Impact Food Pricing has on the Diet Quality of Low-Income Households in the U.S.

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Abstract

Investigation about food pricing is essential when researching the dietary quality of low income American households. There is a strong positive correlation between a more nutrient dense diet and higher costs. There is also a positive association between a less nutrient dense diet and lower costs. To investigate these topics, numerous tools are utilized to assess diet quality. Some of the most common are the Healthy Eating Index, Food Frequency Questionnaire, and 24 Hour Dietary Recall. In addition, possible associations between diet quality and health outcomes, diet quality and price, and diet quality and low income households have been investigated. It's shown that there has been an increase in the prevalence of type 2 diabetic trends. This has shown to be connected to diet quality as diet quality is negatively associated with the risk of developing type 2 diabetes. This is also why low income households are especially at risk for type 2 diabetes. Low income households are shown to have low diet quality and households with higher incomes have shown to have a correlation with a high, more nutrient dense diet. It is important to note that food pricing may not be the only factor in poor diets and impact on low income households in the US. Factors like food deserts and insecurity should also be investigated and require further research. Investigating all factors of poor diet quality is important so that we can identify sources of inequity within our food systems, and improve diet quality for all Americans.

Keywords
Health outcomes, dietary recommendations, diet costs, nutrition, dietary patterns, socioeconomic status

Introduction

Low-income households are defined as an annual family income equal to or below 200 percent of the Federal poverty threshold based on the size of the family (U.S. Department of Agriculture- Documentation). To provide an example, the weighted average poverty threshold for a family of four in 2022 was about 30,000 USD (United States Census Bureau- Poverty Thresholds). In 2022, 11.5% of American Households were considered impoverished (37.9 million people) (*United States Census Bureau- Poverty in the United States: 2022)*. Diet quality in the US is most commonly determined by how closely an individual's diet abides by the recommendations in the Dietary Guidelines for Americans (DGA) (*U.S. Department of Agriculture- Healthy Eating Index (HEI)*).

The DGA recommends three dietary patterns for a healthy lifestyle with the purpose of maintaining a healthy weight and promoting overall health. Those dietary patterns include The Healthy U.S.-Style Dietary Pattern which is in accordance with type and proportion of foods typically consumed by the average American but in a more nutrient dense form in appropriate amounts. The Healthy Vegetarian Dietary Pattern and The Healthy Mediterranean-Style Dietary

Pattern are both variations that also are recommended. These dietary patterns typically recommended similar serving amounts for various food groups with some variation.

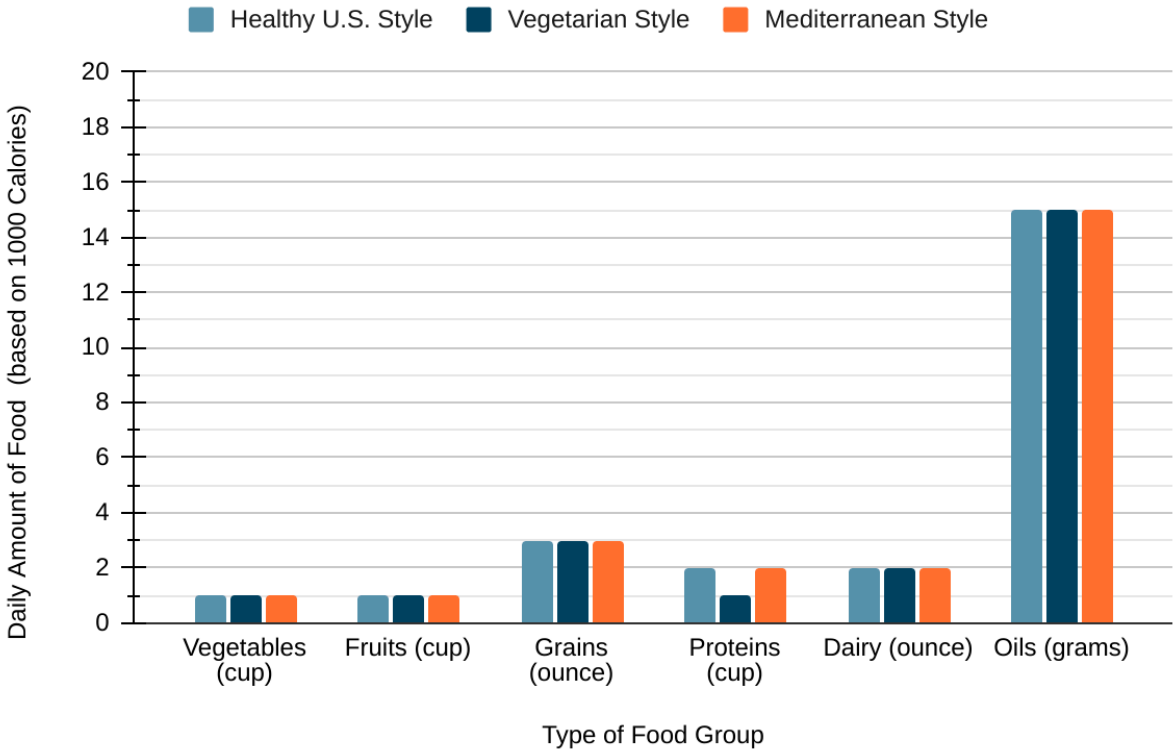

Figure 1. Different dietary style patterns for individuals aged 2 yrs and older

In addition to the dietary patterns presented above, some core recommendations were included. Some examples were vegetables (all types), fruits (preferably whole), grain (at least half that are whole grain), protein foods, and oils (U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025)*.

One of the most extensively used measures of diet quality in the US is the Healthy Eating Index (HEI), which assesses the quality of food based on these dietary patterns and key recommendations from the DGA. The HEI updates every 5 years with the most recent version being from 2020. It utilizes a scoring system to analyze food groups and give an overall score out of 100 on an individual's diet (*U.S. Department of Agriculture- Healthy eating Index (HEI)*) .

Table 1. Common research tools used to collect information on an individual's diet.

Research Tool Type	Description of Research Tool	References
Food Frequency Questionnaire (FFQ)	A checklist consisting of foods and beverages used to determine how often a subject consumed each item over a specific period of time	*Food Frequency Questionnaire At A Glance.* https://dietassessmentprimer.cancer.gov/profiles/questionnaire/ Accessed on 3rd January 2024
24 Hour Dietary Recall	Subjects report the foods and beverages consumed (and their quantities) in the past 24 hours. Commonly done through interview	*24-hour Dietary Recall (24HR) At a Glance.* https://dietassessmentprimer.cancer.gov/profiles/recall/ Accessed on 3rd January 2024
3 Day Food Diary	Subject records the foods and beverages consumed (and their quantities) over a 3 day timeframe. Typically includes 2 days from the working week and 1 day from the weekend (ex: Thursday, Friday, Saturday)	*Food Record At A Glance.* https://dietassessmentprimer.cancer.gov/profiles/record/ Accessed on 3rd January 2024

It is important to note the increase in poverty in the US. In 2020, the poverty rate in the US was 11.4% (37.2 million people). This was a 1% increase from 2019 (Schrider et al., 2021). In 2021, the poverty rate was measured at 11.6% or 37.9 million people. The measure used to determine these numbers was the Official Poverty Measure that defines poverty based on pretax money income in comparison to a poverty threshold based on family size (Creamer et al.,2022). This indicates that whatever impacts food pricing may have on low income populations will increase as the number of households affected by poverty increase.

Studies have also been conducted that investigated the relationship of food pricing to diet quality. Food pricing can be defined as the cost to purchase a specific food item in a specific region/location. Overall food pricing may have an impact on the diet quality of low-income households because of how it provides accessibility to nutritious foods. The reason for this may be because of families having difficulty to afford nutrient dense food options and opting for energy dense food choices. This means that meals feel fulfilling to the consumer but do not provide adequate nutrients for the body to function. Any possible impacts of food pricing on diet quality will be explored in this review paper.

Health Outcomes

Type 2 diabetes has gained a stronger presence in the US population. A study was conducted to investigate trends in diabetes (both type 1 and 2) in American youth and adolescents. An observational, cross-sectional, multicenter study was conducted and all individuals were under 20 years of age and had diagnosed diabetes. Data was collected in 2001, 2009, and 2017 from Colorado, Ohio, South Carolina, and Washington state and Native American reservations in specific locations in New Mexico and Arizona. This study found a noticeable increase in the prevalence of type 2 diabetes in the youth population. Starting from 0.34 out of 1000 youths in 2001, to 0.46 in 2009, and to 0.67 in 2017. This represents a 95.3% relative increase over 16 years (Lawrence et al., 2021). Possible causes could be an increase in poverty in the U.S. Although there may be other factors that influence this increase that have not been explored.

There is an association between diet quality and prevalence of type 2 diabetes. In a study conducted to investigate the relationship between the risk of type 2 diabetes and diet quality in US women, the researchers found evidence of an inverse association between diet quality and risk of type 2 diabetes. The participants of the study were from the Nurses' Health Study II (NHS II), which, beginning in 1989, is a currently ongoing prospective cohort study. All of the women were between the ages of 27-44 years of age. A Food Frequency Questionnaire was used to collect information on the participants' eating habits and diet. This was sent out every 4 years. To assess diet quality, the Global Diet Quality Score was used. The GDQS was also compared to the Minimum Diet Diversity score for Women (MDD-W) and the Alternate Healthy Eating Index-2010 (AHEI-2010). The duration of the study lasted 26 years. A limitation of the study is that since the information about diet is self-reported, it is subject to bias from the reporter. Thus, it creates possible inaccuracies within diet quality.

When observing the relationship between low risk of diabetes and high GDQS, the association for women under 50 years of age was 0.85, and 0.82 for women above or equal to 50 years of age. The AHEI-2010 also provided an inverse association between diet quality and risk for type 2 diabetes. Overall, the results of the study provided evidence to suggest an inverse association with a high diet quality score and diabetes risk (Fung et al., 2021).

Many of the diet-related health effects are also more prevalent in low income communities in the US. In 2019, men and women below the federal poverty line were the most prevalent group with self-reported diagnosed type 2 diabetes (13.7% for men, and 14.4% for women). In addition, 13.4% of adults with diagnosed diabetes had less than a high school education, 9.2% of diagnosed adults, had a high school education, and 7.1% had more than a high school education (*Centers for Disease Control and Prevention- Prevalence of Diagnosed Diabetes*). High school education can be a common determinant of socioeconomic status which pertains to low income status.

Food prices, as well as poverty and type-two diabetes rates have all increased over the years. Studies have also presented evidence to show a possible association between diet quality and risk of type two diabetes. Diabetes rates are shown to be the most prevalent in low-income communities and households, indicating that there may be a correlation between all of these aspects. This may be due to the fact that increased poverty can cause more difficulty to attain healthier foods. When households don't have adequate foods, their diet quality decreases and increases risk of developing Type 2 diabetes.

Relationship Between Food's Nutritional Value and Their Pricing

The access to healthy food may be impacted by the price of the food. If low income families are not able to attain nutritious foods, it makes it difficult to achieve a high diet quality. This can increase chances of diet-related health issues like Type 2 diabetes. That is why it is important to investigate the relationship between food's nutritional value and their pricing. There is evidence to suggest a strong correlation between food pricing and the nutritional value of foods. Numerous studies investigate this correlation.

To reestablish the relationship between the price of food, energy, and nutrients, contemporary data was used on nutrient composition and food prices were extracted from the US Department of Agriculture (USDA). To investigate the nutritional value of foods, the USDA Food and Nutrient Database for Dietary Studies was used to analyze data from What We Eat in America. To determine food pricing The Center for Nutrition Policy and Promotion (CNPP), a food price database, was used. It used information based on the 2001–2002 National Health and Nutrition Evaluation Survey (NHANES). Evidence suggested that fats, oils, and total and added sugars were significantly associated with lower food costs per 100g compared to fruits and vegetables. Meat had the highest price per 100g, a significant difference compared to any other food group. Fats, oil, total and added sugars were all foods deemed to have an overall lower nutritional value in comparison to the other food groups. The study provided evidence to suggest that foods with higher nutritional value were more expensive (Drewnowski, 2010).

In another study, diets with lower nutritional value were associated with lower costs. This research paper investigated how food prices were associated with HEI-2010 scores in young adults. The adults were above or equal to the age of 20 years. The researchers hypothesized that those with higher HEI 2010 scores were due to a more costly diet. The study represents US adults between 2007 and 2010. The database used to determine food pricing was the USDA Center for Nutrition Policy and Promotion (CNPP) national food prices database. The results showed evidence to suggest that there was a significant positive association between higher diet costs and a higher HEI 2010 score. There was also evidence to suggest that lower income family to poverty ratio was associated with lower diet costs and HEI 2010 scores. Overall the evidence showed a correlation between high cost and higher quality of diets (Rehm et al., 2015).

In addition, prices of diets appear to correlate with Americans' compliance to the recommendations set out by the DGA. One study examined this correlation utilizing two measures of food spending (self-reported food spending and Food Frequency Questionnaire

(FFQ)) and made a comparison with scores from the Healthy Eating Index (HEI) 2015. The participants in the study were adults from the ages of 21-59 years and many were recruited from lower income neighborhoods. The study was located in Washington State and was conducted in 3 counties. Food prices were collected by name and location of participants' primary food store through self-reports. Monthly at-home food expenditure data was also collected through self reports based on National Health and Nutrition Examination Surveys (NHANES) questions. Results presented evidence to suggest that those who were on food assistance were associated with lower food expenditures and diet costs. Evidence was also provided to suggest that there was a positive association of diet costs and food expenditures to diet quality (Rose et al, 2020).

An additional study further solidified the association between diet cost and diet quality. In this study, the researchers hypothesized that low cost diets among the women from California would be more dense in energy but have low nutritional value. Low income women were defined in this study as those who were equal to or below 185% of the poverty line. The women in the study were between the ages of 22 to 55 years old. To collect data on diet quality, the Food Frequency Questionnaire (FFQ) was used. A respondent would record portion size and frequency of foods she consumed out of 152 foods and beverage line items listed on the FFQ. This took place over the time period of three months. Diet cost was assessed through utilizing the prices of various local markets around the region. The results presented evidence that suggests that low-cost diets were associated with a significantly higher amount of saturated fat, total fat, and dietary energy density. There was also evidence to suggest that low cost diets were associated with a significantly lower intake in vitamins C and A. Evidence was provided to suggest that higher diet costs were associated with significantly lower dietary energy density, total fats, saturated fats, added sugars, and total energy. Evidence also suggests higher diet costs were associated with significantly higher intake of vitamin A. In conclusion the study provided evidence to suggest a higher cost for a more nutrient dense diet (Townsend et al., 2009).

Foods that had a higher nutrient density were considerably more expensive than those with a lower nutrient density. Overall diet costs were also more expensive with diets of higher quality compared to diets of lower quality. Diets that were the most closely aligned with the recommendations of the DGA were also higher in costs in comparison to diets that were less aligned with those recommendations. It is clear that there is a possible direct association between diet cost and quality.

Relationship Between Low Income Households and Diet Quality

With evidence to suggest a higher cost from more nutrient dense diets (Townsend et al., 2009), research has been conducted to study diet quality of low income households. One research study was located in the Southeast of the US and the participants were recruited from two urban locations characterized by high household poverty and high percentages of racial and ethnic minority residencies. All participants were at least 18 years of age and consisted of predominantly low income African American women. Part of the researcher's hypothesis was that higher income would be positively associated with meeting the dietary guidelines of the US. Data was collected through a 24-hour dietary recall and dietary quality was assessed through the Healthy Eating Index 2010 (HEI 2010).

The results showed that in comparison to the highest income referent group (≥$20,000), the lowest income group was less likely to meet the carbohydrate (61% vs 45%), fruit (24% vs 12%), and combined fruit and vegetable (20% vs 8%) guidelines. Although results indicated only a relatively small number of associations found between income and meeting dietary guidelines, the researchers noted that the finding may be a result of the homogeneity in the sample. The paper referenced larger and more diverse national samples that had found evidence of an association between income and meeting the dietary guidelines (Wilcox et al., 2020).

Another study investigating diet quality and socioeconomic status also indicates a correlation between income and diet quality. The study was conducted in 2008 to 2009 and was located in King County of Washington state. The study consisted of 1226 adults (over 18 years of age) and a telephone survey was used to determine economic and social status. Households below a certain income were oversampled. To determine low-income households, overall household income and education level were used. In addition, a Food Frequency Questionnaire was utilized to collect dietary data about the participants. To determine diet quality, energy density and Mean Adequacy Ratio (MAR) was used. The results of the study provided evidence to suggest an association between a higher MAR score and a significantly higher proportion of those with higher income (increased from 29% to 63% across extreme quintiles). A higher MAR score is a positive indication for good diet quality. Overall there was strong indication to show that higher income was associated with a more nutritional diet. A limitation presented in the study was that collected data through self reported surveys which can be subject to biases (Monsivais et al,. 2012).

The correlation between diet quality and income is again reinforced by another study that tracked the diet quality of American adults from 1999 to 2000. Participants were adults between the ages of 20 and 85 from various socioeconomic groups. Their dietary data was collected using a 24 hour dietary recall and the diet quality of all participants was assessed through the Alternate Healthy Eating Index 2010 (AHEI 2010). Results showed for all groups over the 12 year period an increase in AHEI component scores for sugar-sweetened beverages and fruit juice (0.9 points), whole fruit (0.7 points), whole grains (0.5 points), and nuts and legumes (0.4 points). Although there was a significant decrease for sodium intake (0.5 points). Results also showed a significant increase in AHEI scores in most socioeconomic groups. The group with the highest income had been shown to have an accelerated increase in their scores. The AHEI scores of higher income groups were consistently higher than the lower income group scores. In addition, the gap between the AHEI scores between the higher and lower socioeconomic groups increased over time. (Wang et al., 2014).

Based on the research studies presented, income and socioeconomic status are likely to be positively associated with diet quality. Lower income households were less likely to follow the US dietary guidelines and there was a positive association between income and meeting the dietary guidelines (Wilcox et al., 2020). And while diet quality overall has increased over the years, the gap between higher income and lower income households in terms of diet quality has widened (Wang et al., 2014).

Conclusion

As shown in the studies above, diet costs have a strong association with their nutritional value. There is a strong positive association with diet quality and cost. Higher diet costs were shown to have more nutritional value compared to lower diet costs. In addition, lower income households were also shown to have a lower diet quality in comparison to households with higher diet quality. These associations provide indications to suggest that diet cost is a factor in why low income households have lower diet quality. These correlations can have major negative impacts on public health. Lower quality diets have shown to have an association with prevalence of type 2 diabetes in lower income households. To improve the health and diets of low income households in the U.S and create an intervention, diet cost must be a factor that is taken in consideration.

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