# The Cost of Healthy Foods in Seattle, WA: Price Trends from 2004-2014

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## Abstract

The Cost of Healthy Foods in Seattle, WA: Price Trends from 2004-2014

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**Introduction:** The issues surrounding the cost of healthy foods have emerged as a significant barrier to improving dietary habits, especially for individuals and families of low socioeconomic status. Earlier reports have found that nutrient-dense, low energy-density foods have increased in price at a more rapid rate compared to energy-dense, low nutrient-density food. This study seeks to determine whether or not this pattern has continued from 2004-2014.

**Methods:** This study was a longitudinal time analysis of retail prices for over 384 foods and beverages collected over an 11-year period (2004-2014). Prices were collected at six time points, every 2 y, at local Seattle metropolitan grocery store chains. Food cost was defined in three ways: price per 100 g edible portion, price per 1000 kcal, and price per serving. The independent variables were major food groups, energy density quintiles, and by two measures of nutrient density (NNR and NRF). Statistical analyses for this study consisted of computing the

correlation between 2012 and 2014 prices, descriptive statistics for the mean cost of food, and repeated measures one-way analysis of variance (ANOVA) to determine the effect of time on food prices.

**Results:** Total food prices in 2014 were significantly higher than food prices in 2004. Foods in the meat/poultry/fish food group cost significantly more than all other food groups. The most energy dense foods were less costly per calorie than were less energy dense foods. Food prices per kcal, per 100 g, and per serving increased with increasing nutrient density of foods.

**Discussion:** Reducing barriers to nutritious foods should be viewed as a preventative, cost-saving strategy over the long term. The identification of food pricing trends is a necessary step in the development and implementation of strategies that will improve purchasing behaviors and healthy dietary choices.

**Introduction:**

The consumption of nutrient-dense, low energy-density diets reduces the risk of developing chronic diseases such as obesity, type 2 diabetes, heart disease, and some cancers.[1] Healthier diets are significantly associated with lower body mass index, lower diabetes risk and related health care costs. In one study, food prices were associated with diverse health outcomes indicating that food cost was likely a significant factor influencing overall health outcomes.[2]

The factors preventing people from eating healthy diets are complex; however, the cost of healthy foods may be a factor, especially for individuals and families of low socioeconomic status.[3-6] For example, a recent study found that welfare-dependent families would need to spend 30-40% of their disposable income to meet the national recommendations for a healthy diet, compared to 20% for families earning at an average income level.[7] A related study found that low SES families would need to increase their typical food budget by 35-40% to purchase healthier food items.[8] Additionally, the United States Department of Agriculture (USDA) has estimated an average cost of meeting fruit and vegetable guidelines at $2 to $2.50 per person per day (or $56 to $70 for a family of four per week, or $224 to $280 per family per month which may be a financial burden for lower SES families.[9]

In contrast, one study found that changing from a less healthy diet pattern to a more healthy diet pattern can be achieved with minimal, no change, or even decreased expenditure depending on where the family shops for food.[10] If broadly applicable, this finding would then lend itself to questions of food access for households and whether or not consumers are able to access more affordable stores.[10, 11]

Cost is not the only factor affecting consumer purchasing decisions. Taste, quality, convenience, cooking skills and available equipment, interest in and knowledge of nutrition, accessibility, and other issues influence consumer food choices.

However, those food choices can be even more complex. With respect to cost, there are several themes related to the affordability of healthy foods including: energy-density, nutrient-density, whether or not overall dietary patterns comply with nutrition recommendations, financial and accessibility barriers of low-income populations, and consumer attitudes affecting the perceived cost of healthy foods versus actual food costs.[11-16]

A large cohort study conducted in the UK found that healthier, more varied diets cost significantly more than less healthy, less varied diets.[17] The consumption of a healthier diet pattern based on a food frequency questionnaire was significantly associated with higher socioeconomic status (SES). Other studies have found that low SES populations typically have lower cost diets that are comprised of an increased level of energy dense, nutrient poor foods.[3, 4, 18] These studies indicate that food cost is likely one factor limiting the consumption of healthier, more varied diet in low SES populations.

On average, Americans across all SES levels spend similar proportions of their food budget within the same food groups.[16] Specifically, the largest portion of the food budget across all income levels is spent on "miscellaneous" foods (such as frozen meals and snacks, chips, baking needs, sauces, soups, etc.) followed by animal-based protein foods and the lowest portion of the budget is spent on dairy foods followed by bakery and cereal products.[16] Individual households represented within all SES/income levels are purchasing both healthy or unhealthy dietary patterns.[16] Additionally, higher income groups tend to spend significantly more money

purchasing food away from home which tends to be higher in sodium and fat and lower in fiber and calcium than foods eaten at home.[16]

Overall, current food purchasing patterns are not consistent with recommendations for a healthy diet.[16] Even though in many studies SES level is significantly associated with healthy dietary patterns, other factors are impacting whether or not individual households choose to purchase healthier food items irrespective of SES level. Perception of the cost of healthy food may be one influencing factor.[16] Thus, there are likely other ways to improve diet quality rather than simply spending more that may involve nutrition education.[4, 16]

Various studies assessing the cost of food and diet patterns found that the relative cost of foods and diets depends on the measure used for assessment.[13, 16, 19] A report from the USDA found that grains, vegetables, fruit, and dairy foods were less expensive than most protein foods and foods high in saturated fat, added sugars, and/or sodium when using measures of edible weight or average serving size.[19] Another study found that within food groups, meats/proteins had the largest price differences between least healthy and most healthy food options.[13] Healthier food-based dietary patterns, for example the Mediterranean diet, cost $1.48 more per day compared to least healthy dietary pattern.[13] Nutrient-based dietary patterns had no significant difference in cost when comparing daily intake; however, healthier nutrient-based dietary patterns had a significantly higher cost when using 2000 kcal as the unit of comparison.[13]

The unit of comparison including price per calorie, price per nutrient, price per serving or price per meal affects the reported difference in cost.[13, 16, 19-20] Notably when food prices by weight were compared based on calorie content, low calorie foods like the majority of fruits and vegetables appeared very expensive when compared to other measures of food cost.[19]

Additionally, calorie content of foods does not necessarily reflect satiety. For example, the consumption of 100 calories of broccoli (about 3 ¼ cups) is probably not a reflection of the amount an individual would typically consume at one time and portion size might be a better measure to reflect intake.

A recently published meta-analysis consolidated the most pertinent studies related to the cost of healthy foods.[13] The studies included within this analysis collected pricing data over a limited period of time, ranging in length from one month to five and one-half years.[21-22] Thus, more studies are needed that include longer-term pricing data. The present analyses address this gap because they include continuous pricing data over a 11-year period and provide rich data on food pricing trends over time.

Earlier reports from this same data set have found a large, increasing disparity in food prices as a function of nutrient density and energy density of foods.[14,15] These previous reports demonstrated that nutrient-dense and low energy-dense foods were increasing in price while energy-dense and low nutrient-density foods remained relatively constant over time.[14,15] It is hypothesized that nutrient-dense, low energy-dense foods have continued to increase in price at a more rapid rate compared to energy-dense and low nutrient-density foods.

**Methods:**

Prices for 384 foods were collected six times over eleven years in Seattle, Washington. Faculty and graduate students at the University of Washington in Seattle collected the food price data in 2004, 2006, 2008, 2009, 2012, and 2014.

Data Collection:

The market basket

A market basket is a defined set of food items that exist in purchasable forms. A market basket approach is also used by the US Bureau of Labor Statistics to monitor prices and inflation in goods and services.[14, 15] The market basket used in this study included 384 total foods that were used to populate the food frequency questionnaire (FFQ) used by the Fred Hutchinson Cancer Research Center for population studies on diet and health (G-SEL version). The food items included in the FFQ have been expanded over time to include several ethnic food items in order to better represent population characteristics; 373 foods have been consistently part of the market basket over time. The 384 food and beverage items excluded medical foods and supplements.

Food prices, 2004 to 2014

Food prices were collected six times over eleven years: Apr-Jun 2004, May-July 2006, May-Jul 2008, Jan-Mar 2010, May-Jun 2012, and May-Jun 2014. Prices (in US dollars) were collected at three major grocery chains located within the metropolitan area of Seattle: Safeway, Albertson's, and Quality Food Centers (QFC, a Kroger brand). These grocery stores were selected in 2004 because they represented the majority of the retail grocery market in the Puget Sound region at the time the market basket was established (>60%).[14] Other prices were collected from a local fish market called Mutual Fish and from local branches of fast food

restaurants. Prices were obtained during in-store visits, from online supermarket home shopping websites (Safeway), and from calling local stores. Recorded prices were for regular food prices and did not include any discounts offered with use of store loyalty-cards, sales, or coupons. Efforts were made to consistently collect prices for identical products each year at the same store. Product descriptions included brand, package size, and store. However, when a specific item was no longer available, an attempt was made to find the identical product at the other two stores and the least expensive price was recorded. If an item could not be located, a substitution was made using a product that matched the original description and previous food item as closely as possible and also reflected the lowest pricing available.

After collecting prices, each food item was adjusted for edible portion or yield of the food item and price per 100 g was calculated. Yields reflect losses or gains to food weight that occur during preparation and cooking. Yields were originally obtained from the USDA Handbook 102 as previously described.[14, 15, 23]

Food groups

The 384 foods were grouped into seven food groups based on the USDA's MyPyramid food groups following previously described procedures: fats/sugary beverages/non-grain sweets, dairy, fruits and fruit juices, vegetables, beans/nuts/seeds, grains, and meats/poultry/fish.[15]

Energy density, nutrient density, serving size

Energy density of a food item was defined as available kcal per 100 g. All 384 food and beverage items were included in the energy density analysis.

The values for energy and nutrient composition were based on information obtained from the Nutrient Data Systems for Research (NDSR). The NDSR database has been previously described and includes energy and nutrition variables per 100 g edible portion (EP).[15] Nutrient

density was captured using two different methods: the Naturally Nutrient Rich score (NNR) and the Nutrient Rich Food Index ($NRF_{9.3}$). The NNR score and $NRF_{9.3}$ Index use both nutrients to encourage and nutrients to limit to both qualify and measure nutrient density of foods. The NNR score was calculated as the sum of percent daily values (%DVs) for 16 beneficial nutrients as listed in Table 1, with % DVs based on 2000 kcal of food. The NRF index was calculated as the sum of percent daily values for nine nutrients to encourage minus the sum of percent daily values for three nutrients to limit, also listed in Table 1. All % DVs were calculated per 100 kcal and capped at 100%. Formulas for the NNR score and $NRF_{9.3}$ Index have been described previously.[15]

Serving size for each food was consistent with the serving size in grams defined and used as part of the Fred Hutchinson Cancer Research Center FFQ. The serving size in the FFQ is a defined medium portion size and FFQ participants report whether they ate a small, medium, or large portion compared to the defined medium portion size.[24]

**Table 1:** NNR Score and $NRF_{9.3}$ Index nutrient profiles

| **NNR Score Nutrients** | **$NRF_{9.3}$ Index Nutrients** | **Daily Values** |
|---|---|---|
| | *Nutrients to encourage* | |
| Protein | Protein | 50 g |
| Fiber | Fiber | 25 g |
| Vitamin A | Vitamin A | 5000 IU |
| Vitamin C | Vitamin C | 60 mg |
| Vitamin E | Vitamin E | 20 mg |
| Calcium | Calcium | 1000 mg |
| Iron | Iron | 18 mg |
| Potassium | Potassium | 3500 mg |
| | Magnesium | 400 mg |
| Vitamin D | | 10 μg |
| Thiamin | | 1.5 mg |
| Riboflavin | | 1.7 mg |
| Pantothenic Acid | | 10 mg |
| Vitamin B12 | | 6 μg |
| Folate | | 400 μg |
| Zinc | | 15 mg |
| Monounsaturated Fatty Acids (MUFAs) | | 20 g |
| | | **Max. Recommended Values** |
| | *Nutrients to limit* | |
| | Saturated Fat | 20 g |
| | Added Sugars | 50 g |
| | Sodium | 2400 mg |

Statistical Analysis

The 2012 and 2014 prices were log transformed due to right skewed data and the correlation coefficient ($r^2$) was recorded. After collecting all food prices, price per 1000 kcal and price per serving was calculated for each food item. The food items were then divided into subgroups based on 1) major food groups; 2) quintiles of energy density; 3) quintiles of NNR, and 4) quintiles of $NRF_{9.3}$ scores. The total number of foods and beverages items included in each analysis varied. Analysis by food group included all 384 foods and beverages. Analysis by energy density and nutrient density (NNR and $NRF_{9.3}$) excluded beverages and included 341 foods for analysis. The mean cost for each of the food groups and quintiles of energy density, NNR, and $NRF_{9.3}$ was then calculated using the 2014 data.

Beverages were excluded from the energy density, NNR, and $NRF_{9.3}$ analyses. In order to capture the effect of time on food prices, repeated measures one-way analysis of variance (ANOVA) was performed with the data for food groups, quintiles of energy density, and quintiles of nutrient density with time as a within-group repeated measure and quintile of energy density or nutrient density or food group as between-group factors. Repeated measures ANOVA was performed for price/100 g edible portion, price/1000 kcal, and price/serving. The analyses were performed with IBM SPSS statistical software (version 19.0 IBM SPSS for Windows. Armonk, NY: IBM Corp. 2010) and Microsoft Excel (2010).

**Results:**

Figure 1 shows a strong correlation of $r^2 = 0.96$ between 2012 and 2014 prices. The strong correlation between 2012 and 2014 prices shows that collection methods were reliable between the two years. The average price increase for total foods and beverages was 10.1%.

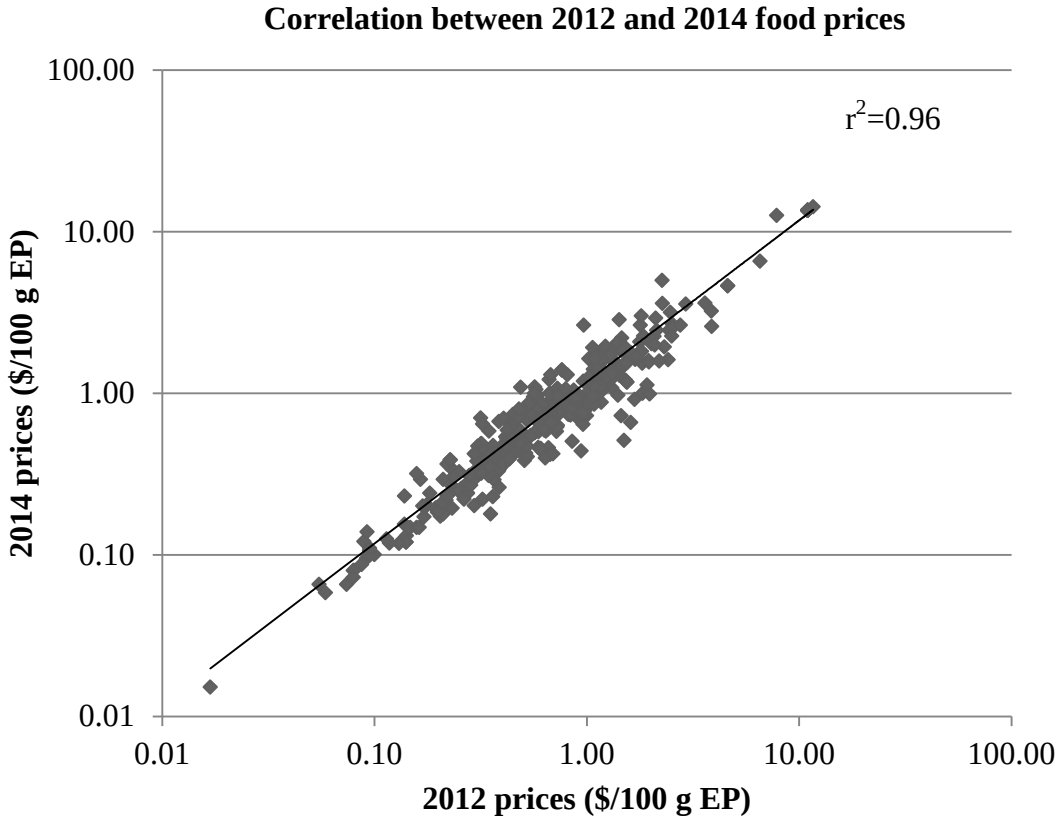
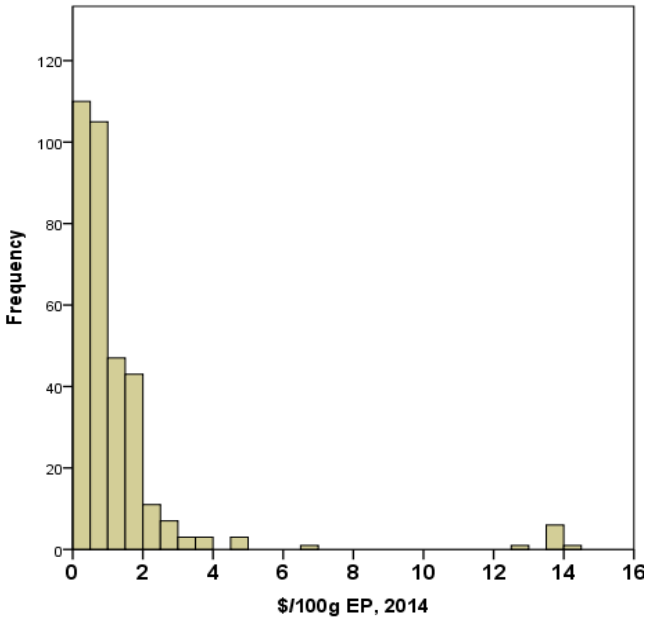



**Figure 1.** Relationship between the 2012 and 2014 pricing data. The overall correlation for the 2012 and 2014 prices was 0.96.

Distribution of Data

Figure 29 shows that the pricing data is right skewed. Boxplots highlighting some of the foods that are outliers in this dataset are shown in Figure 30-32. The highest prices can be attributed to seafood such as oysters, crab, and lobster.

**Figure 29.** Distribution of pricing data expressed as price per 100 g EP.




The distribution of mean prices expressed as price per 100 g edible portion was skewed to the right with several mean food prices that are significantly higher than the majority of the data.

**Figure 30.** Boxplot with outliers for food prices (beverages excluded) expressed as price per 100 g edible portion.

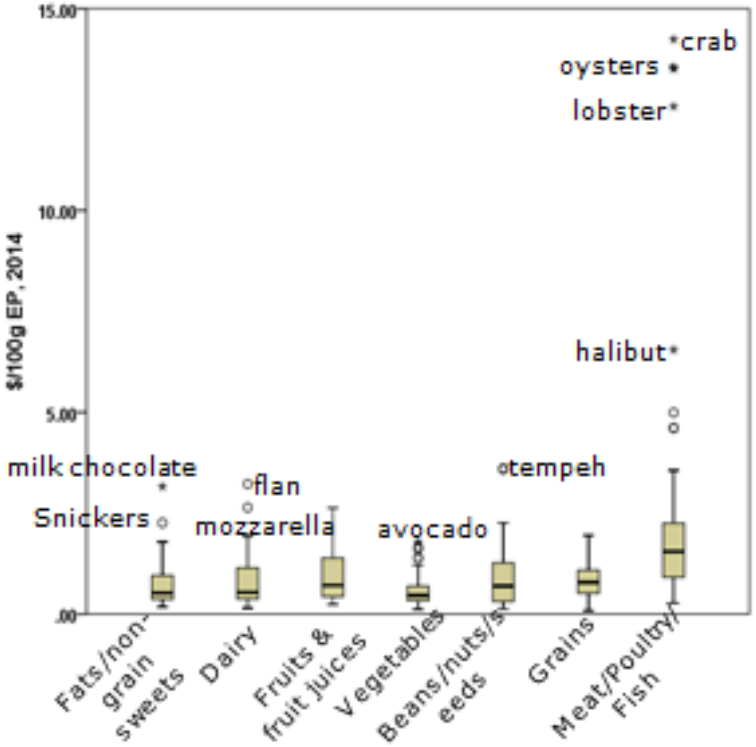
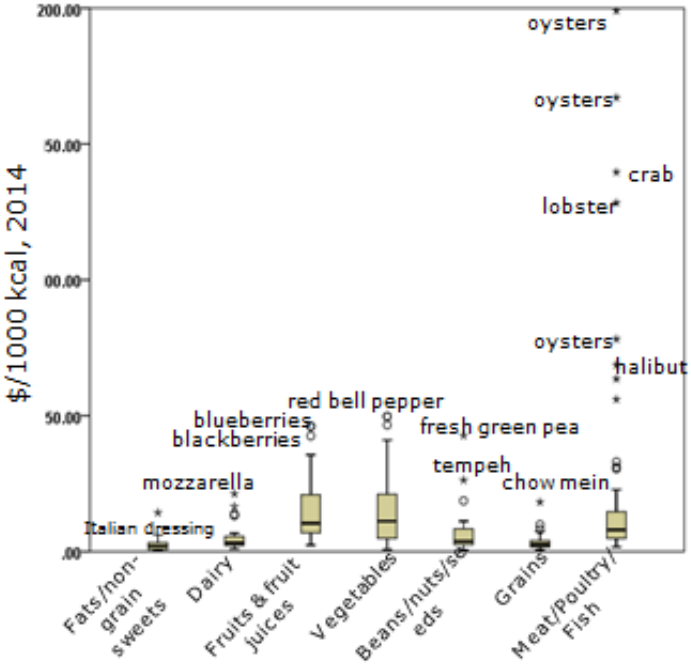


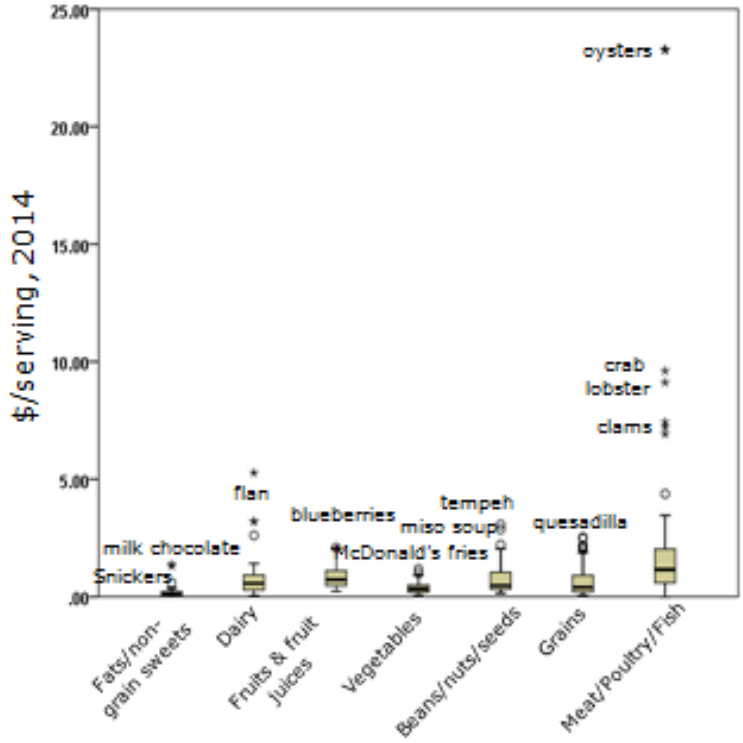

Figure 30 shows that the outliers with the highest prices per 100 g edible portion can be attributed to seafood such as oysters, crab, and lobster.

**Figure 31.** Boxplot with outliers for food prices (beverages excluded) expressed as price per 1000 kcal.




Similar to Figure 30, Figure 31 shows that the outliers with the highest prices per 1000 kcal can be attributed to seafood such as oysters, crab, and lobster. Other outliers include halibut, red bell pepper, blueberries, blackberries, fresh green peas, chow mein, and mozzarella.

**Figure 32.** Boxplot with outliers for food prices (beverages excluded) expressed as price per serving.

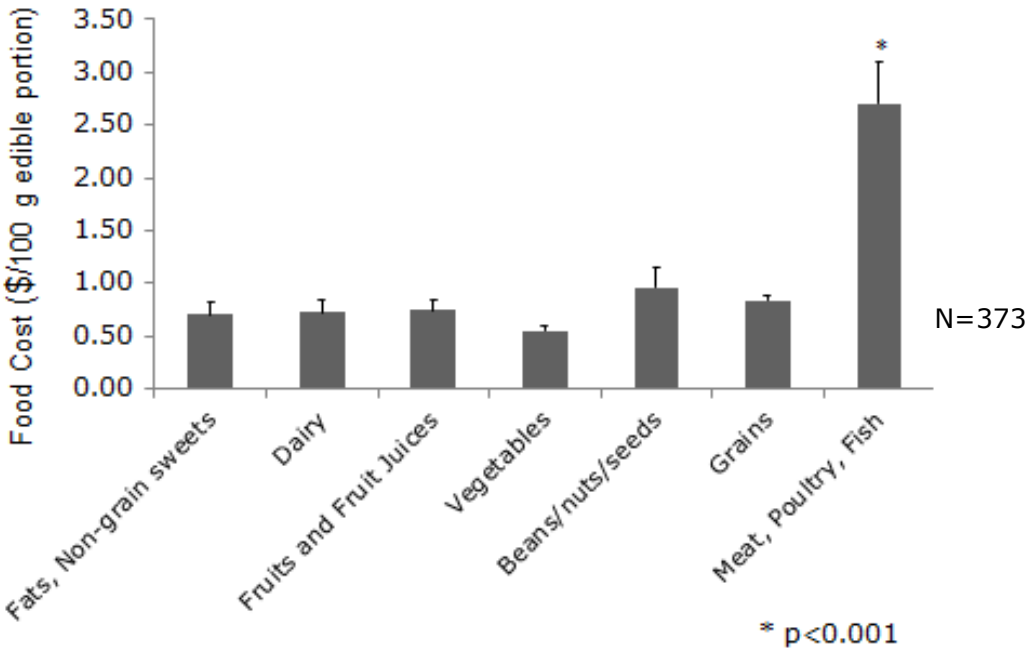



Many outliers shown in Figure 32 are consistent with Figures 30-31 including oysters, crab, lobster, blueberries, tempeh, flan, milk chocolate, and Snickers bar. McDonald's fries, quesadilla, clams, and miso soup are unique outliers when price is expressed as price per serving.

Major Food Groups

In 2014, the mean price of the meat/poultry/fish food group was significantly higher than all other food groups for all three measures of price: price per edible portion, price per calorie, and price per serving. Figures 2-4 show the mean price of each food group using the three different price metrics. Error bars in the figures below represent standard error.

**Figure 2.** Mean price of foods and beverages ($/100g edible portion) by food group.




Mean price per 100g edible portion is shown in Figure 2. As shown in Figure 2, the meat/poultry/fish group was significantly higher in mean price compared to all other food groups ($p<0.001$).

**Figure 3.** Mean price of foods and beverages ($/1000 kcal) by food group.

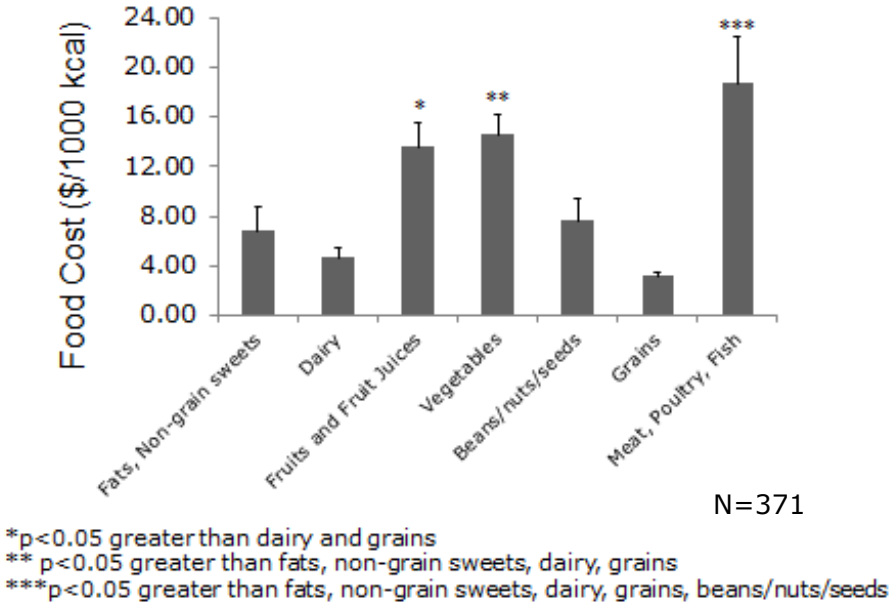
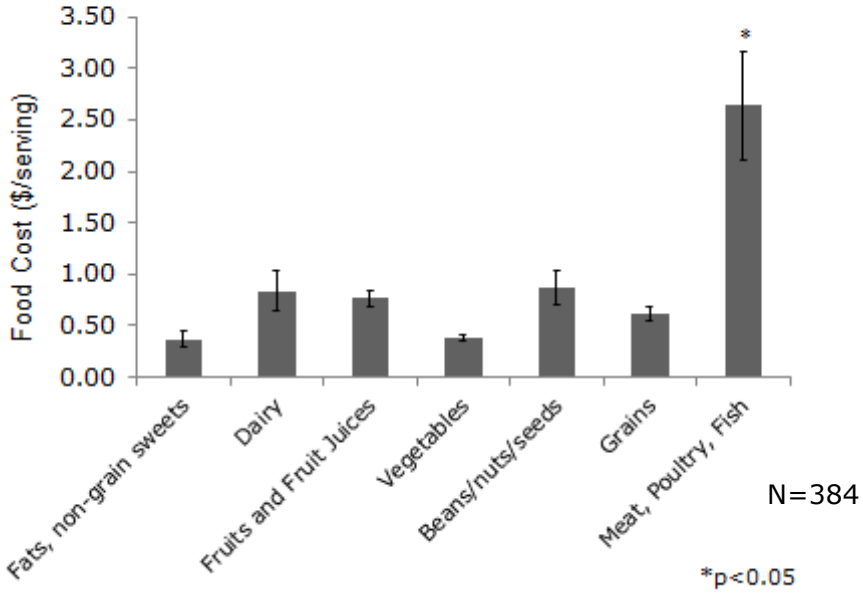



Figure 3 shows that in addition to the meat/poultry/fish food group, the fruit/fruit juices and vegetable groups cost more per 1000 kcal than did the other food groups ($p<0.05$).

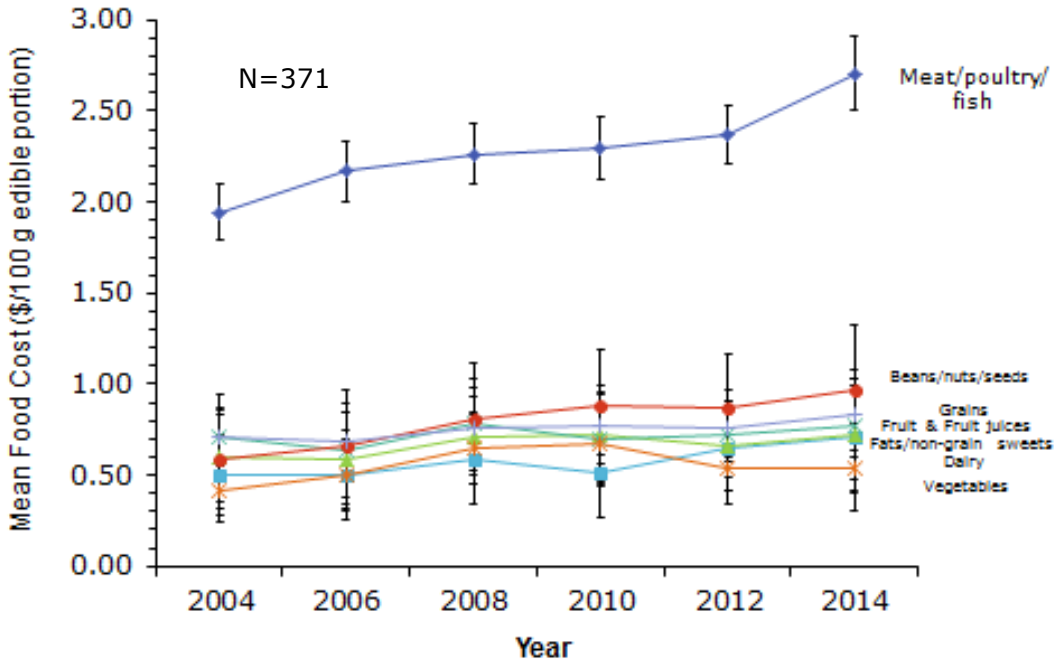
**Figure 4.** Mean price of foods and beverages ($/serving) by food group.



Similarly to Figure 2, Figure 4 shows that the meat/poultry/fish group was significantly higher in mean price compared to all other food groups ($p<0.05$).

Figures 5-7 show that both the trend of elevated mean price of meat/poultry/fish for all three measures and additionally the increased mean price of fruits and vegetables for price per 1000 kcal have held relatively constant over the entire study period of 2004-2014.

**Figure 5.** Trend of food prices over time by food group with price expressed as price per edible portion.




As shown in Figure 5, the meat/poultry/fish group was significantly higher in price than all other food groups.

**Figure 6.** Trend of food prices over time by food group with price expressed as price per 1000 kcal.

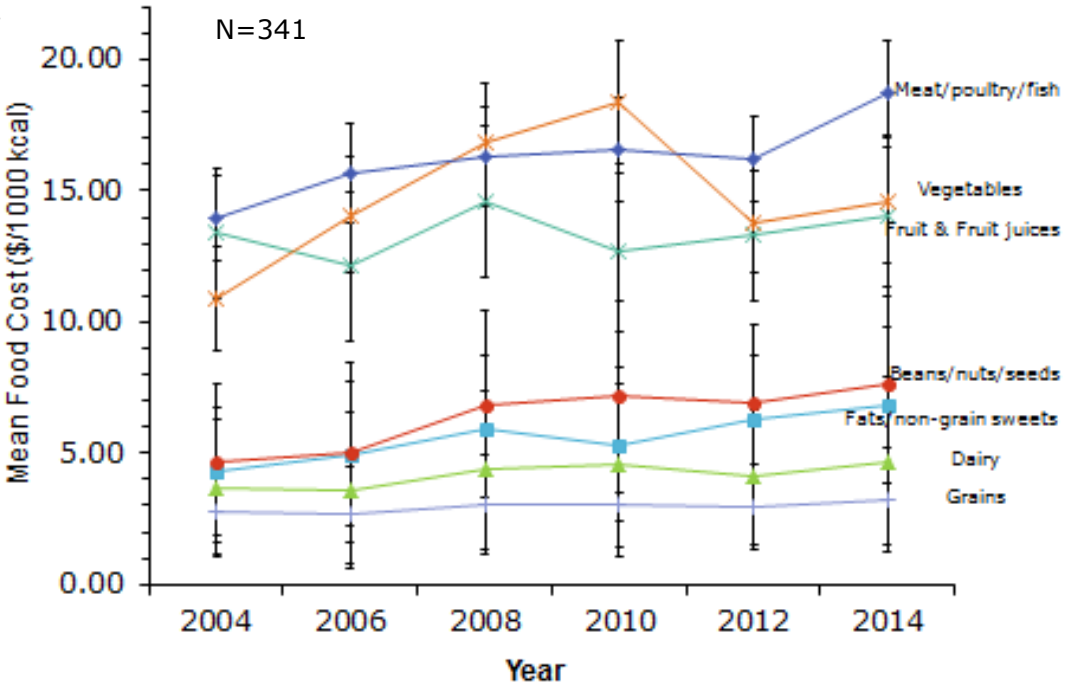
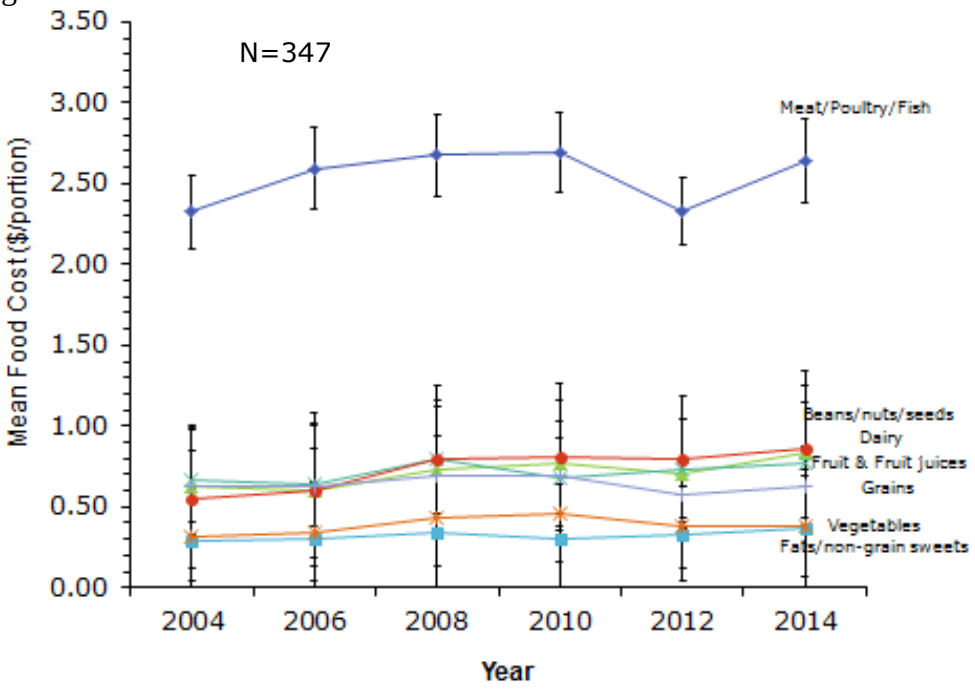



Figure 6 shows that in addition to the meat/poultry/fish food group, the fruit/fruit juices and vegetable groups cost more per 1000 kcal than did the other food groups. This trend was constant over time.

**Figure 7.** Trend of food prices over time by food group with price expressed as price per serving.




As shown in Figure 7, the meat/poultry/fish group was significantly higher in mean price compared to the other food groups and this trend was consistent over time.

Table 2 shows the mean prices for 2014 for all foods and beverages and for each food group. Again, the meat/poultry/fish group had the highest price by all three measures: $2.71/100 g EP, $18.70/1000 kcal, and $2.64/serving. The food groups with the lowest prices varied by measure: the vegetable group had the lowest average price for price/EP ($0.54), the grain group was lowest for price/1000 kcal ($3.20), and for price/serving, the lowest price was found in either the fat/non-grain sweets group and the vegetable ($0.37 and $0.38 respectively).

**Table 2.** Mean 2014 prices for total foods and each food group. Price expressed by $/100 g EP, $/1000 kcal, and $/serving. Standard error and 95% confidence interval are shown for each value.

| | $/100 g edible portion | | | | $/1000 kcal | | | | $/serving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample size | Mean | Standard Error | 95% CI | Sample size | Mean | Standard Error | 95% CI | Sample size | Mean | Standard Error | 95% CI |
| All Foods and Beverages | 373 | 1.20 | 0.10 | (0.99, 1.40) | 371 | 10.54 | 1.0 | (8.56, 12.53) | 384 | 1.06 | 0.13 | (0.81, 1.32) |
| Fats/Non-grain Sweets | 40 | 0.70 | 0.11 | (0.47, 0.94) | 39 | 6.82 | 1.99 | (2.79, 10.86) | 44 | 0.37 | 0.08 | (0.21, 0.53) |
| Dairy | 34 | 0.72 | 0.13 | (0.46, 0.98) | 34 | 4.70 | 0.80 | (3.07, 6.34) | 34 | 0.84 | 0.19 | (0.45, 1.23) |
| Fruits and Fruit Juices | 40 | 0.75 | 0.09 | (0.55, 0.94) | 39 | 13.59 | 1.94 | (9.65, 17.52) | 40 | 0.77 | 0.08 | (0.61, 0.92) |
| Vegetables | 60 | 0.54 | 0.05 | (0.44, 0.64) | 60 | 14.60 | 1.63 | (11.33, 17.87) | 60 | 0.38 | 0.03 | (0.32, 0.44) |
| Beans/Nuts/Seeds | 25 | 0.96 | 0.19 | (0.56, 1.36) | 25 | 7.62 | 1.87 | (3.76, 11.47) | 25 | 0.86 | 0.17 | (0.52, 1.21) |
| Grains | 88 | 0.84 | 0.05 | (0.74, 0.94) | 88 | 3.20 | 0.26 | (2.68, 3.71) | 94 | 0.62 | 0.07 | (0.49, 0.75) |
| Meats/Poultry/Fish | 86 | 2.71 | 0.39 | (1.93, 3.49) | 86 | 18.70 | 3.72 | (11.29, 26.10) | 87 | 2.64 | 0.53 | (1.60, 3.69) |

Table 3 shows the relative and absolute price changes between the 2004 and 2014 pricing data for mean price of total foods and mean prices of individual food groups. There was a >44% increase in mean total price between 2004 and 2014 with an average increase of 7.33% per year. The actual increases in prices between 2004 and 2014 for all foods and beverages were $0.29/100 g EP, $2.47/1000 kcal, and $0.29/serving. The average absolute increases per year for prices was $0.01 to $0.13/100 g EP, $0.08 to $0.62/1000 kcal per year, and $0.01 to $0.06/serving.

The greatest relative change of >60% occurred within the beans/nuts/seeds group with an absolute price change of $0.37/100 g EP, $2.59/1000 kcal, and $0.29/serving between 2004 and 2014. The second highest relative change of >52% occurred within the meat/poultry/fish group. The least amount of change between 2004 and 2014 occurred within the dairy group (>23%), followed by the fruit and fruit juices group (>29%). The actual changes in mean price between 2004 and 2014 for the dairy group were $0.12/100 g EP, $1.01/1000 kcal, and $0.21/serving.

**Table 3:** The relative and absolute price changes between 2004 and 2014 overall and by MyPyramid food groups.

| | | All Foods and Beverages | Fats/ non-grain sweets | Dairy | Fruits & Fruit Juices | Vegetables | Beans/Nuts /Seeds | Grains | Meats/Poultry /Fish |
|---|---|---|---|---|---|---|---|---|---|
| **Relative Change in Price (%)** | | | | | | | | | |
| | $/100g EP | 44.3 | 46.8 | 23.2 | 29.2 | 39.9 | 60.2 | 44.7 | 55.3 |
| | $/1000 kcal | 44.2 | 47.0 | 23.3 | 29.2 | 40.0 | 60.2 | 44.6 | 52.1 |
| | $/serving | 44.5 | 46.8 | 23.2 | 29.2 | 39.9 | 60.2 | 44.7 | 52.1 |
| **Actual Change in Price ($)** | | | | | | | | | |
| | $/100g EP | 0.29 | 0.21 | 0.12 | 0.06 | 0.12 | 0.37 | 0.13 | 0.76 |
| | $/1000 kcal | 2.47 | 2.53 | 1.01 | 0.71 | 3.71 | 2.59 | 0.46 | 3.18 |
| | $/serving | 0.29 | 0.13 | 0.21 | 0.08 | 0.07 | 0.29 | 0.07 | 0.34 |

Energy Density

Figures 8-10 show the relationship between the quintiles of energy density for the 2014 pricing data. Figures 8 and 10 show that Q1, which contained the least energy dense foods, was the lowest in price per 100 g EP and price per serving. However, Figure 9 shows that the least energy dense foods (Q1 and Q2) were significantly higher in mean price ($/1000 kcal) compared to the other three quintiles. When comparing price per 1000 kcal more energy dense foods were significantly less costly per calorie than were less energy dense foods, consistent with the findings in previous papers.[14, 15]

**Figure 8.** Mean price of energy density quintiles in 2014 expressed in price per edible portion.

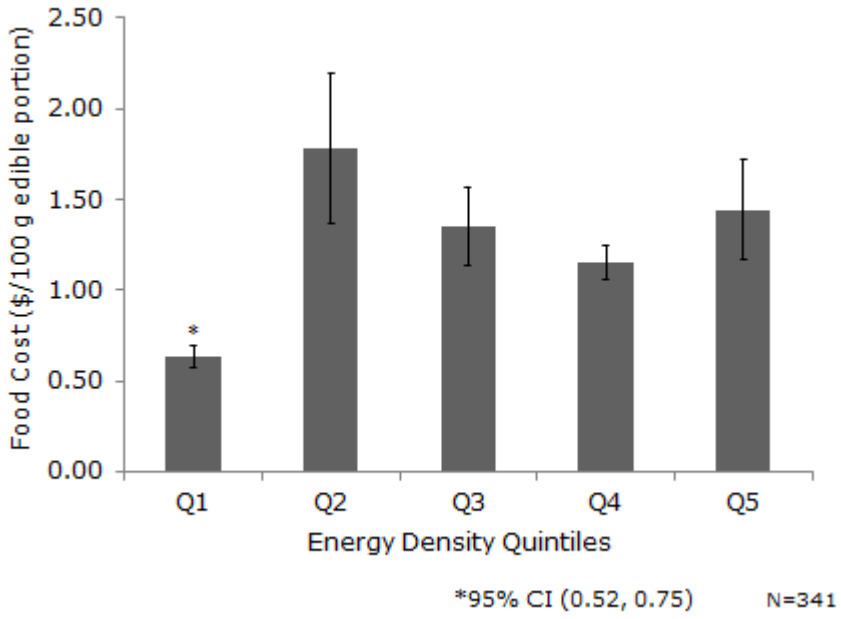
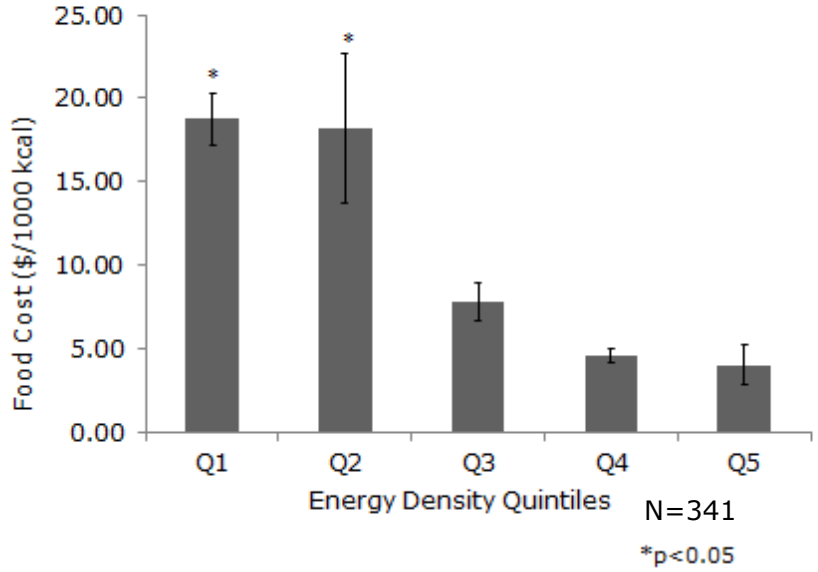



Figure 8 shows that Q1 is significantly lower in price per 100 g EP compared to higher energy density quintiles.

**Figure 9.** Mean price of energy density quintiles in 2014 expressed in price per 1000 kcal.




As shown by Figure 9, the lowest energy density quintiles, Q1 and Q2, are significantly higher in price compared to Q3-Q5.

**Figure 10.** Mean price of energy density quintiles in 2014 expressed in price per serving.

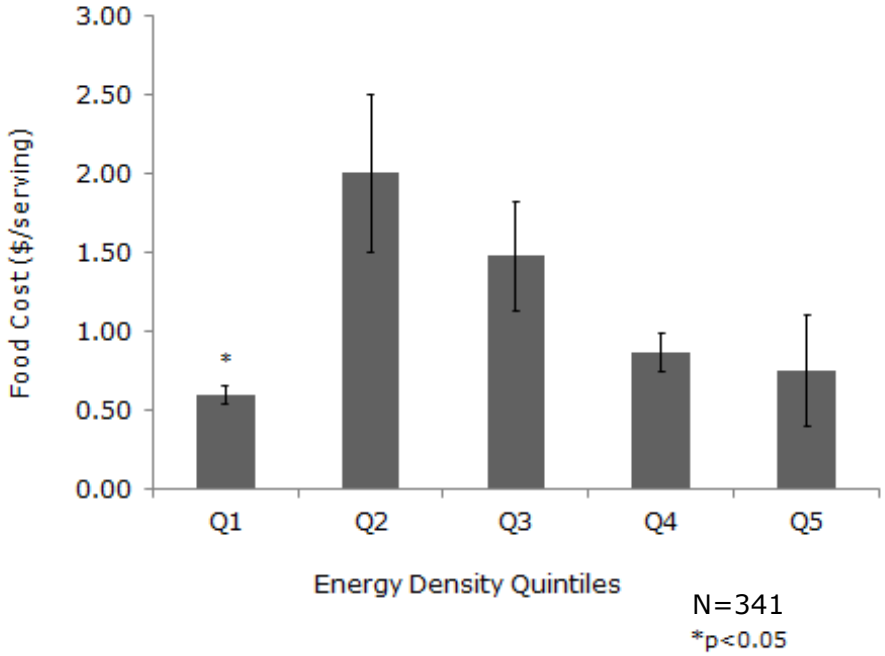
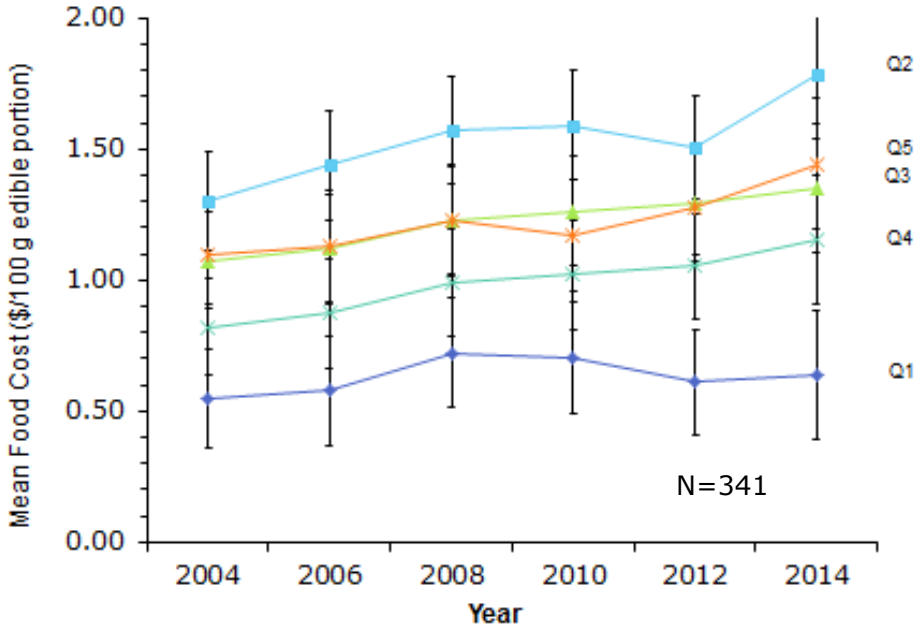



Figure 10 shows that Q1 is significantly lower in price per serving compared to the higher energy density quintiles.

Figures 11-13 show trends in pricing data over time characterized by energy density. Trends differ between each measure of price but are relatively consistent with patterns seen in the 2014 data.

**Figure 11.** Trend of food prices over time by energy density with price expressed as price per edible portion.




As shown in Figure 11, trends in pricing data for price per 100 g EP show that Q1 has remained consistently lower in price than the other energy density quintiles over time.

**Figure 12.** Trend of food prices over time by energy density with price expressed as price per 1000 kcal.

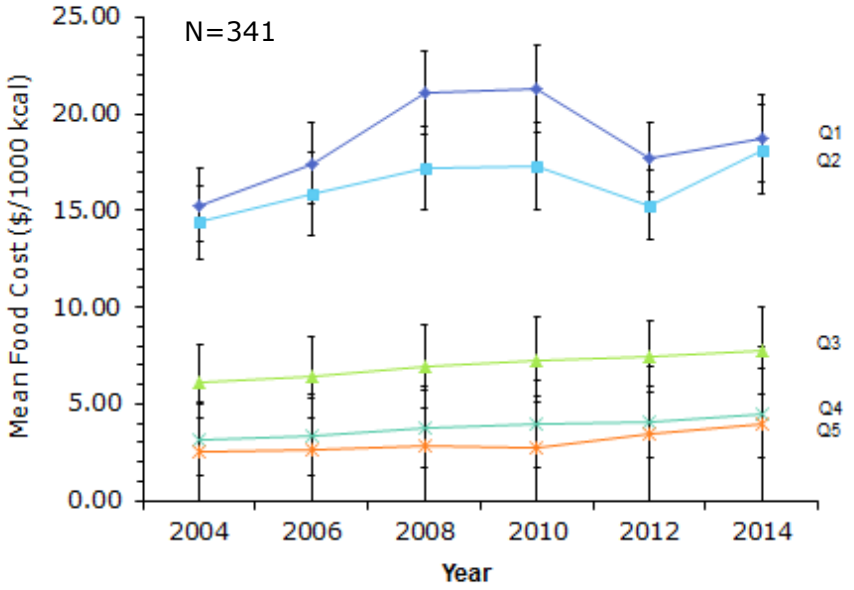
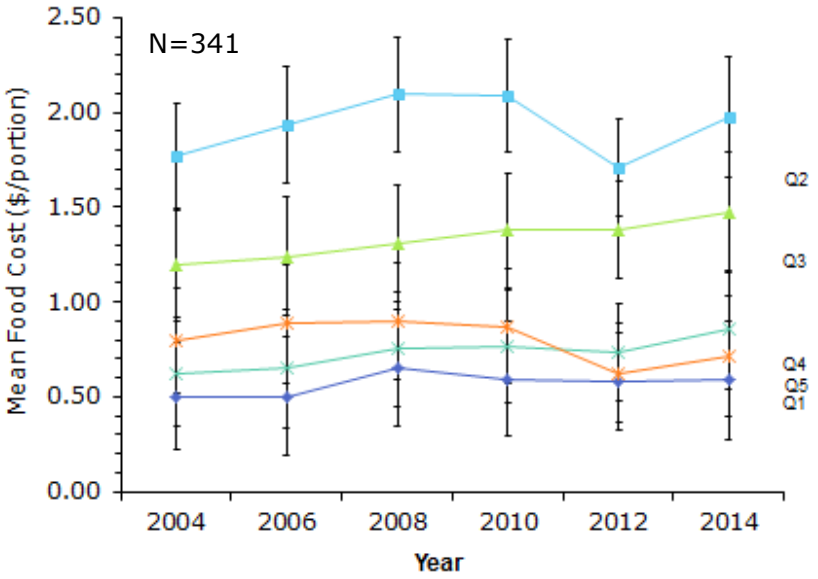



Figure 12 shows that the least energy dense foods (Q1 and Q2) consistently cost significantly more than Q3-Q5 over time.

**Figure 13.** Trend of food prices over time by energy density with price expressed as price per serving.




In Figure 13, trends in pricing data for price per serving show that energy density quintile Q1 consistently has the least mean price over time compared to other energy density quintiles.

Nutrient Density

Both measures of nutrient density, NNR and $NRF_{9.3}$, resulted in similar patterns of increasing price with foods and quintiles of increasing nutrient density. For the NNR measure of nutrient density, Q5, the highest quintile of nutrient density was significantly higher in price than the other four quintiles for all three measures of price ($/100 g EP, $/1000 kcal, $/serving).

**Figure 14.** Mean price of nutrient density quintiles (NNR) in 2014 expressed in price per 100 g edible portion.

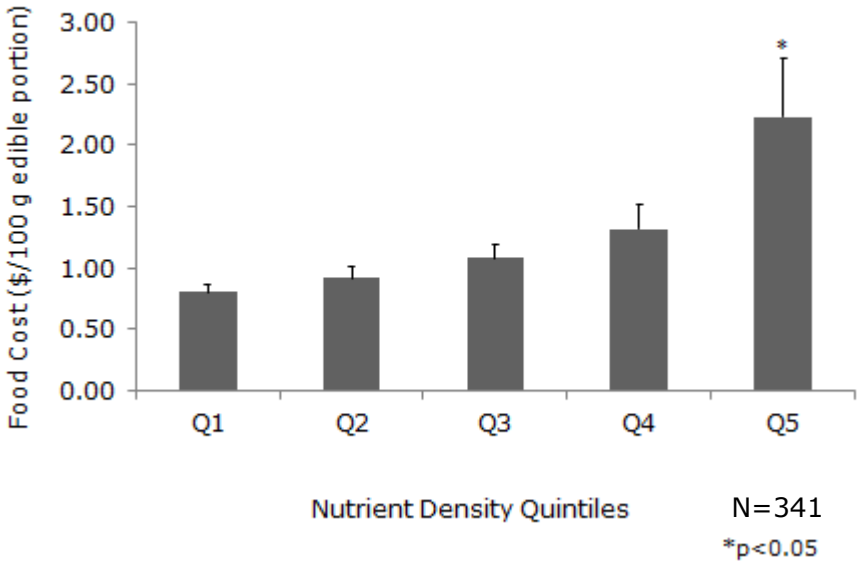
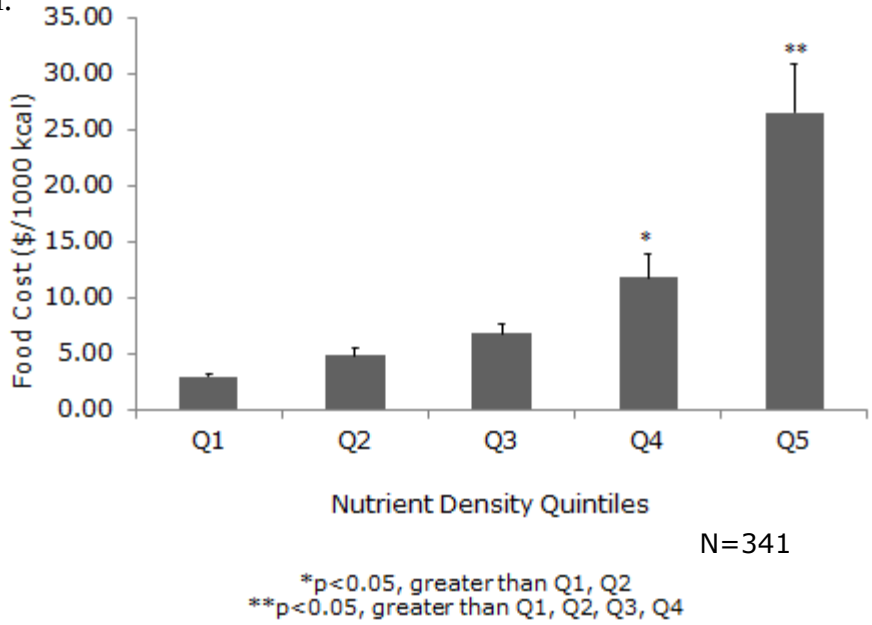



Figure 14 illustrates that Q5, the highest quintile of nutrient density was significantly higher in price than the other four quintiles.

**Figure 15.** Mean price of nutrient density quintiles (NNR) in 2014 expressed in price per 1000 kcal.




As shown in Figure 15, the highest nutrient density quintiles (Q4 and Q5) are significantly higher in price compared to less nutrient dense quintiles. It appears that there was some stepwise pattern of increasing cost with increasing nutrient density quintile such as the increase between Q1-Q3, Q4, and Q5 as seen in Figure 15.

**Figure 16.** Mean price of nutrient density quintiles (NNR) in 2014 expressed in price per serving.

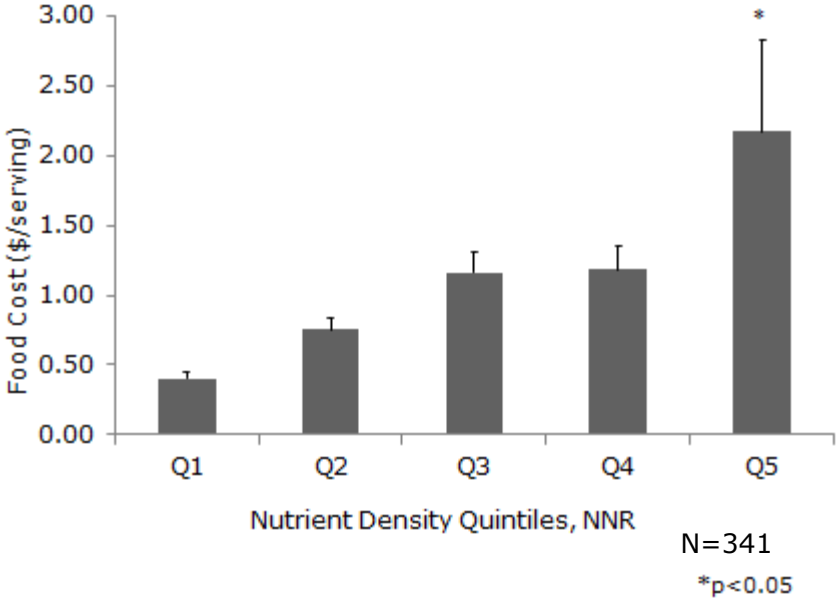



Figure 16 shows that the highest nutrient density quintile is significantly higher in price compared to lower quintiles.

**Figure 17.** Trend of food prices over time by nutrient density (NNR) with price expressed as price per 100 g edible portion.

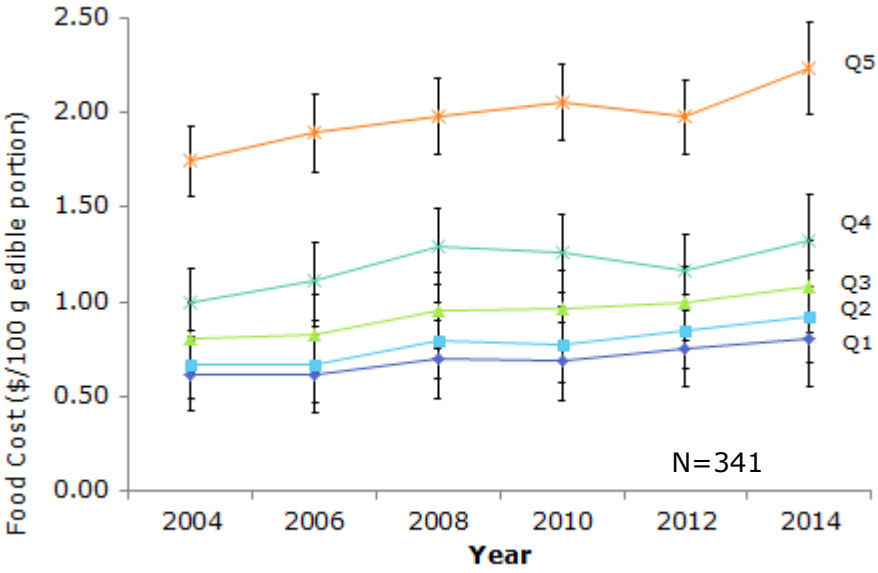
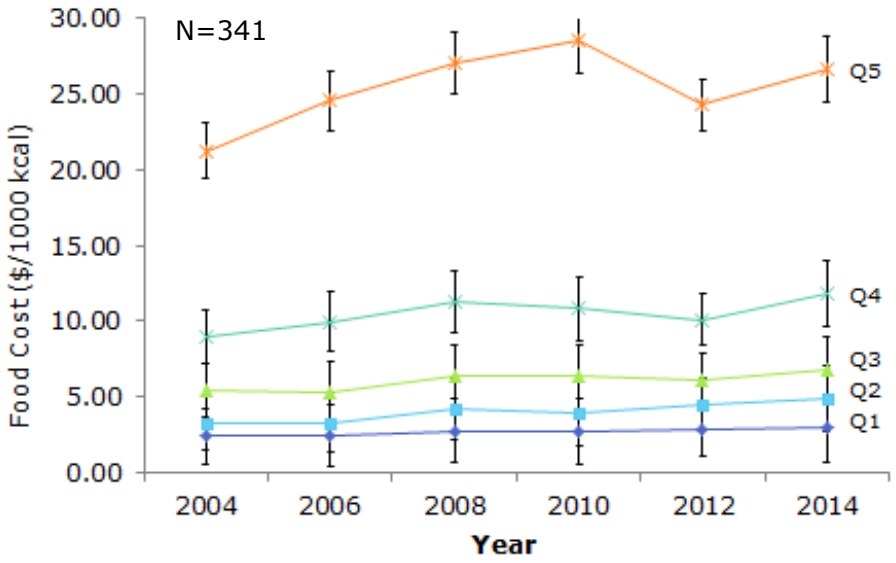



Figure 17 shows that the pattern of increasing price with increasing nutrient density seen in the 2014 results for price per 100 g edible portion has remained constant over time. The most

nutrient dense quintile (Q5) is significantly higher in price compared to the lower quintiles of nutrient density over time.

**Figure 18.** Trend of food prices over time by nutrient density (NNR) with price expressed as price per 1000 kcal.




As shown in Figure 18, food prices increase with increased nutrient density and this pattern is consistent over the length of the study. The highest quintile of nutrient density is significantly higher in price than the other quintiles of nutrient density regardless of which measure of price is used for analysis.

**Figure 19.** Trend of food prices over time by nutrient density (NNR) with price expressed as price per serving.

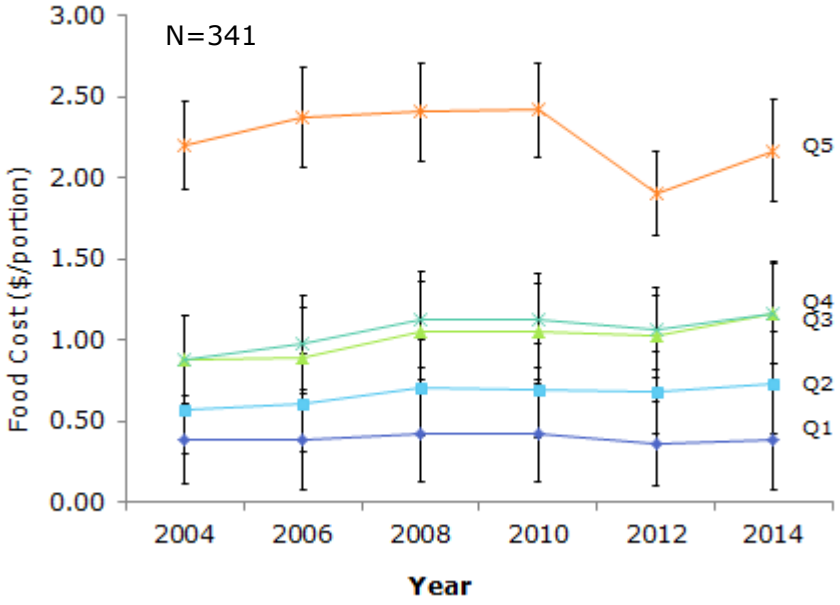



Figure 19 also shows a pattern of increasing price with increasing nutrient density for each time point in the study. A drop in price for Q5 is shown at 2012 but the trend still occurs and Q5 remains significantly higher in price than the other quintiles.

**Figure 20.** Mean price of nutrient density quintiles ($NRF_{9.3}$) in 2014 expressed in price per 100 g edible portion.

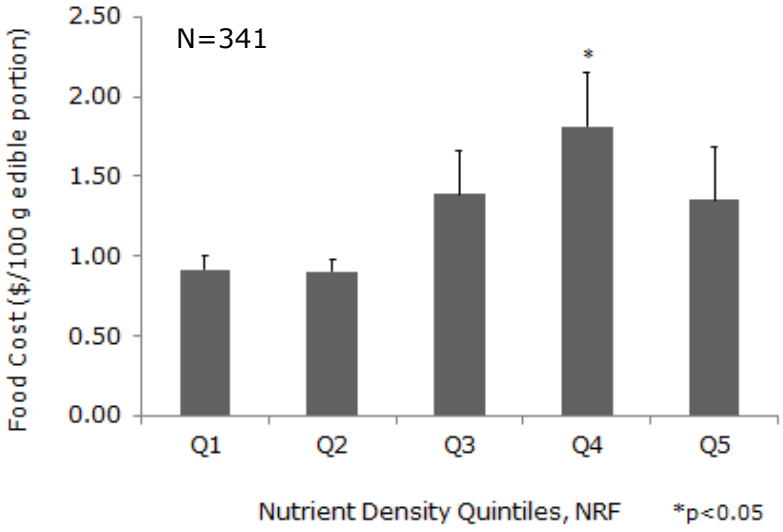


Figure 20 shows that Q4 is significantly higher in price rather than Q5 as seen with the NNR results shown in Figure 14. However, Q4 also represents high nutrient density foods and shows that higher nutrient density is associated with significantly higher food prices.

**Figure 21.** Mean price of nutrient density quintiles ($NRF_{9.3}$) in 2014 expressed in price per 1000 kcal.

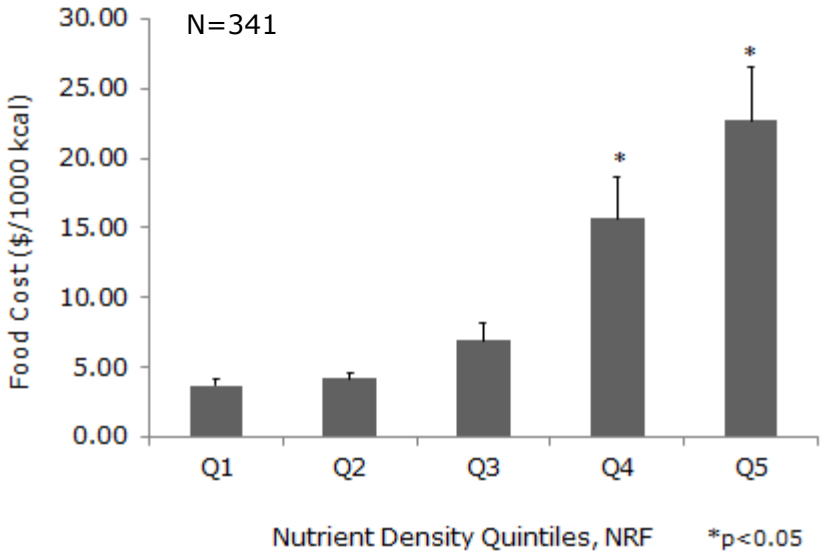



Figure 21 is consistent with trends for NNR and shows significantly higher prices with higher nutrient density. Q4 and Q5 are significantly higher in price than the lower nutrient density foods represented by the lower quintiles.

**Figure 22.** Mean price of nutrient density quintiles ($NRF_{9.3}$) in 2014 expressed in price per serving.

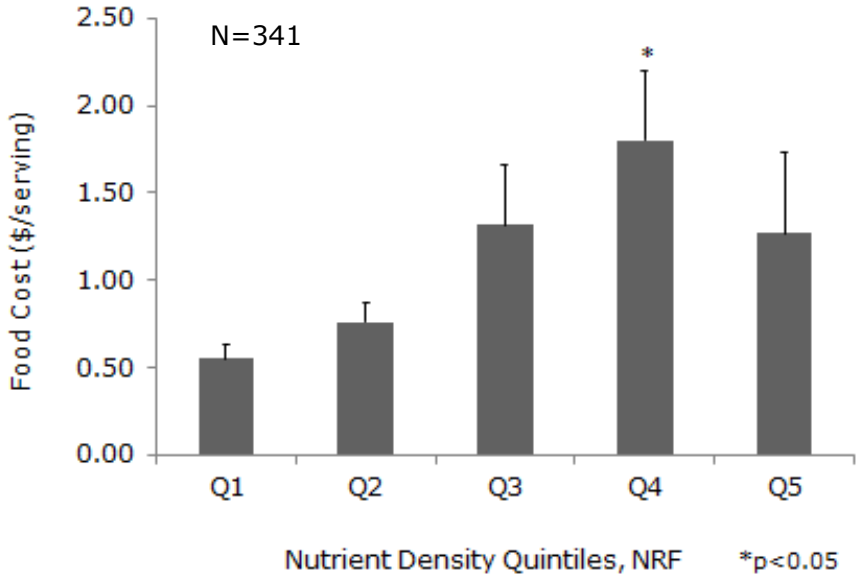
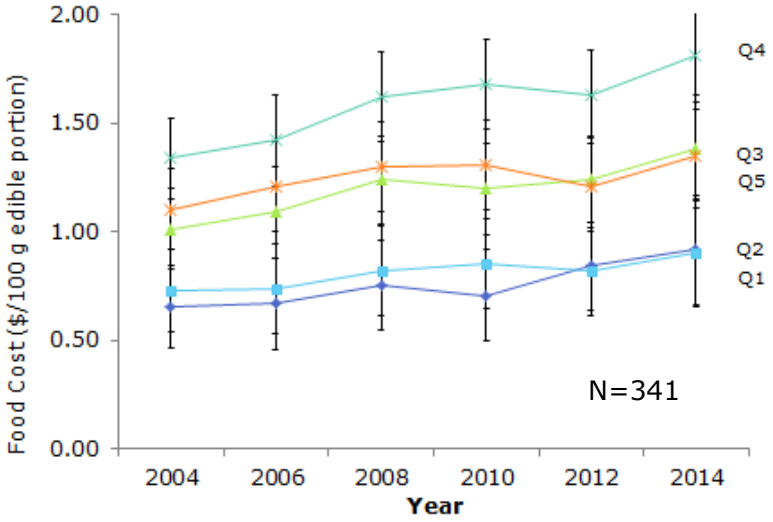



Figure 22 is similar to Figure 20 in that Q4 is significantly higher in price than the other quintiles of nutrient density and nutrient dense foods are significantly more costly.

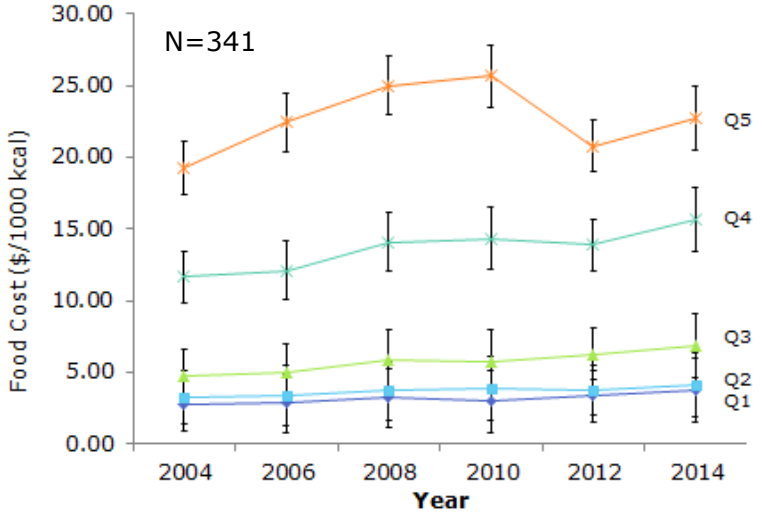
Again, the pattern of increasing price with increasing nutrient density was relatively consistent between both measures of nutrient density, NNR and $NRF_{9.3}$. However, the $NRF_{9.3}$ results show that the highest price quintile is more often Q4 rather than Q5 as seen with NNR. Q4 still contains high nutrient density foods and supports the result that the price of nutrient dense foods is significantly higher than low nutrient density foods. Trends over time are consistent with the trends seen in 2014.

**Figure 23.** Trend of food prices over time by nutrient density ($NRF_{9.3}$) with price expressed as price per 100 g edible portion.




As shown in Figure 23, there is separation between different levels of nutrient density. Higher quintiles of nutrient density have a higher mean price while lower quintiles of nutrient density have a lower mean price.

**Figure 24.** Trend of food prices over time by nutrient density ($NRF_{9.3}$) with price expressed as price per 1000 kcal.




The trends in Figure 24 for price per 1000 kcal continue to be consistent with the other measures of food cost and also with trends for NNR seen in Figures 17-19.

**Figure 25.** Trend of food prices over time by nutrient density ($NRF_{9.3}$) with price expressed as price per serving.

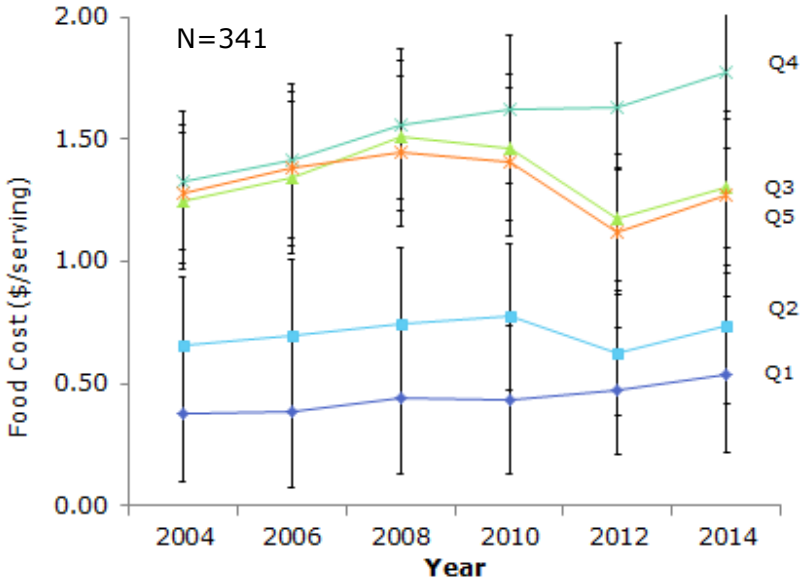
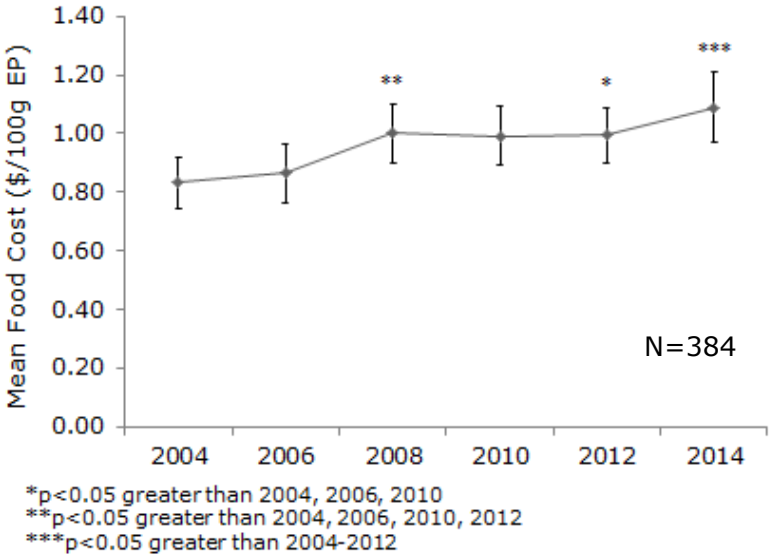



Figure 25 shows that Q4 had the highest mean price per serving compared to the other nutrient density quintiles at each time point. Q2, Q3, Q5 appear to have decreased in mean price in 2010-2012 before increasing in 2014. However, Q1 and Q4 appear to have held constant or increased with time.

Overall Trends: 2004-2014

Despite some fluctuation in the rate of increase, food prices have been climbing over time. Figures 26-28 illustrate trends of total mean food prices from 2004-2014 expressed with the three different food cost measures. In all three trends, the 2014 mean total food price was significantly the highest amount.

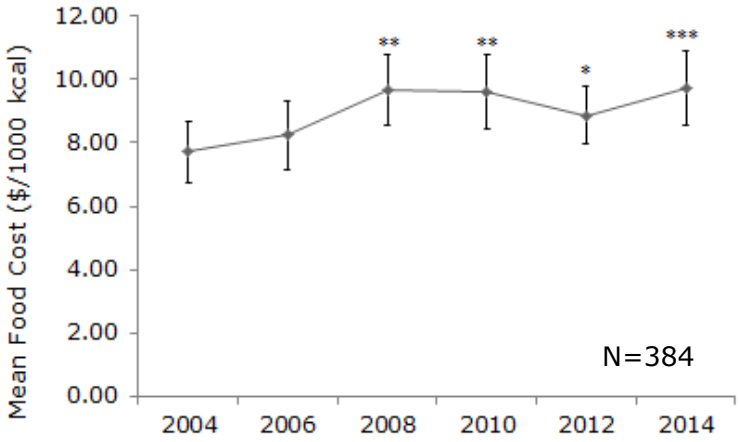
**Figure 26.** Mean Price Total Foods 2004-2014 expressed as price per 100 g edible portion.




*p<0.05 greater than 2004, 2006, 2010
**p<0.05 greater than 2004, 2006, 2010, 2012
***p<0.05 greater than 2004-2012

In Figure 26, the 2014 mean for total foods and beverages expressed as 100 g edible portion was significantly higher than the mean price at all other time points.

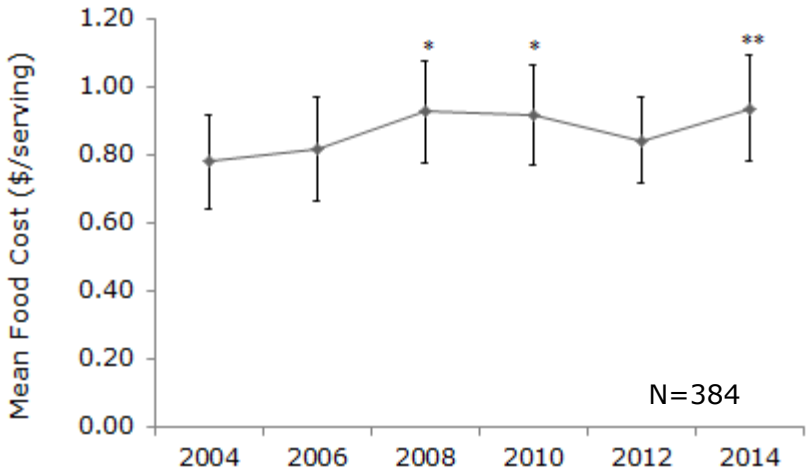
**Figure 27.** Mean Price Total Foods 2004-2014 expressed as price per 1000 kcal.




*p<0.05 greater than 2004
**p<0.05 greater than 2004, 2006
***p<0.05 greater than 2004, 2006, 2012

Figure 27 shows that mean prices for total foods and beverages expressed as price per 1000 kcal have increased significantly since 2004.

**Figure 28.** Mean Prices Total Foods 2004-2014 expressed as price per serving.




*p<0.05 greater than 2004, 2006
**p<0.05 greater than 2012

In Figures 27-28, the 2014 mean price was significantly higher than some years but others were not significantly different from 2014 and showed more variability in mean prices throughout the years of this study. All three figures also show an increase in prices in 2008 and 2010 compared to earlier years and the spike in price was consistent with worldwide food price increases during this time showing that costs were being passed to the consumer.[24]

Table 4 shows relative prices that were reported in earlier papers with two years of data, four years of data, and the current data with 11 years total. Relative and actual price changes are reported for the 2004-2014 period. Overall, prices have increased with time. A disparity in the level of percent increase is seen with both energy density and nutrient density with the 2 year and 4 year data. The 11 year data showed a higher relative increase for the most energy dense foods and only a slightly higher rate of increase for the highest nutrient density compared to the lowest. When comparing actual prices rather than relative price changes for the 11 year data, the change in the most energy dense and least nutrient dense foods were for prices that were originally much lower to begin with ($2.57 and $2.38 respectively) compared with 2004 prices for the least

energy dense and most nutrient dense foods ($15.27 and $21.23 respectively). So even with a >55% increase in price for most energy dense foods, the 2014 price was much less ($4.01) than that of the least energy dense foods ($18.75) and similarly for the price changes in most ($26.57) versus least ($2.97) nutrient dense foods.

**Table 4.** Relative price changes for 2 year, 4 year, and 11 year data. Actual price changes also reported for 11 year data.

| **$/1000 kcal** | 2-yr price relative change[a] | 4-yr price relative change[b] | 11-yr price relative change | 2004 actual mean price | 2014 actual mean price | 11-yr price change actual |
|---|---|---|---|---|---|---|
| Least Energy Dense | +19.5% | +41% | +22.8% | $15.27 | $18.75 | $3.48 |
| Most Energy Dense | - 1.8% | +12.2% | +55.7% | $2.57 | $4.01 | $1.44 |
| Most Nutrient Dense (NNR) | | +29.2% | +25.1% | $21.23 | $26.57 | $5.34 |
| Least Nutrient Dense (NNR) | | +16.1% | +24.6% | $2.38 | $2.97 | $0.59 |

a. 2-year price changes reported by Monsivais and Drewnowski, 2007
b. 4-year price changes reported by Monsivais, McLain, Drewnowski, 2010

**Discussion:**

While prices have not continued to rise as quickly as pricing trends observed from 2004-2010, mean prices collected in 2014 remain elevated compared to 2004 prices. Additionally, the disparity in prices between nutrient dense foods and least nutrient dense foods continued over time. The highest quintiles of nutrient density were significantly more costly than lower nutrient density quintiles for all measures of price: $/100 g EP, $/1000 kcal, and $/serving. The increased price for nutrient dense foods supports the idea that while food prices are changing at various rates, nutrients are becoming more costly with time.

Further analysis might warrant further separating fish from the meat/poultry/fish group in order to better describe how various animal protein sources compare to other food groups and food characteristics because the high seafood prices are likely influencing the results by increasing the mean food prices.

Table 5 compares the rate of inflation estimated by the Consumer Price Index for foods and beverages for the same period of time covered by this study (2004-2014). The CPI calculated interest for 2004 to 2014 is 29.9%. Mean prices for each measure of price were adjusted for inflation using the CPI estimate and then compared to the actual percent increase observed in the study. The rate of inflation differed between the two methods: 32.2%, 24.6%, and 38.8% increase compared to the estimated 29.9% amount of inflation.

The differences in inflation compared to the CPI estimate and the actual change in prices may be due to several factors. The CPI market basket is made up of ~70 foods and beverages whereas this study includes >380 foods and beverages. The CPI market basket reflects current purchasing behaviors of the American population and selects for the most purchased foods and then weights the items depending on amount purchased by consumers. The market basket for this

study is comprised of a variety of foods from all food groups. The CPI market basket likely has a low representation of healthier food options because of common purchasing and consumption patterns of the US population compared to the current market basket which has all types of foods including a wide selection of healthier food choices. Additionally, the CPI measures national data whereas this study only included the Seattle metropolitan area. Despite the differences named, the two estimates are relatively close (2.3% to 8.9% difference) and support the potential to apply this data more broadly than the Seattle metropolitan area.

**Table 5.** Inflation (2004-2014) of food and beverages from CPI compared with measured increase from 2004 and 2014 pricing data.

| | Actual mean price 2004 | Estimated price w/ inflation | Actual mean price 2014 | % increase inflation(CPI food & bev) | Actual % increase |
|---|---|---|---|---|---|
| $/100 g EP | $0.90 | $1.17 | $1.19 | 29.9% | 32.2% |
| $/1000 kcal | $8.20 | $10.65 | $10.35 | 29.9% | 24.6% |
| $/serving | $0.80 | $1.04 | $1.11 | 29.9% | 38.8% |

The relative change in food prices depended on the measure of price used to evaluate the data. Despite controversy on the validity of all measures of food cost, applications exist for the different measures of food cost. Some of the arguments against $/kcal as a valid measure of food cost are based on the idea that an individual might eat 100 kcal of chocolate at one sitting but would be less likely to eat 100 kcal of broccoli (about 3.5 cups).[19] However, price per calorie is applicable to determining food costs and would be best able to define the price of nutrients and would be useful for dietary recommendations and the evaluation of dietary patterns rather than focusing solely on individual foods. Emphasizing and applying information about the price of nutrient dense calories would be an important tool in nutrition education. The implication of increasing price per nutrient per calorie, including foods in the meat/poultry/fish, vegetable, and

fruit and fruit juice food groups, is that it is more expensive for an individual to purchase a nutrient dense diet.

Price per serving may be more applicable to creating direct consumer education materials, programs and recommendations because the US population is typically more familiar with descriptions of a serving compared to the weight of a food or even the amount of a food needed to reach a specific amount of calories. Both number and amount of servings and calorie targets are part of current dietary recommendations. All three measures of food cost could be used to show pricing trends over time.

The strengths of this study are the length of time used for data collection: six data points over 11 years. Another strength is the market basket due to the large number of foods (>380) and the wide variety of foods that include healthy and less healthy options and include a number of ethnic foods. The study compares trends between four different ways to describe and categorize food items (food groups, energy density, NNR, and $NRF_{9.3}$) and three different measures of food cost ($/100 g EP, $/1000 kcal, and $/serving) which allowed for comparison of trends for consistency and differences in trends at different time points and trends overall.

The limitations of this study include the fact that the market basket does not necessarily represent the most commonly purchased/consumed foods by the American population. Additionally, foods and beverages all have equal contribution to the analyses and are not weighted to reflect purchasing patterns. Another limitation is that this is a cross-sectional study and causal inferences cannot be drawn from the data. Also, food prices vary over geographical region and seasonally – the pricing data is limited to a portion of supermarkets in the Seattle metropolitan area. Despite the limitation of being data from a very specific, small area of the nation, these data were able to reflect worldwide food price "crisis" that occurred in 2008-2010

as reported by the Food and Agricultural Organization of the United Nations (FAO).[25] Finally, food prices do not take coupons, store-loyalty discounts, and sales into account when assessing the price of food items. The potential decreases to food prices offered by these various discounts represent increased affordability of food items for consumers.

Strategies that will improve purchasing behaviors and healthy dietary choices including policies and regulations that promote accessibility of nutrient dense foods are necessary as part of interventions to improve the consumption of nutrient dense foods by the US population. Surveillance methods to determine which foods are both nutrient dense and lower in price would likely be useful in assisting consumers and dietetic professionals in identifying what food items would give the most nutrients for the least amount of money.

Further application and research using this dataset should focus on identifying price trends for individual nutrients rather than solely on nutrient density as a whole. Analyses could lead to the evaluation of changes in price for nutrients like fiber and different vitamins for example.

Issues related to food prices are relevant because foods and nutrients associated with lowering chronic disease risk cost more than less nutrient-dense foods.[3, 5,15] A recently published meta-analysis found that, on average, healthier dietary patterns cost around $1.50 more per day and per 2,000 kcal than a diet comprised of less healthy foods.[13] This price difference leads to an increased cost of about $550 per year for an individual who is consuming a healthier diet.

As work to implement policies and interventions to decrease the gap between healthy and less healthy food consumption continues, the disparities in food prices should be considered in the context of the price of healthcare for chronic diseases that are related to poor dietary patterns. The economic burden of these chronic diseases is estimated to be more than $1,200 per year for

every American.[13] Thus, the benefits of consuming more nutritious foods now outweigh the future costs of chronic diseases.

Reducing barriers to nutritious foods should be viewed as a preventative, cost-saving strategy over the long term. The identification of food pricing trends is a necessary step in the development and implementation of strategies that will improve purchasing behaviors and healthy dietary choices.

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**Appendix 1.** Foods and beverages with assigned food groups and serving sizes.

| Foods and Beverages | Food Group | Serving size (grams) |
|---|---|---|
| Margarine, diet | Fats/non-grain sweets | 9.7 |
| Margarine, stick | Fats/non-grain sweets | 9.5 |
| Margarine, tub | Fats/non-grain sweets | 9.5 |
| Butter | Fats/non-grain sweets | 9.5 |
| Lard | Fats/non-grain sweets | 8.5 |
| Oil, olive | Fats/non-grain sweets | 9.0 |
| Oil, canola | Fats/non-grain sweets | 9.1 |
| Oil, soybean/cottonseed | Fats/non-grain sweets | 9.1 |
| Kool-Aid | Fats/non-grain sweets | 247.0 |
| Hi-C | Fats/non-grain sweets | 247.0 |
| Frutopia drink | Fats/non-grain sweets | 247.0 |
| Salad dressing, Italian | Fats/non-grain sweets | 29.4 |
| Dressing, salad, low calorie F | Fats/non-grain sweets | 32.5 |
| Dressing, salad, fat free Ital | Fats/non-grain sweets | 28.9 |
| ranch salad dressing, reg | Fats/non-grain sweets | 29.4 |
| mayo, real, reg | Fats/non-grain sweets | 27.5 |
| mayo, real, lowfat | Fats/non-grain sweets | 30.0 |
| mayo, real, nonfat | Fats/non-grain sweets | 32.0 |
| Candy, milk chocolate, plain | Fats/non-grain sweets | 43.0 |
| Jelly, jam | Fats/non-grain sweets | 20.0 |
| Honey | Fats/non-grain sweets | 21.2 |
| candy, snickers bar | Fats/non-grain sweets | 58.7 |
| candy, toffee | Fats/non-grain sweets | 14.0 |
| candy, lifesavers | Fats/non-grain sweets | 22.5 |
| licorice | Fats/non-grain sweets | 11.0 |
| jelly beans | Fats/non-grain sweets | 75.0 |
| Soft drink, Cola | Fats/non-grain sweets | 368.4 |
| Soft drink, non-cola | Fats/non-grain sweets | 369.6 |
| beer, regular | Fats/non-grain sweets | 356.4 |
| wine, red | Fats/non-grain sweets | 117.6 |
| wine, white | Fats/non-grain sweets | 117.6 |
| whiskey | Fats/non-grain sweets | 41.7 |
| Coffee, black | Fats/non-grain sweets | 236.8 |
| Tea, regular, black | Fats/non-grain sweets | 236.8 |
| Sugar, white | Fats/non-grain sweets | 8.3 |

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| espresso | Fats/non-grain sweets | 243.2 |
| slim-fast, liquid | Fats/non-grain sweets | 271.0 |
| ensure, liquid, cnd | Fats/non-grain sweets | 252.0 |
| instant breakfast, Carnation | Fats/non-grain sweets | 261.5 |
| soda, diet cola | Fats/non-grain sweets | 355.2 |
| soda, non-cola, diet | Fats/non-grain sweets | 355.2 |
| Sour cream | Dairy | 14.4 |
| soup, cheese | Dairy | 251.0 |
| pizza, vegetarian, fast food | Dairy | 172.0 |
| enchilada, cheese | Dairy | 166.0 |
| sauce cheese | Dairy | 60.8 |
| Cottage cheese, 2% fat | Dairy | 113.0 |
| Cottage cheese, 4% fat | Dairy | 105.0 |
| cheese, nonfat | Dairy | 28.4 |
| cheese, mozzarella | Dairy | 28.4 |
| Cheese, cheddar, reduced fat | Dairy | 28.4 |
| Cheese, cheddar | Dairy | 28.4 |
| Cheese, American, processed sl | Dairy | 28.4 |
| Yogurt, nonfat, fruit | Dairy | 245.0 |
| Yogurt, lowfat, plain | Dairy | 245.0 |
| Milk, whole | Dairy | 244.0 |
| Milk, 2% | Dairy | 244.0 |
| Milk, 1% | Dairy | 244.0 |
| Milk, skim | Dairy | 245.0 |
| Cream | Dairy | 240.0 |
| Cream, half and half | Dairy | 242.0 |
| Cream, nondairy, liquid | Dairy | 240.0 |
| cheese, ricotta, whole | Dairy | 123.0 |
| cream cheese | Dairy | 28.4 |
| Custard, baked | Dairy | 199.5 |
| ice cream, Neapolitan | Dairy | 66.0 |
| pudding, choc, from a box with | Dairy | 195.8 |
| sherbet | Dairy | 74.0 |
| icecream, choc, NF | Dairy | 65.0 |
| ice cream, vanilla, Lf | Dairy | 65.5 |
| frozen yogurt, NF, choc | Dairy | 79.5 |
| frozen yogurt, LF, vanilla | Dairy | 100.0 |
| shake, hard ice cream | Dairy | 169.8 |
| shake, softserve | Dairy | 141.0 |

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| hot chocolate | Dairy | 274.3 |
| Apples, fresh, with skin | Fruit and Fruit Juices | 149.0 |
| Pear, fresh | Fruit and Fruit Juices | 178.0 |
| pears, canned | Fruit and Fruit Juices | 125.5 |
| Banana, fresh | Fruit and Fruit Juices | 118.0 |
| Peaches, canned | Fruit and Fruit Juices | 131.0 |
| Peaches, fresh | Fruit and Fruit Juices | 150.0 |
| Nectarine, fresh | Fruit and Fruit Juices | 142.0 |
| Plums, fresh | Fruit and Fruit Juices | 66.0 |
| Apricots, fresh | Fruit and Fruit Juices | 35.0 |
| apricots, canned | Fruit and Fruit Juices | 126.5 |
| Apricots, dried | Fruit and Fruit Juices | 14.0 |
| Prunes, dried | Fruit and Fruit Juices | 43.5 |
| Raisins | Fruit and Fruit Juices | 36.3 |
| Tangerines, fresh | Fruit and Fruit Juices | 176.0 |
| Cantaloupe | Fruit and Fruit Juices | 138.0 |
| Watermelon | Fruit and Fruit Juices | 152.0 |
| Strawberries, fresh | Fruit and Fruit Juices | 83.0 |
| kiwi, fresh | Fruit and Fruit Juices | 138.0 |
| fruit cocktail | Fruit and Fruit Juices | 121.0 |
| Blueberries, frozen | Fruit and Fruit Juices | 115.0 |
| Applesauce | Fruit and Fruit Juices | 123.0 |
| Grapes | Fruit and Fruit Juices | 75.5 |
| pineapple, canned | Fruit and Fruit Juices | 124.5 |
| orange jucie | Fruit and Fruit Juices | 249.0 |
| Grapefruit juice | Fruit and Fruit Juices | 247.0 |
| Grape juice | Fruit and Fruit Juices | 253.0 |
| Apple juice | Fruit and Fruit Juices | 248.0 |
| Mango, fresh | Fruit and Fruit Juices | 168.0 |
| blueberries, fresh | Fruit and Fruit Juices | 74.0 |
| blackberries, fresh | Fruit and Fruit Juices | 72.0 |
| raspberries, fresh | Fruit and Fruit Juices | 61.5 |
| pineapple, fresh | Fruit and Fruit Juices | 82.5 |
| cherries, fresh | Fruit and Fruit Juices | 77.0 |
| strawberries, frozen | Fruit and Fruit Juices | 127.5 |
| Oranges, fresh | Fruit and Fruit Juices | 131.0 |
| Grapefruit, fresh | Fruit and Fruit Juices | 128.0 |
| beve, water (water as a bevera | Fruit and Fruit Juices | 237.0 |
| Vitamin E-fortified juice | Fruit and Fruit Juices | 247.0 |

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| Vitamin C-fortified juice | Fruit and Fruit Juices | 247.0 |
| Calcium-fortified juice | Fruit and Fruit Juices | 247.0 |
| String beans, canned | Vegetables | 76.5 |
| Green beans, fresh, cooked | Vegetables | 62.5 |
| Corn, canned | Vegetables | 82.0 |
| Corn, fresh, cooked | Vegetables | 74.5 |
| Tomatoes, raw | Vegetables | 123.0 |
| Green pepper, raw | Vegetables | 37.3 |
| Peppers, red, raw | Vegetables | 37.3 |
| Broccoli, cooked | Vegetables | 46.0 |
| Spinach, cooked, from frozen | Vegetables | 95.0 |
| Collard greens, cooked | Vegetables | 95.0 |
| Carrots, raw | Vegetables | 61.0 |
| Carrots, cooked | Vegetables | 78.0 |
| Summer squash, cooked | Vegetables | 90.0 |
| Winter squash | Vegetables | 120.0 |
| Cauliflower, cooked | Vegetables | 45.0 |
| Cabbage, cooked | Vegetables | 37.5 |
| Sauerkraut | Vegetables | 59.0 |
| Brussel sprouts, cooked | Vegetables | 38.8 |
| Onions, cooked | Vegetables | 52.5 |
| Onions, green, raw | Vegetables | 25.0 |
| French fries, fast food | Vegetables | 71.0 |
| Hashbrowns | Vegetables | 108.8 |
| Sweet potatoes, canned | Vegetables | 98.0 |
| Sweet potatoes, baked | Vegetables | 127.5 |
| Potato, baked, w/ skin | Vegetables | 173.0 |
| Potato, boiled, w/o skin | Vegetables | 167.0 |
| Potato, mashed w/ milk and fat | Vegetables | 105.0 |
| Salad, potato w/ mayo | Vegetables | 96.5 |
| spinach, fresh | Vegetables | 30.0 |
| lettuce, iceberg, fresh | Vegetables | 57.0 |
| lettuce, romaine, fresh | Vegetables | 47.0 |
| green peppers, cooked | Vegetables | 33.8 |
| peppers, jalapeno, raw | Vegetables | 22.5 |
| peppers, red, cooked | Vegetables | 33.8 |
| broccoli, raw | Vegetables | 45.5 |
| hominy | Vegetables | 82.5 |
| squash, zucchini | Vegetables | 90.0 |

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| greens, mustard | Vegetables | 75.0 |
| onions, white, raw | Vegetables | 40.0 |
| garlic, cooked | Vegetables | 3.0 |
| avocado, fresh | Vegetables | 34.0 |
| guacamole | Vegetables | 58.3 |
| potatoes, fried | Vegetables | 145.5 |
| potatoes, mashed, dehydrated | Vegetables | 105.0 |
| coleslaw, with mayo dress | Vegetables | 92.0 |
| juice, tomato | Vegetables | 243.0 |
| juice, v-8 | Vegetables | 243.0 |
| cauliflower, raw | Vegetables | 53.5 |
| cabbage, raw | Vegetables | 44.5 |
| string beans, frozen,ckd | Vegetables | 67.5 |
| pumpkin, cnd | Vegetables | 122.5 |
| V-8 Splash | Vegetables | 243.0 |
| Soup, tomato | Vegetables | 244.0 |
| Soup, cream of potato | Vegetables | 244.0 |
| Soup, vegetarian-vegetable | Vegetables | 241.0 |
| soup, minestrone | Vegetables | 241.0 |
| chips, potato, LF | Vegetables | 28.4 |
| ketchup, reg | Vegetables | 30.0 |
| salsa, commercial | Vegetables | 64.8 |
| salsa, homemade | Vegetables | 62.7 |
| Peas, canned | Beans/nuts/seeds | 87.5 |
| Peas, fresh, cooked | Beans/nuts/seeds | 80.0 |
| Beans, kidney, cooked | Beans/nuts/seeds | 88.5 |
| Beans, lima, dry | Beans/nuts/seeds | 85.0 |
| Beans, pinto, cooked | Beans/nuts/seeds | 85.5 |
| beans, baked | Beans/nuts/seeds | 123.0 |
| chili, meatless | Beans/nuts/seeds | 112.7 |
| refried beans, cnd, reg | Beans/nuts/seeds | 119.0 |
| refried beans, cnd, fat free | Beans/nuts/seeds | 115.5 |
| refried beans, recipe | Beans/nuts/seeds | 126.5 |
| Soup, bean with bacon | Beans/nuts/seeds | 266.0 |
| Soup, green pea | Beans/nuts/seeds | 253.0 |
| soup, lentil | Beans/nuts/seeds | 248.0 |
| tofu, reg, firm | Beans/nuts/seeds | 85.0 |
| tofu, lowfat | Beans/nuts/seeds | 85.0 |
| tempeh | Beans/nuts/seeds | 85.0 |

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| soy burgers | Beans/nuts/seeds | 85.0 |
| tofu hotdog | Beans/nuts/seeds | 70.0 |
| cheese, tofu | Beans/nuts/seeds | 28.4 |
| soup, black bean | Beans/nuts/seeds | 240.0 |
| soup, miso | Beans/nuts/seeds | 240.0 |
| Peanuts, dry roasted | Beans/nuts/seeds | 36.5 |
| Peanut butter, smooth | Beans/nuts/seeds | 32.3 |
| seeds, sunflower | Beans/nuts/seeds | 36.0 |
| nuts, mixed w/o peanuts | Beans/nuts/seeds | 36.0 |
| Milk, soy, canned | Beans/nuts/seeds | 243.0 |
| Salad, macaroni w/ mayo | Grains | 121.3 |
| Rice, white | Grains | 118.5 |
| Rice, brown | Grains | 146.3 |
| Pasta, cooked | Grains | 120.0 |
| Sauce, white | Grains | 62.5 |
| Macaroni and cheese | Grains | 243.0 |
| lasagna, homemade w meat sauce | Grains | 250.0 |
| Spaghetti with meat sauce, reg | Grains | 248.0 |
| Spaghetti sauce without meat | Grains | 248.0 |
| Tamales with meat | Grains | 167.6 |
| Chilaquiles | Grains | 170.0 |
| Quesadilla | Grains | 142.0 |
| Quesadilla with fat | Grains | 142.0 |
| enchilada, chicken | Grains | 183.6 |
| Tostada, bean and cheese | Grains | 187.8 |
| Soup, clam chowder | Grains | 248.0 |
| Soup, tortilla soup | Grains | 244.0 |
| Soup, chicken noodle | Grains | 237.0 |
| pasta, alfredo sauce | Grains | 200.0 |
| pasta, with oil and parmesan | Grains | 162.1 |
| macaroni and cheese, boxed | Grains | 191.0 |
| rice, fried, pork | Grains | 198.0 |
| Chow mein, chicken | Grains | 171.3 |
| pad thai, vegetarian | Grains | 152.0 |
| pizza, meat, frozen | Grains | 153.0 |
| pizza, vegetable, frozen | Grains | 133.1 |
| burrito, bean, cheese | Grains | 167.8 |
| taco, beef, cheese | Grains | 84.2 |
| soup, ramen | Grains | 233.0 |

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| granola, reg | Grains | 96.0 |
| Oatmeal | Grains | 234.0 |
| Grits, unknown, after cooking | Grains | 257.0 |
| pancake, plain, mix | Grains | 76.0 |
| waffle, homemade | Grains | 95.0 |
| Cereal, All Bran | Grains | 31.0 |
| Cereal, 40% bran | Grains | 40.0 |
| Cereal, Raisin Bran | Grains | 59.0 |
| Cereal, Cheerios | Grains | 28.0 |
| Shredded Wheat | Grains | 54.0 |
| Cereal, Total | Grains | 40.0 |
| Cereal, Product 19 | Grains | 30.0 |
| Cereal, Cornflakes | Grains | 28.0 |
| cream of wheat, made w/water | Grains | 239.0 |
| oatmeal, flavored, pre-package | Grains | 234.0 |
| french toast, plain | Grains | 118.0 |
| waffle, frozen | Grains | 78.0 |
| Muffin, fruit | Grains | 113.0 |
| biscuit, plain | Grains | 37.0 |
| Bread, white | Grains | 50.0 |
| Bread, whole wheat | Grains | 56.7 |
| Cornbread, homemade | Grains | 73.3 |
| Cornbread, made from mix | Grains | 60.0 |
| Chips, potato | Grains | 28.4 |
| Chips, tortilla | Grains | 28.4 |
| Saltines | Grains | 18.0 |
| Popcorn, in oil | Grains | 12.5 |
| Popcorn, air-popped, no fat | Grains | 8.0 |
| scone, plain | Grains | 42.0 |
| croissant, plain | Grains | 57.0 |
| bagel, plain, white | Grains | 105.0 |
| bagel, plain, wheat | Grains | 105.0 |
| english muffin, plain, white | Grains | 57.0 |
| granola bar | Grains | 21.0 |
| cereal bar | Grains | 37.0 |
| power bar | Grains | 65.0 |
| tortilla chips, nonfat, WOW | Grains | 28.4 |
| pretzels | Grains | 28.4 |
| popcorn, microwave, LF | Grains | 6.3 |

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| popcorn, reg, microwave, butte | Grains | 9.0 |
| snacks, cheese puffs | Grains | 28.4 |
| crackers, ritz | Grains | 19.2 |
| crackers, wheat thins | Grains | 19.2 |
| gravy, turkey, made w/dripping | Grains | 59.0 |
| gravy, beef, made w/drippings | Grains | 59.0 |
| Clif bar | Grains | 68.0 |
| chips, corn | Grains | 28.4 |
| tortilla chips, lowfat, baked | Grains | 28.4 |
| chips, potato, nonfat, WOW | Grains | 28.4 |
| crackers, Ritz, reduced fat | Grains | 18.0 |
| crackers, Snackwells's, fat fr | Grains | 18.0 |
| granola bar, lowfat | Grains | 42.0 |
| Tortilla, corn, plain | Grains | 48.0 |
| Tortilla, flour, white | Grains | 102.7 |
| Tortilla, flour, wheat | Grains | 102.7 |
| doughnut, raised | Grains | 60.0 |
| Cake, chocolate, frosted (20 o | Grains | 80.0 |
| cookies, oatmeal raisin | Grains | 26.0 |
| cookies, chocolate chip w/o nu | Grains | 26.0 |
| Pie, apple, double crust (552g | Grains | 162.1 |
| Pie, cherry, double crust(564 | Grains | 148.6 |
| Pie, chocolate cream (912 g) | Grains | 152.4 |
| cookies, figbars | Grains | 32.0 |
| gingersnap cookies | Grains | 14.0 |
| cookies, vanilla wafers | Grains | 8.0 |
| Cookies, graham cracker | Grains | 14.0 |
| Cake, angel food, unfrosted | Grains | 59.6 |
| doughnut, cake | Grains | 47.0 |
| cake, white, not frosted | Grains | 80.0 |
| cookies, choc chip, w/nuts | Grains | 20.0 |
| Beef, ground, regular | Meat/Poultry/Fish | 85.0 |
| beef, chuck, arm, braised | Meat/Poultry/Fish | 28.4 |
| beef, sirloin, wedge bone, bro | Meat/Poultry/Fish | 28.4 |
| pork, whole loin, roasted | Meat/Poultry/Fish | 28.4 |
| Pork, ham, boneless, roasted, | Meat/Poultry/Fish | 28.4 |
| chili, canned with meat and be | Meat/Poultry/Fish | 247.0 |
| chili, homemade, beef and bean | Meat/Poultry/Fish | 254.0 |
| Liver, beef | Meat/Poultry/Fish | 113.4 |

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| Liver, chicken | Meat/Poultry/Fish | 113.4 |
| Organ meats, other | Meat/Poultry/Fish | 113.4 |
| chicken, breast, fried w skin | Meat/Poultry/Fish | 111.0 |
| chicken, breast, rstd w skin | Meat/Poultry/Fish | 111.0 |
| chicken, breast, rstd w/o skin | Meat/Poultry/Fish | 98.0 |
| chicken, thigh, rstd w/o skin | Meat/Poultry/Fish | 70.0 |
| Shrimp, fried | Meat/Poultry/Fish | 145.0 |
| Clams, fried | Meat/Poultry/Fish | 150.0 |
| Shrimp, not fried | Meat/Poultry/Fish | 72.5 |
| crab | Meat/Poultry/Fish | 67.5 |
| oysters | Meat/Poultry/Fish | 172.0 |
| tuna, canned, oil, plain | Meat/Poultry/Fish | 73.0 |
| Tuna salad w/ mayo, oil packed | Meat/Poultry/Fish | 104.0 |
| tuna, canned, water, plain | Meat/Poultry/Fish | 77.0 |
| Tuna salad,w/ mayo, water pack | Meat/Poultry/Fish | 104.0 |
| Tuna casserole, water packed | Meat/Poultry/Fish | 224.0 |
| sole, baked | Meat/Poultry/Fish | 113.4 |
| salmon, baked | Meat/Poultry/Fish | 113.4 |
| Bluefish | Meat/Poultry/Fish | 113.4 |
| luncheon meat, ham | Meat/Poultry/Fish | 56.7 |
| Bologna | Meat/Poultry/Fish | 56.7 |
| Salami, cooked | Meat/Poultry/Fish | 56.7 |
| Hotdog, regular | Meat/Poultry/Fish | 45.0 |
| bratwurst, reg | Meat/Poultry/Fish | 85.0 |
| Beef, ground, lean | Meat/Poultry/Fish | 85.0 |
| Beef, ground, extra lean | Meat/Poultry/Fish | 85.0 |
| Turkey, ground | Meat/Poultry/Fish | 85.0 |
| Beef, chuck, trimmed | Meat/Poultry/Fish | 28.4 |
| Beef, sirloin, trimmed | Meat/Poultry/Fish | 28.4 |
| Pork, whole loin, trimmed | Meat/Poultry/Fish | 28.4 |
| Ham, boneless, trimmed | Meat/Poultry/Fish | 28.4 |
| Soup, tripe | Meat/Poultry/Fish | 250.0 |
| hot dog, lowfat | Meat/Poultry/Fish | 45.0 |
| bratwurst, lowfat | Meat/Poultry/Fish | 85.0 |
| luncheon meat, turkey | Meat/Poultry/Fish | 56.7 |
| bologna, low fat | Meat/Poultry/Fish | 56.7 |
| spam, cooked | Meat/Poultry/Fish | 56.7 |
| lamb, roasted | Meat/Poultry/Fish | 28.4 |
| meatloaf, ckd with reg grd bee | Meat/Poultry/Fish | 106.9 |

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|---|---|---|
| chicken, thigh, fried w skin | Meat/Poultry/Fish | 84.0 |
| chicken nuggets | Meat/Poultry/Fish | 96.0 |
| turkey, white and dark meat | Meat/Poultry/Fish | 85.0 |
| oysters | Meat/Poultry/Fish | 172.0 |
| Clams, (not) fried | Meat/Poultry/Fish | 75.0 |
| lobster, not fried | Meat/Poultry/Fish | 72.5 |
| snapper, baked | Meat/Poultry/Fish | 113.4 |
| cod, baked | Meat/Poultry/Fish | 113.4 |
| mackerel, baked | Meat/Poultry/Fish | 113.4 |
| lamb, curried | Meat/Poultry/Fish | 191.3 |
| chicken, pot pie | Meat/Poultry/Fish | 252.0 |
| casserole, beef, mixed, with g | Meat/Poultry/Fish | 214.0 |
| chicken, thigh, rstd w skin | Meat/Poultry/Fish | 84.0 |
| casserole, chicken, mixed, cre | Meat/Poultry/Fish | 218.0 |
| fish fillets, cod, fried | Meat/Poultry/Fish | 90.0 |
| fish fillet, commercial pre-br | Meat/Poultry/Fish | 85.5 |
| fish, halibut, baked | Meat/Poultry/Fish | 113.4 |
| stew, beef, homemade | Meat/Poultry/Fish | 252.0 |
| turkey, white and dark, w/o sk | Meat/Poultry/Fish | 85.0 |
| lamb, roasted, trimmed | Meat/Poultry/Fish | 28.4 |
| lasagna, frozen | Meat/Poultry/Fish | 141.7 |
| pizza, meat, fast food | Meat/Poultry/Fish | 126.0 |
| meatloaf, ckd with lean grd be | Meat/Poultry/Fish | 106.9 |
| meatloaf, ckd with x-lean grd | Meat/Poultry/Fish | 106.9 |
| chicken, breast, grilled NFA w | Meat/Poultry/Fish | 98.0 |
| chicken, thigh, grilled NFA w/ | Meat/Poultry/Fish | 70.0 |
| chicken, breast, grilled w ski | Meat/Poultry/Fish | 111.0 |
| chicken, thigh, grilled w skin | Meat/Poultry/Fish | 84.0 |
| Oysters, Pacific, fried | Meat/Poultry/Fish | 172.0 |
| Oysters, Pacific, not fried | Meat/Poultry/Fish | 172.0 |
| Oysters, Eastern fried | Meat/Poultry/Fish | 172.0 |
| Oysters, Eastern not fried | Meat/Poultry/Fish | 172.0 |
| Eggs, fried | Meat/Poultry/Fish | 92.0 |
| Eggs, boiled | Meat/Poultry/Fish | 100.0 |
| bacon | Meat/Poultry/Fish | 24.0 |
| sausage, breakfast | Meat/Poultry/Fish | 26.0 |
| eggs, scrambled | Meat/Poultry/Fish | 122.2 |