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Yes we can. Eating healthy on a limited budget

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Abstract

Objective: People who live in low-income households frequently cite cost as a barrier to eating healthy, yet federal cost of food studies maintains that it is possible. This study determines how people who live in low-income households can consume an affordable, nutritious diet.

Design: A community based participatory research (CBPR) project was completed that developed and priced two weeks of healthy menus that met the United States Department of Agriculture (USDA) MyPlate guidelines. Prices were collected from a market basket survey of 13 stores in the City of Chico during October 2010. Initial menu development was begun in 2011-2012. Menus were reviewed in 2017 and reflect current guidelines.

Setting: Chico, California.

Main Outcome Measure: Macro dietary objectives including the caloric content of the foods included in the menus, and servings of fat, sugar, whole grains, and fruits and vegetables. The cost to purchase the market basket of goods for a family of four that achieved those objectives.

Results: The two-weeks of menus all met dietary objectives, although there was variation in meeting all objectives on a daily basis. The daily cost of the menus ranged from \$19 to \$31 if all

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No institutional review board review was necessary as this study did not involve human subjects

food was purchased from a bulk supermarket, with an average daily cost of \$25. The average monthly cost was \$756 in 2010 dollars, or \$838 in 2015 dollars.

Conclusions and Implications: People living in low-income households can afford to eat healthily. Using CBPR principles, daily targets and technical support, the public health partners can partner with community members for member defined solutions that are affordable and meet dietary guidelines. Access to stores that sell low-price “bulk” items is important in being able to afford a healthy diet. Finally, people on food assistance have faced an increasing gap between the growth in food prices and the decline in food assistance benefits between 2010 and 2015, leaving this population vulnerable to food price changes.

Keywords

Low-income; healthy eating; cost; market basket study

Introduction

A healthy diet is a foundation of a healthy lifestyle. Good nutrition is associated with a reduction in chronic diseases including diabetes, heart disease and cancer^{1,2,3}. The affordability of healthier foods has been identified as one constraint to healthier eating by people living in lower income households^{4,5,6}. Research on price disparities between healthy and less healthy foods do show that healthier substitutes are generally more expensive⁴. In a meta-analysis of the cost of healthier foods, Rao et al.⁴ developed an index to compare “healthfulness” across studies with different definitions of “healthier”. “Healthier” can be healthier alternatives within food groups such as ground beef or bread products, or alternative food items across different categories. The results of the meta-analysis estimated that healthier foods are significantly more expensive and were \$1.48 more on average per day for the top quintile compared to the bottom quintile. Other studies have analyzed price data from store receipts that show that budget conscience consumers in lower income households are more likely to purchase food with a lower price per calorie than people in higher income households.^{7,8} These foods also tend to be higher in fat and sugar than foods with a higher price per unit. Finally, using market basket studies, the cost of a market basket of healthier food alternatives, such as whole wheat bread for white bread or low-fat ground beef for regular ground beef, was estimated to be 17% higher⁹.

While observed behavior and store surveys of specific items do show that healthier foods can be more expensive, United States Department of Agriculture (USDA) food plans demonstrate that people can eat healthy on a limited budget¹⁰. The USDA Food Plans estimate the cost of liberal, moderate, low and thrifty plans on a monthly basis that meets the recommendations in the Dietary Guidelines for Americans^{10,11}. A challenge of these plans; however, is that they use composite prices (e.g. the price of protein sub-groups that lump all beef, pork, and chicken products, etc. together rather than the price of, say, 7% fat ground beef¹²) that offer little guidance for actual consumption¹¹. In particular, the Thrifty Food Plan (TFP), which is used to help determine Supplemental Nutrition Assistance Program (SNAP) benefits has been criticized for, among other things, being inadequate as a guideline on resources needed to meet the minimum USDA dietary recommendations¹³.

In response to these criticisms, menus were developed for the TFP based on the 1995 dietary guidelines¹⁴. While the menus did show that diets that met the dietary standards of the day can be developed that were affordable, the diets received intense criticism as being unrealistic and incompatible with time constraints faced by almost all households as the vast majority of meals required cooking a hot meal, and relied on low cost alternatives such as a level of juice consumption not recommended in later versions of the Dietary Guidelines^{15,16}. Questions still remained though as to whether people who live in low-income households can afford a diet that meets the USDA dietary guidelines as presented in the MyPlate nutrition education materials, what that diet would look like and if there were any special circumstances, such as store type, that would influence food costs.

To address these issues, a community based participatory research (CBPR) project was completed in collaboration with a native American community, the Mechoopda Indian Tribe of Chico Rancheria, and a community health clinic, Northern Valley Indian Health, Inc. Community based participatory research is a collaboration between a community and university¹⁷. It gives each partner a seat at the table to collaboratively develop and implement a research project. CBPR uses the strengths of each partner to conduct research relevant to the community. It meets the standards of peer-reviewed research and focuses on the community's priorities to improve the community's quality of life. CBPR has been used successfully in collaborations between American Indian/Native American communities and University collaborators^{18,19,20}.

This project was part of a larger project whose main goal was to train Native American community researchers in University research methods. The community researchers were all members of the Mechoopda Indian Tribe of Chico Rancheria and varied in age from mid-twenties to mid-seventies. The community researchers were mostly female, with one male participant. Over the three year course of the project about seven to eight people were typically actively engaged in the different training phases with a core group of four people. A key element of the training was a "learning by doing" approach consistent with effective adult learning techniques^{21,22,23}. Based on the learning by doing model and the CBPR approach, NVIH and the MIT community researchers would learn how to do research by developing and completing a research project from the ground up. Thus, each group through regular meetings collaboratively defined the research question, developed and administered surveys, and interpreted results. This study presents the results of the CBPR project to develop a two-week menu that meets the DGA, and cost that menu in different store types.

Methods

Project Development

The development and cost of a menu that met the Dietary Guidelines for Americans 2010 (DGA 2010)²⁴ for lower income households uses a market basket approach. Market basket studies are a tool used to assess availability and prices of food items for a bundle of foods commonly consumed by a targeted population.⁹ These studies have frequently been based on menus and shopping lists that were developed for the Thrifty Food Plan¹⁴. Given the past criticisms of the menus developed for the TFP, the MIT community researchers decided to develop their own menus based on what people within the Mechoopda community would

typically eat during the week, and then price those menus. Review by the IRB was not required for this study because human subjects were not involved as per US Department of Health and Human Services guidelines²⁵.

Menu Development

The decision to completely revise the menus originally developed for the 1999 TFP was made by the community researchers who wanted to have menus relevant to their community, rather than foods from menus developed by someone else that do not reflect preferences within their local Native American community. It was also critical to the community researchers that the menus reflected the budget constraints of a lower-income population as 88% of the MIT population surveyed lived in households with an income at or below \$35,000 a year²⁶. In addition, community members spend a significant amount of time at work, school, community development, caring for extended family both within and outside the home, etc. Consequently, the community researchers wanted menus that reflected the amount of time that they would be willing to commit to meal preparation, given their total time commitments.

The meal plans were developed for the same representative family of four that is used in the menus developed earlier for the TFP¹⁴. This family consists of a father, a mother, and two children aged 7 and 10. The first step in completing the menus was to jointly develop specific criteria among all researchers. From the CBPR meetings the community researchers developed the following criteria: “1) Menus based on foods that members of the MIT community like to eat; 2) Menus need to meet the USDA guidelines for healthy eating; 3) Portions should be realistic; 4) Reduced processed food, to reduce the amount of fat and salt in their diets; 5) Time friendly as nobody has time to cook multiple hot meals every day; 6) Lots of options so that people will not get bored eating the same healthy foods; 7) Affordable – everyone is on a budget”.

To develop menus that were culturally appropriate, the MIT community researchers brought in index cards with a meal plan for a breakfast, lunch, snack or dinner. The meal plans were mixed and matched with all research partners of the CBPR project collaborating to develop the foods that would be eaten throughout the day. For meals that used a recipe (such as posole), low-fat versions of those recipes were searched for on-line and used. An Excel (Microsoft Corp, Redmond WA) spreadsheet program was developed by the University research partner to assist in menu development. It was linked to a database of foods, also in Excel, so that once a food item was selected and the number of servings entered, the dietary information (ie. calories, type of food eaten such as fruit, grain, dairy, etc.) would be automatically recorded and compared to the recommendations in the DGA 2010.

The database was developed from various sources. The primary source was the nutritional content of food items originally found in the Mypyramid Tracker. The Tracker was an on-line tool that allowed users to develop their own meals and calculate the nutritional content of those meals. Nutritional information in the Tracker was based on the USDA food and nutrition dietary database 5 (FNDDS 5)²⁷. The Excel database was updated for the USDA Myplate promotions based on the DGA 2015-2020, with the on-line tool renamed Supertracker (this tool was discontinued in June 2018). For foods that were available in the

store for which there was not a good match in the Supertracker (i.e. tamales), the nutritional information on grams of protein, sugar, fat, carbohydrates, etc. was taken from the label, converted into equivalent servings and entered into the database.

Serving sizes were entered in discrete units such as $\frac{3}{4}$ cups, 1.5 oz or one slice of bread. This was done for each member of the household individually (Table 1) until, on average, the daily recommendations in the DGA 2010 were achieved for each person (Appendices 6, 7)²⁴.

The DGA 2010 dietary recommendations varied according to age, gender, and activity²⁴. The recommendations adopted for this study are those for a moderate activity of 30 to 60 minutes a day as recommended in the DGA in order to determine the cost to nourish a healthy lifestyle that includes exercise²⁴. The recommendations were reviewed following publication of the DGA 2015-2020. The recommendations at the level used in this study are identical (Tables A2-1, A3-1)²⁸.

Surveying stores for food prices.

Once the menus were completed, the cost of each menu was calculated using prices gathered from a survey of all grocery stores within the city of Chico. Stores were limited to Chico because that is where the MIT community members shop for food. The survey items were all those listed directly in the menus or the recipes, except for condiments and seasonings (See Supplemental files for shopping list).

The market basket surveys were conducted in October of 2010. Community researchers surveyed each store in teams of two and received training before the surveys began. During the training they were instructed to collect the lowest price per unit. For example, if a half-gallon of milk was \$2.00 and a gallon of milk was \$3.50, the gallon of milk would cost \$1.75 for each half gallon, and was the cheaper price per unit. The \$3.50 per gallon of milk would be recorded. The community researchers were also advised on potential difficult situations that have arisen in other community surveys such as what to do if asked to leave (politely leave), if followed in the store by store employees (engage the employee in assisting you to find survey items), or if the surveyors are treated inappropriately (leave the store and document the incident for a complaint that would be filed). While rare, these situations have arisen in previous grocery store surveys. Each team of surveyors were provided with letters to present to grocery store managers that explained the purpose of the survey along with a phone number of the University researcher to call if there were any questions.

To verify that the prices recorded on the survey were the lowest per unit for a specific item, a different team of community researchers for each store took the completed survey to the store and checked each price. Where prices did not agree, the lowest price per unit was used.

A total of 13 stores in the Chico area were surveyed and included all food stores that offered a variety of meat, dairy, breads and fresh fruits and vegetables. Based on results of a community survey, 50% of the MIT community members live within a five-minute car ride to the grocery store where they purchase most of their food, and 76% live within a 10 minute

car ride²⁵. The town in which the survey was completed had a population of 87,652 in 2012. It is the largest town in the county and the next largest town or city closest to Chico is located 75 miles away.

Calculating the cost of the menus.

The costs of the menus were calculated by multiplying the price per unit collected in the surveys by the amount that each item was consumed, and then summing the values for each day. Before the prices could be used; however, they had to be converted from the price per unit purchased and into a price per unit consumed. For example, prices for oranges would need to be converted from price per pound for an orange purchased (including rind), to price per ½ cup serving of the orange parts that are eaten (i.e. no rind). Prices per unit purchased were converted to prices per unit consumed using conversion factors from the USDA school purchasing guidelines²⁹. These factors were developed to help school officials determine how much raw meat to purchase for 1 ounce of cooked meat consumed, or how many pounds of fresh fruit and vegetables to purchase in order to get a serving of a fruit or vegetable.

Once an individual store's market basket costs were calculated, the cost was averaged over stores of the same type. The stores were grouped into four categories: 1) a bulk supermarket such as Food Maxx or Winco (n=4); 2) a general supermarket such as Ralph's or Safeway (n=5); 3) a discount market such as Grocery Outlet (n=2), or 4) a specialty market such as the local Coop (n=2). The total market basket cost for each store was then averaged over the stores that belonged in the same category. In stores where an item was not available, the average price for similar stores was used. For the discount markets, the price from the bulk supermarkets was used. For specialty markets the price from the general supermarket category was used. Data analysis on the cost of each menu was completed in 2012. In 2016 the Consumer Price Index for food³⁰ was used to inflate the cost of the market basket as a whole into 2015 dollars.

Statistical Analysis

The mean market baskets costs by store type were compared using a one-way ANOVA analysis in STATA (STATA SE version 15.1, STACORP 2018, College Station, TX). The null hypothesis that was tested was whether the mean market basket cost was similar across all store types at a statistical significance level of $p < .05$. Based on the results a post-hoc pairwise analysis using a Bonferroni correction was then completed. The post-hoc pairwise analysis tested whether there were significant differences in cost between market baskets from two different store types.

Results

The two-week community menus

The two weeks of menus contained a variety of proteins, carbohydrates, and fruits and vegetables (Table 2). The menus also allowed for treats as part of the discretionary calories, such as "funsized" candy bars, or whipped topping on fruit, etc, (Table 2), in a way that allowed a family member to meet all requirements in the DGA.

Meeting the nutritional guidelines did not occur by meeting the daily guidelines. Rather, some days would exceed a serving of grains or protein, or the optional calories would exceed the recommended amounts. However, on other days there would be lower than recommended consumption. For example, in the day one menu the adult male consumed 11 oz of grains, even though nine was the minimum recommended value. However, on day three he consumed only seven servings. At the end of the two-week period, on average, he was consuming nine ounces a day, or 126 oz total (Table 3). Similarly, on day two the 10 year old child consumed four teaspoons of oils and fats even though five was the recommended amount. However, on day four the child consumed seven. Total teaspoons consumed over the two-week period were 70 and the recommended amount was 70. At the end of the two-week period all categories achieved the recommended levels for each person by age and gender (Table 3). For calories consumed the final totals were 36,345 for the adult male compared to 36,400 recommended, 27,945 calories consumed by the adult female compared to 28,000 recommended, 25,166 calories consumed for the 10 year old child compared to 25,200 recommended, and 22,442 calories consumed for the seven year old child compared to 22,400 recommended.

Availability of items in stores.

Both bulk supermarkets and general supermarkets had the highest availability of food items. Out of a total of 105 items for which prices were collected, on average, six items were unavailable the day the survey was completed in bulk supermarkets and an average of five items from general supermarkets. This number climbed dramatically to an average of 43 items missing in specialty food markets and an average of 52 items in discount supermarkets. The items most frequently missing were turkey ham (9), cod (8), and ground beef with over 20% fat (7). In many cases there were close substitutes that were available. Very lean ham was available in bulk and general grocery stores that did not have turkey hams. Ground beef was available in all stores, but with a lower percentage of fat. Other varieties of fish were available in stores without cod.

The cost of the community menus

The bulk supermarket and discount market basket costs were the lowest with an average cost of \$25 a day (Table 4). Daily costs varied from \$19 to \$31 depending on what was purchased. While the average cost at the discount market was the same as the bulk supermarket, daily costs varied from \$19 to \$34. Supermarkets had the next highest prices on average at \$29 with daily costs that varied from \$24 to \$35. Specialty supermarkets had the highest average prices overall at \$39 with daily costs varying from \$32 to \$60. The cost of all food purchased for the menus was 59% higher in the specialty markets compared to the bulk supermarkets.

ANOVA results

A one-way ANOVA was completed to compare the mean cost of a market basket by store type. There was a significant effect on the cost of a market basket by store type for $p < .05$ [$F(3,178) = 51.15, p < .001$]. Post hoc comparisons using the Bonferroni adjustment for $p < .05$ indicate that the mean cost of a market basket from a discount store ($M=24.15, SD=4.11$) was not significantly different than the mean cost from a bulk supermarket ($M=24.18,$

SD=5.16) ($p=1.000$). However, the mean cost from a discount store was significantly different than the mean cost from a general supermarket ($M=28.5$, $SD=4.01$), ($p < .001$), and the mean cost from a specialty food store ($M=38.47$, $SD=8.86$), ($p < .001$). The mean cost of a market basket of food from a bulk supermarket was also significantly different than the mean cost from a general supermarket ($p < .001$) and from a specialty food store ($p < .001$). Finally, the mean cost of a market basket from a general supermarket is significantly different than the mean cost from a specialty food store ($p < .001$).

Discussion

The results of this study expand the previous literature on the affordability of a healthy diet by low-income households in several important ways. First, it supports the results of the USDA food plan studies¹¹ by developing two weeks of menus that meet the recommendations in the DGA 2010²⁴ and pricing the food in that market basket. It improves on the food plans by providing examples of what can be eaten throughout the day and what different items cost, instead of relying on generic categories that provide minimal guidance on what combinations of foods will meet the requirements.

Secondly, through the CBPR approach the menus developed by the community researchers show that achieving the recommendations for protein, fat, carbohydrates, sugar, fiber, fruits and vegetables is frequently not done by substituting items such as low-fat ground beef for higher-fat ground beef, but by shifting food between groups. What this study has shown is that healthy menus that are affordable can be achieved by using a different mix of proteins and whole grain products. For example, beans instead of higher fat proteins, or oatmeal and corn products (such as tortillas) instead of whole wheat breads. In fact, when whole wheat breads were entered throughout the menus, it made it more challenging to meet the discretionary calorie restrictions as the whole wheat flour products in the survey contained higher amounts of sugar in general than the white flour products. In the process of meeting the guidelines for discretionary calories in many instances white bread products replaced the whole wheat products initially used, quantities adjusted, and servings of tortillas and oatmeal increased to achieve the whole grain and fiber recommendations.

These menus also show that achieving a healthy diet was done by balancing out the daily targets over two weeks, not every day. While some people, such as people with diabetes, may have some constraints in how much they can borrow fat and sugar from one day to use in another, others can “save” up for birthdays and other celebrations. This puts the focus of healthy eating on balance, rather than deprivation. Developing skills to balance energy intake is one strategy to address the concerns of obesity and other dietary related illness³¹.

This study also extends the previous research on the topic of the affordability of eating healthy by highlighting the specific circumstances under which the menus based on the DGA 2010 are affordable. Importantly, the menus that meet the USDA dietary guidelines can be within the range of the USDA low-cost food plan for a family of four, but only if people do all of their shopping at a bulk supermarket. This result is consistent with the results of previous market basket studies that show that bulk supermarkets routinely have the lowest food prices.⁹ In Chico, these supermarkets were about a five to 10 minute drive away

on average for most members of the MIT community²⁵. People who live in areas without nearby access to the type of stores that have the lowest price per unit may have more difficulty shopping for food as needing to travel further away to shop in stores with the lowest food prices would raise the total cost to purchase the items in the menus.

Finally, this study extends the existing literature by providing more context for the affordability of a healthier diet within the USDA food plans. The diet developed as a part of this project is a diet consistent with the costs of the USDA low-income food plan, not the TFP diet used to determine SNAP benefits for the lowest income demographic. Using the average daily cost from the bulk supermarket of \$25, the monthly cost of the healthy menus would be \$750 for a 30-day month. In comparison, the USDA low-cost meal plan was \$756 in October 2010, or about the same cost as the community menus¹¹. In comparison, SNAP benefits at the time the survey was completed in October 2010 were \$668 for a family of four¹¹. Since the survey was completed food prices have increased. In 2015 dollars (inflating the total cost of food using the consumer price index for food consumed at home²⁹) the cost of the menus developed by the community researchers is equal to about \$27.95 a day, or \$838 a month. This represents an increase of 11.8% in the cost of food. In contrast the maximum SNAP benefits in 2015 were \$639 a month for a representative family of four. This represents a decline of 4.3% in benefits while food prices are increasing, making it harder for the most economically vulnerable to achieve to consume a diet that nourishes a healthy lifestyle.

Limitations

This study addresses only stated concerns about cost constraints. It does not address other constraints in this specific population such as time constraints, the costs associated with adjusting to a very different routine, access, or emotional triggers for unhealthy eating such as stress or anxiety. However, addressing cost concerns does ease one barrier to healthy eating^{4,5}.

One of the other key issues associated with costs is transaction costs. Transaction costs are all those costs associated with purchasing food, in addition to the cost of food itself. It includes the cost of time to plan menus, develop shopping lists, travel to bulk supermarkets further away that offer the lowest prices, search mail flyers to find the stores with the lowest prices or where the item will be available, etc. All of these costs are important to understanding how economic considerations influence healthy eating. Costs are not just the cost of food.

Another limitation is that by construct, the amounts of perishable food items that are included in the menus may not readily translate into the discrete units available for purchase on the day that a shopper buys his or her food. A market basket needs to have standardized quantities whereas items such as bananas do not have a standardized size. In real life if shoppers were to adhere strictly to the shopping list, there would probably be some waste, especially of fresh fruits and vegetables. However, the skills learned as a result of developing the menus and creating balance could be applied to real life food shopping situations. For example, fewer bananas may be purchased and more apples so that quantities purchased match up with quantities consumed and there is no expected waste.

Implications for research and practice

One community strength that this project highlights is the common knowledge of what constitutes a healthy diet. Community members were all able to cite the predominate health education messaging that they should eat lean meats, low-fat dairy, whole grains, and lots of fruits and vegetables. One implication is that among adults the gains to education may already be realized. Additional educational efforts may have only a marginal effect. Additional gains may be realized by engaging communities more actively, such as with CBPR projects, to collaboratively develop solutions appropriate for individual communities.

While there has been significant research on disparities in healthy eating between people with different incomes, there are also significant disparities in healthy eating by households within a specific income level. Another implication is that understanding the socio-economic factors that cause some people within a specific income category to eat healthy and why some do not is an important extension of this research. Indeed, within households that have similar incomes but significant differences in the dietary quality, it may be transaction costs that account for a significant portion of those differences. Better understanding of these issues will then lead to better policies or interventions to address these issues.

The community based participatory research approach was essential to the success of this project. CBPR allows each group to contribute their strengths to complete a project relevant to all. The community members were able to define a project relevant to the interests of their community. They were also able to use their experiences shopping on a limited budget to pick food items that were both affordable and in their preferences. They were able to make their own decisions about whether to substitute foods within categories (such as lower fat ground beef for higher fat ground beef) or between categories (such as beans instead of meat) in order to meet the guidelines of the DGA. The University researchers and staff at NCI provided facilitation, and confirmed that the menus were consistent with meeting the DGA 2010, rather than creating menus. This created a greater sense of ownership and empowerment among the MIT community researchers, demonstrating to themselves that a healthy diet is possible on a limited budget.

Developing the menus through the CBPR approach is an active learning process in applying health knowledge that is consistent with recommendations for effective adult education. Learning the exact recommendations and how to build menus is not done directly through instruction, but rather through normal meal planning activities over an entire day. The development of the menus was fun, and the community researchers could swap stories and strategies about the foods they eat and what they do to reduce fat in recipes. They learned from each other on how to eat healthier. Learning about the specific recommendations for men, women and children and how to meet them was a significant by-product of the study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Li Y, Pan A, Wang DD, Liu X, Dhana K, Franco OH, Kaptoge S, Di Angelantonio E, Stampfer M, Willett WC, Hu FB. Impact of Healthy Lifestyle Factors on Life Expectancies in the US Population. *Circulation*. 2018. doi:10.1161/CIRCULATIONAHA.117.032047. [Epub ahead of print]
2. Stefanic ML, Rohan TE, Lane D, Qi L, Snetselaar L, Prentice RL. Association of Low-Fat Dietary Pattern With Breast Cancer Overall Survival: A Secondary Analysis of the Women's Health Initiative Randomized Clinical Trial. *JAMA Oncol*. 2018 5 24:e181212. doi: 10.1001/jamaoncol.2018.1212. [Epub ahead of print]
3. Micha R1, Peñalvo JL1, Cudhea F1, Imamura F2, Rehm CD3, Mozaffarian D1. Association Between Dietary Factors and Mortality From Heart Disease, Stroke, and Type 2 Diabetes in the United States. *JAMA* 2017 3 7;317(9):912–924. doi: 10.1001/jama.2017.0947. [PubMed: 28267855]
4. Bhawra J, Cooke MJ, Hanning R, Wilk P, Gonneville SLH. Community perspectives on food insecurity and obesity: Focus groups with caregivers and metis and Off-reserve first nations children. *Int'l J for Equity in Health*. 2015;14:96 DOI 10.1186/s12939-015-0232-5.
5. Haynes-Maslow L, Parsons SE, Wheeler SB, Leone LA. 2013 A qualitative study of perceived barriers to fruit and vegetable consumption among low-income populations, North Carolina, 2011. *Prev Chronic Dis*. 2013;10:120206 DOI: 10.5888/pcd10.120206.
6. Rao M, Afshin A, Singh G, Mozaffarian D. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open* 2013;3:e004277. doi:10.1136/bmjopen-2013-004277
7. Drewnowsky A, Eichelsdoerfer P. Can low-income Americans afford a healthy diet? *Nutr Today*. 2010;44(6):246–249. [PubMed: 20368762]
8. Aggarwal A, Monsivais P, Drewnowski A, Nutrient Intakes Linked to Better Health Outcomes are associated with higher diet costs in the US. *PLoS ONE* 2012;7:e37,533.
9. Jetter KM, Cassady DL. The availability and cost of healthier food alternatives. *Am J Prev Med* 2006;30(1):38–44. [PubMed: 16414422]
10. Carlson A, Dong D, Lino M. Association between total diet cost and diet quality is limited. *J of Ag and Res Econ*. 2014;39(1):47–68.
11. Center for Nutrition Policy and Promotion. 2010 Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, October 2010. United States Department of Agriculture Washington DC Accessed July 7, 2017 <http://www.cnpp.usda.gov/USDAFoodPlansCostofFood/reports>. Accessed 1/7/16.
12. Carlson A, Lino M, Juan WY, Hanson K, Basiotis PP. Thrifty Food Plan, 2006 Center for Nutrition Policy and Promotion. United States Department of Agriculture CNPP-19 4 2007 Washington DC.
13. Natale ME, Super DA. The Case Against the Thrifty Food Plan as the Basis for the Food Component of the AFDC Standard of Need. 1991 Food Research and Action Center Washington DC 12 pages.
14. United States Department of Agriculture. 1999 The Thrifty Food Plan, 1999. Washington, DC: Center for Nutrition Policy and Promotion.
15. Hartline-Grafton Heather, and Weill James. Replacing the Thrifty Food Plan in order to provide adequate allotments for SNAP beneficiaries 2012 Food Research and Action Center, Washington, DC 13 pages.
16. Cassady D, Jetter KM, Culp J. Is price a barrier to eating more fruits and vegetables for low-income families? *J Am Diet Assoc*. 2007 (107)1909–15. [PubMed: 17964310]

17. Minkler M, Wallerstein N. editors. Community-based participatory research for health. San Francisco: Josey Bass; 2003.
18. Castleden H, Garvin T. Huu-ay-aht First Nation. Modifying Photovoice for community-based participatory Indigenous research. *Social Science & Med*, 2008;66:1393–1405. doi:10.1016/j.socscimed.2007.11.030.
19. Gray N, de Boehm C Oré, Farnsworth A, et al. (2010) Integration of Creative Expression into Community Based Participatory Research and Health Promotion with Native Americans. *Family Community Health*, 2010;33(3)186–192. doi: 10.1097/FCH.0b013e3181e4bbc6. [PubMed: 20531099]
20. Jernigan VB, Jacob T, Tribal Community Research Team, Styne, D. The Adaptation and Implementation of a Community-Based Participatory Research Curriculum to Build Tribal Research Capacity. *Am J of Public Health*. 2015;105(S3):S424–S432. [PubMed: 25905848]
21. Mezirow J A critical theory of adult learning and education. *Adult Ed*. 1981(32)3–24.
22. Balatti J, Falk I. Socioeconomic Contributions of Adult Learning to Community: A social capital perspective Discussion Paper D10/2001. CRLRA Discussion Paper. Series ISSN 1440-480X 2001 University of Tasmania Hobart, Australia 19 pages.
23. Andresen L, Boud D, Cohen R. Experience-based learning. Chapter published in Foley G. (Ed.) *Understanding Adult Education and Training*. Second Edition. Sydney: Allen & Unwin, 2000 225–239.
24. United States Department of Agriculture and United States Department of Health and Human Services Dietary Guidelines for Americans 2010. 7th Edition Washington DC U.S. Government Printing Office 12 2010.
25. United States Department of Health and Human Services, Office for Human Research Protections. Human Subject Regulations Decision Charts. <http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html#cl>
26. Jetter KM, Adkins J, Cortez S. Hopper G, McHenry D, Shively V, Styne D, Beavers M, Bill K. Healthy Eating: Why do we do what we do and doing it better Final Report. University of California Agricultural Issues Center 2017 100 pages.
27. Montville JB, Ahuja JKC, Martin CL, Heendeniya KY, Omolewa-Tomobi G, Steinfeldt LC, Anand J, Adler ME, LaComb RP, Moshfegh A. USDA Food and Nutrient Database Studies (FNDDS), 5.0. *Procedia Food Science*. 2013(2)99–112.
28. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th. Edition 12 2015 Available at <http://health.gov/dietaryguidelines/2015/guidelines/>.
29. United States Department of Agriculture 2008 Food Buying Guide: Calculator for Child Nutrition Programs. Washington D.C. <http://fbg.nfsmi.org/>
30. Economic Report of the President 2016 TABLE B–10. Changes in consumer price indexes, 1946–2015. <https://www.gpo.gov/fdsys/browse/collection.action?collectionCode=ERP&browsePath=2016&isCollapsed=false&leafLevelBrowse=false&isDocumentResults=true&ycord=0>
31. Hill JO, Wyatt, HR, Peters JC. Energy Balance and Obesity. *Circulation*. 2012. 126–132.

Table 1.

Recommended servings and calorie levels for each person in the representative household assuming a moderate level of activity.

	Adult Male	Adult Female	10 year old child	7 year old child
Grains* (oz)	9	6	6	5
Whole grains	4.5	3	3	3
Vegetables (servings)	7	6	5	4
Fruits (servings)	4	4	3	3
Dairy (servings)	3	3	3	3
Meat, nuts and beans (oz)	8.5	5.5	5	5
Oils and fats (teaspoons)	8	6	5	5
Calories consumed	2600	2000	1800	1600
Discretionary calories	380	270	170	130

Source: Dietary Guidelines for Americans 2015-2020, Tables A2-1 and A3-1.

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Table 2.

Weekly Menus for the USDA representative family of four*.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Breakfast	Oatmeal with raisins Bran muffin Orange juice	Scrambled eggs with cheese and veggies English muffin Orange juice	Fiber One cereal Banana Yogurt Milk	Fried potatoes with veggies English muffin Orange juice	Scrambled eggs with cheese Sausage Toast Orange juice	Yogurt Granola English muffin Orange juice	Scrambled eggs with cheese and veggies Bagel with cream cheese Orange juice
Lunch	Cream of Potato Soup Crackers Baby carrots Grapes Milk	Peanut butter & jelly sandwich Carrots Ranch Dressing Milk	Grilled cheese Chicken noodle soup Baby carrots	Chicken Salad Sandwich Cucumber slices Ranch dressing Apple Milk	Peanut butter & jelly sandwich Banana Carrots Ranch dressing Milk	Tuna salad sandwich Vegetable soup Grapes Milk	Mini pizzas Mixed veggies Canned fruit Milk
Dinner	Turkey meatloaf Corn Pineapple Wheat roll	Stuffed pepper Spanish rice Refried beans Fruit cocktail	Pozole Corn tortillas Corn Milk	Cheeseburger Mixed veggies Canned peaches Milk	Chicken enchiladas Black beans Seasoned rice Tossed salad Milk	Baked chicken nuggets Broccoli Mashed potatoes Milk	Baked salmon Steamed rice Steamed vegetables Wheat roll
Snacks	String cheese Almonds Celery sticks	Crackers Apple Yogurt	Crackers Celery sticks Peanut butter	Yogurt Boiled egg Dried fruit Crackers	Yogurt Pumpkin Seeds	Orange Almonds Crackers	Apple with peanut butter Yogurt Carrots & ranch dressing

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Table 3.

Total quantities as calculated from menus compared to quantities recommended over two weeks for the USDA representative family of four.

	Adult Male	Adult Female	10 Year Old	7 Year Old
<u>Quantities from menus</u>				
Grains (oz)	126	95	91	82
Whole grains	73	55	53	47
Vegetables (servings)	106	84	70	60
Fruits (servings)	64	58	45	42
Milk (servings)	64	52	51	44
Meat, nuts and beans (oz)	120	90	81	72
Oils and fats (teaspoons)	110	81	70	66
Calories consumed	36345	27954	25166	22442
<u>Quantities recommended in the Dietary Guidelines *</u>				
Grains (oz)	126	84	84	70
Whole grains	63	42	42	42
Vegetables (servings)	98	84	70	56
Fruits (servings)	56	56	42	42
Milk (servings)	42	42	42	42
Meat, nuts and beans (oz)	119	77	70	70
Oils and fats (teaspoons)	112	84	70	70
Calories consumed	36400	28000	25200	22400

* For Grains, Vegetables, Fruits, Milk, and Meat, nuts and beans the recommendations are minimum recommendations. For Oils and Fats, the recommendations are maximum recommendations. Source: Dietary Guidelines for Americans 2010²⁴.

Table 4.

Daily total market basket cost for each community menu for the USDA representative family of four in 2010 U.S. dollars.

Day	Bulk Supermarket	Discount Supermarket	General Market	Specialty Market
1	25	21	32	40
2	24	24	28	37
3	22	28	27	37
4	25	25	29	41
5	19	19	24	32
6	24	24	27	38
7	28	28	34	37
8	26	23	30	43
9	23	22	27	34
10	27	28	31	41
11	26	23	31	43
12	25	26	30	35
13	22	21	25	33
14	31	34	35	60
Total	347	346	410	552
Mean ^a	24.79 ^d (2.914)	24.71 (3.872)	29.29 ^c (3.197)	38.36 ^b (6.902)

^aANOVA analysis was used to compared group means, followed by a a post-hoc pairwise analysis using a Bonferroni correction.

^bMean market basket cost for the specialty markets is significantly different than the mean market basket costs for the other markets at p .05.

^cMean market basket cost for the general supermarkets is significantly different than the mean market basket costs for the other markets at p .05.

^dMean market basket cost for the bulk supermarkets is significantly different than the mean market basket costs for the specialty markets and general supermarkets, but is not significantly different than the mean market basket cost for the discount market at p .05.

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