fat intake (1,284 calories/day), ranks third in happiness, weakening the direct correlation.

Animal vs. Vegetable Protein:

The United States shows a preference for animal protein (305 vs. 254 calories), while India relies heavily on vegetable protein (324 vs. 82 calories). Brazil and Japan have relatively balanced protein sources. This variation in protein sources does not appear to correlate consistently with happiness levels.

Insights:

The nutritional-happiness relationship becomes less consistent when comparing countries of similar economic standing. Although the United States, Germany and Japan all have relatively high winter protein intake, their happiness levels differ. This suggests that other factors like social cohesion, cultural norms and institutional quality may be more influential than just diet alone. Fat intake also shows minimal variation across the top 4 countries, yet their happiness scores vary substantially, indicating that fat consumption is also unlikely to be a primary driver of well-being. India's significantly lower fat/protein intake and lower happiness score appear more reflective of broader development disparities rather than specifically the effect of winter diets.

These patterns point toward winter dietary intake functioning as a reflection of a country's economic capacity rather than a determinant of subjective well-being. Happiness is multidimensional and the observed nutritional indicators capture only 1 narrow aspect of living conditions.

Limitations:

- The sample size is very small (5 countries), hence it doesn't capture the larger population.
- Relationships observed here are correlational, but many interrelated societal factors shape happiness.

- Winter diets do not fully represent overall annual dietary behaviour.
- Cultural expectations and social interpretations of happiness vary widely and may bias rankings.
- National averages mask within-country inequality, regional dietary differences, and varied access to resources.
- Development indicators such as GDP, corruption, healthcare access, social trust and political stability were not included in the analysis.

Q17. Long-term fat trend vs happiness

To investigate the relationship, we needed to reconcile two datasets with different time scales:

1. daily_intake: Provided yearly data on average fat intake per country from 1960 to 2020.
2. happiness: Provided a single static entry for each country's happiness_rank and happiness_score.

To make these datasets comparable, we first calculated the mean average daily fat intake for each country over the entire 60-year period (1960–2020). This single, long-term average value could then be directly compared against the static happiness metrics.

Our correlation analysis revealed a statistically significant relationship between long-term fat intake and both happiness metrics.

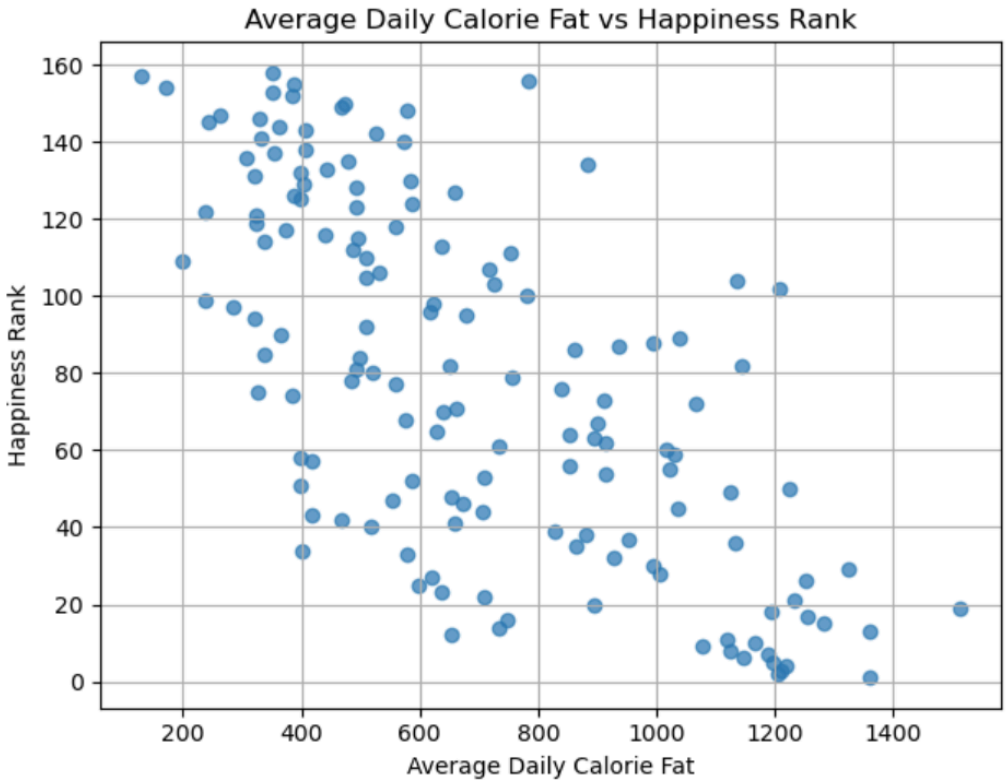
country	happiness_rank	happiness_score	avg_fat_intake
Switzerland	1	7.587	1360.23
Iceland	2	7.561	1206.07
Denmark	3	7.527	1210.15
Norway	4	7.522	1218.41
Canada	5	7.427	1197.45
Finland	6	7.406	1146.37
Netherlands	7	7.378	1189.63

Sweden	8	7.364	1124.64
New Zealand	9	7.286	1077.02
Australia	10	7.284	1166.43

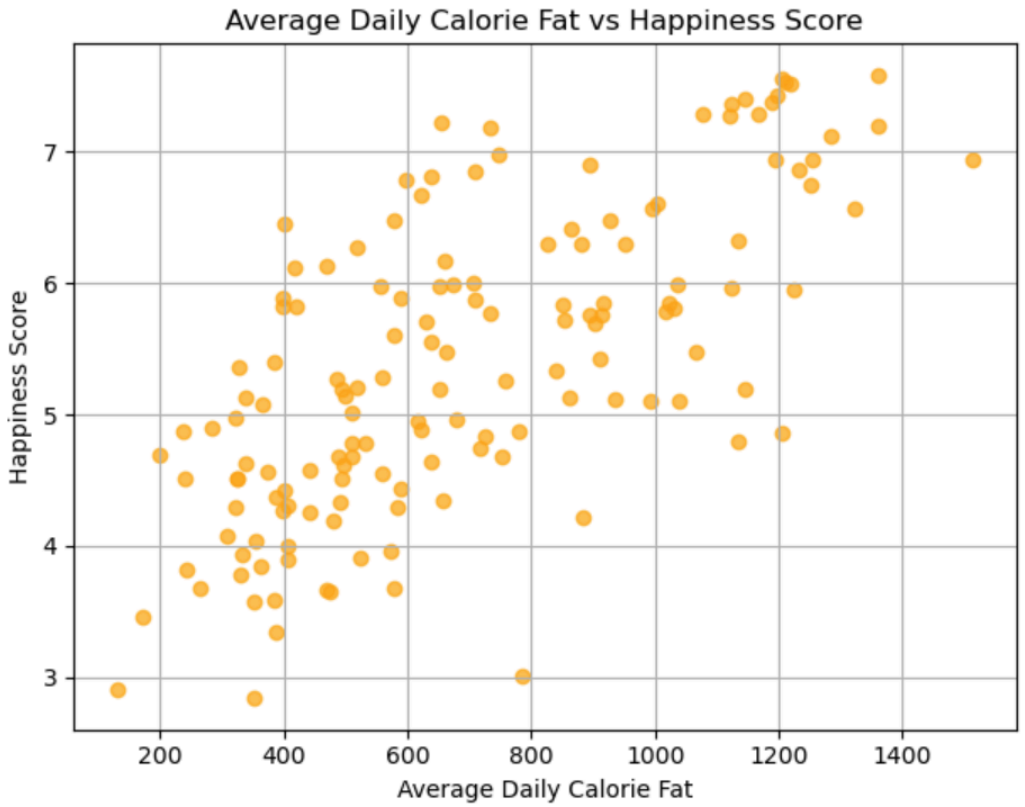
However, when visualising the relationship between fat intake and health rank, this relationship becomes less clear:

country	happiness_rank	happiness_score	avg_fat_intake
Denmark	3	7.527	1210.15
Iceland	2	7.561	1206.07
Norway	4	7.522	1218.41
Switzerland	1	7.587	1360.23
Argentina	30	6.574	994.19
Australia	10	7.284	1166.43
Austria	13	7.2	1360.96
Belgium	19	6.937	1514.03
Brazil	16	6.983	746.49
Canada	5	7.427	1197.45

In order to better visualise this trend, we chose to create two scatterplots of fat intake against both happiness_score and happiness_rank using pyplot, as shown below:




```
Correlation between Average_Daily_calorie_fat and Happiness_Rank:  -0.689
Relationship strength (Fat vs Rank): moderate
```




```
Correlation between Average_Daily_calorie_fat and Happiness_Score: 0.696
Relationship strength (Fat vs Score): moderate
```

We have already established that there exists a moderately strong statistical correlation between the average fat calorie consumption and overall happiness as can be seen where the absolute value of the correlation coefficient in both datasets sits at around 0.7 which indicates the presence of a relatively strong linear correlation between both happiness score and happiness rank with fat

Insights:

While the correlation has already been established, a critical distinction must be made: correlation does not imply an inherent causation.

The most plausible explanation for this observation is not necessarily that fat intake causes happiness but that both are related to a third variable: National wealth and socioeconomic development.

This is reflected in two broader trends:

Wealth and Happiness: Countries with higher GDP per capita typically have more stable governments, better healthcare, better access to schools and education, robust social safety nets and other social services.

Wealth and Diet: These same wealthy, developed nations also have more industrialized food systems. This leads to greater availability, accessibility and consumption of “richer” diets, including more meat, dairy and other processed foods which contain higher fat contents. Other poorer countries likely cannot afford large amounts of such processed foods or meat and would subsist on a diet rich in carbohydrates.

Therefore while there is a correlation between fat consumption and happiness, it cannot be said that fat intake are directly linked as both are indicators of a third underlying factor: a country’s overall level of economic development. A “richer” diet and “higher” happiness are both common features of a more affluent society.

To test this hypothesis, a future analysis should include GDP per capita as a control variable in a multiple regression model. We would predict that when controlling for national wealth, the statistical significance of “fat intake” as a predictor for “happiness” would greatly diminish or disappear.

Q18. Lower nutrient variation vs happiness

Introduction

This report addresses the question: Are countries with lower nutrient variation happier? The analysis aimed to determine if stability in a nation's macronutrient supply (animal protein, vegetal protein, fat, and carbs) relates to its national Happiness Score.

The primary finding is that there is only a weak link between these two factors. The data shows that lower nutrient variation does not strongly predict higher national happiness.

Methodology

A three-step process was used to prepare and analyze the data:

Annualise Nutrient Data: For each country, the daily intake calories from animal protein, vegetal protein, fat, and carbohydrates were summed for each year from 1961 to 2020.

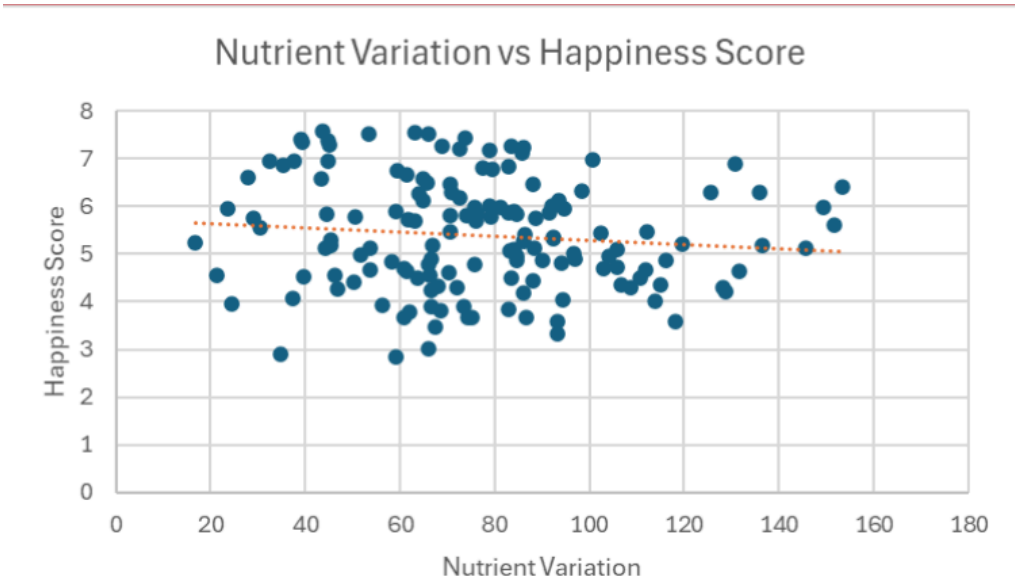
Compute Variation: The variation was calculated as the standard deviation (StdDev) across the years (1961-2020) for each nutrient. This created an "average yearly variation" index, where a lower score indicates a steadier, more stable food supply over time.

Join Datasets: This nutrient variation index was then joined with the happiness table , resulting in a final dataset of one row per country, which compared the variation score against the latest available Happiness Score.

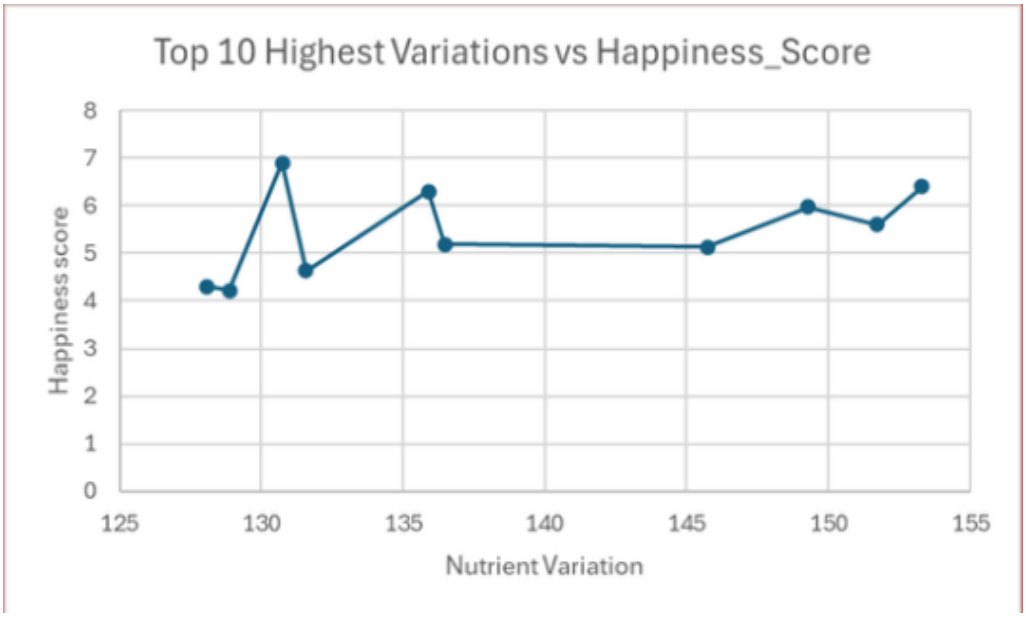
Findings and Analysis

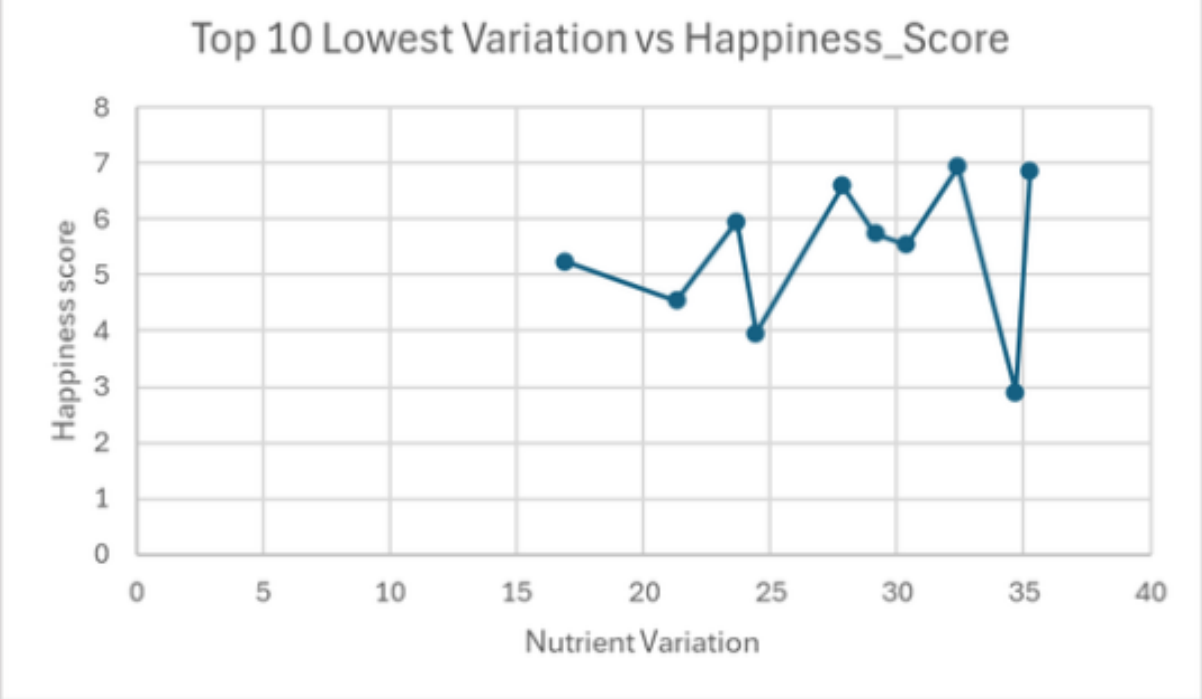
Overall Correlation

The main scatter plot, which plots Nutrient Variation (x-axis) against the Happiness Score (y-axis), reveals a weak correlation.



The dotted trend line in the chart shows a weak, slightly negative relationship. This indicates that a very steady nutrient supply (low variation) does not automatically guarantee high happiness. Similarly, high variation does not necessarily lead to low happiness. Many countries cluster between Happiness Scores of 5 to 7, regardless of their nutrient variation level. This suggests that other factors such as income, healthcare, and social support likely have a more dominant influence on happiness outcomes.





Analysis of Extreme Cases

An analysis of the "extreme tables" (the top 10 most and least variable countries) reinforces this conclusion:

- **Top 10 Highest Variations:** The 10 countries with the most variable nutrient supply still demonstrate a range of mid to high happiness scores. There is no systematic drop in happiness associated with high variation.
- **Top 10 Lowest Variations:** Conversely, the 10 countries with the most stable (lowest variation) food supplies are not all at the top of the happiness rankings.

This comparison confirms that nutrient variation alone does not explain national happiness levels.

4. Conclusion and Takeaways

There is a weak correlation between nutrient variety and happiness score which means sower nutrient variation does not strongly predict national happiness. It is likely that macroeconomic and social factors, such as income, social support, and healthcare, are more significant mediators of happiness outcomes. From a policy perspective, efforts should be aimed at ensuring quality and access to a reliable, adequate, and nutritious supply rather than simply chasing low variation.

2.2 Insights for Q19 - Q23 (Blue-Sky Questions)

Q19. Country Trends: Processed Food vs Fast Food Menus Health

Before analysing the relationship between processed food intake, fast-food menu health, happiness and health outcomes, a preliminary exploration of the 2 core nutrition datasets: daily_intake (long-term macronutrient supply per entity) and simulated_food_intake_2015_2020 (short-term nutrient patterns) was conducted. This provides essential context for understanding national dietary baselines.

entity	avg_calories_animal_prot...	avg_calories_vegetal_prot...	avg_calories_f...	avg_calories_carbohydra...
Afghanistan	56.64	210.66	351.04	1725.67
Africa	50.8	185.74	424.09	1640.09
Africa (FAO)	53.05	187.29	435.61	1647.97
Albania	143.03	213.5	678.74	1761.7
Algeria	73.3	217.78	576.9	1821.59

Aggregating the daily_intake dataset by country reveals clear and consistent dietary profiles that have been formed over several decades:

1. High-fat, high-processed diets in developed Western countries
    - Countries such as the United States, Australia, Canada and Western Europe report fat intake often exceeding 1100 calories, carbohydrate intake between 1500-1900 calories and higher animal protein compared to vegetal protein
    - These patterns reflect entrenched consumption of processed foods, industrial oils and meat-dense diets
2. Moderate-fat, balanced diets in East Asia and parts of Europe
    - Countries like Japan, South Korea and Germany showed lower fat levels of 800-1000 calories, higher vegetal protein intake and more diverse nutrient distribution
    - This aligns with culturally balanced diets and lower reliance on processed foods
3. High-carb, low-fat diets in South Asia and Africa
    - Countries such as India, Nepal and Nigeria show fat intake often below 700 calories while carb intake is more than 1800 calories
    - These diets depend heavily on staple grains due to food system constraints and lower availability of processed fats

Overall, this dataset reveals that diets vary more between countries than over time; national diary patterns are structural and long-standing, shaped by culture, income and food system maturity; countries with high processed food intake tend to be wealthier and more exposed to high-calorie commercial food environments.

entity	year	avg_calories_animal_prot...	avg_calories_vegetal_prot...	avg_calories_f...	avg_calories_carbohydra...
United States	2015	299.39	247.78	1292.2	1801.03
United States	2016	298.65	250.14	1300.88	1803.37
United States	2017	299.41	251.55	1295.29	1796.29
United States	2018	300.62	251	1296.11	1811.48
United States	2019	299.03	250.96	1306.84	1805.88

To complement the long-term picture, the simulated_food_intake_2015_2020 dataset shows short-term nutrient patterns across 2015-2020, focusing on the same core macronutrients:

1. Year-to-year intake is extremely stable
    - Fat, carb and protein levels vary only ±2–3% between years
    - For example (United States): fat was 1292 in 2015 and stayed relatively consistent throughout to 1306 in 2019; carbs was 1801 in 2015 and stayed relatively consistent throughout to 1805 in 2019
    - This suggests an established and unchanging dietary habits
2. Clear differences occur between countries rather than over time
    - US: highest fat and carb
    - Brazil: moderate fat and high carbs
    - Japan: moderate fat and balanced protein
    - India: lowest fat and highest reliance on carbs
    - These findings align almost perfectly with the long-term profiles from daily_intake
3. No major transitions or shocks from 2015-2020
    - There is no meaningful upward or downward trend in any nutrient type within this period
    - This entails that diet compositions are locked in for each country and differences in diet quality stem from structural factors, not recent changes.

From these findings, diets are stable and highly path-dependent and nutrient composition reflects structural factors rather than short-term shocks.

category	avg_calories	avg_fat	avg_carb	avg_protein
Burgers	635	38.96	38.92	33.5
Chicken	513.89	32.5	36.33	19.5
Breakfast	389.39	23.83	31.61	11.76

In addition, nutritional profiles of major fast-food chains represented in the dataset (burger_king_menu, mcdonaldata and starbucks) was carried out. Although these chains operate globally with offerings potentially differing with region, their menus consistently reflect high-calorie, high-fat and high-carbohydrate patterns characteristic of processed food environments:

1. Burger King
    - The highest calorie density among the 3 chains, particularly in its Burgers category, which averages 635 calories, fat of 38.96 and 38.92 carbohydrates per item
    - Chicken items also remain calorie-heavy, while Breakfast items show moderately lower levels but still contribute substantial fat and carbs
2. McDonald
    - Displays wider variation across menu categories
    - Gourmet category is nutrient-dense, averaging 434 calories, 28.55 fat and 49.18 carbs, comparable to Burger King's burgers
    - In contrast, categories like McCafe and Condiments show significantly lower values, reflecting lighter or supplementary items rather than full meals
3. Starbucks
    - Traditionally positioned as a beverage and light-meal chain, still demonstrates notable processed-food characteristics
    - Categories like Bakery and Parfait exhibit carbohydrate-heavy compositions (eg. Bakery: 54.34 carbs and 368.78 calories) while lower-calorie categories such as Petite and Salad remain exceptions rather than the norm
    - Despite offering relatively lighter items than Burger King and McDonald, Starbuck's menu still reflects high reliance on sugars and refined carbohydrates

Overall, the macronutrient patterns across all 3 fast-food chains reveal a consistent reliance on calorie-dense, fat-rich and carbohydrate-heavy processed foods. This descriptive overview serves as a foundation for understanding how fast-food menu profiles may relate to national processed food intake and the broader implications for happiness and health.

19.1 Are there any relationships between processed food intake and fast-food menus?

<u>Interpretation of the question:</u>

This sub-question investigates whether diets in countries with high processed-food consumption resemble the nutritional composition of fast-food meals. To investigate and determine the relationship, compare:

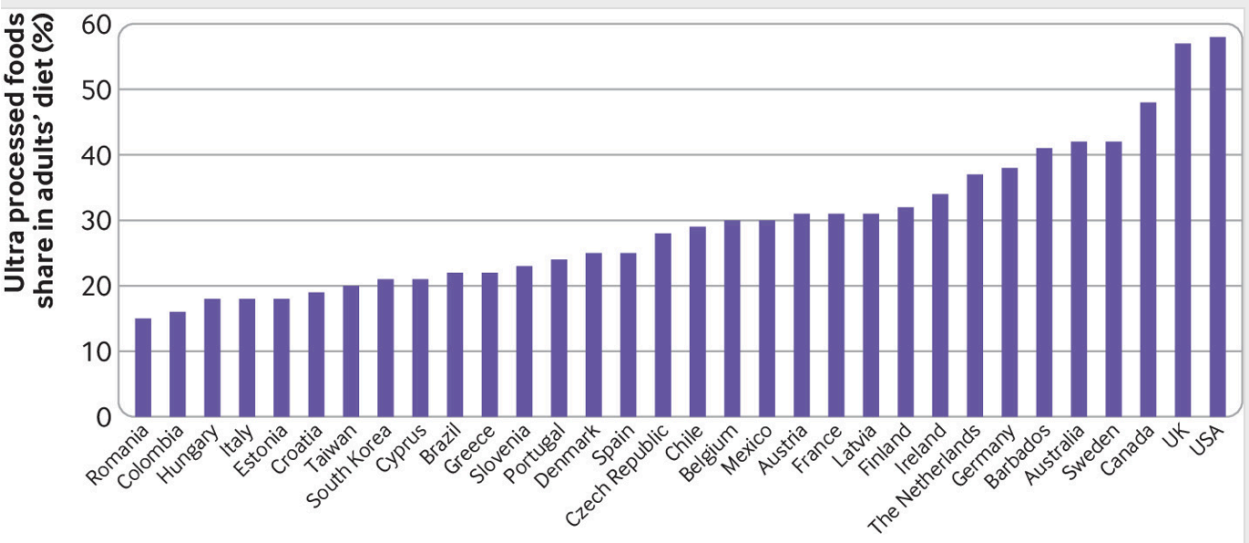
1. Macronutrient profiles of fast-food meals
2. Macronutrient intake patterns from national dietary data
3. Countries with high processed-food consumption identified from external research

If the macronutrient distribution in national diets reflects that of fast-food meals, this suggests a meaningful relationship between processed-food reliance and fast-food nutritional characteristics.

Approach:

avg_calories	avg_fat	avg_carb	avg_protein
409.36	21.49	38.98	17.67

1. Compute the average macronutrient breakdown of fast-food meals
    - Averaged the nutrition of actual fast-food “meal-type” categories across Burger King, McDonald’s and Starbucks, included are:
        - Burger King: Burgers, Chicken and Breakfast
        - McDonald’s: Regular, Breakfast and Gourmet
        - Starbucks: Bakery, Bistro Box, Hot Breakfast and Sandwich
    - The final combined query produced an overall average fast-food meal containing approximately 409.36 calories, 21.49 fat, 38.98 carbs and 17.67 protein
    - Carbohydrates are the highest, followed by fat and protein is lowest in the average fast-food meal



2. Identify countries with the highest processed-food intake using external data

    - Based on BMJ 2023, the 2 countries highest globally for processed-food intake are United States (58% of adult diet processed foods) and United Kingdom (57% of adult diet processed foods)

entity	avg_calorie_ca...	avg_calorie_fat	avg_calorie_animal_protein
United Kingdom	1653.23	1231.71	226.56
United States	1738.45	1283.48	287.54

3. Compute the average macronutrient intake of the US and UK

    - United States: 1738.45 calories from carbs, 1283.48 calories from fat and 287.54 calories from animal protein

    - United Kingdom: 1653.23 calories from carbs, 1231.71 calories from fat and 226.56 calories from animal protein

    - Both countries have diets dominated by carbohydrates and fat, with protein being much lower in comparison

<u>Findings:</u>

1. Fast-food nutritional profile

    - Carbohydrate-heavy

    - Fat is second largest macronutrient

    - Protein is consistently lowest

2. US and UK nutritional profile
    - Carbohydrates form the largest share of calorie intake
    - Fat intake is the second largest
    - Protein is the lowest
3. Both patterns match closely
    - This alignment suggests that diets in high-processed-food countries resemble fast-food macronutrient proportions

Analysis:

1. A clear macronutrient alignment
    - The similarity between the fast-food nutrient profile and the overall national nutrient intake indicates that:
        - Populations depend heavily on convenience-style foods
        - Highly processed foods tend to share similar nutrient ratios with fast-food meals
        - Structure of national diets may gradually shift to mirror fast-food composition due to high availability of ultra-processed food products
2. Why this relationship exists (interpretation)
    - Processed foods and fast food share food characteristics
        - High refined carbs, high added fats, lower protein density, longer shelf life, cost-efficiency and scalability
    - Fast-food culture strongly shapes national eating patterns
        - US and UK have high fast-food penetration
        - Processed supermarket foods often mimic fast-food flavour profiles and nutrient structures
    - Economic and lifestyle factors
        - Time constraints, cost accessibility and widespread marketing

Conclusion:

There is strong evidence of a positive relationship between processed-food intake and fast-food menus as the analysis above has shown that:

- Fast-food meals are carbohydrate and fat-heavy, with relatively low protein
- Countries with the highest processed food intake show the same macronutrient pattern in their national diets
- This indicates that high reliance on processed foods may reinforce or mirror fast-food nutritional structures within the broader food environment

Overall, countries with higher processed-food consumption tend to exhibit dietary macronutrient patterns that closely resemble those found in fast-food meals, indicating strong evidence of a positive relationship between processed-food intake and fast-food menus.

19.2 What can be the impact of processed food and fast-food consumption on happiness?

Interpretation of the question:

This part of the question investigates whether countries that consume more processed and fast foods tend to report higher or lower levels of happiness and vice versa for countries that consume less of such foods. This part examines whether any patterns or associations exist between dietary habits and overall happiness.

To determine the impact of process/fast-food consumption on happiness, compare:

1. Happiness metrics for countries with high intakes
2. Happiness metrics for countries with low intakes

It is also important to factor in other socioeconomic factors that may influence both processed-food consumption and happiness such as wealth, healthcare access or overall quality of life.

Approach:

1. Identify countries with high processed/fast-food consumption
    - Based on BMJ 2023, the countries with the highest levels of processed/fast-food consumption include: United States, United Kingdom, Canada, Sweden, Australia
2. Identify countries with low processed/fast-food consumption
    - Based on BMJ 2023, the countries with low levels of processed/fast-food consumption include: Romania, Colombia, Hungary, Italy, Estonia
3. Compute the average happiness metrics for each group of countries
    - This allowed comparison of happiness levels between high and low intake groups

Findings:

avg_rank	avg_score
11.8	7.2122
69.2	5.5556

1. High processed/fast-food intake countries
    - Average happiness rank: 11.8
    - Average happiness score: 7.21
2. Low processed/fast-food intake countries
    - Average happiness rank: 69.2
    - Average happiness score: 5.56

From these values, it is observed that countries with higher processed/fast-food intake tend to hold higher ranks on the happiness scale as well as have higher happiness scores as compared to countries with lower intake. This discrepancy is rather significant as well considering that the high intake group averaged 11.8 and 7.21 for rank and score respectively, which is considerably higher than the 69.2 and 5.56 for the low intake group.

Analysis:

The data indicates a clear positive association between processed/fast-food intake and happiness scores, suggesting that its consumption has a net benefit impact on happiness. While other factors certainly contribute to happiness, the findings imply that countries with higher consumption benefit from greater overall happiness.

However, it is important to factor in other considerations that may play an influential role:

1. Real driver could be wealth rather than processed food
    - High intake countries are all high income nations that enjoy strong healthcare systems, higher life expectancy, better social safety nets, higher education levels and more stable political environments, all of which are well-established determinants of happiness
    - Low intake countries tend to be middle income or emerging economies that may experience lower GDP per capita, limited healthcare access, higher economic insecurity and more volatile environments
    - These structural differences are far more powerful and influential predictors of happiness as compared to dietary habits

2. Processed/fast-food consumption may simply reflect industralisation

    - High intake countries tend to be highly industralised, naturally having higher availability of convenience food and busier lifestyles that promote fast-food consumption

    - Processed/fast-food intake is a symptom or a side effect that came with a wealthier society, not a cause of its happiness

Conclusion:

Although countries with higher processed/fast-food consumption appear to have higher happiness metrics, it does not necessarily mean that such diets make people happier. Instead, the pattern could be driven by other underlying factors such as socioeconomic strength. High intake wealthier countries consume more processed foods and report higher happiness due to stronger institutions, better healthcare and overall higher living standards.

Hence, processed food intake does not directly impact happiness, but simply coincides with broader national advantages that elevate overall well-being.

19.3 What about health outcomes?

Interpretation of question:

This sub-question examines whether countries that consume more processed/fast-foods tend to exhibit better or worse health outcomes compared to countries with lower consumption levels. The aim is to determine whether any observable associations exist between dietary patterns and broader health indicators.

To explore this, the analysis compares:

1. Health metrics for countries with high intake

2. Health metrics for countries with low intake

Life expectancy is used as the primary health metric, supplemented by GDP per capite, family and freedom, factors which are known to be influential to long-term health.

Approach:

1. Identify countries with high processed/fast-food consumption

    - Based on BMJ 2023, the countries with the highest levels of processed/fast-food consumption include: United States, United Kingdom, Canada, Sweden, Australia

2. Identify countries with low processed/fast-food consumption

- Based on BMJ 2023, the countries with low levels of processed/fast-food consumption include: Romania, Colombia, Hungary, Italy, Estonia

3. Compute the average health metrics for each group of countries

    - This allowed comparison of health levels between high and low intake groups

Findings:

avg_life_expectan...	avg_gdp_per_cap...	avg_family	avg_freedom
0.903856	1.330492	1.2906999999999997	0.61726
0.789358	1.097176	1.150778	0.38354

1. High processed/fast-food intake countries

    - Average life expectancy: 0.903856
    - Average GDP per capita: 1.330492
    - Average family: 1.2907
    - Average freedom: 0.61726

2. Low processed/fast-food intake countries

    - Average life expectancy: 0.789358
    - average GDP per capita: 1.097176
    - Average family: 1.150778
    - Average freedom: 0.38354

From these findings, it is observed that countries with higher processed/fast-food intake actually have a higher average life expectancy (0.90) as compared to countries with lower intake (0.78). Expectedly, countries with higher intake had a higher average GDP per capita (1.33), higher average family scores (1.29) and higher average freedom scores (0.61) as compared to those metrics of countries with lower intake 1.09, 1.15 and 0.38 respectively.

Analysis:

Although processed/fast-food are often associated with negative health implications, the observed results are counter-intuitive as countries with higher processed/fast-food intake actually show better health-related outcomes than countries with lower intake.

This does not mean processed/fast-food improves health. Instead, the pattern is more plausibly explained by confounding socioeconomic factors:

1. Higher GDP per capita offsets health risks

    - High intake countries have significantly higher GDP per capita, which typically means greater access to high quality healthcare, better preventive screening, wider availability of fitness amenities and stronger infrastructure supporting chronic disease management

    - This can counterbalance poorer diets and give a net benefit on overall health, leading to overall higher life expectancy

2. Stronger social support

    - High intake countries reported higher average family scores, which typically reflect supportive social networks, accessible community resources and reduced psychological stress

    - These elements contribute to improved physical and mental health, thus mitigating negative dietary patterns and having a net benefit on overall health

3. Higher freedom scores

    - Greater autonomy in lifestyle choices is associated with more opportunities to exercise, better mental health and higher life satisfaction, factors associated with better overall health

    - Countries with low intake tend to be less economically developed, which often correlates with lower autonomy and fewer resources that promote overall good health, resulting in lower average life expectancy

Cumulatively, these factors help counterbalance the negative health effects of processed/fast-food diets.

<u>Conclusion:</u>

Although countries with higher processed/fast-food consumption appear to have better health outcomes, this does not imply that these foods are harmless, instead:

- High intake countries tend to be wealthier and better equipped to handle the consequences and repercussions of unhealthy diets

- Low intake countries often face limited health, economic instability and weaker social systems that together result in lower overall health metrics

Therefore, the observed differences reflect economic and institutional disparities, not the healthfulness of processed/fast-food.

<u>Final summary:</u>

Across all 3 parts, the overarching insight is clear that processed-food intake, fast-food nutritional structure, happiness and health outcomes are interconnected not because of diet itself, but rather because of the socioeconomic environments in which these diets occur.

Wealthier nations consume more processed food and have higher happiness and health indicators, but diet is not the main driver, rather national capacity and structural advantages are.

Q20. Does fast-food consumption increase health risk? Could the risk be mitigated?

Interpretation of the question

Understanding whether fast-food consumption increases health risks and more importantly, whether those risks can be reduced through reformulation is crucial for public health and nutrition policy. This analysis uses Burger King's (BK) full menu as a case study to investigate how reformulation affects the distribution of high, medium, and low-risk food items. The question aims to assess not only the presence of nutritional risk in fast-food menus, but also whether practical mitigation strategies can produce meaningful improvements without reducing menu size.

Approach

Using the burger_king_menu dataset in MongoDB, each menu item was assigned a risk score based on sodium and saturated-fat levels per 100 kcal:

- 2 = High risk (both sodium and saturated-fat flags triggered)
- 1 = Medium risk (one flag triggered)
- 0 = Low risk (neither flag triggered)

This scoring system follows a traffic-light model, ensuring clear and interpretable categorisation.

Two scenarios were computed:

1. Baseline scenario
   - Original nutritional values from the BK dataset.
2. Mitigated scenario
   - Reformulated values using threshold-based improvements (e.g., modest reductions to sodium and saturated fat).
   - SKU count kept constant at 77 items to maintain menu parity.

An aggregation pipeline calculated total items per risk category and converted these into percentages. Results were extracted and visualised.

Findings

The results show meaningful shifts when the menu is reformulated:

Metric	Baseline	Mitigated	Δ (pp)
High-risk share	23.38	19.48	−3.90
Medium-risk share	51.95	49.35	−2.60
Low-risk share	24.68	31.17	6.49

These findings indicate that:

- High-risk items drop by 3.90 percentage points,
- While low-risk items increase by 6.49 percentage points,
- All without reducing the total number of SKUs.

The combined results confirm that nutritional risk can be reduced through targeted reformulation.

The results show a clear shift in risk profile after reformulation:

- High-risk items fall from 18 to 15 SKUs (about –3.9 percentage points)
- Medium-risk items dip slightly from 40 to 38 SKUs
- Low-risk items rise from 19 to 24 SKUs (about +6.5 percentage points)

All of this happens while keeping the menu at 77 items in both scenarios, showing that targeted reformulation can meaningfully reduce nutritional risk without cutting customer choice.

Analysis

1. Fast-food menus contain substantial nutritional risk

Over 23% of baseline BK items trigger both sodium and saturated-fat risk flags. This supports the broader view that fast-food consumption can contribute to negative health outcomes such as hypertension and cardiovascular risk.

2. Reformulation materially improves the menu's risk distribution

Despite modest adjustments (small reductions rather than full redesign), low-risk items increased from 24.68% to 31.17%. This shows that fast-food companies can meaningfully shift product composition with minimal operational disruption.

3. Risk mitigation does not require fewer menu items

A key insight is that health improvements come from reformulation, not product elimination. Restaurants can preserve customer choice while improving health profiles.

4. Item-level recommendations highlight clear reformulation targets

The table of reformulation candidates shows items exceeding sodium or fat thresholds, most notably chicken and burger products. These items represent high-impact opportunities for risk reduction.

Conclusion

This analysis demonstrates that fast-food consumption does increase health risk, as evidenced by the proportion of high-risk items in the baseline Burger King menu. However, the study also shows that risk can be significantly mitigated through targeted nutritional reformulation. By reducing sodium and saturated-fat content while maintaining the same SKU count, the overall menu shifted toward a healthier profile, increasing low-risk items by 6.5 percentage points. These findings underscore a practical policy takeaway: healthier fast-food is achievable without compromising menu variety, making reformulation a viable strategy for industry and public health stakeholders.

Q21. Long-term US dietary transition

Before examining the long-term drivers behind U.S. dietary trends, it is useful to determine whether the forces shaping American diets reflect broader global patterns. Many studies suggest that rising national wealth is associated with dietary shifts, particularly increases in fat intake, total caloric intake, and animal protein consumption. Global diet trends can be obtained from the already existing datasets:

Using the methods used in Q17 and Q19, global dietary data from the daily_intake dataset were processed to extract

- Average national fat intake
- Average animal protein intake
- Average Vegetable protein intake
- Average carbohydrate intake
- Total average caloric intake

This is then merged with the global happiness dataset which includes socioeconomic indicators such as

- Economy(GDP per capita)
- Health(Life Expectancy)
- Family

A snapshot of the top 5 data entries in the processed dataset has been provided below, the data is sorted by overall caloric intake

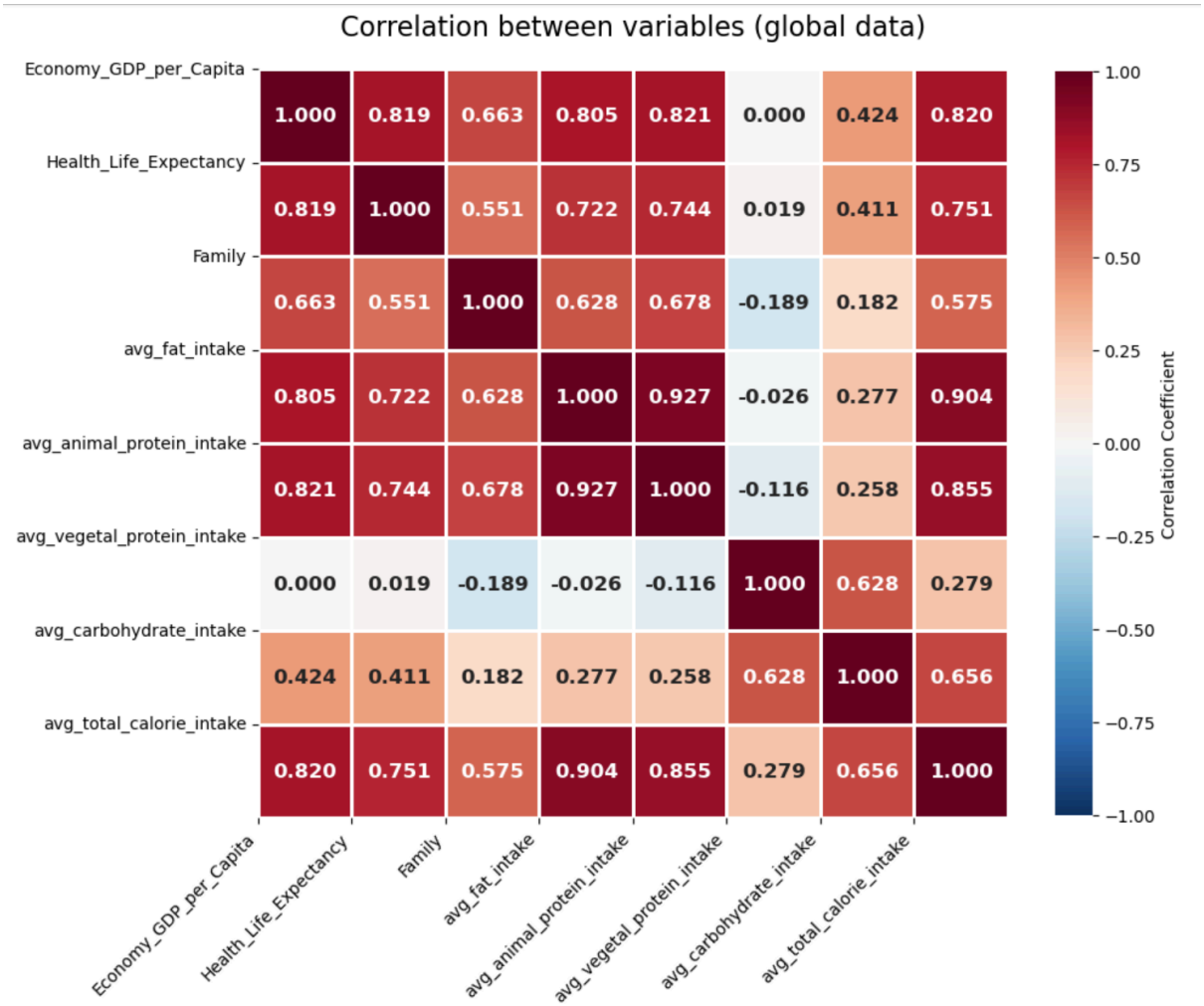
country	Economy_GDP_per_Capita	Health_Life_Expectancy	Family	Avg Fat Intake	Avg Animal Protein Intake	Avg Veg Intake	Avg Carbs Intake	Avg Total Calorie Intake
Belgium	1.30782	0.89667	1.28566	1514.03	248.44	159.88	1845.08	3767.43
Saudi Arabia	1.39541	0.72025	1.08393	863.22	146.74	254.46	2385.99	3650.41
Ireland	1.33596	0.89533	1.36948	1193.55	278.78	170.23	1934.57	3577.13

Serbia	0.92053	0.74836	1.00964	936.23	219.38	251.29	2156.09	3562.99
Austria	1.33723	0.89042	1.29704	1360.96	245.01	153.59	1736.61	3496.17

While the data is informative, it is not visually intuitive. Therefore to understand the relationships between all variables, a correlation coefficient matrix was generated using this processed data.

Initial Data Visualisation and assessment (Global)

In order to visualise this relationship between the different data within the merged dataset, we can use a correlation coefficient matrix to map out the links present, this allows us to visualise all 8 data types and compare them against the others present



The correlation coefficient matrix reveals several key relationships between the variables:

1. Vegetable protein consumption has absolutely 0 relation to the GDP per capita

    a. This suggests that plant-based protein consumption remains stable across nations regardless of income.

2. Fat intake and Animal protein intake are strongly positively correlated

    a. This is expected, as diets high in meat typically contribute both animal protein and dietary fat.

3. GDP per capita and life expectancy are strongly correlated.

    a. Wealthier nations generally have more advanced healthcare systems, explaining the link.

4. Fat intake and animal protein intake correlate strongly with both GDP per capita and life expectancy.

    a. This indicates that economic development is associated with a nutritional transition toward richer, more energy-dense diets.

5. Total caloric intake is highly correlated with fat and animal protein intake.

    a. Higher-calorie diets also tend to be meat-heavy and fat-rich.

Interpretation:

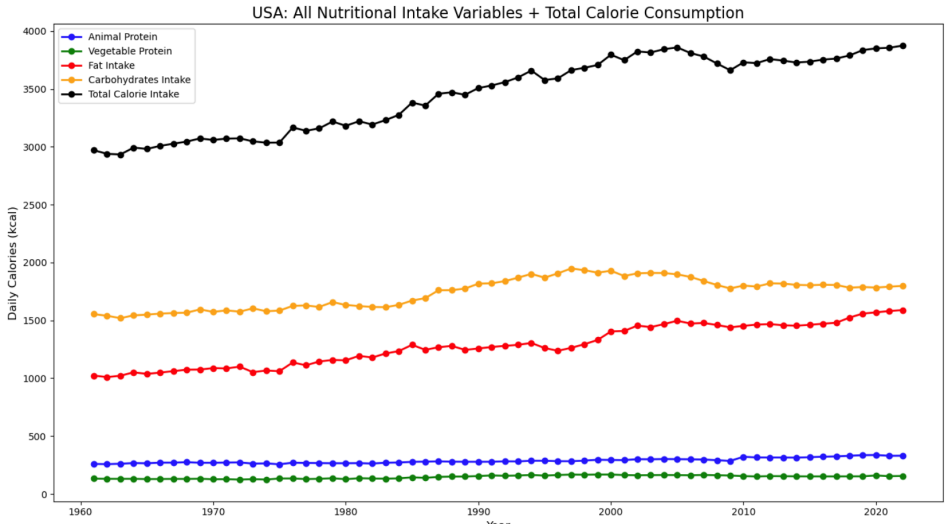
These relationships show that economic development drives a global shift toward higher consumption of fats and animal proteins, contributing to increased total caloric intake. This pattern aligns with the well established concept of the “nutrition transition,” where countries move from carbohydrate-dominant subsistence diets to higher-fat, higher-protein diets as income rises.

U.S. Dietary Trends and GDP per Capita:

Having established the global relationships, the next step is to test whether the United States follows the same trajectory.

Visual Analysis of U.S. Nutritional Data

It would be important to visualise the data for US Dietary consumption to see if any changes can be seen from the graph

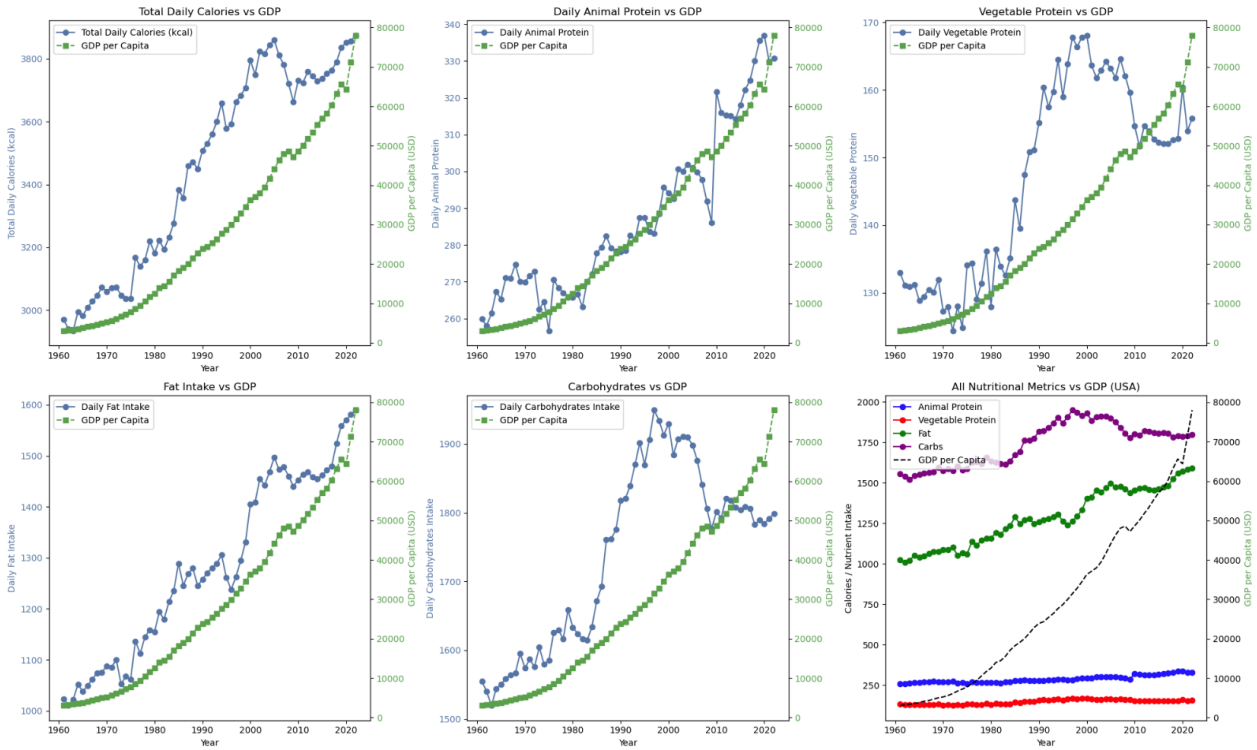


Several decades of U.S. dietary data (1960–2020) show:

1. Carbohydrate and fat consumption dominate the U.S. diet.
2. Vegetable protein and animal protein intake remain comparatively low (approximately 150–250 kcal vs. 1500+ kcal from carbs and ~800–1200 kcal from fats).
3. Total Caloric intake has been steadily increasing over time from 1960 to 2020.
4. Fat and carbohydrate intake both show long-term upward trends.

Visualisation and comparison to GDP per Capita Change:

Now that the trends in US consumption have been established, it can now be compared to the change in US GDP per capita change.



The six graphs (five single-variable plots + one aggregate plot) illustrate that most dietary variables rise in tandem with GDP per capita.

Yearly GDP Data obtained from:
https://www.kaggle.com/datasets/fredericksalazar/global-gdp-pib-per-capita-dataset-1960-present

Correlation Coefficient between Animal Protein & GDP per capita	0.9570
Correlation Coefficient between Vegetable Protein & GDP per capita	0.7336
Correlation Coefficient between Fat Intake & GDP per capita	0.9683
Correlation Coefficient between Carbohydrate Intake & GDP per capita	0.7168
Correlation Coefficient between Total Calorie Intake & GDP per capita	0.9187

Interpretation:

The strongest relationships are:

- Fat Intake (0.9683)
- Animal Protein Intake (0.9570)
- Total calorie intake (0.9187)

This closely mirrors the global trend, indicating that the United States is not an outlier. Increases in GDP per capita are strongly associated with increased consumption of richer, more energy-dense foods.

Final Analysis & Conclusion

Across both global data and U.S.-specific data, the results consistently indicate that dietary patterns shift significantly as national wealth increases. The global dataset shows that nations with higher GDP per capita tend to consume more fats and animal proteins, and this pattern is reflected clearly in the United States over time.

The strong correlations between fat intake, animal protein intake, and GDP per capita in the U.S. suggest that as the nation has grown wealthier, its dietary habits have moved toward richer, more energy-dense foods. This mirrors the classic nutrition transition observed around the world.

Conclusion

The long-term dietary transition in the United States is characterized by:

- Rising total calories
- Increased fat and carbohydrate consumption
- increase in animal protein intake

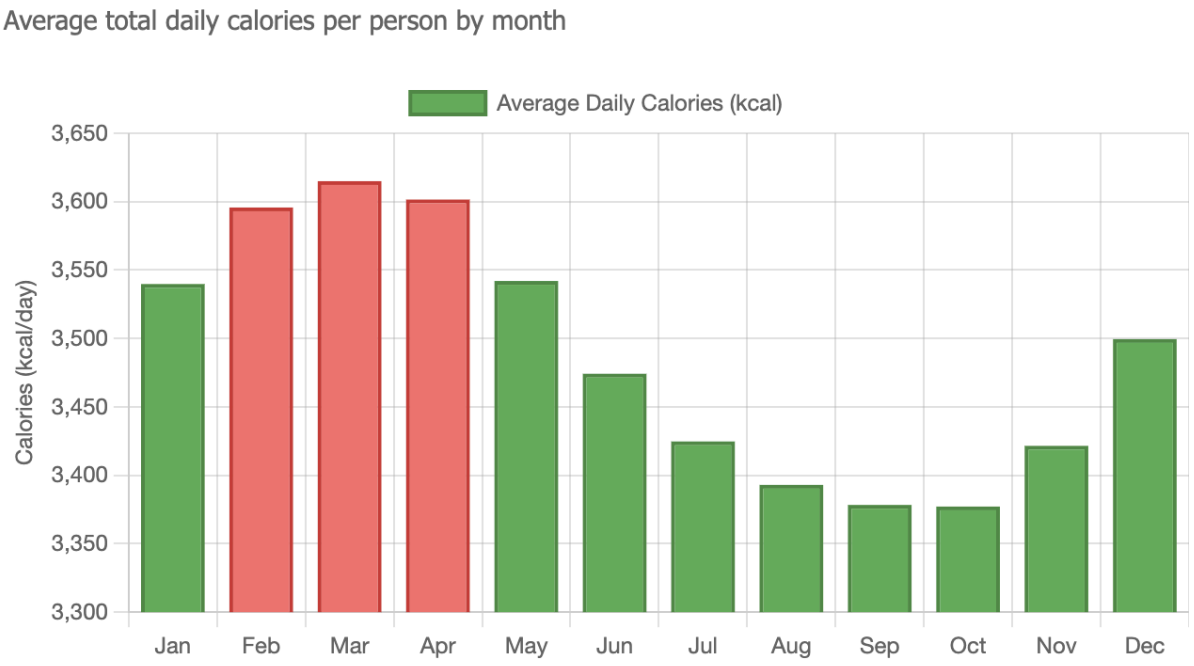
These shifts are strongly correlated with rising GDP per capita, indicating that economic factors rather than healthcare improvements or social dietary trends alone have been the primary driver of the observed changes.

Overall, the U.S. nutritional evolution reflects a classic economic-driven nutrition transition, where wealth and accessibility largely dictate dietary composition. This has implications for public health, as the increase in energy-dense, high-fat diets may contribute to the rise in obesity and diet-related chronic diseases. Future interventions should consider both economic influences and behavioral trends to promote healthier dietary patterns.

Q22. Months of unhealthy food spikes + healthy fast-food promotion

What months should governments increase public awareness:

Based on the simulated_food_intake_2015_2020 dataset, we identified which months were calorie intake the highest. We calculated the average total calories per person per day for each month and then ranked them in descending order.



The top results were:

Month	Average Total Calories (kcal)
3 (March)	3614.97
4 (April)	3601.53
2 (February)	3595.73
5 (May)	3542.05
1 (January)	3539.81

This shows a clear spike in total calorie intake from February to April, with March and April slightly higher than February. Later months such as August and September have noticeably lower averages (~3288 - 3293 kcal), suggesting that early-year intake is systematically higher than in the rest of the year. Governments should therefore prioritise public awareness campaigns on unhealthy food consumption during the first half the year, when caloric intake is the highest.

Availability of healthier fast-food options for campaigns:

To assess whether there are “healthier” fast-food choices that could realistically be promoted during these high risk months, the mcdonaldata table was analysed.

Items were filtered to identify relatively healthier main meals using the following criteria:

- Menu category in ‘regular’ or ‘breakfast’ or ‘gourmet’ (typical main items)
- Calories ≤ 400 kcal
- Protein > 15 g
- Total fat < 20 g
- Sodium < 1000 mg

Items were filtered to identify relatively healthier drinks using the following criteria:

- Menu category in ‘mccafe’ or ‘beverage’ (typical drink items),
- Sugar = 0 g

We also excluded common deep fried sides such as nuggets, fries and hash browns. This filtering confirmed that there are several items on the existing menu that meet stricter nutritional thresholds and can therefore be promoted credibly in public campaigns as better choices, rather than asking consumers to avoid fast food entirely.

Healthier fast-food options that can be introduced:

Within the constraints above, several specific items from the mcdonaldata dataset can be highlighted as healthier fast-food options.

For Mains:

Item	Category	Calories (kcal)	Protein (g)	Total fat (g)	Sodium (mg)

Sausage Mc Muffin	Breakfast	~281	16.25	10.81	742.60
Sausage Mc Muffin with Egg	Breakfast	~290	22.46	15.94	804.04
Filet-O-Fish Burger	Regular	348	15.44	14.16	530.54
Mc Chicken Burger	Regular	400	15.66	15.70	766.33

For Drinks:

Item	Category	Calories (kcal)	Sugar (g)
Coke Zero Can	Beverage	~1	0
Vedica Natural Mineral Water	Beverage	0	0

These products already exist on the menu, which means they can be easily introduced in campaigns immediately without reformulating recipes or creating new items.

Why these options are suitable:

The suitability of these options follows directly from the nutritional patterns observed in the data.

1. **Lower energy density within the dataset**

All 4 highlighted main items are at or below 400 kcal, placing them on the lower end of the calorie distribution for McDonald's mains, where many burgers exceed 500 - 600 kcal. Choosing these items instead of higher-calorie alternatives would reduce overall energy intake, which is particularly relevant between February to April when average total calories in the population are already elevated.

2. **Higher protein, controlled fat**

Each main provides ≥ 15 g protein (with the Sausage Mc Muffin with Egg exceeding 20 g), which is substantially higher than many lighter snacks or beverages in the dataset. This level of protein is likely to improve satiety compared with very low-protein items. At the same time, total fat remains below 20 g, which is more moderate than many other burgers with both higher calories and higher fat.

3. Moderate sodium compared to other items

Sodium contents between roughly 530 - 804 mg are not negligible, but they remain below the 1000 mg cut-off applied in the SQL filtering. Many larger burgers and full meals in mcdonaldata exceed this threshold. The selected options therefore represent relatively moderate sodium choices within the fast-food context.

4. Minimal energy and sugar from beverages

Coke Zero and mineral water are effectively zero-calorie and sugar-free, in stark contrast to many sugary soft drinks in the dataset. Substituting these beverages for regular soft drinks directly lowers sugar and calorie intake without requiring customers to change where they eat.

Implementation suggestions:

Based on the findings above, several policy actions could be considered.

1. Targeted timing campaigns

Governments should concentrate major public-awareness efforts on unhealthy eating during February to April. Campaigns in these months can focus on avoiding over-consumption and making more balanced choices when eating out or ordering delivery.

2. Promotion of “better choice” fast-food meals

Taking the mcdonaldata dataset as an example, health agencies can work with fast-food chains to actively promote items, which are lower in calories (≤400 kcal) and provide at least 15 g of protein with controlled fat and sodium compared to many other options.

Campaigns and voluntary agreements could encourage chains to make Coke Zero and mineral water the default drink options in value meals, with sugar-sweetened beverages offered only by active selection. Given that these drinks are essentially zero-calorie and sugar-free, this simple default shift directly reduces sugar and energy intake without changing where people eat.

Additionally, these products could be highlighted on menu boards, digital kiosks and food-delivery apps as “healthier set meals” during the high-risk months.

3. Labelling and app design

Items meeting the nutritional criteria used in our analysis (≤ 400 kcal, > 15 g protein, < 20 g total fat, sodium <1000 mg, sugar-free drinks) could be marked with clear icons on menus and in

ordering apps. During February to April, apps can further surface these options via banners or “swap to a lighter option” prompts when checking-out.

Q23. Impact of reduction of fat or sugar-based diets

The global rise in obesity, diabetes, and diet-related health issues has sparked debate over how governments should respond. Two policy approaches have emerged: explicit regulation (such as sugar taxes and mandatory reformulation) and implicit measures (such as public awareness campaigns and promoting healthier alternatives). This report examines whether dietary fat and sugar reduction impacts population happiness, health outcomes, and economic prosperity, using data from 147 countries to provide evidence-based policy recommendations.

Research Objective:

This analysis aims to answer: Should countries explicitly regulate sugar and fat consumption through taxes and mandates, or employ implicit policies that promote education and choice?

Specifically, we investigate:

• The relationship between dietary fat intake and national happiness levels

• How economic prosperity (GDP) influences this relationship

• The current health risk profile of fast-food environments

• Which countries would benefit most from intervention

Methodology:

This analysis integrated three primary datasets:

- **Daily Intake Dataset [daily_intake]:** Historical nutritional intake data (1961-2020) covering fat, protein, and carbohydrate consumption across 147 countries
- **Happiness Dataset [happiness]:** National happiness scores, GDP per capita, and life expectancy metrics for 147 countries
- **Fast Food Menu Datasets [mcdonaldata] & [burger_king_menu]:** Nutritional profiles of McDonald's (138 items) and Burger King (64 items) menu offerings

Using MySQL, we executed five analytical queries to examine different dimensions of the policy question. Query results were exported to CSV format and visualised using Excel to create scatter plots, bar charts, and comparison graphics. The analysis focused on the 2010-2020 period to reflect recent dietary patterns while maintaining data completeness.

Observations:

The Fat-Happiness Paradox

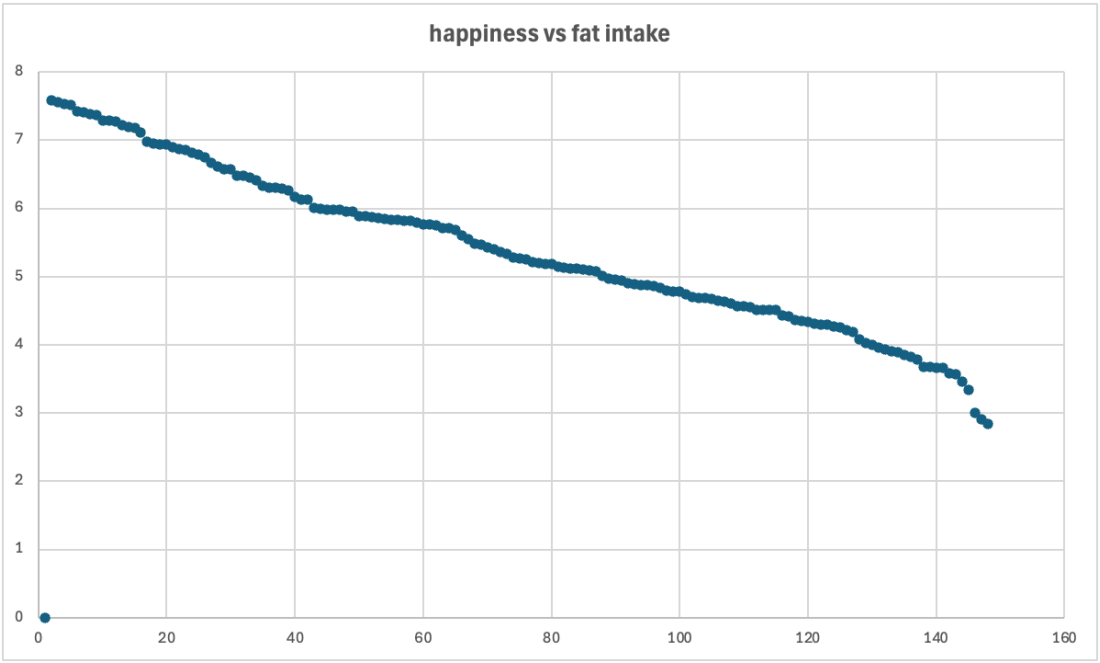


Figure 23-1: Scatterplot of Happiness (y-axis) vs Fat Intake (x-axis)

The scatter plot reveals a surprising negative correlation between fat intake and happiness, but not in the expected direction. Countries with higher fat intake tend to report higher happiness scores. The data shows a clear downward trend from left to right on the x-axis, meaning as we move from high fat intake to low fat intake, happiness decreases.

This counterintuitive finding challenges conventional wisdom about dietary restrictions improving wellbeing.

Category Analysis Reveals Wealth Effect

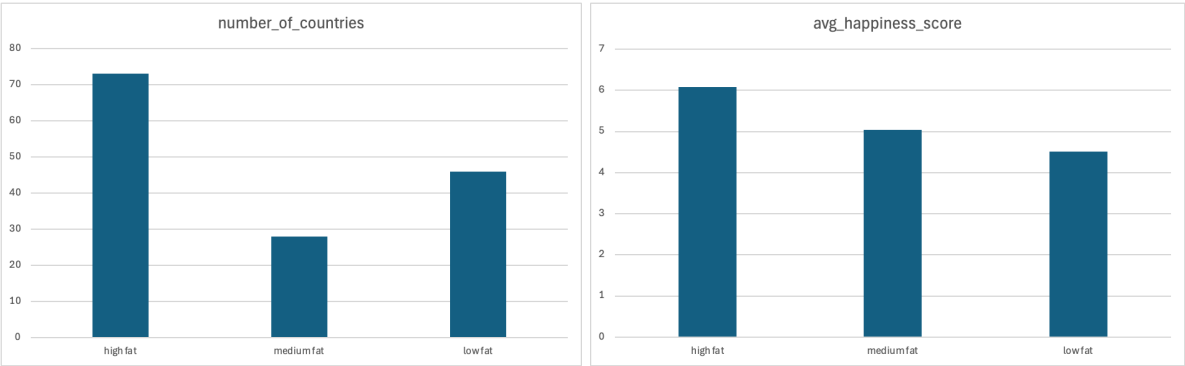


Figure 23-2: Bar Charts of countries in each Fat Intake Category

Figure 23-2(a): number of countries in each category

Figure 23-(b): average happiness score of each category

When countries are grouped by fat intake levels, a striking pattern emerges:

- **High Fat countries**: 73 countries, average happiness 6.09
- **Medium Fat countries**: 28 countries, average happiness 5.03
- **Low Fat countries**: 46 countries, average happiness 4.51

Countries consuming more fat report 35% higher happiness than those consuming less (6.09 vs 4.51). However, this relationship is not causal, it reflects economic development rather than dietary benefits.

Fast Food Environment Shows Low Sugar Risk (Figure 23-3)

Restaurant	Total items	Avg Sugar	High Sugar Items	Proportion of High Sugar Items
Mcdonalds	138	15.74	5	3.62%
Burger King	64	7.98	0	0%

Figure 23-3: Comparison between Mcdonald's and Burger King

Analysis of major fast-food chains reveals:

- McDonald's: Only **3.62%** of items (5 out of 138) contain high sugar (>50g)
- Burger King: **0%** of items exceed the high sugar threshold
- Average sugar content: McDonald's (15.74g), Burger King (7.98g)

Contrary to public perception, fast-food menus show relatively low sugar content per item, suggesting that excessive sugar intake comes from consumption frequency and portion sizes rather than extreme sugar concentrations in individual products.

GDP Drives the Relationship (Figure 23-4)

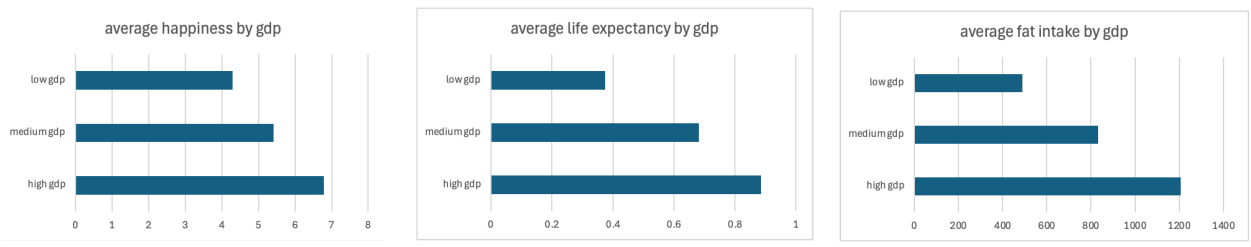


Figure 23-4: Comparison between GDP groups

The grouped bar chart reveals that economic prosperity, not dietary patterns, primarily determines happiness:

- High GDP countries: Happiness 6.79, Fat intake 1,205 cal/day
- Medium GDP countries: Happiness 5.41, Fat intake 831 cal/day
- Low GDP countries: Happiness 4.29, Fat intake 490 cal/day

Wealthier nations consume nearly 2.5x more fat than poorer nations yet report 58% higher happiness. This demonstrates that GDP per capita is the dominant factor, with fat intake serving as a proxy for economic development and food security rather than a direct happiness determinant.

Intervention Priorities Identify At-Risk Nations (Figure 23-5)

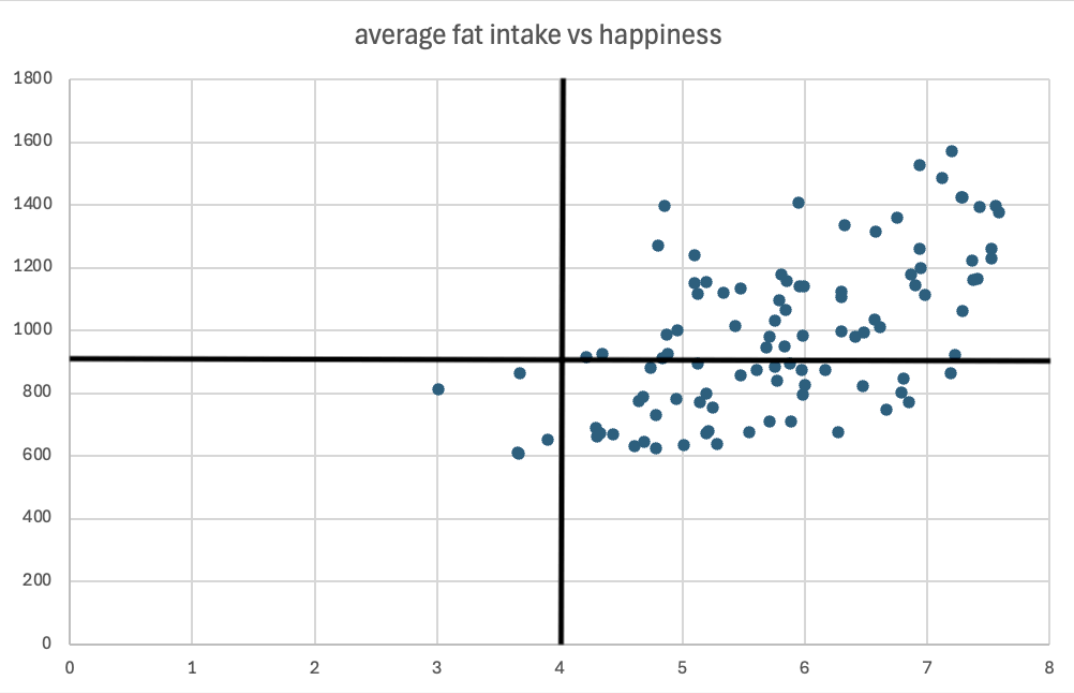


Figure 23-5: Countries which need the most intervention

The quadrant analysis (using 5.0 happiness and 800 cal/day fat intake as thresholds) identifies three policy groups:

Priority for Intervention (11 countries): High fat intake + Low happiness

- Syria (3.01), Central African Republic (3.68), Bulgaria (4.22), Armenia (4.35), Tunisia (4.74), Hungary (4.80), Lebanon (4.84), Greece (4.86), Mongolia (4.87), Dominican Republic (4.89), Albania (4.96)

- These nations face a double burden: economic challenges AND dietary concerns

Consider Intervention (37 countries): Medium-to-high fat intake with moderate happiness

- Notable examples: Ukraine, China, Portugal, Japan, South Korea, Italy
- These countries may benefit from preventive measures

Monitor (99 countries): Either high happiness or low fat intake

- Includes highly developed nations (Nordic countries, Switzerland, Canada) and lower-income countries with naturally lower fat consumption

Insights

The Wealth-Diet Confound

Our analysis reveals that the apparent correlation between fat intake and happiness is almost entirely explained by GDP per capita. Wealthy countries can afford calorie-dense foods, comprehensive healthcare systems, and robust social safety nets - all of which contribute to both higher fat consumption and higher happiness. Poor countries consume less fat due to economic constraints, not health-conscious choices.

This finding is critical: reducing fat intake in wealthy nations would not necessarily reduce happiness (which comes from economic security), but mandating fat reduction in poor nations experiencing food insecurity could worsen wellbeing.

Sugar Is Not the Primary Fast-Food Concern

With only 3.62% of McDonald's items and 0% of Burger King items containing excessive sugar, fast-food regulation should focus on total caloric density, portion sizes, and consumption frequency rather than sugar content alone. Explicit sugar taxes may be misdirected if applied broadly to fast food.

Policy Recommendation

Based on our findings, we recommend against universal explicit regulation and for a tiered, context-aware strategy:

TIER 1 - Priority Intervention Countries (11 nations):

Recommendation: Implicit policies with economic support

- These countries have low happiness primarily due to economic hardship, not dietary excess
- Policy focus: Economic development, food security programs, affordable nutrition
- Avoid: Sugar taxes that further burden struggling populations

TIER 2 - Consider Intervention Countries (37 nations):

Recommendation: Mixed approach (soft regulation + education)

- These middle-income nations show moderate health risks
- Policy focus: Awareness campaigns, voluntary industry reformulation, clear labeling
- Consider: Targeted taxes on ultra-processed foods (not staple calories)

TIER 3 - Monitor Countries (99 nations):

Recommendation: Implicit policies for high-GDP nations; no intervention for low-GDP nations

- High-GDP nations (Nordic countries, Switzerland, Canada): Education, subsidies for healthy options, voluntary partnerships work well given high baseline happiness
- Low-GDP nations: Focus on poverty reduction and nutrition access, not restriction

3. Discussion

One pattern emerges throughout the analyses: economic development, rather than diet per se, underlies any relations of nutrition with happiness. In Questions 16-18 and 21, it was determined that wealthy countries consume more fat, protein, and total calories while reporting higher levels of happiness, but this reflects prosperity enabling both industrial food systems and strong institutions, healthcare, and social support. The US nutrition transition revealed in Q21, with its 0.97 correlation between GDP and fat intake from 1960-2020, reflects the global pattern whereby development predictably shifts diets toward energy density. Counterintuitively, Q19 found that high-processed-food countries report better health (life expectancy 0.90 vs 0.78) and happiness (7.21 vs 5.56) than low-intake countries—not because processed food improves wellbeing, but because rich nations can afford both ubiquitous convenience foods and healthcare systems that mitigate dietary harms. Question 18's finding that variation in nutrient supply only weakly correlates with happiness confirms further that diet stability on its own explains little about wellbeing.

This realization fundamentally changes the policy implications: Q22 and Q23 showed that broad-based diet restrictions would be misguided, as poor countries with food insecurity need economic support, not regulations that would further burden populations, while rich countries could use targeted interventions such as concentrated awareness campaigns during peak intake months (Feb–Apr) and promotion of existing healthier fast-food options (≤400 kcal items already available). Noticeably, sugar content is not the major concern—only 3.62% of McDonald's items exceed thresholds—and would imply that the focus should shift toward the total caloric density and frequency of consumption. Limitations to the analysis are simulated data, cross-sectional happiness metrics preventing causal inference, missing confounders (corruption, healthcare expenditure, inequality), and temporal misalignment across datasets, but the consistency across questions supports the core implication: that effective nutrition policy needs to address economic context first and dietary composition second

4. Conclusion

4.1 Main Insights

Our analysis of Questions 16–23 yields five key findings:

1. Happiness is determined by wealth rather than diet. The nutrition-happiness association is a proxy for economic development. Richer diets are consumed in wealthy nations that provide better conditions for wellbeing through healthcare, social support, and economic security.
2. Fast-food environments are a reflection of national wealth. Countries that consume the most processed food have better health outcomes and are happier, which suggests that national capacity is more important than diet per se.
3. Dietary patterns are driven economically. Dietary changes come about gradually in response to economic growth, as evidenced by both short- and long-term data, reflecting a global “nutrition transition.”
4. Such policies also need to be site-specific. Low-income countries need economic support, rather than economic constraints. Middle-income countries benefit from mixed approaches. High-income countries can use voluntary partnerships and education.
5. Strategic interventions work within existing systems. Conceive campaigns during high-risk months, such as February to April; promote existing healthier options rather than demanding avoidance; and recognize that total calories matter more than specific nutrients.

4.2 Why This Matters

These findings have significant implications: public health efforts should address root causes like poverty, food insecurity, and lack of healthcare rather than simply restricting choices. Policymakers should use stratified approaches over universal mandates. Development programs need to recognize that improving dietary quality requires addressing broader economic constraints.

The findings challenge the simplistic narrative of “bad” foods as causing unhappiness. Rich countries can afford both energy-dense diets and the systems that manage the consequences. Poor countries face lower happiness mainly because of economic constraints.

4.3 Practical Implications

1. Strategically target resources during high-risk periods with realistic alternatives.

2. Avoid blanket regulations, targeting interventions according to economic context.

3. Focus on economic determinants of health and happiness.
4. Work within food environments—through better choices, not elimination.
5. Invest in research explaining causation through longitudinal and individual-level studies.

4.4 Final Reflection

This project shows that nutrition, fast-food consumption, and happiness are linked mainly through the channel of economic development. The same diet has quite different implications according to wealth, food security, healthcare capacity, and social infrastructure. Policies will be effective only if they adopt holistic approaches that address economic security, healthcare access, and social support along with nutrition. Diet matters, but in a larger ecosystem of factors shaping human wellbeing.

5. Task Allocation Sheet

BC2402 Group Project – Task Allocation

Question (Individual = 4 marks, group = 1 mark)	Member (strictly only one member for both SQL and noSQL)
1	Brent Wong Chuan Yuan
2	Brent Wong Chuan Yuan
3	
4	
5	Syed Abdillah Bin Syed Omar Binsumait
6	Syed Abdillah Bin Syed Omar Binsumait
7	
8	
9	Wong Siang Yu
10	Wong Siang Yu
11	Stephen Michael Lee
12	Stephen Michael Lee
13	
14	Chua Jun Jie
15	Chua Jun Jie

If a question is not attempted, leave the corresponding member entry blank. If more than a single member is listed for a question, both members receive a 50% penalty for the question, and the team gets a 10% overall penalty. Members who did not attempt any questions from Q1 to Q15 receive zero marks individually. The team gets a 10% overall penalty.

Question (Individual = 4 marks, group = 1 mark)	Strictly 2 members maximum	
	Member 1	Member 2

16	Stephen Michael Lee	Chua Jun Jie
17	Brent Wong Chuan Yuan	Wong Siang Yu
18	Syed Abdillah Bin Syed Omar Binsumait	

If a question is not attempted, leave the corresponding member entries blank. If more than two members are listed for a question, the members receive a 50% penalty for the question, and the team gets a 10% overall penalty. Members who did not attempt any questions from Q16 to Q18 receive zero marks individually. The team gets a 10% overall penalty.

Question	Members (no limit)	Note
19	Brent Wong Chuan Yuan	
20	Syed Abdillah Bin Syed Omar Binsumait	
21	Wong Siang Yu	
22	Stephen Michael Lee	
23	Chua Jun Jie	

If a question is not attempted, leave the corresponding entries blank. You may use the note to provide additional details about specific task allocations within the question. Members who did not attempt any questions from Q19 to Q22 receive zero marks individually. The team gets a 10% overall penalty.

6. References

Touvier, M., Louzada, M. L. da C., Mozaffarian, D., Baker, P., Juul, F., & Srour, B. (2023). *Ultra-processed foods and cardiometabolic health: Public health policies to reduce consumption cannot wait*. **BMJ, 383**, e075294. https://doi.org/10.1136/bmj-2023-075294