

# Effect of frequency of rice/grain rice intake on BMI

## Research Question

Does the frequency of eating rice/grain rice have an effect on BMI?

## Data Management

This report utilizes data from the National Health and Nutrition Examination Survey (NHANES), specifically the 2008 survey that encompasses a broad segment of the U.S. population over several years, aimed at evaluating the nation's health and nutrition.

The selected dataset centers on the respondents' frequency of rice and grain rice consumption (FFQ0058 and FFQ0058A) and their BMI (BMXBMI). Exposure is defined as the frequency of rice intake and is expressed as a categorical variable (rice: 1 for "never", 11 for "twice a day"; grain rice: 1 for "never", 5 for "daily"). The outcome is the BMI, which is a continuous variable.

Data preprocessing involved removing invalid entries (values of 88 and 99 indicate non-responses and error data, respectively, as well as missing BMI values) and consolidating the data tables to ensure SEQN numbers matched. After cleaning, the dataset comprised 5,449 records.

## Data Visualization Methods

To effectively illustrate the relationship between rice consumption frequency and BMI, we utilized both static scatterplot and boxplot and dynamic, interactive visualizations via a Shiny app.

We initially employed ggplot2 to create boxplot that also included fitted lines. These plots display the distribution range, median, quartiles, and outliers for BMI across different consumption frequencies, highlighting central tendencies and dispersion. A fitted line illustrates the BMI trend in relation to the categorical variables.

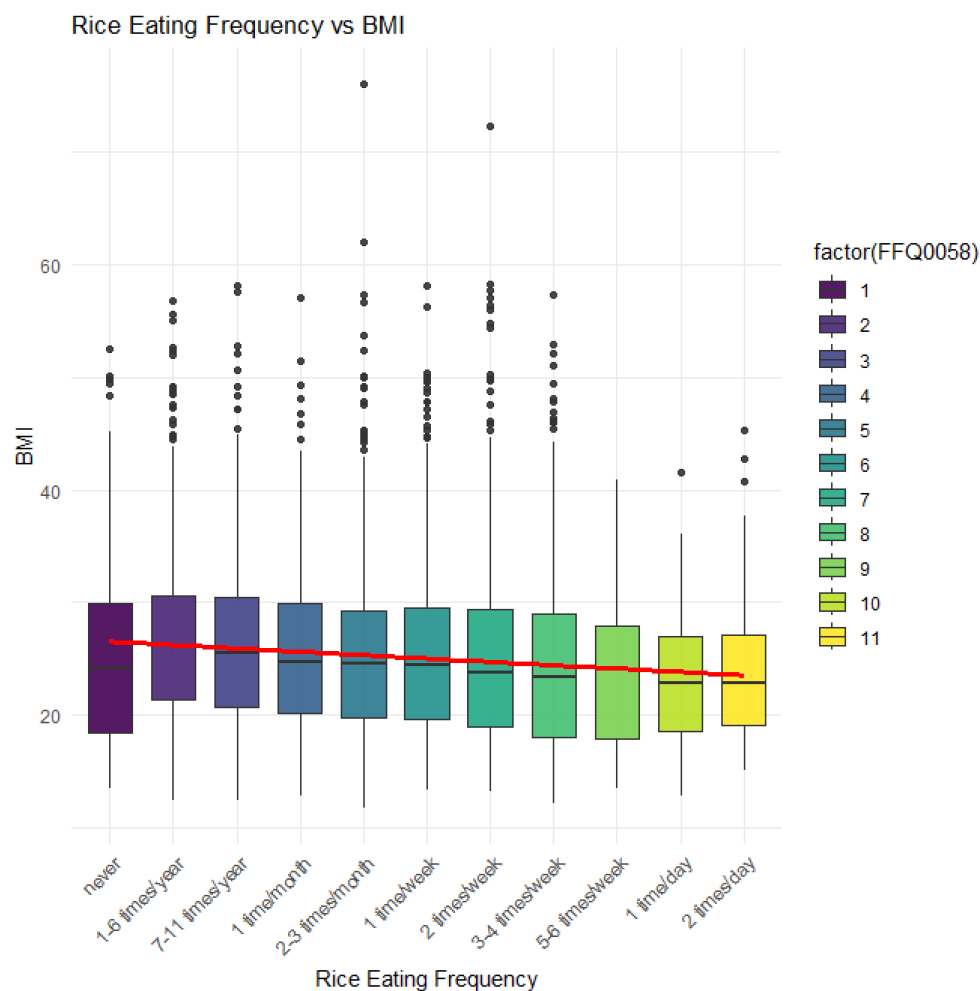
In the scatterplots, data points are represented as semi-transparent dots to minimize overlap, which clarifies the precise locations and density distribution of the points, reducing bias from sparse data in certain categories.

The Shiny app allows users to interactively alter the display using a selection box and slider. The selection box enables choosing specific population segments (based on rice consumption frequency), while sliders control the histogram's interval segmentation.

## Results

Statistical analysis revealed a Pearson's product-moment correlation between the frequency of rice consumption (FFQ0058) and BMI (BMXBMI). The correlation coefficient ( $r$ ) is -0.09, with a notably small p-value less than 0.001. This p-value indicates that the correlation is statistically significant, suggesting a low likelihood that this relationship is due to chance.

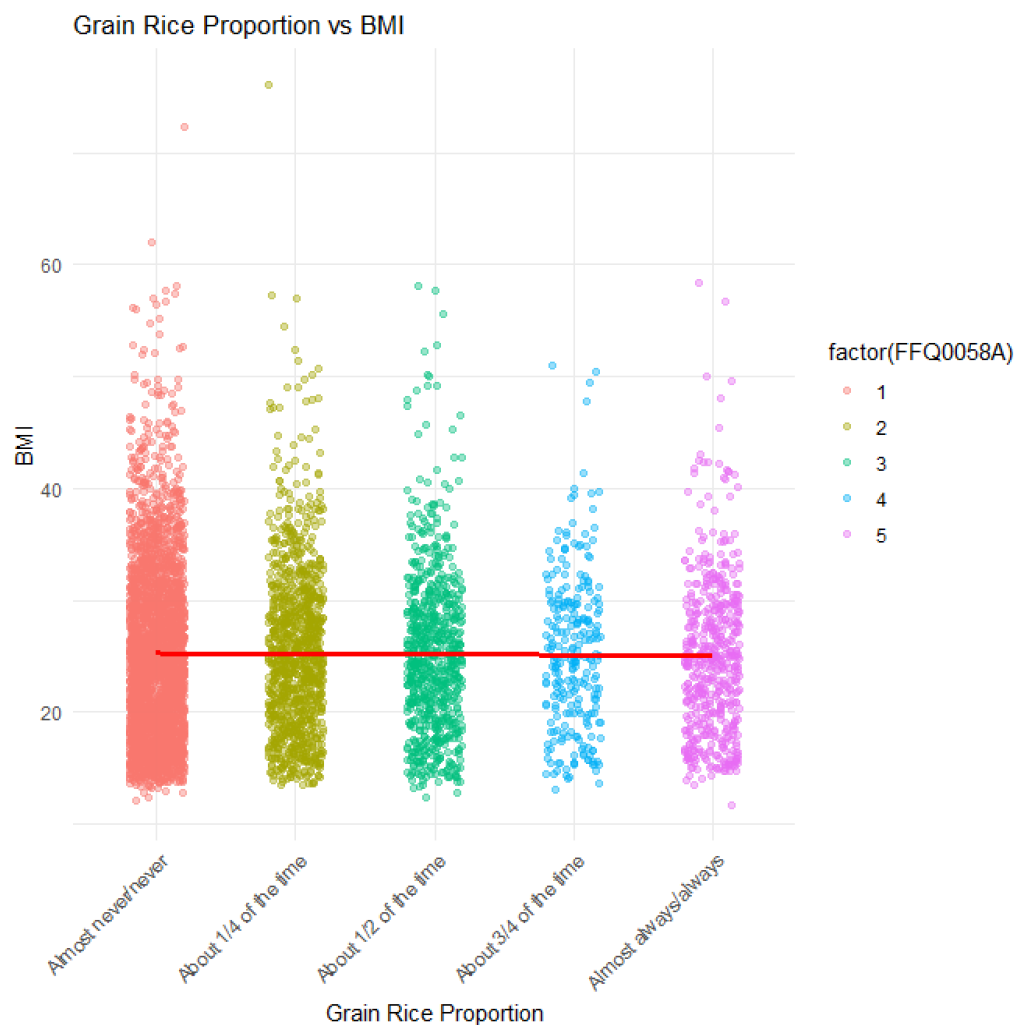
This correlation is further supported by the boxplot, which shows BMI across various rice consumption frequencies, created with ggplot2. A red fitted line within this plot demonstrates a negative slope. The combined visual and statistical evidence indicates a statistically significant, albeit weak, negative correlation between rice consumption frequency and BMI.



However, the correlation coefficient is very close to zero, indicating only a very weak negative correlation. For instance, if Participant A consumed rice 1-6 times per year and Participant B ate it almost daily, Participant B's BMI would only be about 0.9 points lower than Participant A's. If both participants are adults around 1.7 meters tall, the difference in their weight would be approximately 2.6kg. Although the relationship

between these two variables is statistically significant, the strength of the association is weak.

The correlation between the proportion of grain rice consumed and BMI is not statistically significant, with a correlation coefficient of -0.0088 and a p-value of 0.51. Visually, there appears to be no discernible trend in the fitted line, which is nearly horizontal, suggesting that the data does not support a relationship between the frequency of grain rice consumption and a decrease in BMI.



When examining the histograms in the Shiny app, it becomes evident that the BMI distribution approaches normality when the number of BMI bins is increased to over 40. A more noticeable positively skewed trend is observed in the BMI distribution among participants who consumed rice more frequently (1-8 times per month) compared to those who ate it less frequently (1-11 times per year). This observation aligns with previous analyses, indicating that those who consumed rice more frequently had a marginally lower BMI.

Conclusively, this research reveals that people who eat rice regularly may be slightly slimmer, but eating grain rice doesn't necessarily keep one slim.