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The Impact of Neighborhood Income on the Cost of Energy-Dense and Nutrient-Dense Foods in Supermarkets

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Abstract

Prices of 14 nutrient-dense and energy-dense food items were collected at full-service grocery stores in 2009. Using econometric models that included both supply and demand factors, analysis was conducted to determine whether income and demographic variables had differential impacts on the pricing of energy-dense versus nutrient-dense foods. Results showed that the store's being part of a supercenter was the most important pricing determinant for both food types. All other independent variables were significant for only one to three food items. Very limited statistical evidence was found to support neighborhood per-household income having differential impacts on nutrient-dense versus energy-dense food pricing.

Keywords: food deserts, poverty, nutrition

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Introduction

Poor diet quality of low-income consumers has historically been a worldwide policy concern (Garcia and Pinstrup-Anderson 1987; von Braun et al. 1992). A number of U.S. government programs such as the Supplemental Nutrition Assistance Program (SNAP) child nutrition programs, of which the National School Lunch Program and the School Breakfast Program are a part, have sought to alleviate the impacts of this problem on children. Some posit that low diet quality among the poor has resulted in large part because increased diet quality often results in higher food costs: energy-dense, nutrient-poor foods are generally lower-cost per kilocalorie (kcal) than nutrient-dense, energy-poor foods (Monsivais and Drewnowski 2009). The results of higher costs for healthy foods on a per kcal basis have recently been verified, but have also been found to be dependent on the metric utilized to measure the costs of foods. Specifically, on an average portion size measure, many healthy foods such as fruit, vegetables and dairy cost less than more energy-dense, less healthy food items, such as soft drinks and chips, that are high in saturated fatty acids, sodium, or added sugars (Carlson and Frazão 2012).

A number of studies have sought to determine patterns in grocery store pricing by neighborhood, focusing almost exclusively on affordability of food items that could be used to meet the Dietary Guidelines for Americans (e.g., Hatzenbuehler, Gillespie, and O'Neil 2012; subsequently referenced as HGO 2012). These studies have generally investigated whether grocery stores in low-income areas charged higher or lower prices for foods than grocery stores in higher-income areas. Results have been mixed (Chung and Myers 1999; Hayes 2000). The authors are unaware, however, of studies that have analyzed the differential impacts of neighborhood income and other demographic variables on individual items within a subset of energy-dense and nutrient-dense foods. The objective of this study is to determine whether household income, other household demographic variables, and store characteristics explain the variation in prices of 14 selected commonly consumed foods, nine of which are considered "healthy" nutrient-dense foods, and five of which are considered less healthy energy-dense foods.

The question this study addresses is whether nutrient-dense foods are relatively less expensive in higher-income than in lower-income neighborhood grocery stores, and whether energy-dense foods are relatively less expensive in lower-income than in higher-income neighborhood grocery stores. This study differs significantly from HGO (2012), which used the same dataset but did not address differences in the pricing of nutrient-dense versus energy-dense foods by store neighborhood income levels. We are interested primarily in whether low-income people can purchase nutrient-dense and energy-dense foods for the same prices in the supermarkets located in their neighborhoods as in supermarkets in higher-income areas.

This question stems from observations made by the authors, as well as consideration of economic theory. During surveys of grocery stores in lower-income areas, reduced-price specials were often observed for energy-dense foods, with displays prominently placed in easily accessible locations toward the front of the store. Cameron et al. (2012) showed that, in Melbourne, Australia, shelf space devoted to selected energy-dense snack foods relative to fruits and vegetables was greater in socioeconomically disadvantaged areas. If demand for energy-dense foods were higher in low-income neighborhoods due to exogenous, non-price or demographic related factors such as tastes and preferences, then stores in those neighborhoods should be able to charge more for those foods. On the other hand, this situation may result in stores running specials or generally charging lower prices on these foods, a marketing strategy to attract people into the store. The models we develop allow us to examine, for a limited set of items, whether energy-dense and nutrient-dense foods are priced differently based on neighborhood demographics, notably household income.

Background

Nutritional guidance has advocated the regular, sufficient consumption of foods such as whole grains, fruit, vegetables, lean meats, and low fat dairy, while limiting energy-dense, nutrient-poor foods (Dietary Guidelines for Americans, 2010). Energy-dense, nutrient-poor foods generally "provide excess energy relative to their nutrient value" (Briefel, Wilson, and Gleason 2009) and may be considered "competitive foods" – those that compete with nutrient-dense foods with regard to grocery consumer choices. Energy-dense foods are typically relatively high in energy, lipids, cholesterol, or added sugars; yet low in essential nutrients such as (i) vitamins A, B-6, B-12, C, D, E, and K; folate, choline, pantothenic acid, niacin, riboflavin, and thiamin; and (ii) minerals such as calcium, iron, magnesium, phosphorus, zinc, copper, manganese, and selenium. Nutrient-dense foods are relatively higher in vitamins and minerals and lower in energy, lipids, cholesterol, and sugars.

Literature Review

Previous studies have examined whether grocery stores in low-income areas charge higher prices for foods that could be used to meet dietary recommendations than stores in higher-income areas. The results have been mixed (Alcaly and Klevorick 1971; Kunreuther 1973; Hayes 2000). Studies finding lower food prices in low-income areas include Hayes (2000) and Andreyeva et al. (2008). Bell and Burlin (1993) and Chung and Meyers (1999) found higher grocery prices in low-income areas, but also differences in store type. Food prices have been lowest in chain stores and supercenters, with those stores being less available in lower-income urban areas (Bell and Burlin 1993; Chung and Meyers 1999; HGO 2012). HGO (2012) found that higher income areas have stores with both the lowest and highest prices, but mean prices in high and low income areas were not significantly different.

Studies have shown lower grocery store accessibility in rural areas (Kaufman 1999), which are often lower-income on average than urban and suburban areas, and there are also fewer chain stores in rural areas (Powell et al. 2007). MacDonald and Nelson (1991) found that urban grocery stores charged higher prices for food than suburban food stores, where there was more competition by warehouse stores. King, Leibtag, and Behl (2004) showed that, if grocery stores in lower-income neighborhoods charged more for food, the higher prices would not be the result of higher operating costs. In sum, a consistent finding has been that smaller stores charge higher prices for food (Goodman 1968; Kunreuther 1973; MacDonald and Nelson 1991; Bell and Burlin 1993; Kaufman et al. 1997; Chung and Meyers 1999; Woo et al. 2001) and chain and supercenter stores charge lower prices (Bell and Burlin 1993; Kaufman et al. 1997; Chung and Meyers 1999; Woo et al. 2001; HGO 2012). The aforementioned studies have focused primarily on the prices of either a subset of commonly purchased "healthy" foods or an aggregate market basket of "healthy" foods, unlike the present study, which addresses differences in pricing patterns among energy-dense, nutrient-poor and nutrient-dense, energy-poor foods. Though this study uses the same data as HGO (2012), it addresses a different topic, specifically whether there are differential impacts of store neighborhood income on pricing of energy-dense versus nutrient-dense foods.

Data and Methods

Grocery Store Data Collection

Pricing data for 208 food items in 60 full-service grocery stores in the Baton Rouge, Louisiana, nine-parish metropolitan statistical area were collected in an on-site survey over a three-week period in January, 2009. The price data were collected by two faculty members, two graduate students and two staff members of the Louisiana State University Agricultural Center after a training session on data gathering methods. A variety of foods were included for pricing: (1) foods that were included in a two-week menu developed by Stewart (2006) to meet the 2005 Dietary Guidelines for Americans and that would appeal to Southern Louisiana consumers, (2) foods that were included in the "Recipes and Tips for Healthy, Thrifty Meals" (Thrifty Food Plan) menu developed by Pennsylvania State University with the USDA Center for Nutrition Policy and Promotion, and (3) foods that were reported to have been consumed during 24-hour dietary recalls with low-income women in Southern Louisiana (Smith 2002). Thus, included in the pricing survey were a variety of nutrient-dense food items such as fresh, canned, and frozen vegetables; fresh, canned, and frozen fruit; fresh and canned meats; whole-grain items; dairy products; and energy-dense items such as chips, snack cakes, ice cream, and others. A complete list of foods included in the survey is found in Hatzenbuehler (2010).

We limited our survey to full-service grocery stores (supermarkets) because it would be difficult if not impossible to purchase a market basket of foods to meet the Dietary Guidelines for Americans at most convenience stores. These stores rarely have extensive selections of the nutrient-dense foods such as the fresh fruit and vegetables that we are analyzing, so they do not apply to our analysis. Cameron et al. (2012) and Thornton et al. (2012) selected 35 supermarkets for their examinations of the availability of snack foods in Melbourne, Australia.

All six individuals who collected food price data were trained on how to record price data and conducted the first survey together. The survey form specified size and form of all food items for which a price was to be recorded. The lowest priced item was recorded, irrespective of brand, assuming all items of the same type and size to be of equal quality regardless of brand. This assumption would hold for most cases, though in cases of highly processed items, some variation might be found. We chose the lowest-priced items regardless of brand because they would be the most affordable for economizing consumers. For our purposes of nutritional equivalence, for instance, Store A's having a higher brand-name cola price than Store B would mean little if Store A had a lower-priced alternative cola brand of similar quality while Store B did not. For purposes of this study, where most of the nutrient-dense food items were in raw form (bananas, navel oranges, broccoli, carrots, red potatoes) or minimally processed (skim milk, chicken fryer) or a specific brand was priced (snack cakes), this should not pose major concerns for differential product quality. For the remaining items, whole-wheat bread, oatmeal, cola, fruit drink, potato chips, and vanilla ice cream, we argue that their nutritional contents are unlikely to vary greatly and low-income consumers, who generally have relatively higher own-price elasticities of demand (Jones 1997), will choose the lower priced items. If a sale price was the lowest price, the sale price was recorded. In cases where the specified item size was unavailable in the store, the closest-sized item to the specified size was included and indicated on the survey form. Bulk items were not priced.

In addition to food prices, the following were also collected for each store: retail space of the store, measured by the surveyor (square feet); and additional services offered by the store, such as a salad bar, prepared hot meals, prepared salads, sliced meats, prepared baked goods, and an olive bar. United States census data were used to determine demographics of the neighborhoods in which the stores resided (2010 Census: Atlas: The Louisiana Statewide GIS). For these variables, the census tract value was used.

Selecting Food Items for Inclusion in the Analysis

Of the 208 items included in the in-store pricing survey, 14 were chosen for this analysis: nine nutrient-dense and five energy-dense foods. The foods included: fresh bananas (1-lb), loose navel oranges, fresh broccoli (head), whole carrots (1-lb bag), red potatoes (5-lb bag), whole wheat bread (loaf), oatmeal (18-oz box), 1-gallon fat-free milk, whole chicken fryer, snack cakes (box), 2-liter cola, 1-gallon fruit drink, regular potato chips (12-oz bag), and vanilla ice cream (1/2 gallon). These items were chosen as representative of foods that could be used not only as meal components, but also as snacks, i.e., bananas, broccoli, and carrots for "healthy" snacks and snack cakes, cola, and potato chips as energy-dense snacks. Furthermore, they are not strong complements with other food items such that another item would need to be purchased and they were available at most of the supermarkets. Our choices of energy-dense foods to analyze are consistent with Briefel, Wilson, and Gleason's (2009) listed examples of energy-dense foods: "sugar-sweetened beverages, salty/high-fat chips, high-fat baked goods, and desserts." The nutrient-dense foods are represented by fresh fruit, green vegetables, orange vegetables, starchy vegetables, grains, dairy, and meat. The energy-dense foods are represented by sodas, sweets, and salty snacks.

To compare and contrast the energy-dense and nutrient-dense foods, nutrient analyses of each of the selected food items are shown in Appendix B, Tables 1A-3A. Examining minerals and vitamins per 100g edible portion and per 100kcal, the nutrient-dense items are generally higher except for sodium. In terms of energy per 100g edible portion, the lowest of the nutrient-dense items is raw broccoli, at 28kcal, while the highest is whole wheat bread, at 247kcal. In comparison, the lowest of the energy-dense items is cola, at 37kcal, and the highest is potato chips, at 536kcal. Total lipids are generally higher for the energy-dense foods, with the exceptions of cola and fruit drinks. Sugars are generally higher for the energy-dense foods, with the exception of potato chips. Sodium is generally higher per 100g for the energy-dense foods, with the exceptions of cola and fruit drink (relatively low) and whole wheat bread (relatively high).

Table 1 presents estimates of nutrient density and energy density scores for each of the selected food items. Nutrient density scores are estimated according to Drewnowski's (2005) Naturally Nutrient Rich Score, which measures the average of the percentage daily values of the following 14 nutrients in 2000 kcal of food: protein, calcium, iron, vitamin A, vitamin C, thiamine, riboflavin, vitamin B-12, folate, vitamin D, vitamin E, monounsaturated fat, potassium, and zinc. Limitations of nutrient density calculations are that there is no standard method; not all formulas include all healthful nutrients. For example, Drewnowski's (2005) formula does not include fiber and some formulas do not subtract nutrients that may be unhealthy if over-consumed, such as sodium and saturated fatty acids. Foods categorized as "nutrient-dense" generally have higher nutrient density scores, particularly navel oranges, raw broccoli, cooked broccoli, raw carrots, and cooked carrots. It is noted, however, that snack cakes also has a relatively "good" nutrient density score because the flour is enriched, which provides iron, folate, and other B vitamins. The potato chips also have among the highest nutrient density scores since they are high in monounsaturated fatty acids, potassium, and vitamin C. Both, however, also have among the highest energy-density scores in the group and are high in saturated fat as well as added sugar and/or sodium.

Table 1. Nutrient Density and Energy Density Scores, Selected Foods

Food Item	Nutrient Density Score	Energy Density Score
Nutrient-Dense Foods		
Banana	2.99	89
Naval Orange	12.79	49
Raw Broccoli	11.99	28
Cooked Broccoli	22.37	35
Raw Carrots	14.00	41
Cooked Carrots	13.43	35
Red Potatoes Cooked	5.43	78
Whole Wheat Bread	9.00	247
Oatmeal	2.09	71
Chicken Fryer	8.40	190
Fluid Fat Free Milk	4.59	34
Energy-Dense Foods		
Snack Cakes	9.25	247
Cola	0.08	37
Fruit Drink	0.09	64
Potato Chips	17.50	536
Vanilla Ice Cream	5.73	207

Energy density refers to the amount of energy in a given weight of food or beverages. It depends on the fat, fiber, and water content of the food. Energy density was defined as kcals per 100 grams of food / beverage consumed (2005 DGA Advisory Committee Report). Foods with the highest energy density scores include snack cakes, potato chips, and vanilla ice cream. Whole wheat bread also has a relatively high energy density score, though we categorize it as a nutrient-dense food because it is also relatively nutrient-dense and has relatively high fiber content, low added sugar, and low saturated fat. The nutrient density and energy density scores as shown illustrate some of the challenges in attempting to classify foods into these two categories, particularly since existent nutrient density scores do not account for all healthful nutrients and it is possible for a food item to score relatively high for both nutrient density and energy density. Given the challenges, however, of classifying foods based upon imperfect scoring systems, our selection of energy-dense foods is consistent with Briefel, Wilson, and Gleason's (2009) definition of energy-dense foods and the 2010 Dietary Guidelines for Americans food components that are recommended to be reduced. The 2010 Dietary Guidelines for Americans recommends the reduction of items containing sodium, solid fats, added sugars, and refined grains, some or all of which our "energy-dense" foods include; these are listed as "foods and food items to reduce" in the guidelines. Furthermore, our categorization of "nutrient-dense" foods is consistent with the 2010 Dietary Guidelines categorization of "foods and food items to increase."

Examination of the selected energy-dense relative to nutrient-dense foods shows that they are relatively inexpensive on per-kcal bases (Table 2). Price/100g and price/kcal were calculated using average prices collected in the survey. Comparing the mean of the prices per 100g of the nine nutrient-dense items with the mean of the prices of the five energy-dense items, both were 32.8¢/100g. However, comparing the mean of the average prices per kcal, nutrient-dense foods cost more than energy-dense foods: 0.5¢/kcal versus 0.1¢/kcal, a finding that is consistent with Monsivais, Maclain, and Drewnowski (2010) and Carlson and Frazão (2012), which helps to explain why cash-constrained low-income people may opt for energy-dense, nutrient-poor foods as less expensive energy sources.

Table 2. Average Price per 100 Grams and Price per Kilocalorie, Selected Foods, 60 Surveyed Baton Rouge Grocery Stores

Item	**Average Price of Edible Food (Cents / 100 Grams)**	**Average Price (Cents / Kilocalorie)**
Nutrient-Dense Foods		
Bananas, Fresh	25.63	0.29
Naval Oranges, Fresh	49.95	1.02
Broccoli, Fresh	39.37	1.41
Carrots, Fresh	24.43	0.60
Red Potatoes, Fresh	16.01	0.21
Whole Wheat Bread	34.33	0.14
Oatmeal	31.17	0.44
Skim Milk	11.19	0.33
Chicken Fryer	62.76	0.33
Energy-Dense Foods		
Snack Cakes	48.64	0.12
Cola	5.50	0.15
Fruit Drink	4.85	0.08
Potato Chips	88.35	0.16
Vanilla Ice Cream	16.51	0.08

A Model to Estimate Food Price Drivers

To determine the impact of supply and demand factors on food prices, Equation (1) is estimated, where $Price_i$ is the price per unit of a food item in store *i*, for $i = 1...n$:

$$(1) \quad Price_i = f(MargCost_i, Competition_i, Demand_i),$$

where $MargCost_i$ represents store *i*'s marginal costs, which are supply factors such as store size and scope of services, $Competition_i$ is a measure of the extent of spatial market competition experienced by the store, and $Demand_i$ measures the impact of demand factors such as income and demographic characteristics on pricing. This equation is estimated using ordinary least squares regression. Since *Price* and *Competition* may be simultaneously determined, this raises the concern of endogeneity of *Competition* in the *Price* equation, and thus the likelihood of *Competition* being correlated with the error term in (1). Therefore, we used the Hausman (1978) test to determine whether endogeneity was present, including measures for population density and average household size as instruments. In no case was endogeneity found, suggesting that we can include our estimated measure for *Competition* directly in the model. In our models, heteroskedasticity-consistent robust standard errors are estimated. In addition to separate models for each food item, we sum the costs for each of the items within a group (nine nutrient-dense foods and five energy-dense foods) and estimate the impacts of *MargCost, Competition,* and *Demand* on the costs of the market baskets of both groups.

Independent Variables

Demand variables included in the model are *Income* ($\bar{X} = 45{,}392$), the median household income, divided by 1,000 for computational purposes, and *Black* ($\bar{X} = 0.39$), the portion of individuals self-identified as African American. These demand variables are included to explore the impacts of income and tastes and preferences of the population around the grocery store on food pricing. Marginal cost or supply variables included in the model are *High Real Estate Value* and *Low Real Estate Value* dummy variables, which are dummy variables that indicate whether average home values in the census tract where the grocery store is located are >$170,000 and <$124,000, respectively. The base includes home values between those two values, with the three categories divided as approximate tertiles of home values. These variables are used as proxies for fixed property costs of the grocery store. *Urban* ($\bar{X} = 0.88$) is included to control for transportation costs, as in Stewart and Davis (2005).

Other independent variables for supply are *Chain* ($\bar{X} = 0.38$), a discrete variable defined as the store being part of a firm owning and operating ≥11 stores (Marion et al. 1979); *Supercenter* ($\bar{X} = 0.18$), a discrete variable defined as "a very large discount department store that also sells a complete line of grocery merchandise"; *Services* ($\bar{X} = 3.08$), defined as the total number of the following included in the grocery store: salad bar, olive bar, prepared hot meals, prepared salads, full-service deli, and full-service bakery; and *Store Size* ($\bar{X} = 12{,}291$), defined as the number of square feet of retail space in the grocery store, divided by 1,000 for computational purposes. Supercenter and chain stores were expected to charge lower prices for food items (Kaufman et al. 1997; Woo et al. 2001; HGO 2012). Stores with more services have been found to charge higher food prices (MacDonald and Nelson 1991; Anderson 1993; and, King, Leibtag, and Behl 2004), although HGO (2012) found lower costs for market baskets meeting the 2005 Dietary Guidelines for Americans and Thrifty Food Plan in stores with more services. Larger stores were also generally expected to charge lower food prices (MacDonald and Nelson 1991; Binkley and Connor 1998; Hayes 2000), though Anderson (1993) suggested that longer hours and higher utility costs increased the costs of larger stores, driving up food costs, and HGO (2012) found larger stores charged higher fruit prices.

Competition is a spatial competition gravity index variable, calculated as follows for each of the 60 surveyed stores:

$$(2)\quad Competition_{ij} = \sum_{j=1}^{n} \frac{Distance_{ij}}{(Distance_{ij})^2}$$

where *i* refers to the store of interest, *j* refers to other stores within a 10-mile radius of store *i*, and *n* is the number of stores within a 10-mile radius of store *i*. $Distance_{ij}$ is the distance in miles between stores *i* and *j*. Several full-service grocery stores in the Baton Rouge metropolitan statistical area were not surveyed; they were, however, included in calculations for $Competition_i$ if they were within a 10-mile radius of store *i*. Given this gravity model as calculated via equation (2), stores closer to store *i* become more heavily weighted than those further away, as they are considered to be more direct competitors. Blanchard and Matthews (2007) described areas outside a 10-mile radius of a store as having “low access;” thus stores outside a 10-mile radius were not considered competitors. Distances were measured using MapQuest to determine actual driving distances between stores. It is expected that competition reduces food prices in grocery stores.

The natural logs of continuous variables *Income*, *Black*, *Services*, *Store Size*, and *Competition* are used in the model, as are the natural logs of the prices of each of the food items, so the interpretation of the results is akin to an elasticity – percentage change in price with respect to a percentage change in the independent variable. *Chain, Supercenter, High Real Estate Value, Low Real Estate Value*, and *Urban* are dummy variables, so we do not use natural logs of these variables.

Examining the Relationship between Income and Ratios of Nutrient-Dense / Energy-Dense Food Prices

To further examine whether nutrient-dense and energy-dense foods were priced differently in neighborhoods with higher versus lower median household incomes, regression analysis was used in similar manner to that in Equation (1) except that the ratios of the prices of each of the nutrient-dense foods to the prices of each of the energy-dense foods served as the dependent variables, for a total of 9 nutrient-dense × 5 energy-dense = 45 regressions. The same independent variables were included in these models as were included in the individual pricing models. This allowed us to determine whether supply and demand factors including income influenced the relative pricing of nutrient-dense versus energy-dense foods.

One of the stores was a significant pricing outlier, specializing in higher-end and organic foods, so for all statistical analyses, 59 of the 60 stores were included (unless there were missing values for a price, where fewer were analyzed). The pricing outlier store's inclusion in the analyses resulted in non-normal distributions of errors (HGO 2012).

Results

Table 3 (see Appendix A) shows individual food pricing model results for nutrient-dense and energy-dense foods. Multicollinearity did not appear to be influencing the data, as variance inflation factors were all <5 and no correlation coefficients for any of the independent variables were >0.75. Several of the models (carrots, potatoes, chicken fryer, snack cakes, and fruit drink) either had regression F values that were not significant at the $P \leq 0.10$ level or had no estimates that were significant at the $P \leq 0.10$ level; these results are not included in Table 3 and are not discussed, despite some of the ones with non-significant F values having one or two significant coefficients that were generally consistent in sign with those of the discussed analyses.

Results show limited impact of demand factors influencing the pricing of energy-dense foods, with grocery stores in higher-income neighborhoods charging more for potato chips and the market basket of energy-dense foods than grocery stores in lower-income neighborhoods. Results suggest that a 10% increase in income around the store increases the price of potato chips by 5.4% and the market basket of energy-dense foods by 2.4%. These results are generally consistent with studies that have found higher prices in higher-income areas (i.e., Hayes 2000) and inconsistent with those finding lower prices in higher-income areas (i.e., Chung and Myers, 1999). Grocery stores with higher percentages of African Americans residing in their neighborhoods charged more for oranges and ice cream.

Supply factors other than *Supercenter* generally had limited impact on pricing of either nutrient-dense or energy-dense foods. Stores in areas with high-valued real estate charged less for potato chips than stores in areas with medium-valued real estate. Furthermore, stores in areas with low-valued real estate charged more for the market basket of energy-dense foods than those located in areas with medium-valued real estate. Both results are inconsistent with expectations, given that assumed higher real estate values would lead to greater fixed costs for the stores. When we did not include real estate values in the models, the *Income* results did not change in sign or significance, so we cannot conclude that these values are serving as additional proxies for income level. Stores in urban areas charged less for skim milk and whole wheat bread than stores in rural areas, consistent with lower transportation costs for these stores to obtain goods, but more for oranges. Chain stores charged less for oranges, cola, and the market basket of energy-dense foods than non-chain, non-supercenter stores, consistent with results by HGO (2012), who found lower market basket costs in chain stores. Stores that provided more services charged less for whole-wheat bread, a result that would be consistent with economies of scope in grocery stores and consistent with HGO (2012), but inconsistent with the argument that greater services lead to greater costs to be spread over the full line of grocery items. Larger stores charged more for oranges, a result that is counter to expectations if economies of size lead to lower prices, but consistent with HGO (2012) results for fruit and Anderson's (1993) argument that these stores might be higher cost due to longer hours and higher utility costs.

Supercenter was the most important determinant of pricing, with supercenters charging less than non-supercenter stores for seven of the individual items: broccoli, whole wheat bread, oatmeal, skim milk, cola, potato chips, and ice cream. Furthermore, supercenter stores charged less for the market baskets of both energy-dense and nutrient-dense foods. *Competition* was significant with the expected sign for bananas and for the market basket of energy-dense foods. Overall, with the exception of *Supercenter*, it would be ill-advised to draw final conclusions that any of the variables have significant impacts on grocery store pricing on the basis of our analysis since at most any of the other variables showed significant impacts on the pricing in three of the 11 regressions. Thus, the possibility of a making a type 1 error in concluding general impact is quite high in these cases. Noteworthy, however, is that *Income, Low Real Estate Value, Chain,* and *Competition* were significant in the energy-dense market basket analysis, with results that provide preliminary evidence of lower prices for energy-dense foods in lower income areas.

Of the regression analyses for the 45 nutrient-dense / energy-dense pricing ratios, only 27 were significant at the $P \leq 0.10$ level. These are the only regressions we include in our discussion of the following results. Though in a few cases some of the independent variables were significant in regressions that were not significant, they are not included in the percentages of positive and negative impacts we found, which are provided in Table 4. *Income* was significant for 26% of the regressions at $P \leq 0.10$, with 15 percent indicating that higher income resulted in relatively higher prices for nutrient-dense foods relative to energy-dense foods and 11 percent indicating the opposite. The positive results for income were for whole-wheat bread, potatoes, and oatmeal, all relative to snack cakes, and oatmeal relative to cola. The negative results were for skim milk and bananas relative to cola and bananas relative to potato chips. When the nutrient-dense market basket / energy-dense market basket cost ratio was analyzed, *Income* was non-significant. Considering that snack cakes, oatmeal, and cola are common to multiple cases and that there is no consistency in signs by income, we cannot infer a general relationship between income and differential pricing of nutrient-dense versus energy-dense foods.

Table 4. Summary of Results of Nutrient Dense / Energy-Dense Pricing Ratio Regression Models

	Percentage of β Estimates of the 27 Regressions Indicating Positive and Negative Influences at P≥0.10 on Price Ratios	
Independent Variable	Positive	Negative
Income	14.8	11.1
Black	0	18.5
High Real Estate Value	29.6	3.7
Low Real Estate Value	37.0	14.8
Urban	0	7.4
Chain	0	0
Supercenter	14.8	14.8
Services	3.7	0
Store Size	25.9	11.1
Competition	11.1	3.7

A summary of other results suggests that, for 19 percent of the cases, higher percentages of African Americans residing in a neighborhood resulted in relatively higher prices of energy-dense foods. Real estate values had significant impacts on price ratios, with mixed results. For 7 percent of the combinations, stores located in urban areas charged relatively higher prices for energy-dense foods relative to nutrient-dense foods. No relationship was found between chain stores and nutrient-dense / energy-dense price ratios and for equal numbers of price ratios, supercenters charged higher or lower prices for nutrient-dense relative to energy-dense foods. Furthermore, for the nutrient-dense market basket cost relative to the energy-dense market basket cost, supercenters charged relatively higher prices for nutrient-dense foods relative to energy-dense foods when comparing to non-supercenter stores. For 26 percent of the cases, larger stores charged relatively more for nutrient-dense than energy-dense foods, while for 11 percent of the cases, the opposite was found. For 11 percent of the cases, stores with more competition charged relatively more for nutrient dense relative to energy-dense foods. Overall, no clear patterns of influence on pricing of nutrient-dense relative to energy-dense foods were found.

Conclusions and Observations

Previous research showing diet quality to be lower for low-income individuals coupled with observations of prominently-displayed specials of energy-dense foods in grocery stores in low-income Baton Rouge, Louisiana, neighborhoods led us to question whether there were differences in relative prices of energy-dense and nutrient-dense foods in grocery stores by neighborhood income. Furthermore, while a number of studies had examined nutrient-dense food pricing, none were found examining impacts of neighborhood demographics on energy-dense food pricing. Our results do not provide statistical evidence for consistent patterns of differential pricing of energy-dense and nutrient-dense foods by neighborhood income level. Of the 14 items tested, one energy-dense food and the market basket for energy-dense foods showed higher prices in higher-income neighborhoods than in lower-income neighborhoods. However, regression analysis of the ratios of nutrient-dense to energy-dense food prices with median neighborhood income level did not suggest a consistent pattern of differential pricing of these food types by neighborhood income level. Therefore, we cannot conclude that differential supermarket pricing exists for these food types by neighborhood income. From an industry perspective, inconclusive evidence of differential pricing of these food types by neighborhood income is not too surprising. This is because stores could either (1) use the generally lower-priced energy-dense foods to pull in more customers in low-income areas or (2) charge higher prices for the energy-dense foods that are in greater demand.

Consistent with HGO (2012) findings with market baskets that met the 2005 Dietary Guidelines for Americans and USDA's Thrifty Food Plan, the store's being a part of a supercenter appears to have the greatest influence on individual food item pricing, regardless of whether the food item is an energy-dense or nutrient-dense product. In seven of the 14 cases and for both energy-dense and nutrient-dense market baskets, supercenter stores charged lower prices than non-chain, non-supercenter stores. Thus, location near these stores appears to be the most important factor in having access to lower food prices regardless of nutrient or energy density. It appears that in cases where cities are attempting to attract grocery stores into low-income food desert areas, the high-volume supercenter stores will provide residents with the lowest-cost food, regardless of whether the foods are energy-dense or nutrient-dense.

Our results should not be interpreted as suggesting lower and upper-income individuals have equal access to competitively-priced nutrient-dense foods. This study did not address that issue, as the issue has already been addressed by others, such as HGO (2012), who showed fewer supermarkets in lower-income areas. In lower-income areas with fewer grocery stores, shoppers may be more likely to frequent convenience stores, which are generally higher priced and unlikely to carry full selections of nutrient-dense foods such as those analyzed in this study. We must be clear, however, that our results hold only for full-service grocery stores. For fresh fruits and vegetables and some others, this is not a major limiting assumption since full-service grocery stores are the major places where these items are purchased. However, for foods that are more heavily processed, the assumption is a greater limitation, particularly given the recent expansion of "dollar" stores that carry food items.

In conducting this study, identifying foods we could agree upon as being categorized under "energy-dense" and "nutrient-dense" labels was generally not difficult. However, within-category nutrient density and energy density scores for those foods varied widely, such that some nutrient-dense (energy-dense) foods had higher energy density (nutrient-density) scores than some of the energy-dense (nutrient-dense) foods. Thus, examining only one of these scores without the other, and without further examining more specific nutrients of the foods could be misleading. Furthermore, for the subsets of nutrient-dense and energy-dense foods we studied, energy-dense foods had lower prices on per kcal bases, but not on per 100 g bases, than nutrient-dense foods. This supports recent studies showing that differences in food pricing between nutrient-dense and energy-dense foods depends upon the units by which the food is measured.

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Appendix A

Table 3. Regression Models for Pricing of Nutrient-Dense and Energy-Dense Foods

Variable	Banana 1 Pound	Orange 1 Pound	Oatmeal 18 Ounces	Skim Milk 1 Gallon	Brocolli 1 Pound	Whole Wheat Bread 20 Ounces
Intercept	1.771	-3.139	-3.898	-1.820*	-1.630	-0.800
	(2.590)	(2.199)	(3.395)	(0.969)	(2.013)	(2.842)
Income	-0.212	0.225	0.401	0.117	0.207	0.167
	(0.237)	(0.204)	(0.307)	(0.087)	(0.185)	(0.257)
Black	0.001	0.139***	-0.002	0.010	0.004	-0.013
	(0.034)	(0.041)	(0.063)	(0.022)	(0.032)	(0.052)
High Real Estate Value	0.125	0.056	-0.155	-0.053	-0.079	-0.139
	(0.099)	(0.145)	(0.146)	(0.042)	(0.102)	(0.151)
Low Real Estate Value	-0.046	0.066	0.159	0.032	0.011	0.041
	(0.053)	(0.122)	(0.128)	(0.043)	(0.071)	(0.147)
Urban	0.071	0.305**	-0.043	-0.142*	-0.088	-0.245*
	(0.072)	(0.134)	(0.119)	(0.071)	(0.091)	(0.140)
Chain	-0.014	-0.448***	-0.117	0.062	-0.048	-0.031
	(0.098)	(0.145)	(0.127)	(0.045)	(0.091)	(0.180)
Supercenter	-0.031	-0.104	-0.297**	-0.086**	-0.430***	-0.228*
	(0.069)	(0.129)	(0.114)	(0.037)	(0.079)	(0.130)
Services	0.017	-0.002	-0.001	-0.005	-0.003	-0.052*
	(0.024)	(0.018)	(0.025)	(0.010)	(0.018)	(0.031)
Store Size	0.014	0.212**	0.010	-0.019	0.012	-0.019
	(0.072)	(0.091)	(0.089)	(0.033)	(0.055)	(0.109)
Competition	-0.021*	-0.016	-0.014	0.008	-0.002	-2.20E-4
	(0.011)	(0.026)	(0.022)	(0.009)	(0.012)	(0.022)
Prob > F	0.008	0.000	0.006	0.001	0.000	0.036
R^2	0.128	0.358	0.206	0.326	0.424	0.220
Observations	59	58	58	59	59	58

Note. Food items, Income, Black, Services, Store Size, and Competition are specified as natural logs.

Table 3. *Continued.* Regression Models for Pricing of Nutrient-Dense and Energy-Dense Foods

Variable	**Potato Chips 12 Ounces**	**Cola 2 Liter Bottle**	**Ice Cream Half Gallon**	**Energy-Dense Foods**	**Nutrient Dense Foods**
Intercept	-4.120*	-2.057	-1.821	-0.429	0.712
	(2.386)	(2.457)	(2.055)	(1.466)	(1.501)
Income	0.543**	0.082	0.121	0.237*	0.143
	(0.215)	(0.225)	(0.186)	(0.131)	(0.138)
Black	0.193	0.045	0.050*	-0.033	0.010
	(0.047)	(0.034)	(0.026)	(0.024)	(0.028)
High Real Estate Value	-0.359***	-0.122	0.075	-0.080	-0.028
	(0.123)	(0.128)	(0.094)	(0.074)	(0.080)
Low Real Estate Value	0.045	-0.026	0.021	0.166**	0.046
	(0.097)	(0.096)	(0.068)	(0.068)	(0.057)
Urban	0.025	-0.066	-0.059	0.100	0.020
	(0.105)	(0.091)	(0.047)	(0.073)	(0.044)
Chain	-0.105	-0.365***	-0.089	-0.187*	-0.079
	(0.112)	(0.096)	(0.098)	(0.097)	(0.076)
Supercenter	-0.480***	-0.520***	-0.257***	-0.402***	-0.166**
	(0.105)	(0.120)	(0.080)	(0.083)	(0.062)
Services	-0.010	-0.027	-0.023	-0.024	0.007
	(0.028)	(0.021)	(0.021)	(0.025)	(0.016)
Store Size	-0.069	-0.019	0.075	0.028	0.039
	(0.073)	(0.085)	(0.050)	(0.054)	(0.047)
Competition	-0.025	-0.015	-0.015	-0.027**	-0.004
	(0.021)	(0.014)	(0.019)	(0.012)	(0.009)
Prob > F	0.000	0.000	0.018	0.000	0.070
Adjusted R^2	0.486	0.488	0.217	0.596	0.184
Observations	57	58	59	40	50

Note. Food items, Income, Black, Services, Store Size, and Competition are specified as natural logs.

Appendix B

Table A1. Nutrient Analyses of Fruit and Vegetables Used in the Analysis

	Raw Banana, 36% ref		Raw Navel Oranges, 32% ref		Raw Broccoli[1]		Cooked Broccoli[2]	
Nutrient	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal
Water (g)	74.91	84.17	85.97	175	90.69	323.89	89.25	255
Energy (kcal)	89	----	49	----	28	----	35	----
Protein (g)	1.09	1.22	0.91	1.84	2.98	10.64	2.38	6.8
Total lipid (g)	0.33	0.37	0.15	0.31	0.35	1.25	0.41	1.17
SFA (g)	0.11	0.12	0.1	0.2	0.05	0.18	0.08	0.23
MUFA (g)	0.03	0.03	0.03	0.06	0.02	0.07	0.04	0.11
PUFA (g)	0.07	0.08	0.03	0.06	0.17	0.61	0.17	0.49
Cholesterol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ash g	0.82	0.92	0.43	0.88	0.92	3.29	0.77	2.2
Carbohydrate (g)	22.84	25.66	12.54	25.59	5.24	18.71	7.18	20.51
Fiber (g)[4]	2.6	2.92	2.2	4.49	N/A	N/A	3.3	9.43
Sugars, Total (g)	12.23	13.74	8.50	17.35	N/A	N/A	1.39	3.97
Starch	5.38	6.55	0.00	0.00	N/A	N/A	0.00	0.00
Calcium (mg)	5	5.62	43	87.76	48	171.43	40	114.29
Iron (mg)	0.26	0.29	0.13	0.27	0.88	3.14	0.67	1.91
Magnesium (mg)	27	30.33	11	22.45	25	89.29	21	60
Phosphorus (mg)	22	24.72	23	46.94	66	235.71	67	191.43
Potassium (mg)	358	402.25	166	338.78	325.24	1160.71	293	837.14
Sodium (mg)	1.0	1.12	1	2.04	27	96.43	41	117.14
Zinc (mg)	0.15	0.17	0.08	0.16	0.40	1.43	0.45	1.29
Copper (mg)	0.08	0.09	0.04	0.08	0.05	0.18	0.06	0.17
Manganese (mg)	0.27	0.30	0.03	0.06	0.23	0.82	0.19	0.54
Selenium (mcg)	1.0	1.12	0.0	0.00	3.0	10.71	1.6	4.57
Vitamin C (mg)	8.7	9.78	59.1	0.01	93.2	332.86	64.9	185.43
Thiamin (mg)	0.03	0.03	0.07	0.14	0.07	0.25	0.06	0.17
Riboflavin (mg)	0.07	0.08	0.51	1.04	0.12	0.43	0.12	0.34
Niacin (mg)	0.67	0.75	0.43	0.88	0.64	2.29	0.55	1.57
Pantothenic acid (mg)	0.33	0.37	0.26	0.53	0.54	1.93	0.62	1.77
Vitamin B-6 (mg)	0.37	0.42	0.08	0.16	0.16	0.57	0.20	0.57
Folate (mcg_DFE)	20	22.47	34	69.39	71	253.57	108	308.57
Choline (mg)	9.8	11.01	8.4	17.14	N/A	N/A	40.1	114.57
Vitamin B-12 (mcg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vitamin A (mcg_RAE)	3	3.37	12	24.49	150	535.71	77	220
Vitamin E (mg)	0.10	0.11	0.15	0.31	N/A	N/A	1.45	4.14
Vitamin D (mcg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vitamin K (mcg)	0.5	0.56	0.00	0.00	N/A	N/A	141.1	403.14

Appendix Table A1 *Continued.* Nutrient Analyses of Fruit and Vegetables Used in the Analysis

	Raw Carrots, 11% refuse		Cooked Carrots[2]		Cooked Red Potatoes[3]	
Nutrient	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal
Water (g)	88.29	215.34	90.17	257.63	77.80	99.74
Energy (kcal)	41	----	35	----	78	----
Protein (g)	0.93	2.27	0.76	2.17	2.86	3.67
Total lipid (g)	0.24	0.59	0.18	0.51	0.10	0.13
SFA (g)	0.04	0.10	0.03	0.09	0.03	0.04
MUFA (g)	0.01	0.02	0.01	0.29	0.00	0.00
PUFA (g)	0.12	0.29	0.09	0.26	0.04	0.05
Cholesterol	0.00	0.00	0.00	0.00	0.00	0.00
Ash g	0.97	2.37	0.67	1.91	2.04	2.62
Carbohydrate (g)	9.58	23.37	8.22	23.49	17.21	22.06
Fiber (g)[4]	2.8	6.83	3.0	8.57	3.3	4.23
Sugars, Total (g)	4.74	11.56	3.45	9.86	N/A	N/A
Starch	1.43	3.49	0.17	0.49	N/A	N/A
Calcium (mg)	33	80.49	30	85.71	45	57.69
Iron (mg)	0.30	0.73	0.34	0.97	6.07	7.78
Magnesium (mg)	12	29.27	10	28.57	30	38.46
Phosphorus (mg)	35	85.37	30	85.71	54	69.23
Potassium (mg)	320	780.49	235	674.43	407	521.79
Sodium (mg)	69	168.29	58	165.71	14	17.95
Zinc (mg)	0.24	0.59	0.20	0.57	0.44	0.56
Copper (mg)	0.05	0.12	0.02	0.06	0.88	1.13
Manganese (mg)	0.14	0.34	0.16	0.46	1.34	1.72
Selenium (mcg)	0.1	0.24	0.7	2	0.3	0.38
Vitamin C (mg)	5.9	14.39	3.6	10.29	5.2	6.67
Thiamin (mg)	0.07	0.17	0.07	0.2	0.03	0.04
Riboflavin (mg)	0.06	0.15	0.04	0.11	0.04	0.05
Niacin (mg)	0.98	2.39	0.65	1.86	1.22	1.56
Pantothenic acid (mg)	0.27	0.66	0.23	0.66	0.36	0.46
Vitamin B-6 (mg)	0.14	0.34	0.15	0.43	0.24	0.31
Folate (mcg_DFE)	19	46.34	14	40	10	12.82
Choline (mg)	8.8	21.46	808	2308.57	N/A	N/A
Vitamin B-12 (mcg)	0.00	0.00	0.00	0.00	0.00	0.00
Vitamin A (mcg_RAE)	835	2036.59	852	2434.29	0.00	0.00
Vitamin E (mg)	0.66	1.61	1.03	2.94	N/A	N/A
Vitamin D (mcg)	0.00	0.00	0.00	0.00	0.00	0.00
Vitamin K (mcg)	13.2	32.20	13.7	39.14	N/A	N/A

Appendix Table 2A. Nutrient Analyses of Other Nutrient Dense Foods Used in the Analysis

	Bread, Whole Wheat[1]		**Oatmeal**[2]		**Chicken Fryer**[3] **46% refuse**[4]		**Milk, Fluid, Skim**[5]	
Nutrient	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal
Water (g)	38.58	15.62	83.61	117.76	63.79	33.57	90.84	267.18
Energy (kcal)	247	----	71	----	190	----	34	----
Protein (g)	12.95	5.24	2.54	3.58	28.93	15.23	3.37	9.91
Total lipid (g)	3.35	1.36	1.52	2.14	7.41	3.9	0.08	0.24
SFA (g)	0.75	0.30	0.31	0.44	2.04	1.26	0.06	0.18
MUFA (g)	1.60	0.65	0.44	0.62	2.66	1.4	0.03	0.09
PUFA (g)	0.60	0.24	0.56	0.79	1.69	0.89	0.03	0.09
Cholesterol	0.00	0.00	0.00	0.00	89	46.84	2	5.88
Ash g	3.82	1.55	0.34	0.48	1.02	0.54	0.75	2.21
Carbohydrate (g)	41.29	16.72	12	16.90	0.00	0.00	4.96	13.79
Fiber (g)[4]	6.8	2.75	1.7	2.39	0.00	0.00	0.00	0.00
Sugars, Total (g)	5.57	2.26	0.27	0.38	0.00	0.00	5.09	14.97
Starch	N/A	N/A	11.60	16.34	0.00	0.00	N/A	N/A
Calcium (mg)	107	43.32	9.0	12.68	15	7.89	122	358.83
Iron (mg)	2.43	0.98	0.90	1.27	1.21	63.68	0.03	0.09
Magnesium (mg)	82	33.20	27	38.03	25	13.16	11	32.35
Phosphorus (mg)	202	81.78	77	108.45	195	1.03	101	297.06
Potassium (mg)	248	100.40	70	98.59	243	127.89	156	458.83
Sodium (mg)	472	191.09	4.0	5.63	86	45.26	42	123.53
Zinc (mg)	1.80	0.73	1.0	1.41	2.10	1.11	0.42	1.24
Copper (mg)	0.38	0.15	0.07	0.10	0.07	0.04	0.01	0.03
Manganese (mg)	2.14	0.87	0.58	0.82	0.02	0.01	0.00	0.00
Selenium (mcg)	40.3	16.32	5.4	7.61	22.0	11.58	3.1	9.12
Vitamin C (mg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thiamin (mg)	0.35	0.14	0.08	0.11	0.07	0.04	0.05	0.15
Riboflavin (mg)	0.22	0.09	0.02	0.03	0.18	0.09	0.18	0.53
Niacin (mg)	4.71	1.92	0.23	0.32	9.17	4.83	0.09	0.26
Pantothenic acid (mg)	0.69	0.03	0.31	0.44	1.10	0.58	0.36	1.06
Vitamin B-6 (mg)	0.21	0.09	0.01	0.01	0.47	0.25	0.37	1.09
Folate (mcg_DFE)	50	20.24	6	8.45	6	3.16	5	14.71
Choline (mg)	26.5	10.73	7.4	10.42	78.8	78.8	15.6	45.88
Vitamin B-12 (mcg)	0.00	0.00	0.00	0.00	0.33	0.17	0.50	1.47
Vitamin A (mcg_RAE)	0.00	0.00	0.00	0.00	16	8.42	61	179.41
Vitamin E (mg)	0.55	0.22	0.08	0.11	0.27	0.14	0.01	0.03
Vitamin D (mcg)	0.00	0.00	0.00	0.00	0.1	0.05	1.2	3.53
Vitamin K (mcg)	7.8	3.16	0.03	0.04	2.4	1.26	0.00	0.00

Appendix Table 3A. Nutrient Analyses of Energy-dense Food Items Used in the Analysis.

Nutrient	**Chocolate[1] Chip Cookies**		**Snack Cakes**		**Cola[3]**		**Fruit Drink[4]**		**Chips, Potato[5]**		**Ice Cream, Vanilla**	
	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal
Water (g)	6.48	1.37	13.61	3.36	90.31	244.08	83.87	131.05	1.9	0.35	61.00	29.47
Energy (kcal)	474	---	405	---	37	---	64	---	536	---	207	---
Protein (g)	5.12	1.08	4.80	1.19	0.07	0.19	0.00	0.00	7.0	1.31	3.50	1.69
Total lipid (g)	23.31	4.92	16.30	4.02	0.02	0.05	0.00	0.00	34.60	6.46	11.00	5.31
SFA (g)	9.95	2.10	4.23	1.04	0.00	0.00	0.00	0.00	5.43	1.01	6.79	3.28
MUFA (g)	7.28	1.54	8.97	2.21	0.00	0.00	0.00	0.00	18	3.36	2.97	1.43
PUFA (g)	2.68	0.57	2.26	0.56	0.00	0.00	0.00	0.00	9.16	1.71	0.45	0.22
Cholesterol	0.00	0.00	16.39	4.05	0.00	0.00	0.00	0.00	0.00	0.00	44	21.26
Ash g	1.23	0.26	1.30	0.32	0.04	0.11	0.10	0.16	3.6	0.67	0.90	0.43
Carbohydrate (g)	63.86	13.47	63.90	15.78	9.56	25.84	16.03	25.05	52.90	9.87	23.60	11.40
Fiber (g)[6]	2.4	0.51	2.13	0.53	0.00	0.00	0.00	0.00	4.8	0.90	0.7	0.34
Sugars, Total (g)	35.14	7.41	36.61	9.04	8.97	23.16	15.85	24.77	N/A	N/A	21.22	10.25
Starch	26.91	5.68	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium (mg)	26	5.49	29.51	7.29	2	5.41	3	4.69	24	4.48	128	61.84
Iron (mg)	3.2	0.68	2.25	0.56	0.11	0.00	0.00	0.00	1.63	0.30	0.09	0.04
Magnesium (mg)	39	8.23	31.15	7.69	0.00	0.00	1	1.56	67	12.5	14	6.76
Phosphorus (mg)	84	17.72	101.64	25.10	10	0.00	0.00	0.00	165	30.78	105	50.72
Potassium (mg)	147	31.01	149.18	36.83	2	5.41	31	48.44	1275	237.87	199	96.14
Sodium (mg)	344	72.57	249.18	61.53	4	10.81	36	56.25	594	110.82	80	38.65
Zinc (mg)	0.65	0.14	0.72	0.18	0.02	0.05	0.00	0.00	1.09	0.20	0.69	0.33
Copper (mg)	0.27	0.06	0.23	0.06	0.00	0.00	0.01	0.02	0.31	0.06	0.23	0.11
Manganese (mg)	0.37	0.08	0.13	0.03	0.00	0.00	N/A	N/A	0.44	0.08	0.01	0.00
Selenium (mcg)	4.0	0.84	6.23	1.54	0.1	0.27	0.00	0.00	8.1	1.51	1.8	0.87
Vitamin C (mg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.1	5.8	0.6	0.29
Thiamin (mg)	0.17	0.04	0.26	0.06	0.00	0.00	0.00	0.00	0.17	0.03	0.04	0.02
Riboflavin (mg)	0.15	0.03	0.21	0.05	0.00	0.00	0.00	0.00	0.20	0.04	0.24	0.12

Appendix Table 3A *Continued.* Nutrient Analyses of Energy-dense Food Items Used in the Analysis.

Nutrient	**Chocolate[1] Chip Cookies**		**Snack Cakes**		**Cola[3]**		**Fruit Drink[4]**		**Chips, Potato[5]**		**Ice Cream, Vanilla**	
	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal	Per 100 g edible portion	Per 100 kcal
Niacin (mg)	1.92	0.41	1.72	0.42	0.00	0.00	0.00	0.00	3.83	0.71	0.12	0.06
Pantothenic acid (mg)	0.25	0.05	0.54	0.13	0.00	0.00	N/A	N/A	0.40	0.07	0.58	0.28
Vitamin B-6 (mg)	0.03	0.01	0.34	0.08	0.00	0.00	0.00	0.00	0.66	0.12	0.05	0.02
Folate, (mcg_DFE)	69	14.56	72.13	17.81	0.00	0.00	0.00	0.00	45	8.40	5	2.42
Choline (mg)	17.1	3.61	10	2.47	0.3	0.81	0.00	0.00	N/A	N/A	26	12.56
Vitamin B-12 (mcg)	0.06	0.01	0.07	0.02	0.00	0.00	0.00	0.00	N/A	N/A	0.39	0.19
Vitamin A (mcg_RAE)	0.00	0.00	19.67	4.86	0.00	0.00	0.00	0.00	0.00	0.00	118	57.00
Vitamin E (mg)	2.24	0.47	0.15	0.04	0.00	0.00	0.00	0.00	N/A	N/A	0.30	0.14
Vitamin D (mcg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	0.20	0.10
Vitamin K (mcg)	5.2	1.10	6.56	1.62	0.00	0.00	0.00	0.00	N/A	N/A	0.3	0.14