Published in final edited form as:
Food Policy. 2010 December 1; 35(6): 514–520. doi:10.1016/j.foodpol.2010.06.004.

The rising disparity in the price of healthful foods: 2004–2008

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Abstract

Nutrient dense foods that are associated with better health outcomes tend to cost more per kilocalorie (kcal) than do refined grains, sweets and fats. The price disparity between healthful and less healthful foods appears to be growing.

This study demonstrates a new method for linking longitudinal retail price data with objective, nutrient-based ratings of the nutritional quality of foods and beverages. Retail prices for 378 foods and beverages were obtained from major supermarket chains in the Seattle, WA for 2004-8. Nutritional quality was based on energy density (kcal/g) and two measures of nutrient density, calculated using the Naturally Nutrient Rich (NNR) score and the Nutrient Rich Foods index ($NRF_{9.3}$). Food prices were expressed as $/100g edible portion and as $/1,000 kcal. Foods were stratified by quintiles of energy and nutrient density for analyses.

Both measures of nutrient density were negatively associated with energy density and positively associated with cost per 1,000 kcal. The mean cost of foods in the top quintile of nutrient density was $27.20/1,000 kcal and the 4 y price increase was 29.2%. Foods in the bottom quintile cost a mean of $3.32/1000 kcal and the 4 y price increase was 16.1%.

There is a growing price disparity between nutrient-dense foods and less nutritious options. Cost may pose a barrier to the adoption of healthier diets and so limit the impact of dietary guidance. Nutrient profiling methods provide objective criteria for tracking retail prices of foods in relation to their nutritional quality and for guiding food and nutrition policy.

Keywords

Energy density; energy intake; food price; inflation; diet cost; dietary guidance; poverty; obesity; economics

1. Introduction

1.1 Objective

The present goal was to determine whether the cost of more nutritious foods, defined using objective, nutrient-based criteria, increased disproportionately over the past four years

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Conflict of Interest: None

relative to less nutritious foods. Whereas previous studies on food prices and inflation were focused on major food groups, the present analyses directly addressed energy density (kilocalories per gram) and nutrient density (nutrients per calorie) of foods, transcending the need to assign foods into groups.

1.2 Background

There are growing concerns that the American diet is becoming energy-rich but nutrient-poor (Basiotis et al., 2004). Nutrition policy in the US has adapted, taking a more nuanced approach to dietary recommendations. Rather than simply emphasizing that consumers consume more of some food groups (fruits, vegetables) and less of others (meat, fat and sweets), the 2005 Dietary Guidelines for Americans recommended that consumers should increase their intake of nutrient-dense foods across all food groups (United States. Dept. of Agriculture. Human Nutrition Information Service. Dietary Guidelines Advisory Committee. et al., 2004). Nutrient-dense foods were not identified explicitly but rather described as those foods that provided relatively more nutrients per calorie, enabling consumers to satisfy nutrient requirements without exceeding daily energy needs. In practical terms, whole grains, lean meats, low fat dairy products, vegetables and fruit have been recognized as nutrient-dense foods (United States. Dept. of Agriculture. Human Nutrition Information Service. Dietary Guidelines Advisory Committee. et al., 2004; Drewnowski, 2005). By contrast, the term energy-dense is commonly applied to refined grains, added sugars and added fats (Prentice et al., 2003; Drewnowski, 2005; World Cancer Research Fund / American Institute for Cancer Research, 2007; Briefel et al., 2009).

Nutrient profiling techniques offer objective metrics of the nutritional quality of individual foods. The Naturally Nutrient Rich (NNR) score (Drewnowski, 2005) and the Nutrient Rich Food ($NRF_{9.3}$) index (Drewnowski et al., 2008) are two such metrics that provide a useful measure of the foods' overall nutrient quality or nutritional value. Both metrics assess the amounts of key nutrients that a food contains in relation to the dietary energy that it provides. The NNR index is based on 14 nutrients to encourage, notably protein, fiber, monounsaturated fatty acids and a variety of vitamins and minerals (Drewnowski, 2005). The $NRF_{9.3}$ index is based on 9 nutrients to encourage: protein, fiber, vitamins A, C, and E, calcium, iron, potassium and magnesium, and 3 nutrients to limit: saturated fat, added sugar, and sodium(Drewnowski et al., 2008).

Past studies have established that foods of higher nutrient density and low energy density tend to be associated with higher monetary costs per unit of food energy (Darmon et al., 2005; Maillot et al., 2007; Monsivais et al., 2007). While Americans reportedly enjoy the most affordable food supply in the world (Cuellar, 2008), the price gap is growing between nutrient rich foods and foods that are energy dense but nutrient poor. Studies of United States food price data have shown that fruits and vegetables have increased in price over time to a greater extent than other food groups (Putnam et al., 2002; Sturm, 2005; Christian et al., 2009).

The monitoring of food prices has to a large extent been the domain of labor and agriculture economists. However, the disparity in cost between nutrient rich and nutrient poor foods and rising food prices are undermining nutrition and public health, a point that was emphasized in a statement from the World Health Organization (Chan, 2008). The policy responses to these problems should be guided by food price data as they relate to the nutritional quality of foods, but existing data are limited (Todd, 2009). The present study demonstrates a new approach, linking longitudinal food price data with nutrient density indices as an objective way to explore patterns in food prices and to monitor the impact of inflation on foods of different nutritional quality.

2. Methods

2.1 The Market Basket

A market basket is simply a list of defined products in purchasable form. The market basket used in this study was based on 384 component foods in the database of the food frequency questionnaire (FFQ) developed by the Fred Hutchinson Cancer Research Center and used previously in large-scale cross-sectional and cohort studies on diets and health (Neuhouser et al., 1999; Patterson et al., 1999). The foods and beverages represented all seven MyPyramid food groups (Lupton, 2005). However, the “oils” group, which in this data set included only three items, was grouped into the “discretionary calories” group, which included non-dairy fats (e.g., margarine), sugars, sweets, sweetened drinks, and alcoholic beverages. resulting in six food groups for analysis. The 384 items excluded medical foods and supplements.

2.2 Food Prices

Prices for 378 out of 384 foods and beverages were obtained in 2004, 2006 and 2008. Three of the foods (two vitamin-fortified juices and whole wheat flour tortillas) were not priced in 2004 and, along with drinking water and two diet soft drinks were excluded from analysis. Details of the procedures for translating foods and beverages from the FFQ component food database into purchasable form were reported previously(Monsivais et al., 2007).

Food prices (in US dollars) were obtained from three supermarkets in the Seattle metropolitan area from April-June, 2004 and from May-July, 2006 and May-July 2008. Safeway, Albertson’s and Quality Food Centers (a subsidiary of Kroger) were selected in 2004 because these three outlets collectively represented over 60% of the retail grocery market in the Puget Sound region at that time(Tice, 2003). Prices were obtained during in-store visits and from supermarket home shopping websites (Safeway, Albertson’s), which reported to list the same prices as those available to in-store customers. Some fresh seafood was priced at a major fish market in Seattle and some ready to eat foods were priced at and local branches of national fast-food restaurants.

For each food, price (in US dollars) was adjusted for food energy (Frazao, 2008; Christian et al., 2009) taking into account the edible portion or yield. Yield values reflect the gain or loss of food weight that occurs during preparation, because of discarding of non-edible portions (e.g., peel or bone) and hydration during cooking (grains and pulses). Yields were obtained from the United States Department of Agriculture (USDA) Handbook 102(1975). Prices were expressed as $/1000 kcal.

Having established a list of specific purchasable foods for the 2004 database, prices were again obtained for the identical items in 2006 and 2008. For each specific item (brand, package size) a return visit was made to the same supermarket chain where the product had been priced in 2004. If the product was no longer available at the same chain, the other two chains were searched and the lowest price available for the identical product was selected. In rare cases, the 2004 product had either been discontinued by the manufacturer or had been modified in package size. When this was the case, the item specified in 2004 was replaced with an alternative product that closely matched the original food description. Between 2004 and 2006, 15.8% of items (63 items out of 378) were not perfectly matched (same-product, same-store) while between 2006 and 2008, 11.1% (43 out of 378) of items could not be matched.

2.3 Energy density and nutrient density

Calculations of energy and nutrient density for 378 foods and beverages were based on energy and nutrient values from the Nutrient Data System for Research (NDSR), which is based on nutrient data maintained by the Nutrition Coordinating Center of the University of Minnesota. Each of the 378 foods and beverages were identified in the NDSR by research dietitians at the Western Human Nutrition Research Center in Davis, California. The NDSR analyses provided energy (kcal, kj) and 142 nutrition variables per 100g edible portion. Energy density was defined as kcal/g edible portion for each food and caloric beverage. The NNR was computed based on sixteen nutrients using the following formula:

$$\mathrm{NNR}_{16}{=}\sum\nolimits_{1-16}(\%\mathrm{DV}_{100\mathrm{kcal}})$$

All sixteen nutrients contributed positively to the total score. The nutrients and their daily recommended values, as defined by the Food and Drug Administration are shown in Table 1.

Twelve nutrients were used to compute the Nutrient Rich Food index 9.3 ($\mathrm{NRF}_{9.3}$) for each food. The nutrients included in the calculation were nine beneficial nutrients and three nutrients to limit (Table 1) (Drewnowski, 2005). The formula for computing the $\mathrm{NRF}_{9.3}$ is:

$$\mathrm{NRF}_{9.3}{=}(\sum\nolimits_{1-9}(\mathrm{Nutrient}/\mathrm{DV})\times 100)-(\sum\nolimits_{1-3}(\mathrm{Nutrient}/\mathrm{MRV})\times 100)$$

2.4 Statistical analyses

The database of 378 items was analyzed as a complete list containing both caloric and non-caloric beverages. Once the NNR was computed for all items, the database was stratified into quintiles of NNR. The relations between NNR score quintile and energy density and between quintile of NNR and cost ($/1000 kcal) were tested using one-way analysis of variance (ANOVA) and Bonferroni-corrected multiple comparisons were used to identify significantly different pairs in post-hoc analyses. Bivariate Pearson correlation was used to measure the agreement between prices in 2004 and 2008 and to measure the degree of association between the nutrient density measures, energy density and energy cost. The NNR scores and energy density values in the foods and beverages in the present analysis were strongly right-skewed and were thus log-transformed prior to correlation analysis. To further explore the effect of time on prices in relation to energy density and nutrient density, repeated-measures ANOVAs were performed, with time as a within-group repeated measure and quintile of energy density or nutrient density as between-group factors. A second nutrient density measure, the $NRF_{9.3}$, was included in the inter correlation analysis and in the analysis of secular trends. In the repeated-measures ANOVA, the univariate tests of within-group effects were subject to the Huynh-Feldt correction. When ANOVAs were significant, Bonferroni-corrected pairwise comparisons were used in post-hoc analyses to identify significant differences among groups. Analyses were conducted using SPSS statistical software (version 11.0.1 SPSS Inc, Chicago, IL, 2001).

3. Results

3.1 Energy and Nutrient density of food groups

Food groups, as defined by the USDA's My Pyramid plan, showed great variability in energy and nutrient density. Box plots in Figure 1 show the log-transformed energy density (**A**) nutrient density scores (**B**) based on NNR across the six food groups (n=378 foods and beverages). The ranges of log-NNR score overlapped to a large extent for all food groups. The meat/bean/seed group (n=115 foods) and the grain group (n=93 foods) were included several outliers. The lowest median score was observed in the discretionary calories category (n= 40, log NNR = 0.74) while the highest median was for the vegetables group (n=60, log NNR = 1.74). It is notable that the meat/bean/seed group showed a slightly higher median nutrient density (log NNR = 1.31) than the fruit and fruit juices group (n = 39, log NNR = 1.27). The remaining analyses focused exclusively on foods defined in terms of energy and nutrient density.

Energy density and the NNR score were both strongly linked with food energy cost ($/1,000 kcal), based on 2008 prices. Higher quintiles of energy density were associated with progressively lower food energy costs while higher quintiles of $NRF_{9.3}$ were associated with higher energy cost. In both analyses, differences in energy cost among quintiles were and substantial, as shown in Figure 2A, B. The lowest quintile of energy density was associated with a mean energy cost of $19.82/1,000 kcal and the highest quintile was associated with a mean energy cost of $2.82/1,000 kcal. The lowest quintile of NNR score was associated with a mean energy cost of $3.32 per 1000 kcal of energy while the highest quintile was associated with an energy cost of $27.24/1000 kcal. One-way ANOVA of the energy cost showed significant effects of energy density: $F(4,373) = 13.9$, $P < 0.001$, and nutrient density: $F(4,373) = 26.6$, $P < 0.001$. Post-hoc analyses showed that the cost of least energy dense foods was significantly greater than costs in quintiles 3–5 ($p<0.001$). Similarly, the cost of most nutrient dense foods was significantly greater than foods in the lowest 4 quintiles ($p < 0.001$, all comparisons).

The intercorrelations among log-transformed NNR scores, log-transformed energy density and cost were quantified using Pearson correlation (Table 2). These analyses confirmed a high inverse correlation between NNR scores and energy density values ($r = -0.51$). The analyses also showed that while energy density was negatively associated with energy cost ($r = -0.39$), NNR was positively correlated with energy cost ($r = 0.45$). Moreover, A second measure of nutrient density, the nutrient rich food index ($NRF_{9.3}$) was also positively associated with energy cost (r=0.36) but negatively associated with energy density (r = −0.52).

3.2 Food Prices from 2004 to 2008

Food price collection methods were highly reproducible over the four years of price collection. Figure 3 illustrates the relationship between food prices collected ($/1000kcal) in 2004 and in 2008 for the same 378 foods and beverages. There was a strong correlation between 2004 and 2008 prices ($r^2 = 0.89$), and the mean price increase calculated for all foods and beverages was 25.2% from 2004 to 2008.

3.3 Price Inflation in Relation to Energy and Nutrient Density

The present hypothesis was that foods of lower energy density and higher nutrient density would show a disproportionately higher increase in price over the 4 y period. Figure 4 shows the mean prices ($/1000 kcal) among quintiles of energy density (**A**) and nutrient density (**B**) over the period from 2004 to 2008. Foods in the lowest quintile of energy density rose in price by an average of 41%, while the highest energy density foods rose in price by 12.2%. Foods in the lowest quintile of NNR showed on the average a 15.9% increase in prices Foods in the highest quintile of NNR showed the steepest rise in price, with an average increase in prices over the same period of 29.2%. Repeated-measures ANOVA showed a significant main effect of time ($p < 0.001$) and a significant interaction between time and quintile of NNR score ($p < 0.001$). The result indicates that the different quintiles of nutrient density had significantly different average rates of inflation.

To test whether the observed price trends by quintile of NNR could be generalized to other measures of nutrient density, we also analyzed prices in relation to the Nutrient Rich Food index ($NRF_{9.3}$), which is based on 9 nutrients to encourage and 3 to limit(Drewnowski et al., 2008). The analysis based on the $NRF_{9.3}$ was consistent with the NNR-based analysis. Repeated-measures ANOVA showed a significant main effect of time ($p < 0.001$) and a significant interaction between time and quintile of $NRF_{9.3}$ ($p < 0.001$). The highest quintile of nutrient density showed an average 4-y rise in price of 34.8% while the lowest quintile of nutrient density showed an average rise in price of 19.9%.

Based on the NNR analysis, representative foods from the bottom and top quintiles of nutrient density are shown in Table 3, arranged in ascending and descending order of nutrient density, respectively. The bottom quintile contained foods ranging in nutrient density from 0 to 0.42 NNR units. The top quintile ranged from 1.99 to 16.32 units. While fresh produce, seafood and some fresh meats dominated the top quintile of nutrient density, the lowest quintile of nutrient density included fats, sweets, candies and soft drinks.

4. Discussion

4.1 The present study is based on a previously established market basket to assess the prices of foods over time (Monsivais et al., 2007). Unlike previous studies, this study demonstrates the use of objective, nutrient-based metrics to classify foods in relation to secular trends in retail prices. The NNR score used in the present analyses included fiber, calcium, protein, zinc, and iron, potassium, magnesium as vitamins A, C, and E. These nutrients either enter into the FDA definition of what constitutes a healthy food - or are "nutrients of concern" in the American diet (2005). The present findings, based on Seattle-area prices, clearly show that while all food prices have risen substantially between 2004 and 2008, the price of the most nutrient dense foods, has risen the fastest. These data are consistent with longer-term analyses of price increases by food groups tracked by the USDA (Putnam et al., 2002; Sturm, 2005) and by other organizations (Christian et al., 2009).

Nutrition recommendations for public health, such as those in the 2005 *Dietary Guidelines for Americans* (2005), the 2005 USDA *MyPyramid* (USDA), the cancer prevention food plan from the American Institute for Cancer Research (World Cancer Research Fund / American Institute for Cancer Research, 2007) and the World Health Organization (2008) consistently emphasize the need to improve the nutrients-to-energy ratio in the diet, but there has been less consideration given to the higher monetary cost of such diets.

4.2 Methodological Considerations and Limitations of the Present Study

A comparison of the present findings with data from Bureau of Labor Statistics' Consumer Price Index (CPI) is warranted. In the present study, the four-year inflation observed for food overall, 25.2%, was higher than the 17.3% inflation rate for food at home reported by the CPI over the same period[1]. Several factors might explain the difference between the findings reported here and those from the CPI. First, the data sets are based on different market baskets. The 378 foods and beverages in the market basket used in this study are derived from a food frequency questionnaire, which included a wide variety of foods from all food groups (Patterson et al., 1999). In contrast, the CPI market basket is currently composed of less than 70 specific food and beverage items that reflect recent, typical US purchasing habits. Second, the foods in the CPI market basket are not linked to a nutrient database, making nutrient-based analyses of prices and inflation unfeasible. Third, the 378 items in the present market basket were equally weighted, whereas the components of the CPI basket are weighted differently to reflect their relative importance in the food budget. One more factor that should be noted is that the CPI basket is dynamic, with foods and beverages removed and added regularly to reflect changing consumer habits. Taken together, these factors limit the utility of the CPI for conducting the types of analyses presented here.

This study was limited by several factors. First, food prices collected for a market basket-based assessment can only reflect prices that were posted at select retail outlets in the Seattle metropolitan region. Retail Food prices vary regionally (Leibtag et al., 2007) and price changes over time also show variation in different geographical areas (Clauson et al., 1997). Third, the market basket that was evaluated for this study originated from a food frequency questionnaire, and thus was limited in its representation of many foods that are commonly consumed (Willett, 1998). Fourth, each food and beverage was priced using methods that did not take into account sale prices, loyalty card discounts, coupons, or other shopping strategies that can help consumers control food expenditures (Leibtag, 2003). As a result, the

[1]Increase is in the cost of food-at-home between May 2004 and June 2008 for the Seattle-Tacoma-Bremerton Metropolitan Statistical Area The Consumer Price Index http://data.bls.gov/PDQ/outside.jsp?survey=cu February 27, 2009.

prices and inflation rates reported here might not be representative of the prices experienced by particular consumer groups.

5. Implications and Conclusion

The sharp price increase observed for nutrient rich foods relative to other less nutritious foods indicates that economic constraints may pose a barrier to a healthful diet. Lost or diminished incomes combined with rising food prices could have adverse consequences for consumers' diet quality, and as a result, their nutritional status and health.

The overall affordability of the US food supply has been attributed to scale and efficiencies of production (Cuellar, 2008). Some have argued that policies that increase sugars and fats in the food supply through agricultural subsidies contribute to growing rates of obesity and chronic disease (Wallinga et al., 2009) but economic models indicate that the affordability of most foods are not linked to government subsidies to producers (Miller et al., 2007). The recent period of global inflation in the food prices has been attributed to increasing meat consumption in developing countries (2007), policies promoting biofuels (Boddiger, 2007) and the rising transport costs associated with long distances over which foods must travel to reach the consumer (Edwards et al., 2008). Fresh produce prices are particularly vulnerable to rising energy costs as these items are heavy and often require refrigeration during shipping and storage (McLaughlin, 2004). These effects were seen recently in Britain, where, over a 9-month period, food prices on the whole showed an 8.3% rise while fresh produce prices rose by nearly 15% during the same period (2008).

Policies must be examined not simply in terms of how they may affect the affordability of food in the aggregate but also how they affect the affordability of the most nutritious foods in the food supply. Existing publicly available data systems do not provide this information. At best, food price data are tracked by food groups, which are heterogeneous in their nutritional quality. Merging nutrient profiling techniques with economic surveillance systems at the national level can provide a solution. In the US, this would require merging retail price data collected by the Department of Labor with nutrient databases maintained by the Department of Agriculture. Such a data system could guide food and nutrition policy. For example, nutrient rich foods, irrespective of the food groups to which they belong, could be promoted via subsidies to producers or other monetary promotions targeted at consumers (Ni Mhurchu et al.; Miner, 2006; Ni Mhurchu et al., 2010).

At the same time, nutrient profiling can provide for improved nutrition guidance. In the US, nutrient profiling has been the basis of front-of-pack and shelf labels created by the food industry and supermarket chains. Internationally, the emphasis has been on regulation. In the EU, nutrient profiling was initially intended to provide the basis for approving (or disapproving) nutrition and health claims. Whether through regulatory policy or consumer communication, nutrient profiling can help emphasize the most affordable- and acceptable-food sources of nutrients in the food supply, irrespective of food group (Maillot et al., 2008).

Acknowledgments

The authors thank Dr. Nancy Keim and research staff at the Western Human Nutrition Research Center in Davis, California for their support with the food and nutrient database used in this project.

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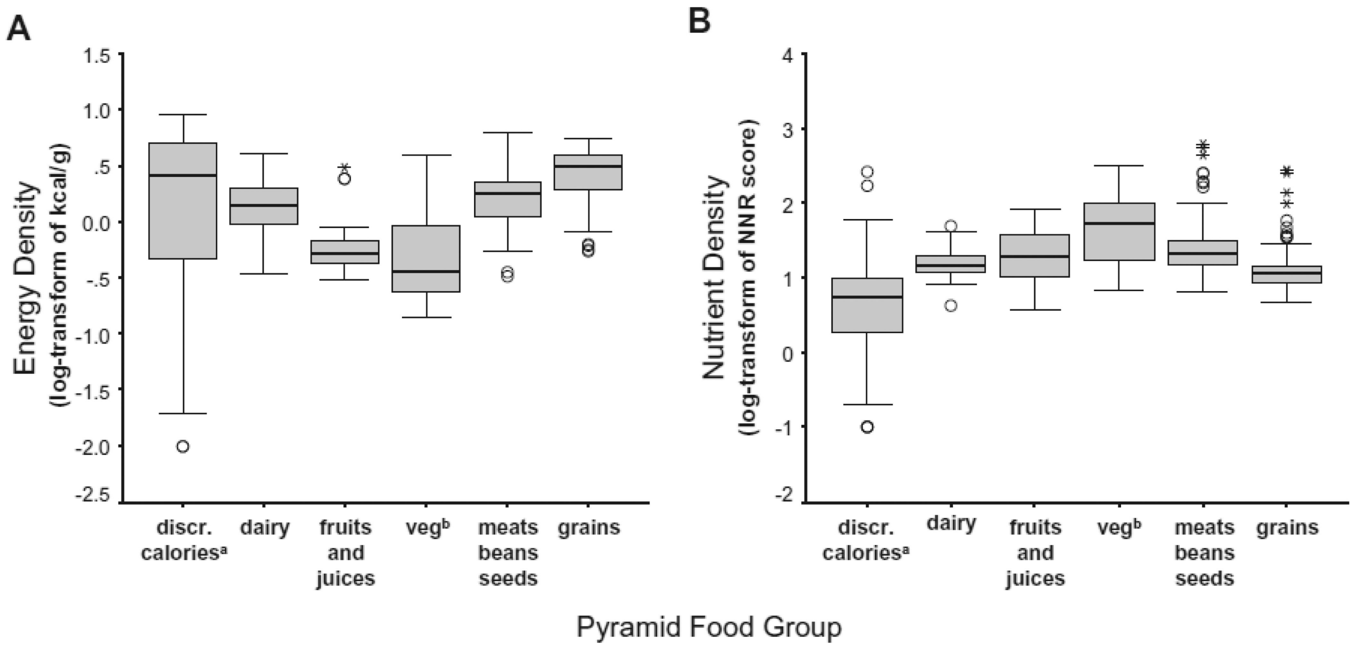

Figure 1.

Food energy density (log-transformed kcal/g) and nutrient density (log-tranformed NNR score) for all foods and beverages (n=378) categorized by My Pyramid food group. [a] disc. calories, discretionary calories group included oils, non-dairy fats, sugars, sweets and sweetened beverages and alcoholic beverages. [b] vegetable group. ° indicates statistical outlier, defined as 1.5–3 times the 25th or 75th percentiles. * indicates extreme statistical outlier, defined as more than 3 times the 25th or 75th percentiles.

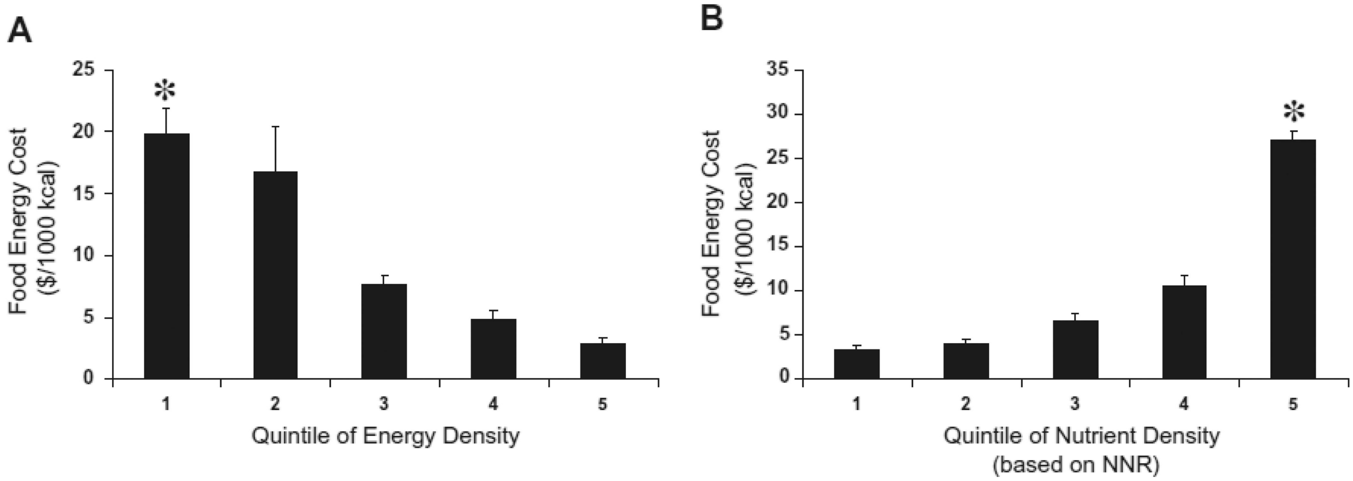

Figure 2.

Food energy cost ($/1000kcal), by quintile of energy density (**A**) and nutrient density (NNR score; **B**) for all foods and beverages (n=378). Prices were based on 2008 Seattle-area retail prices. Higher energy density was associated with significantly lower food energy costs while higher nutrient density was associated with significantly higher food energy costs (* indicates different at p<0.001).

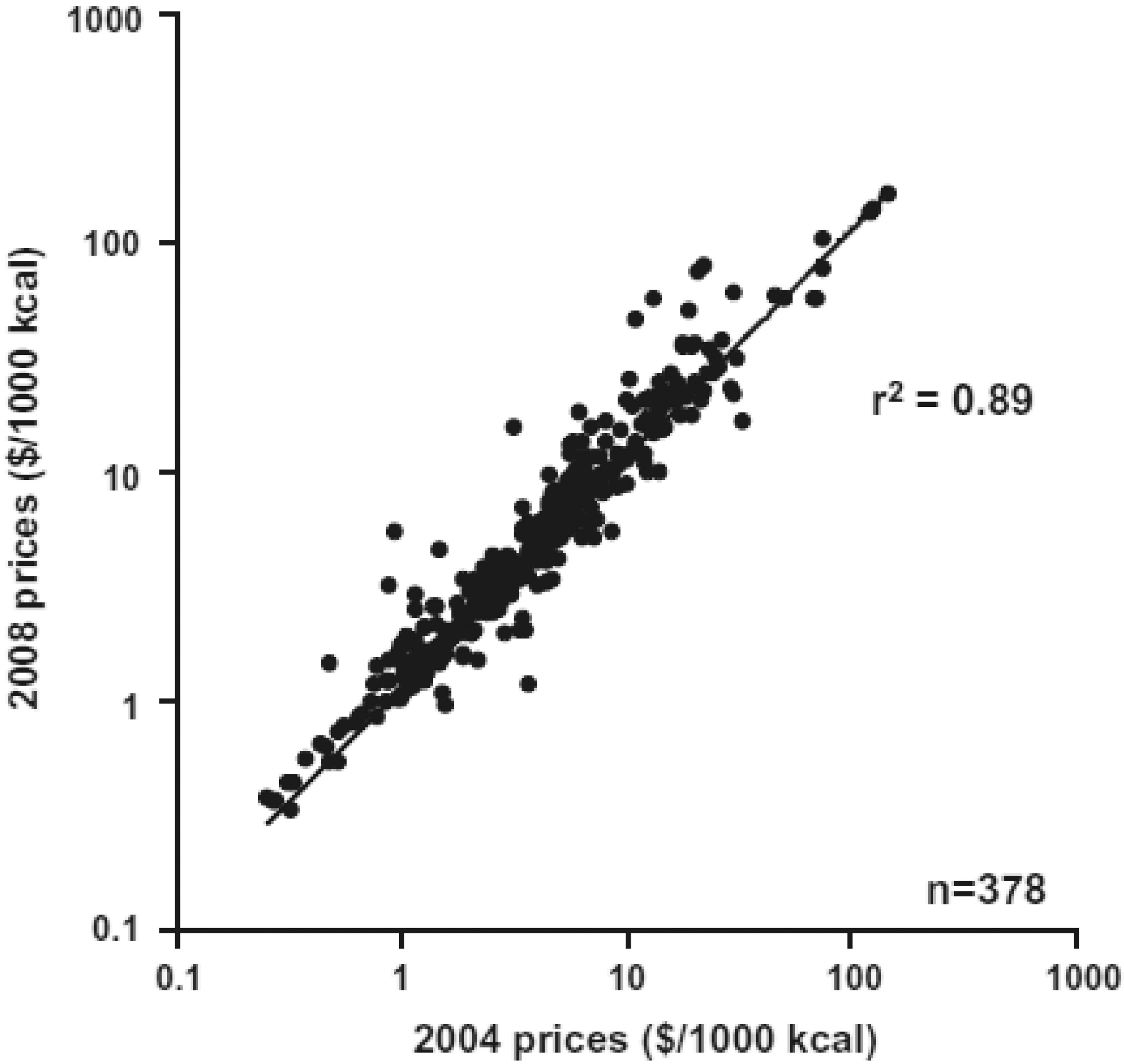

Figure 3.
Seattle-area prices collected in 2008 were strongly correlated with 2004 prices. Relationship between retail prices of 378 foods and beverages collected in Seattle-area supermarkets in 2004 and 2008. The overall correlation (r^2) between 2004 and 2008 prices was 0.89.

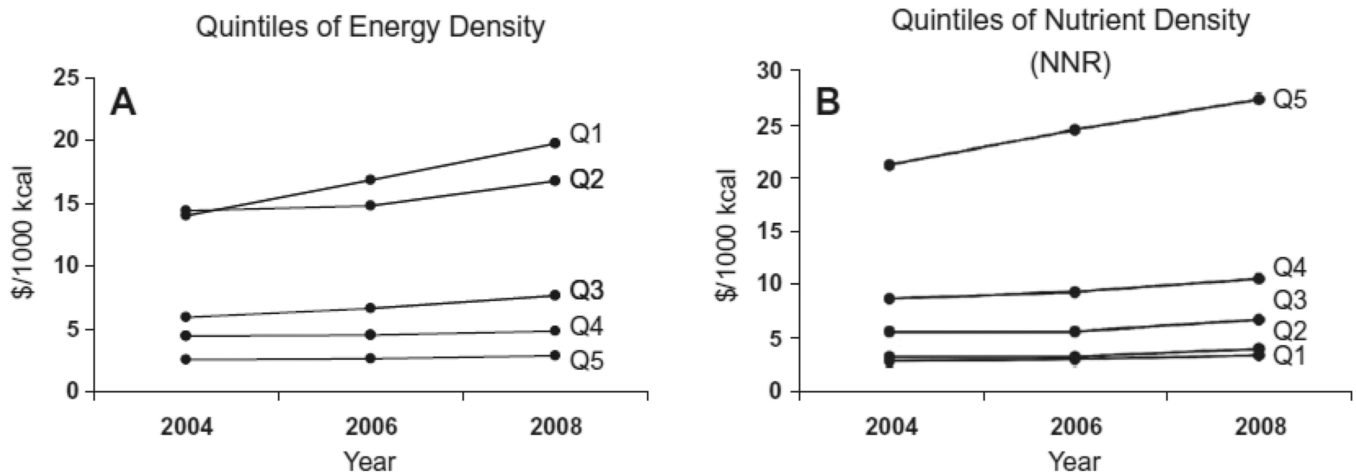

Figure 4.

Secular trends in retail food prices over four years, with foods stratified into quintiles of energy density (**A**) or nutrient density (**B**) of all foods and beverages. Curves show mean food energy costs ($/1000 kcal) for each quintile of over the four years of the study. Lowest energy density foods showed the sharpest rise in prices. Likewise, high nutrient density foods (based on NNR) showed the highest inflation rate between 2004 and 2008. The inflation rate for the highest nutrient density group at 29.2% compared to 15.9% for the foods in the lowest nutrient density quintile.

Table 1

Nutrients used to compute the naturally nutrient rich food score (NNR) and the Nutrient Rich Food index (NRF 9.3) of all foods and beverages For the NNR, levels of 16 nutrients were additive in computing the total score. For the NRF 9.3, levels of nine nutrients were additive while levels of three nutrients subtracted from the total score.

NNR score		NRF index 9.3	
Nutrients	**Daily values**[a]	**Nutrients to encourage**	**Daily values**[a]
Protein	50g	Protein	50g
Monounsaturated fatty acids	20g	Fiber	25 g
Fiber	25g	Vitamin A	5000 IU
Vitamin A	5000 IU	Vitamin C	60 mg
Thiamin (B1)	1.5 mg	Vitamin E	20 mg
Riboflavin (B2)	1.7 mg	Calcium	1000 mg
Pantothenic acid (B5)	10 mg	Iron	18 mg
B12	6 μg	Potassium	3500 mg
Vitamin C	60 mg	Magnesium	400 mg
Vitamin D	10 μg		
Vitamin E	20 mg	Nutrients to limit	MRVs[b]
Folate	400 μg	Saturated fat	20 g
Potassium	3500 mg	Added sugars	50g
Calcium	1000 mg	Sodium	2400 mg
Iron	18 mg		
Zinc	15 mg		

[a] Daily values from the food and drug administration guidelines.

[b] MRVs, maximum recommended values from the Institute of Medicine.

Table 2

Pearson correlation coefficients between energy density, naturally nutrient rich score, nutrient rich food score 9.3 and energy cost of foods (*n* = 378).

	NNR[a]	NRF 9.3	Energy cost ($/1000 kcal)
Energy density[a]	−0.51	−0.52	−0.39
NNR[a]		0.66	0.45
NRF 9.3			0.36

[a]For purposes of correlation analysis, energy density and NNR scores were log-transformed.

Table 3

Ten selected foods in the lowest and highest quintile of nutrient density based on the naturally nutrient rich score (NNR).

Lowest nutrient density quintile (nutrient density score 0.0–0.42		Highest nutrient density quintile) (nutrient density score 1.99–16.32)	
Nutrient density (NNR score)	**Food**	**Nutrient density (NNR score)**	**Food**
0.00	Sugar, white granulated	16.32	Peppers, red, raw
0.01	Hard candy	16.19	Oysters, raw
0.01	Jelly beans	16.04	Spinach
0.03	Cola soft drink	15.41	Mustard greens
0.04	Honey	13.6	Lettuce, romaine, fresh
0.05	Licorice	12.11	Beef liver
0.13	Jelly, jam	11.27	Carrots
02	Vegetable oil	10.77	Canned pumpkin
0.21	Mayonnaise, regular	10.48	Collard greens
0.22	Angel food cake	10.39	Cereal, whole grain nutrient fortified