# Young Bites, Big Questions: Unpacking Diet and Disparity among US Children

## Introduction and Research Questions

The dietary habits of children are emerging as a critical aspect of public health discourse. This project examines dietary consumption frequency in early and middle childhood (ages 0-12), where nutrition may play a pivotal role in shaping health outcomes later in life.[1, 2] It asks:

1. What is the prevalence of unhealthy consumption among US children?
2. How are socio-economic factors associated with unhealthy consumption patterns?

## Data Management

This project analysed the National Health and Nutrition Examination Survey (NHANES),[3] featuring dietary and socio-economic data. Data management included:

*Bash:*

- Joining raw datasets.
- Filtering observations by age.
- Recoding missing values.

*R:*

- Undertaking interval validation.
- Variable creation*
- Removing extraneous columns.
- Creating visualisations and a `shiny` app.

*Dietary questions (e.g. "How often do you eat *apples*?") had ordinal responses from 1 ("never") to 11 ("2+ times per day"). These were grouped into fruit, vegetable, or sugar groups, treated as continuous, and averaged to form *consumption indices*. Additionally, derived binary variables indicate whether *any* fruit/vegetable was consumed at each frequency (e.g. `fruit_1` signifies *never* consuming fruit) – or, for sugar, *at least one* item at that frequency.

## Visualisation Approach

*First visualisation (research question one)*

- Density plots: captures overarching index distribution information, utilising colour and shape for pattern perception.
- Overlapping plots: utilises 'boundary perception' principles for comparative analysis, highlighting differences in distribution shapes/areas.[4]
- Transparency effect: prevents information loss by occlusion.

*Second visualisation (research question one)*

- Bar chart: groups data for response comparison among extreme-consumption groups.
- Faceting by category: shifts comparative focus from *cross-* to *within*-food groups.
- Data literacy considerations:

- Y-axis fixed at '50%' to avoid inadvertently overinflating prevalence through exaggerated vertical scaling.
- Direct bar labelling provides precise quantitative insight.

*Shiny dashboard (research question two)*

Available at: https://sammakesapps.shinyapps.io/YoungBites/

Designed for policymakers, this dashboard allows users to undertake advanced filtering of the data to identify vulnerable groups, in line with the second research question. Additional features focussed on ease-of-use for non-technical audiences, including:

- Use of 'natural language' for subsetting options.
- A data table to offer a more precise quantitative assessment.
- A 'variable guide' to assist interpretability.
- A colour-blindness-friendly mode to enhance accessibility, aligning with principles for inclusive visual design.[5]

## Results

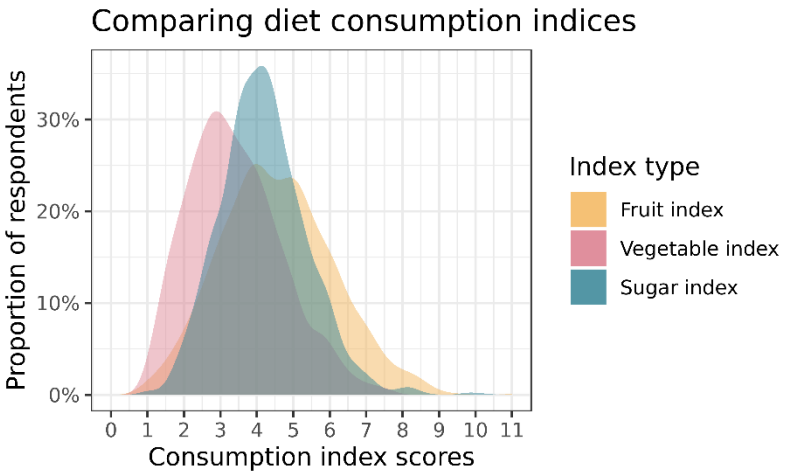


*Figure 1: distribution of fruit, vegetable and sugar indices.*

For sugar consumption, *Fig.1* reveals that the most commonly occurring index score is ~4, corresponding to a mode frequency of "once a month". The distribution's right tail indicates a segment consuming sugar far more frequently.

The vegetable index most commonly registers at ~3, corresponding to consumption at just 7-11 times *annually*. The fruit index shows greater variance, indicating a greater mix of low and high fruit consumption.

*Fig.2* outlines the 'extreme ends' of consumption. 1.9% of children consume fruit no more than 1-6 times p/year, and 1% for vegetables. Remarkably, 0.5% abstain from fruits or vegetables entirely.

While this data reflects consumption *frequency*, not *quantity* - and so cannot directly indicate malnourishment - it does imply significant deviations from federal guidelines, recommending 1-3.5 cups of fruit/vegetables *daily* for children.[6]

For sugar, a quarter of the sample consume any high-sugar item 5-6 times weekly, with 5.1% consuming them multiple times daily.

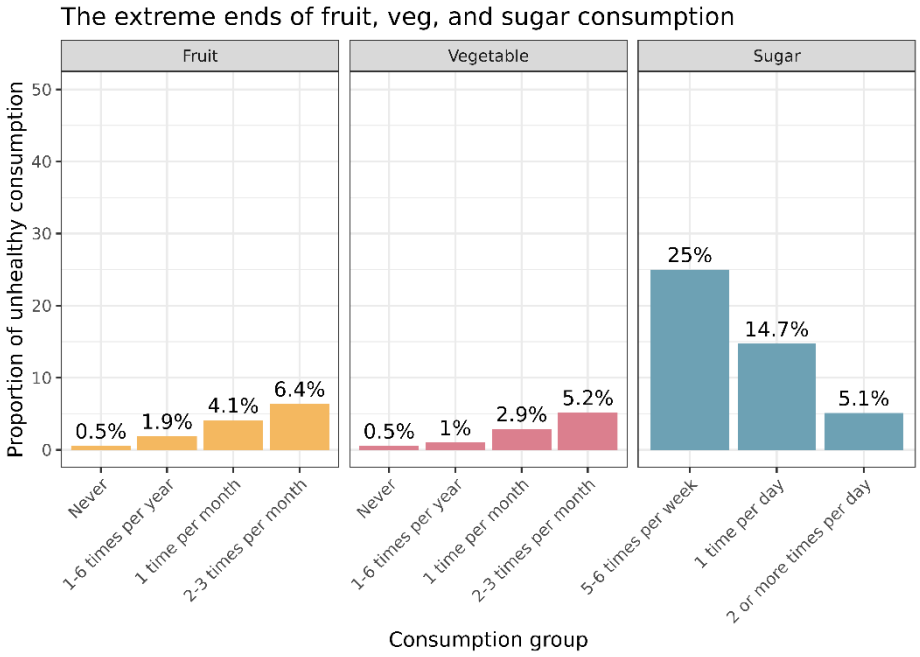


*Figure 2: Proportion of respondents within different frequency levels. Frequency levels are 'in the last year…'.*

*Shiny app*

For brevity, this section focuses on 'age' and 'household income'.

Dashboard data indicates that low fruit/vegetable and high sugar consumption increases with age. Notably, 9% of children aged 9+ exhibit low fruit consumption, compared to 4% and 5.8% in the 0-4 and 5-8 age groups, respectively. This indicates a potential correlation between age and unbalanced dietary choices, possibly linked to increased dietary autonomy.

Intriguingly, children in the top two income bracket have notably lower fruit/vegetable index scores. This contrasts with population-wide studies associating lower income with less healthy food choices,[7] and underscores the need for tailored approaches in dietary studies and interventions - recognising children as a unique demographic.

Furthermore, analysis of both age and income reveals children aged 9+ in the $45,000-$64,999 bracket show notably lower fruit/vegetable index scores - with 14.6% and 12.5% showing in low fruit/vegetable consumption, respectively. This pinpoints a specific demographic where targeted nutritional interventions could be greatly beneficial.

## References

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