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Changes in Fruit and Vegetable Household Food Availability Among
Low-income Families Over a One-Month Period

Ann Wells

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

Rickelle Richards, Chair
Lora Beth Brown
Nora K. Nyland

Department of Nutrition, Dietetics, and Food Science

Brigham Young University

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ABSTRACT

Changes in Fruit and Vegetable Household food Availability Among Low-income Families Over a One-Month Period

Ann Wells

Department of Nutrition, Dietetics, and Food Science, BYU
Master of Science

Objective: There is little evidence of how fruit and vegetable (FV) household food availability changes over a one-month period among low-income households. The objective of this study was to analyze how FV variety and sustainability changes over a 4-week period.

Design: Inventories were conducted in low-income family households (n=49) once a week over a 4-week period. Trained researchers gathered the weights of all FV, including legumes, within the home. Previously determined mean container weights were subtracted to obtain the estimated weight of the FV. All weights were then converted to edible cups of FV, taking into account the weight that is removed when stems, peels, skins, and canning liquid are removed.

Analysis: Variety was measured by analyzing the number of kinds of FV within the USDA subgroups (100% fruit juice, citrus fruits, other fruits, dark green vegetables, orange vegetables, dry beans and peas, starchy vegetables, and other vegetables) found in the home. In addition, sustainability was analyzed by the number of days into the future at which households can meet 100% of the FV recommendations. Data were combined for all households, according to the time points with the most amount of FV (HFV), the second-most amount of FV, the third-most amount of FV, and the least amount of FV (LFV) available in the household.

Results: Vegetables, specifically canned vegetables, comprised the majority of all measurements taken throughout all inventories. When combined, the kinds of total FV decreased significantly from 25 ± 1.1 kinds on HFV to 21.2 ± 1.1 kinds on LFV ($p < .0001$). Days into the future at 100% of the fruit recommendation fell significantly from 11.4 ± 0.1 days on HFV to 7.1 ± 0.1 days on LFV ($p < .0001$). Total vegetables decreased significantly from 25.3 ± 0.1 days on HFV to 19.1 ± 0.1 days on LFV ($p < .0001$). Even at the peak of FV availability, dark green vegetables remained the lowest subgroup at 2.1 ± 0.1 days and decreased to 1.6 ± 0.1 days at LFV ($p = 0.01$).

Conclusions and Implications: Low-income households have greater variety of FV during the times when they have the most food resources compared to when they have the least food resources. The days into the future that the household FV supply could be maintained at 100% of the USDA's subgroup recommendation varies widely between subgroups, from about two days up to more than one month. Further research is needed to determine how to maintain subgroup variety and constancy of a FV supply throughout the month for low-income FV.

Keywords: low-income families, household food inventories, fruit and vegetable availability, fruit and vegetable variety

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MANUSCRIPT

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Low-income Families Over a One-Month Period

Authors: Wells A, Eggett D, Richards R

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INTRODUCTION

Low-income individuals' fruit and vegetable (FV) intakes are lower than national recommendations and lower than those of other income levels (1). This prevents low-income individuals from obtaining the maximum health benefits associated with adequate FV intake (2-7). Healthy People 2020 set specific goals for Americans regarding FV intake (8). These goals are to increase the amount of FV consumed in the diets of people two years and older as well as to increase the variety of vegetables (8). Variety is specifically referred to as increasing the amount of dark green vegetables, orange vegetables, and legumes consumed (8).

Not only are FV intakes lower for low-income individuals overall, there is also evidence that low-income household food availability varies throughout the month. Wilde and Ranney (9) found that for low-income households who shop once a month or less often, energy intake from the first to the fourth week decreases from 83% to 73.4% of the RDA. This suggests that some households may not adequately store foods to meet needs consistently throughout the month (9). For low-income households, food shortages are most severe at the end of the month, when household resources are drained (10-12). Food expenditures per person in a household have been shown to peak the first three days from food stamp receipt and then decrease and remain much lower throughout the rest of the month (9). Studies show that FV availability is linked with consumption of FV (13-18). However, from these studies, it remains unclear how household FV supplies vary through the course of the month and whether the amount of FV on-hand in the home was sufficient to meet dietary recommendations for all members of the household.

The most common methods to assess household food availability are the use of grocery-store receipts and household food inventories (15,16,19-43). The majority of studies using

household food inventories have gathered data at a single time-point to assess household food availability. Kaiser and Melgar-Quiñonez (29) examined how food security related to food availability within Latino households using a 171-item inventory sheet where foods were either marked as present or missing and found that food insecure households were associated with less food availability. This study, however, conducted the inventory on only one occasion and did not measure the amount of foods present, but rather, their presence alone. Another study evaluated the need for multiple inventories and found that many foods were not consistently available in households throughout the month, thus emphasizing the importance of multiple measures to assess household food availability (40). However, there have been relatively few studies that have completed household food inventories on more than one occasion (28,40-47). Bryant and Stevens (42) conducted household food inventories among low-income African American women using Universal Product Code technology. Inventories were completed on three different occasions, with each visit being about two months apart. This study found an association between the amount of FV in homes and dietary intake. However, this study did not inventory leftovers, gather weights of fresh FV, or convert the amount of inventoried food into edible portions of the FV. In addition, inventories did not measure the changes over a one-month period in the household. These studies have limitations when addressing the FV availability of low-income populations because of their small sample size or failure to express FV availability in terms of edible portions. Although household food inventories are not accurate measures of dietary intake, evidence supports the important role that the household food environment can play in relation to individual intake (15,42,48).

The present study sought to determine the ebb and flow of household FV availability in low-income households over a 4-week period. Our first hypothesis is that low-income

households have greater variety of FV during the times when they have the most household food resources compared to when they have the least household food resources. Our second hypothesis is that low-income households have fewer days into the future that the household FV supply could be maintained at 100% of the USDA's FV recommendations when they have the least household food resources compared to when they have the most household food resources.

METHODS

Participants and Study Design

A convenience sample of low-income households with at least one child under the age of 18 years of age living in the household was recruited for this study (n=49). Low-income was defined as $\leq 185\%$ of the poverty level, which is dependent upon the number of people in the household and annual income (49). If participants received benefits from a government food assistance program (i.e., WIC, SNAP) they automatically qualified for the income requirements of the study. College students were excluded from this study because they likely represented temporary low-income status and could introduce bias in that their experiences with food assistance programs and/or education level might differ from low-income non-students. In addition, participants were required to live in permanent housing in which household food could be stored. This excluded all low-income individuals and families without a home-base. Participants were recruited via posting flyers at a local food bank and WIC clinic, and by word-of-mouth. Data collection was from May to September 2011. Fifty-seven households participated in this study; however, eight were excluded from data analysis because only three of the four inventories were completed. Participants were compensated up to \$50 for participating in the one-month study. This amount was summed as follows: participants received \$10 per week during the first, second, and third visits during the one-month period. For the fourth and

final visit, participants received \$20 for the final home food inventory and completion of a 114-item food survey and sociodemographic information. All compensation was given at the end of the one-month period. If a home food inventory was unable to be completed for one week, no compensation was given for that week. The Brigham Young University Institutional Review Board approved this research study.

Food Inventory Protocol

Researchers were trained prior to study implementation to standardize data collection and to determine inter-rater reliability. Training took place during four different sessions in which researchers were trained extensively on scale use and how to properly weigh foods, as well as accurately estimate container and can sizes, categorize FV inventoried, and determine the difference between as purchased (AP) and edible portion (EP) weights. AP is defined as the amount of food before processing. The AP weight can change during processing due to removal of peels, stems, skins, and canning liquid. The resulting weight is called the edible portion (EP). EP is the amount of food available for eating after preparation and/or cooking (50). A convenience sample (n=4) was used to finalize training, ensure usability of study methods, and determine inter-rater reliability. Raters received an inter-rater reliability score for each FV subcategory recorded: citrus fruit (0.97), other whole fruit (0.99), 100% fruit juice (0.99), dark green vegetables (0.92), orange vegetables (0.81), dry beans and peas (1.00), starchy vegetables (0.99), and other vegetables (0.84).

A pilot study (n=10) was conducted among low-income households meeting the study eligibility criteria to predict an appropriate sample size. Household food inventories were conducted once a week in each household over a four-week period by trained researchers. Prior to the first visit, participants were asked about their usual grocery-shopping pattern: if they went

grocery-shopping once a month, bi-monthly, weekly, or multiple times a week. Participants were requested to continue their usual shopping pattern, and if they were planning on shopping the week of a researcher visit, to shop within 1-2 days prior to the visit. This request was made as an attempt to measure the peak household food availability after a grocery-shopping trip.

Signed consent was obtained upon the arrival of the first visit. The participants were asked to point out all areas of the house where food was stored. Researchers prompted additional locations for food commonly forgotten, such as basements, garages, and storage rooms. FV in the household in any form (fresh, canned, frozen, dried, or 100% juice) were recorded, including foods found in leftover storage containers. According to the USDA MyPyramid recommendations, legumes are counted as vegetables after the daily protein recommendation has been met (51). Since legumes can be measured as vegetables in some cases, the researchers chose to include these items in the food inventories. The weights of all FV were recorded during the inventory. Weights of unopened, packaged FV were recorded from the package label. Packaged, opened FV or those without a label (e.g., fresh FV, home-canned FV) were weighed by researchers and the container size, if present, was recorded. FV were weighed in pounds and ounces on a calibrated, portable scale brought by researchers into each household. Weights were recorded to the nearest 0.125 oz. FV mixed with meats, grains, dairy, or those used as condiments or seasonings were not measured (e.g., berries and yogurt, meat and vegetable stew, dried hot peppers, or pickle relish). During the final household food inventory visit, sociodemographic data were collected and participants were asked to fill out the 18-item USDA Food Security scale (52). No changes in the data collection protocol described above were required after conducting the pilot study, therefore the same methods were used with the study sample and the pilot data were included in the final analysis. A sample size calculation

conducted from the pilot data was determined to be 50 households for detecting a mean difference of 0.4 cups for total fruit, 2.4 cups for other whole fruit, 2.5 cups for 100% fruit juice, 0.7 cups for citrus fruits, 0.6 cups for total vegetables, 1.5 cups for dark green vegetables, 3.0 cups for dry beans and peas, 1.2 cups for orange vegetables, 4.5 cups for starchy vegetables, and 3.2 cups for other vegetables.

Data Analysis

Descriptive statistics, including frequencies and means, were used to analyze the sociodemographic data. For the USDA Food Security Scale, responses of “yes,” “often true,” “sometimes true,” and three or more days of cutting meal sizes or not eating the whole day were coded as affirmative. The sum of affirmative responses provided the household’s raw score. Raw scores were classified as the following: 0 = high food security, 1-2 = marginal food security, 3-7 = low food security, and 8-18 = very low food security (52). For the purposes of this study, high food security and marginal food security were categorized as food secure, while low food security and very low food security were categorized as food insecure. Only the sociodemographic data and USDA Food Security Scale from the food survey was analyzed in the current study. Participants reported the employment status of all adults in their household: full-time employment, part-time employment, unemployed and looking for a job, unemployed but not looking for a job, retired, or homemaker. The highest employment status in the household was determined by summing the number of total households with at least one adult with a full-time job. The households that did not fit this criterion but had at least one adult in a part-time job were then summed. The remaining households were categorized as unemployed. All households were counted only once.

Researchers classified the weights of inventoried FV as EP or AP upon collecting data in participants' households. All weights, whether they were AP or EP, were converted into edible cups obtained from the USDA Food and Nutrition Service's *Food Buying Guide for Child Nutrition Programs, 2001* (53). For example, one pound of unpeeled bananas (AP) converts to 0.64 pounds of peeled, edible banana (EP), and is approximately 1.75 cups of sliced banana (53). When converting the AP weights to EP weights, the EP weight used was the most common edible form for a particular food, as determined by a Registered Dietitian. As an example, the EP weight for frozen fruits was the drained, thawed weight; the EP weight for canned kidney beans was the drained, heated weight; fresh carrots were converted to cups of peeled, edible, fresh carrots. Mixed FV were categorized as other fruits or other vegetables (e.g., mixed tomatoes with beans were placed in the subcategory "other vegetables" rather than "dry beans and peas"). According to MyPyramid, two cups of raw, leafy greens equates to one cup of vegetables (54). Likewise, one-half of a cup of dried fruit equates to one cup of fruit (38). Therefore, all measured cups of raw, leafy greens were divided by two and cups of dried fruit were multiplied by two to obtain accurate servings of FV available within the households. In addition, before collected weights of FV were converted to edible cups, container weights were subtracted to obtain the actual weight of each food. For each size of container recorded during the inventories, an average of 1-3 containers of the same size and type (e.g., plastic, glass, aluminum) was used for this subtraction calculation.

For this study, variety was measured in two different ways. First, variety was measured according to the number of subgroups found in the home. One study concluded that variety was best measured by analyzing the extent to which diets are composed of 22 food subgroups from the five major Food Guide Pyramid groups (i.e., dairy, fruits, vegetables, grains, and

meat/proteins). They concluded that variety could be measured using subgroups to predict dietary quality (55). In the present study, we used a similar method to evaluate variety in the home through the use of subgroups. The subgroups chosen for our study were those defined by MyPyramid (56,57). Fruit was subcategorized into 100% fruit juice, citrus fruit, and other fruit. Vegetables were subcategorized into dark green vegetables, orange vegetables, legumes, starchy vegetables, and other vegetables. Second, variety was measured by summing the number of different kinds of FV in the home. Two other studies described variety by counting the frequency of the different kinds of FV found in the home (40,41). We took a similar approach to variety by counting the kinds of FV within the home. Each type of fruit or vegetable (fresh, frozen, canned, dried, 100% fruit juice) was sorted according to its kind (e.g., fresh apples, applesauce, and 100% apple juice were considered to be one kind of fruit: apple).

To evaluate changes in FV variety and days into the future, at 100% of the recommended level, each household inventory measurement was separated into the time point with the highest number of inventoried FV (HFV), the second-highest number of inventoried FV (SFV), the third-highest number of inventoried FV (TFV), and the lowest number of inventoried FV (LFV). ANOVA analyses determined the difference of kinds of FV between HFV and all other weeks. The underlying assumption was that the time of the month when low-income households have the highest number of FV corresponded to the time when households have the most resources available to obtain food, whether that is from household funds, SNAP, WIC, or the food bank. Similarly, we assumed that the time of the month when low-income households have the lowest number of FV corresponds to when the least resources are available to obtain food. The kinds of FV (variety) were sorted by each time point into the ten most-frequently inventoried fruits across households and the ten most-frequently inventoried vegetables across households.

Edible cups of each inventoried fruit or vegetable were used to calculate how many days into the future, at 100% of the MyPyramid FV serving recommendations, each household could continue using the inventoried amount of food in their home at each time point measured. Since children ages 2-12 have lower calorie needs and MyPyramid serving size recommendations than adults, an adult equivalent factor was created to account for this difference. The MyPyramid Food Intake Pattern Calorie Levels were averaged for sedentary to moderately active children aged 2-12 and expressed as a percentage of 2,000 kilocalories (38,58). This adult equivalent factor was 0.73. The factor for adults and children aged 13 and older was 1.0. A similar technique was used in a food inventory study evaluating household nutrient intake based on household food availability (62). MyPyramid adult serving size recommendations based on a 2,000 kilocalorie diet are: total fruits (2 cups/day), total vegetables (2.5 cups/day), dark green vegetables (3 cups/wk), orange vegetables (2 cups/wk), legumes (3 cups/wk), starchy vegetables (3 cups/wk), and other vegetables (6.5 cups/wk). Using the adult equivalent factor for children aged 2-12, the MyPyramid serving size recommendations are: total fruits (1.5 cups/day), total vegetables (1.8 cups/day), dark green vegetables 2.2 cups/wk), orange vegetables (1.5 cups/wk), legumes (2.2 cups/wk), starchy vegetables (2.2 cups/wk), and other vegetables (4.7 cups/wk). Although fruit was categorized into citrus, 100% juice, and other fruit (as defined by MyPyramid), no recommendations for MyPyramid fruit subgroups currently exist, so only the total fruit per day recommendation was used to measure days into the future of fruit.

The total number of edible FV servings in the study sample was divided by recommended number of adult equivalent servings in the household to calculate the adequacy of each household's FV inventory for each week. The adult equivalent factor was also used to determine how many days into the future specific types of FV (fresh, frozen, canned, dried, 100% fruit

juice) in the home could provide 100% of the recommendations for total fruits and total vegetables. Because the data were non-normally distributed, log-transformations were used. As some households inventoried had foods unavailable in one or more MyPyramid subgroup categories, a constant number of 1 was added to the cups of food variable prior to log-transformation. ANOVA was used to determine the differences between time points in the number of days into the future FV could last in the household based on the total household equivalent. The means were back-transformed at each time point (HFV, SFV, TFV, LFV) to determine days into the future at 100% of the recommendation. Tukey-adjusted p-values and confidence intervals were used to determine significance of differences between weeks. To account for multiple comparisons bias, the level of significance was set at $p < 0.01$.

RESULTS

Sociodemographic Characteristics

The majority of participants were Caucasian, unemployed, and female, with a mean age of 35.6 years (Table 1). Most respondents stated that their religious affiliation was with the Church of Jesus Christ of Latter-Day Saints (Mormons). The majority described their health as good, very good, or excellent and the majority of respondents stated that they considered their diets to be somewhat healthy.

The average household size was 3.8 people with an average of 1.8 children within each household. The majority of children (74.1%) were aged 12 and under. Most households (59.2%) reported that the highest level of education in their household was at least some college/technical/vocational school or completion of a university or college degree. The annual household income of most (63.3%) participants was $< \$20,000$ and over half of households

participated in WIC (51.0%) and/or Food Stamps/SNAP (53.1%). Based on the 18-item USDA Food Security Scale, 57.2% of households were food secure, while 42.8% were food insecure.

Of the 11,023 individual measurements taken, 73.7% were vegetables and 26.32% were fruits. Canned FV comprised the majority of measurements at 56.4%, compared to fresh (21%), frozen (9.3%), dried (8.6%), and 100% fruit juice (4.31%) (Table 2). More vegetables than fruits were inventoried for canned, fresh, frozen, and dried types of FV.

Variety

When combined, the kinds of total FV significantly decreased from 25.0 ± 1.1 kinds on HFV to 21.2 ± 1.1 kinds on LFV ($p < 0.0001$) (Table 3). When analyzed separately, the kinds of total fruits (week 1 = 9.1 ± 0.5 , week 4 = 7.4 ± 0.5 , $p < 0.0001$) and total vegetables (week 1 = 16.0 ± 0.7 , week 4 = 13.8 ± 0.7 , $p < 0.0001$) also significantly decreased from HFV to LFV. Kinds of dark green vegetables significantly decreased (week 1 = 0.9 ± 0.1 , week 4 = 0.5 ± 0.1 , $p < 0.0002$) from HFV to LFV. The kinds of dry beans and peas remained relatively equal from HFV to LFV at 1.3 ± 0.1 to 1.4 ± 0.1 kinds ($p = 0.4$). The top five most available FV stayed the same from HFV to LFV (Table 4). They were: apples, peaches, oranges, mixed fruit, and pears. The top five vegetables were also the same for HFV and LFV. They were: tomatoes, dry beans, corn, potatoes, and mixed vegetables.

Projected Days into the future

Days into the future at 100% of the recommendation for fruits decreased significantly from 11.4 ± 0.1 days on HFV to 7.1 ± 0.1 days on LFV ($p < 0.0001$) (Table 5). Total days into the future for vegetables decreased significantly from 25.3 ± 0.1 days on HFV to 19.1 ± 0.1 days on LFV ($p < 0.0001$). Dark green vegetables, orange vegetables, starchy vegetables, and other

vegetables also significantly decreased on HFV to LFV. The decrease of 17.7 ± 0.2 to 13.6 ± 0.2 days for dry beans and peas was marginally significant ($p = 0.01$).

When analyzed separately, days at 100% of the daily MyPyramid fruit recommendation for both fresh and canned fruits significantly decreased from HFV to LFV (Table 5). Days met by frozen fruits and dried fruits remained relatively constant from HFV to LFV. Days at 100% of the daily MyPyramid recommendation decreased significantly from HFV to LFV for fresh, canned, and dried vegetables. Days met by frozen vegetables remained relatively constant and was not significantly different from HFV to LFV.

DISCUSSION

This study examined the household FV availability, variety, and sustainability among low-income participants. To our knowledge, this is the first study to directly observe household FV availability over a one-month period in terms of the USDA's FV serving recommendations. Studies show that household food availability and FV availability are linked with consumption of FV (13-16,18). These findings emphasize the importance of the household food environment. Two recent household food inventory studies have also completed household food inventories over a one-month period (40,41). These studies used a predetermined 251-item instrument that enabled researchers to record the frequency of food items present in households but did not allow weights to be measured. The sample size of these two studies was small, with $n=6$, and $n=9$. The present study categorized measurements into over 400 different kinds and forms of FV. Our study was unique because we gathered weights of all FV within households, including leftovers and FV stored in containers. The container weights were then subtracted from all necessary foods (i.e., FV weighed in containers) to obtain an estimated weight of the food. And finally, all weights were converted to serving sizes to measure household FV variety and sustainability.

While one study found that low-income households maintain a relatively consistent food supply throughout the month, our study found that FV supply varies over a 4-week period (59). More specifically, our findings suggest that, overall, more vegetables than fruits were available within low-income households. Some evidence suggests that vegetables are less expensive than fruits. The USDA Economic Research Service found that on average, fresh fruits cost more than fresh vegetables at about \$0.18 and \$0.12 per serving, respectively, and canned FVs were about \$0.25 and \$0.17 per serving, respectively (60). This difference in prices between FV may be influential during the purchasing decision for low-income households and, consequently, affect household FV availability. In the present study, households had more canned forms of FV than any other forms. This may be partly due to participant recruitment taking place at the local food bank where recipients are given a substantial number of canned food items. Participants also may have had more canned FV since canned food has a prolonged shelf life and is easy to store.

Our first hypothesis, that low-income households have greater variety of FV during the times when they have the most household food resources compared to when they have the least, was supported by the findings in this study. There were 21-25 different kinds of FV available throughout the four different time points measured. Adequate variety is important because of the array of nutrient profiles associated with individual FV (55). Recommendations for subgroups of vegetables are given to encourage the consumption of foods with varying nutrient compositions (61). Two other studies recently examined variety by using a specified food inventory list to indicate the number of different kinds of FV available in the home. The use of a specified food inventory list potentially limited the variety researchers were able to capture within each household. No description of the kinds of FV present, according to subgroups, was indicated. Our study went one step further and categorized the kinds available in a household according to

subgroups of FV. Overall, the different kinds of FV, including subgroups, significantly decreased from HFV to LFV. This suggests that the number of kinds of FV does not stay constant as the FV supply decreases. Of note, there was less than one kind of dark green vegetable present in the households when most FV were available, and this decreased by about half in LFV. This suggests that there is inadequate variety of individual subgroups, such as dark green vegetables within the home. In 2009, the US Department of Agriculture reported that on average, low-income Americans consumed less dark green vegetables than middle- and high-income Americans, at only 18% of the recommendation (1). Therefore, it is not surprising to find in our study that there is decreased availability of dark green vegetables in low-income households when consumption has been noted to be so low. The same study found that the starchy vegetable subgroup is the only vegetable subgroup low-income individuals consume more of when compared with middle- and high-income individuals (1). In our study, the starchy vegetable subgroup could last more days into the future at 100% of the recommendation than any other subgroup. Additionally, four of the top five vegetables found in households were starchy vegetables, providing evidence that starchy vegetables are an important part of the low-income household food environment.

Furthermore, the kinds of dry beans and peas remained unchanged or constant throughout the change in food supply amount in our study. This is likely due to dry beans and peas being stored as long-term food storage, since the majority were canned or dried and have an extended shelf life. For example, one of the households in our study had eighteen 25-pound bags of dry pinto beans used for household food storage that remained constant throughout the month of the study. In addition, over 50% of our sample were using WIC at the time of the study and dry or canned beans are a part of available food packages.

The top five fruits with the most households having at least one measurement of its kind were: apples, peaches, oranges, mixed fruit, and pears. The top five vegetables were: tomatoes, dry beans, corn, potatoes, and mixed vegetables. Even though the number of households with at least one of these FV decreased from HFV to LFV, the top five FV remained the same. This suggests that although overall variety changes throughout the month, common FV remain within most households.

The second hypothesis that low-income households have fewer days into the future at 100% of the FV recommendations when they have the least household food resources compared to when they have the most household food resources was also supported by the findings of this study. Both total fruits and total vegetables decreased significantly in the number of sustainable days at 100% of the recommendation. From the lowest household food supply to the highest, FV could sustain households for 1 – 1 ½ weeks (7-11 days) and about 1/3 – 1 month (19-25 days), respectively. Dark green vegetables could sustain households for 1.6-2.1 days at 100% of the subgroup recommendation. Even at the highest number of household FV availability, households could only meet the recommendation for dark green vegetables for 2.1 days. Since the majority of participants went shopping once a week or less, this suggests that peak household food availability does not meet recommendations for this particular subgroup. On the other hand, starchy vegetables could sustain households for 23-35 days, which was the most days compared with all other subgroups. This evidence is consistent with research by the USDA reporting that low-income Americans consume more starchy vegetables than the medium- and high-income households (1). Beans and peas also stayed consistent regardless of number of FV available and could last 14-18 days into the future. Frozen FV remained relatively constant from week to week, suggesting that frozen FV supply does not fluctuate along with the other changes

in household food resource availability. One important application of looking at the number of days into the future low-income households can meet 100% of the FV recommendations is to consider the household instabilities that may occur throughout the month that may lead to households needing to rely on the food supply currently in the home. Such unforeseen occurrences may include the loss of a job, inability to work due to sudden illness or disability, personal emergencies, or natural disasters. The Federal Emergency Management Agency recommends that all people have a 3-day non-perishable food supply on-hand in case of emergency, with recommendations for up to 2 weeks (62,63). Our study shows that most participants could meet the recommendation of a 3-day FV supply, although recommendations for some subgroups may not be met. Since the federal government is increasingly concerned about the household food environment as it relates to natural disasters and public health, the results from this study suggest the need for initiatives and education to be developed regarding how to maintain variety during times of household instability.

Limitations

Several limitations were evident in this study. The underlying assumption was that the time of the month when low-income households have the highest number of FV corresponded to the time when households have the most resources available to obtain food, whether that be from household funds, SNAP, WIC, or the food bank. Similarly, we assumed that the time of the month when low-income households have the lowest number of FV corresponds to when the least resources are available to obtain food. However, it might be that other factors influenced the availability of food at the various time points such as limited time to go shopping or illness preventing people from shopping. Because the FV availability was organized from highest to least FV available (from HFV to SFV to TFV to LFV), researchers expected a natural decrease

in the number of days into the future that total FV combined would decrease. Thus, analyses were evaluated separately according to fruits, vegetables, and subgroups. Results indicated that decreases in mean days into the future were not consistent between all subgroups. This suggests there was a change that was not due merely to how the data were analyzed. Another limitation is that this study sought to analyze variety, although there is no specific definition and it has been difficult to measure in research (55). Future research should define adequate variety since neither a definition nor guidelines exist to determine what constitutes adequate variety.

CONCLUSION

Low-income households experience changes in FV availability throughout the month, as evidenced by the findings in our study. Overall, more vegetables than fruits were available within participating low-income households. Low-income households have a greater variety of FV during the times when they have the most household food resources compared to when they have the least household food resources. In addition, days into the future that the household FV supply could be maintained at 100% of the USDA's vegetable subgroup recommendation varies widely between subgroups, from about two days up to more than one month. It is unknown, however, whether these findings are specific to low-income households or if they may apply to middle- and high-income households as well. Additional studies are needed to determine if the ebb and flow of FV over a one-month period is a phenomenon of income or is typical for most households. In addition, a definition is required to determine the number of kinds of FV that represent adequate variety. Further research is essential to establish strategies to increase subgroup sustainability and maintain variety throughout the month, even when the food supply is the smallest.

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TABLES

Table 1. Demographics of Participants (n=49)	
Survey Respondent Characteristics	No. (%)
Gender	
Male	4 (8.2)
Female	45 (91.8)
Age, y (mean \pm SD)	35.6 \pm 9.9
Race	
American Indian	1 (2.0)
Asian	1 (2.0)
Caucasian (White)	34 (69.4)
Hipanic	11 (22.5)
Pacific Islander	2 (4.1)
Current Religious Affiliation	
No religious affiliation	5 (10.2)
Catholic	4 (8.2)
Latter-Day Saint (LDS/Mormon)	34 (69.4)
Protestant	1 (2.0)
Some other affiliation	5 (10.2)
In general, how would you describe your health?	
Excellent	4 (8.2)
Very Good	17 (34.7)
Good	21 (42.9)
Fair	5 (10.2)
Poor	2 (4.1)
In general, how would you describe your diet?*	
Extremely healthy	1 (2.0)
Very healthy	12 (24.5)
Somewhat healthy	36 (73.5)
Household Characteristics	
Household size, mean \pm SD (min,max)	3.8 \pm 1.9 (2,12)
No. of Children, 2 and older, in household, mean \pm SD (min, max)	1.8 \pm 1.6 (0,9)

Age of total people in households, people	
2-12 years	63 (34.1)
13-17 years	22 (11.9)
> 18 years	99 (53.5)
Highest education in household	
< High school graduate	7 (14.3)
Completed high school, GED	13 (26.5)
Some college/technical/ vocational school	16 (32.7)
4-year college, university degree or advanced degree	13 (26.5)
Annual household income, \$	
< \$5,000	12 (24.5)
\$5,001 - \$9,999	8 (16.3)
\$10,000-\$19,999	11 (22.5)
\$20,000-\$39,999	15 (30.6)
> \$40,000	3 (6.1)
Highest employment status in household	
Full time	23 (46.9)
Part time	14 (28.6)
Unemployed	12 (24.5)
Participate in WIC	
Yes	25 (51.0)
No	24 (49.0)
Participate in Food Stamps (SNAP)	
Yes	26 (53.1)
No	23 (46.9)
Food Security Status	
Food Secure	28 (57.1)
Food Insecure	21 (42.9)
* = Zero respondents answered "very unhealthy" and "extremely unhealthy"	

Table 2. Total Inventoried Fruits and Vegetables and Fruits and Vegetables by Types

		No. (%)
Total Food Measured, by types		
Fresh		2361 (21)
Frozen		1024 (9.3)
Canned		6216 (56.4)
Dried		947 (8.6)
100% Fruit Juice		475 (4.3)
Total fruits and vegetables		
Fruits		2901 (26.3)
Citrus Fruit		213 (1.9)
Other Whole Fruit		2116 (19.2)
100% Fruit Juice		572 (5.2)
Vegetables		8122 (73.7)
Dark Green Vegetables		170 (1.5)
Orange Vegetables		594 (5.4)
Dry Beans and Peas		1282 (16.2)
Starchy Vegetables		1420 (12.9)
Other Vegetables		4156 (37.7)
Total Number of Fruits and Vegetables Inventoried, according to types		
	Fruits (% of Type)	Vegetables (% of Type)
Fresh	711 (30)	1650.0 (70)
Frozen	219 (21)	805.0 (79)
Canned	1303 (21)	4913.0 (79)
Dried	193 (20)	754.0 (80)
100% Juice	475 (100)	-

Table 3. Variety of fruits and vegetables, according to subgroups from the time point of the highest highest number of fruits and vegetables in the household (HFV) to the least number of fruits and vegetables in the household.

	# of Kinds	Mean Diff.*	Tukey Adj. **		
			P-value	CI upper	CI lower
Total, fruit and vegetables combined					
HFV	25.0 ± 1.1	-	-	-	-
SFV	24.0 ± 1.1	1 ± 0.5	0.2	-0.3	2.3
TFV	23.2 ± 1.1	1.8 ± 0.5	0.001	0.6	3.1
LFV	21.2 ± 1.1	3.8 ± 0.5	<.0001	2.6	5.1
Fruit					
Total Fruit					
HFV	9.1 ± 0.5	-	-	-	-
SFV	8.5 ± 0.5	0.5 ± 0.3	0.2	-0.2	1.2
TFV	8.2 ± 0.5	0.8 ± 0.3	0.02	0.1	1.5
LFV	7.4 ± 0.5	1.7 ± 0.3	<.0001	1.0	2.4
Citrus Fruits					
HFV	0.7 ± 0.1	-	-	-	-
SFV	0.7 ± 0.1	0 ± 0.1	1	-0.2	0.2
TFV	0.7 ± 0.1	0.1 ± 0.1	0.8	-0.1	0.2
LFV	0.6 ± 0.1	0.2 ± 0.1	0.1	0.0	0.3
Other Whole Fruit					
HFV	7.1 ± 0.4	-	-	-	-
SFV	6.6 ± 0.4	0.5 ± 0.2	0.2	-0.2	1.1
TFV	6.3 ± 0.4	0.8 ± 0.2	0.01	0.2	1.4
LFV	5.9 ± 0.4	1.2 ± 0.2	<.0001	0.6	1.8
100% Fruit Juice					
HFV	1.3 ± 0.2	-	-	-	-
SFV	1.2 ± 0.2	0.1 ± 0.1	1.0	-0.3	0.4
TFV	1.3 ± 0.2	0.0 ± 0.1	1.0	-0.4	0.3
LFV	1.0 ± 0.2	0.3 ± 0.1	0.1	0.0	0.6
Vegetables					
Total Vegetables					
HFV	16.0 ± 0.7	-	-	-	-
SFV	15.5 ± 0.7	0.5 ± 0.4	0.6	-0.5	1.4
TFV	15.0 ± 0.7	1.0 ± 0.4	0.03	0.1	1.9
LFV	13.8 ± 0.7	2.1 ± 0.4	<.0001	1.2	3.1

Dark Green Vegetables					
HFV	0.9 ± 0.1	-	-	-	-
SFV	0.8 ± 0.1	0.1 ± 0.1	0.7	-0.1	0.3
TFV	0.7 ± 0.1	0.2 ± 0.1	0.1	0.0	0.4
LFV	0.5 ± 0.1	0.4 ± 0.1	0.0002	0.2	0.6
Orange Vegetables					
HFV	2.0 ± 0.2	-	-	-	-
SFV	2.0 ± 0.2	0.0 ± 0.1	1.0	-0.2	0.2
TFV	2.0 ± 0.2	0.0 ± 0.1	1.0	-0.2	0.2
LFV	1.8 ± 0.2	0.2 ± 0.1	0.02	0.0	0.5
Dry Beans and Peas					
HFV	1.4 ± 0.1	-	-	-	-
SFV	1.4 ± 0.1	0.0 ± 0.1	1.0	-0.1	0.2
TFV	1.4 ± 0.1	0.0 ± 0.1	1.0	-0.1	0.1
LFV	1.3 ± 0.1	0.1 ± 0.1	0.4	-0.1	0.2
Starchy Vegetables					
HFV	2.7 ± 0.1	-	-	-	-
SFV	2.6 ± 0.1	0.1 ± 0.1	0.7	-0.1	0.3
TFV	2.6 ± 0.1	0.1 ± 0.1	0.7	-0.1	0.3
LFV	2.5 ± 0.1	0.2 ± 0.1	0.02	0.0	0.4
Other Vegetables					
HFV	9.0 ± 0.5	-	-	-	-
SFV	8.8 ± 0.5	0.2 ± 0.3	0.8	-0.5	1.0
TFV	8.3 ± 0.5	0.7 ± 0.3	0.1	0.1	-0.1
LFV	7.8 ± 0.5	1.2 ± 0.3	0.0004	0.4	2.0
* = All weeks are compared to HFV					
** = Tukey adj. was used to account for multiple comparisons bias. The significance level was set at p < 0.01.					
HFV = the week with the highest number of fruits and vegetables, SFV = the week with the second-highest number of fruits and vegetables, TFV = the week with the third-highest number of fruits and vegetables, LFV = the week with the least number of fruits and vegetables					

Table 4. Top ten kinds of fruits and vegetables with at least one measurement in households

	HFV Kinds	No. (%) of households	LFV Kinds	No. (%) of households
Fruits, by rank				
1	Apples	47 (95.9)	Apples	44 (89.8)
2	Peaches	41 (83.7)	Oranges	34 (69.4)
3	Oranges	40 (81.6)	Peaches	33 (67.3)
4	Mixed fruit	35 (71.4)	Pears	33 (67.3)
5	Pears	33 (67.3)	Mixed fruit	27 (55.1)
6	Bananas	26 (53.1)	Pineapple	25 (51.0)
7	Pineapple	25 (51.0)	Grapes	24 (49.0)
8	Strawberries	24 (49.0)	Strawberries	17 (34.7)
9	Grapes	24 (49.0)	Lemon	16 (32.7)
10	Lemon	20 (40.8)	Apricots	16 (32.7)
Vegetables, by rank				
1	Tomatoes	49 (100)	Tomatoes	48 (98.0)
2	Dry Beans	46 (93.9)	Dry Beans	45 (91.9)
3	Corn	45 (91.9)	Corn	42 (85.7)
4	Potatoes	46 (91.9)	Potatoes	41 (83.7)
5	Mixed Vegetables	44 (89.8)	Mixed Vegetables	41 (83.7)
6	Green Beans	42 (85.7)	Green Beans	40 (81.6)
7	Green Peas	40 (81.6)	Green Peas	37 (75.5)
8	Carrots	37 (75.5)	Carrots	35 (71.4)
9	Onions	35 (71.4)	Onions	34 (69.4)
10	Cucumbers	32 (65.3)	Cucumbers	27 (55.1)

Table 5. Days into the future at 100% of the fruit and vegetable recommendation from the time point of the highest number of fruits and vegetables in the household (HFV) to the least number of fruits and vegetables in the household (LFV)

	Mean # of Days	Proportion Diff.*	Tukey Adj.**			% Decrease
			P-value	CI Upper	CI Lower	
Total Fruit						
HFV	11.4 ± 0.1	-	-	-	-	-
SFV	9.6 ± 0.1	0.8 ± 0.1	0.01	0.7	1.0	-
TFV	8.8 ± 0.1	0.8 ± 0.1	<.0001	0.7	0.9	-
LFV	7.1 ± 0.1	0.6 ± 0.1	<.0001	0.5	0.7	40%
Total Vegetables						
HFV	25.3 ± 0.1	-	-	-	-	-
SFV	23.9 ± 0.1	0.9 ± 0.03	0.3	0.9	1.0	-
TFV	21.4 ± 0.1	0.8 ± 0.03	<.0001	0.8	0.9	-
LFV	19.1 ± 0.1	0.8 ± 0.03	<.0001	0.7	0.8	24%
Dark Green Vegetables						
HFV	2.1 ± 0.1	-	-	-	-	-
SFV	1.9 ± 0.1	0.9 ± 0.1	0.8	0.7	1.2	-
TFV	1.7 ± 0.1	0.8 ± 0.1	0.1	0.6	1.0	-
LFV	1.6 ± 0.1	0.7 ± 0.1	0.01	0.6	0.9	30%
Orange Vegetables						
HFV	10.2 ± 0.2	-	-	-	-	-
SFV	9.3 ± 0.2	0.9 ± 0.1	0.7	0.7	1.1	-
TFV	9.0 ± 0.2	0.9 ± 0.1	0.5	0.7	1.1	-
LFV	7.3 ± 0.2	0.7 ± 0.1	0.002	0.6	0.9	28%
Dry Beans and Peas						
HFV	17.7 ± 0.2	-	-	-	-	-
SFV	17.6 ± 0.2	1.0 ± 0.1	1.0	0.8	1.2	-
TFV	15.9 ± 0.2	0.8 ± 0.1	0.6	0.7	1.1	-
LFV	13.6 ± 0.2	0.8 ± 0.1	0.01	0.6	1.0	23%
Starchy Vegetables						
HFV	34.9 ± 0.2	-	-	-	-	-
SFV	32.1 ± 0.2	0.9 ± 0.1	0.7	0.7	1.1	-
TFV	27.0 ± 0.2	0.8 ± 0.1	0.01	0.6	1.0	-
LFV	22.7 ± 0.2	0.7 ± 0.1	<.0001	0.5	0.8	35%

Other Vegetables

HFV	25.7 ± 0.1	-	-	-	-	-
SFV	24.3 ± 0.1	0.9 ± 0.5	0.6	0.8	10.7	-
TFV	22.4 ± 0.1	0.9 ± 0.5	0.02	0.8	1.0	-
LFV	19.8 ± 0.1	0.8 ± 0.5	<.0001	0.7	0.9	23%

Types (canned, frozen, fresh, dried, 100% fruit juice)

	Mean # of Days	Proportion Diff.*	Tukey Adj**			% Decrease
			P-value	CI Upper	CI Lower	
Fruit						
Fresh						
HFV	3.6 ± 0.1	-	-	-	-	-
SFV	3.1 ± 0.1	0.9 ± 0.1	0.4	0.7	1.1	-
TFV	2.8 ± 0.1	0.8 ± 0.1	0.05	0.6	1.0	-
LFV	2.2 ± 0.1	0.6 ± 0.1	<.0001	0.5	0.8	39%
Frozen						
HFV	1.9 ± 0.1	-	-	-	-	-
SFV	2.0 ± 0.1	1.0 ± 0.1	1.0	0.9	1.2	-
TFV	2.0 ± 0.1	1.0 ± 0.1	0.9	0.9	1.3	-
LFV	2.0 ± 0.1	0.9 ± 0.1	0.6	0.8	1.1	8%
Canned						
HFV	4.4 ± 0.1	-	-	-	-	-
SFV	4.3 ± 0.1	1.0 ± 0.04	1.0	0.9	1.1	-
TFV	4.0 ± 0.1	0.9 ± 0.04	0.1	0.8	1.0	-
LFV	3.6 ± 0.1	0.8 ± 0.04	<.0001	0.7	0.9	18%
Dried						
HFV	2.3 ± 0.1	-	-	-	-	-
SFV	2.2 ± 0.1	1.0 ± 0.1	1.0	0.8	1.2	-
TFV	2.2 ± 0.1	1.0 ± 0.1	1.0	0.8	1.3	-
LFV	2.0 ± 0.1	0.9 ± 0.1	0.5	0.7	1.1	12%
100% juice						
HFV	4.9 ± 0.1	-	-	-	-	-
SFV	3.7 ± 0.1	0.8 ± 0.1	0.02	0.6	1.0	-
TFV	3.5 ± 0.1	0.7 ± 0.1	0.003	0.6	0.9	-
LFV	3.2 ± 0.1	0.7 ± 0.1	<.0001	0.5	0.8	35%

Vegetables							
Fresh							
HFV	5.6 ± 0.1	-	-	-	-	-	-
SFV	4.8 ± 0.1	0.9 ± 0.1	0.2	0.7	1.0	-	-
TFV	4.1 ± 0.1	0.7 ± 0.1	0.0003	0.6	0.9	-	-
LFV	3.7 ± 0.1	0.7 ± 0.1	<.0001	0.5	0.8	-	34%
Frozen							
HFV	2.6 ± 0.1	-	-	-	-	-	-
SFV	2.4 ± 0.1	0.9 ± 0.04	0.2	0.8	1.0	-	-
TFV	2.5 ± 0.1	1.0 ± 0.04	0.8	0.9	1.1	-	-
LFV	2.3 ± 0.1	0.9 ± 0.04	0.05	0.8	1.0	-	11%
Canned							
HFV	11.1 ± 0.1	-	-	-	-	-	-
SFV	10.9 ± 0.1	1.0 ± 0.04	1.0	0.9	1.1	-	-
TFV	10.5 ± 0.1	0.9 ± 0.04	0.4	0.9	1.0	-	-
LFV	9.5 ± 0.1	0.9 ± 0.04	<.0001	0.8	0.9	-	15%
Dried							
HFV	7.9 ± 0.2	-	-	-	-	-	-
SFV	7.5 ± 0.2	0.9 ± 0.1	0.8	0.8	1.1	-	-
TFV	6.5 ± 0.2	0.8 ± 0.1	0.1	0.7	1.0	-	-
LFV	6.2 ± 0.2	0.8 ± 0.1	0.002	0.7	0.9	-	22%

* = All weeks are compared to HFV

** = Tukey adj. was used to account for multiple comparisons bias. The significance level was set at p < .01.

HFV = the week with highest number of fruits and vegetables, SFV = the week with the second-highest number of fruits and vegetables, TFV = the week with the third-highest number of fruits and vegetables, LFV = the week with the least number of fruits and vegetables

APPENDICES

APPENDIX A: Literature Review

Review of the Literature

Statement of the Problem

Low-income individuals' fruit and vegetable (FV) intakes continue to remain lower than national recommendations and lower than all other income levels (1). This prevents low-income individuals from obtaining the maximum health benefits associated with adequate FV intake (2-7). Although household food inventories are not good measures of dietary intake, there is evidence supporting the important role that the household food environment can play in relation to individual intake (8,9). While one-time inventories have been shown to be inaccurate measures of household food inventories, there have been relatively few studies that have completed household food inventories on more than one occasion (10-16).

Research Question

How does household food inventory of FV change over a one-month period among low-income ($\leq 185\%$ poverty level) households?

Hypotheses

- Low income households have greater variety of FV during the times when they have the most household food resources compared to when they have the least household food resources
- Low income households have fewer days into the future that the household FV supply could be maintained at 100% of the USDA's FV recommendations when they have the least household food resources compared to when they have the most household food resources.

Fruit and Vegetable Intake

Evidence continues to accumulate as to the health benefits of FV consumption (2-4). Healthy eating, which includes adequate consumption of FV, can help prevent and manage chronic disease (2-7). Because of these health benefits, the 2005 Dietary Guidelines for Americans encouraged Americans to increase FV intake. For the first time, recommendations were given for specific types of vegetables: dark green vegetables, orange vegetables, starchy vegetables, other vegetables, and legumes (5). Healthy People 2020 set specific goals for Americans regarding FV intake (17). These goals are to increase the amount of FV consumed in the diets of people two years and older as well as increase the variety of vegetables (17). Variety is specifically referred to as increasing the amount of dark green vegetables, orange vegetables, and legumes consumed (17).

In 2009, the US Department of Agriculture reported that on average, low-income Americans consumed less dark green vegetables (18% of the recommendation), orange vegetables (29% of the recommendation), and “other vegetables” (66% of the recommendation) compared to medium- and high-income Americans (1). In contrast, low-income Americans consumed more starchy vegetables than the medium- and high-income households, even though their intake for this subgroup was still below the recommendation (72% of the recommendation) (1). Interestingly, the starchy vegetable subgroup is the only vegetable subgroup excluded from the Healthy People 2020 goals, and yet it is the only vegetable variety the low-income individuals were found to consume more of when compared with those of a higher socioeconomic status.

Casagrande (18) analyzed NHANES data and found that only 28% of adults met the recommendation for daily fruit consumption (2 or more servings per day) and only 32.5% for daily vegetable consumption (3 servings per day). It should be noted that this data analyzed FV

intakes when the recommendations were stated in servings rather than cups. In addition, only those individuals from households >125% of the poverty level had an increased likelihood of meeting the FV recommendations (18). This study suggests that it is more difficult for low-income individuals to meet FV guidelines than for their higher income counterparts.

Kratt (9) studied 1,196 parent and child questionnaires and 24-hour recalls to calculate FV availability within the home in addition to FV intake. FV availability was found to increase as family income increased (9). In addition, in homes where there was a higher availability of FV, there was a higher intake of FV (9). One study confirmed that low-income households consume less FV than other households, but pointed out that increasing the income level in low-income households was not correlated with increased FV intake (19). Rather, researchers postulate that perhaps tastes and preferences, along with time constraints, may be the primary factors influencing FV intake among low-income households (19,20). One additional factor that may affect FV household food availability is access to grocery stores (21).

Energy Density .and Diet Cost

Healthier foods such as fruits, vegetables, and meats, have a lower energy density than less-healthy foods such as refined grains and sweets (22). Energy density, often used to label total diets (23) and individual foods (24), is a measure of energy per unit of weight. It is expressed as kcal/g or MJ/kg. Energy density can also be used to assess dietary quality. Drewnowski et al (25) found that men and women with lower energy dense diets also consumed foods and beverages with greater weights and had overall lower dietary energy intakes. Ledikwe (23) analyzed 24-hour recalls from 7,500 adults and found that participants who consumed low energy-dense diets, such as those containing FV, also had a higher quality diet than participants with high energy-dense diets. In addition to being associated with higher quality diets (23),

lower energy-dense diets are associated with a lower body mass index (BMI) (22). Decreasing energy density in the diet by consuming more FV is a common weight management strategy recommendation (26). These studies suggest consuming adequate amounts of low energy-dense foods like FV is an important factor in determining diet quality and long-term health for individuals.

Increasing evidence suggests that lower energy-dense diets are associated with higher diet costs (25,27-31). Monsivais (28) analyzed the relationship between energy density and energy cost. Food items were obtained from a Food Frequency Questionnaire (FFQ) and their price per 100g was calculated by dividing the food price (obtained from three different local supermarkets) by the product edible weight in grams. Energy density, defined as kcals/g edible portion, was found to be strongly and inversely correlated with energy cost. Foods in the highest quintile of energy density were an average of \$1.76/1000kcal compared to foods in the lowest quintile of energy density that were an average of \$18.16/1000kcal. In addition, foods in the lowest quintile of energy density had a 19.5% increase in prices compared to 1.8% drop in prices for the foods in the highest quintile of energy density over a two-year time period. This study provides evidence that the price of lower energy-dense foods increases much more compared to foods of higher energy-density.

Food cost has been shown to be the most important factor in food purchasing decisions (32). In one study by Monsivais (30), dietary energy-density decreased as household income increased. Energy density in the low-income population was specifically addressed by Townsend (31) in a study that analyzed the Food Frequency Questionnaires (FFQ) of low-income women. Energy density as well as diet cost was analyzed and energy density was significantly associated with lower diet cost among low-income women. Since higher-quality

diets (which are low in energy-density and contain more FV) have been found to cost more, this implies that adequate nutrition and appropriate energy intakes through consuming more FV may be a financial concern, especially among low-income families and individuals. This may also help to explain why obesity is prevalent in low-income populations (27).

Bernstein (33) found that dietary improvements, but not necessarily adequate diets, can be achieved without increasing spending. While some reports conclude that low-density diets containing FV are more expensive, the USDA reports that a consumer can purchase three servings of fruits and four servings of vegetables per day for 64 cents (34). In 2004, Reed (34) found that 63% of fruits and 57% of vegetables were least expensive in their fresh forms when compared to their processed equivalents. On average, fresh fruit and fresh vegetables were found to cost about \$.18 and \$.12 per serving, respectively, and canned FVs were about \$.25 and \$.17, respectively. Frozen fruit was the most expensive at \$.51 per serving (34). Since 2004, reports have not been updated regarding the average cost of FV, although it has been noted that between 2004 and 2008 food cost increased 15% (35). As a comparison, canned vegetables increased 25.6% and canned fruit increased 18.9% (35). This suggests that the price of canned FV rose more than other foods typically consumed at home since 2004.

Household Food Environment

Ninety-three percent of the food consumed by those who are categorized as “cooking most meals at home” can be found in the home food environment, whereas 72% of the overall food consumed by Americans is found in the home (8). This suggests that although a household member’s diet is not exclusively made up from foods in the home, the home food environment continues to impact a significant portion of food consumption.

Household food inventories have been used to assess household food resources. One-time measurements have been found to be inaccurate indicators of household food resources (15) and there have been relatively few studies that have completed household food inventories on more than one occasion (10-16). Two recent studies completed household food inventories over a 30-day period, but they had a very small sample size (n=6, n=9) and did not account for changes in seasonality (15,16).

For low-income households, food shortages are most severe at the end of the month when household resources are drained (36-38). Food expenditures per person in a household peak the first three days from food stamp receipt and then decrease and remain much lower throughout the rest of the month (39). Wilde and Ranney (39) found that for low-income households who shop once a month or less often, energy intake from the first to the fourth week decreases from 83% to 73.4% of the RDA. Since some households seem to have decreased intake during the end of the month, this suggests that some households are not adequately storing foods to meet needs consistently throughout the month (39).

Hamelin et al (37) reported this variability in home food availability throughout the month. One participant commented that “towards the end of each month, both the number of foods and the serving sizes shrink”. Tarasuk (40) evaluated low-income Canadian mothers over a 30-day period and found that those classified as moderately or severely food secure had significantly lower intakes of energy, carbohydrate, vitamin B-6, and FV. Low-income participants have been found to be using “fresh [FV] at the beginning of the month, then using frozen and finally using cans at the end as ‘the last reserve’” (41). In addition, significant declines in energy intake have been observed in relation to increased time since receipt of monthly income and decreased food security (40). In another study, low-income white

participants' energy intakes were above the recommended levels during the first week after receipt of food stamps and public assistance and below the recommended levels during the fourth week (42). However, in the same study low-income black participants were below the recommended calorie levels throughout the whole month (42). The author found that the majority of participants bought most of their food in the first two weeks, but both groups maintained a relatively consistent food and nutrient supply throughout the month (42). Krukowski (43) found that there was a negative association between duration from receipt of food stamps and energy intake; as the number of days from receipt of SNAP increased, kilocalorie intake decreased. Darko et al (44) found from focus group sessions that low-income participants spent more of their food budget on healthier foods at the beginning of the month compared to the end of the month. Participants reported that they depended more on high-carbohydrate and pre-packaged/canned foods at the end of the month to stretch their food supply (44).

Both perceptions of diminishing food supply and physical food supply shrinkage affects the health of low-income individuals. A paradox exists from findings that low-income families are more likely to be overweight. Dietz (45) was the first to hypothesize a relationship between obesity and hunger in 1995 by suggesting that physiologic responses to periodic food shortages and insecurity might increase body fat. Townsend (46) found that food insecurity was significantly related to overweight in women. In this study, overweight increased as the severity of food insecurity increased from mild to moderate food insecurity. The same relationship was not found with severe food insecurity. This study suggested that overeating by food-insecure families could result when food is available followed by a period of restriction when resources

are depleted, and again followed by overeating (46). This resulting pattern is called the “food stamp cycle” hypothesis, and may contribute to weight gain in low-income families over time.

Food Assistance Programs

Food assistance programs such as the Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program, and the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) were created to provide low-income families and individuals with an adequate food supply to prevent hunger, decrease food insecurity, improve nutritional status, and create better access to foods (47). The Food Stamp Program (FSP) was created in 1939 and allowed participants to purchase orange stamps that could be used to buy any food. For every one dollar of orange stamps purchased, 50 cents worth of blue stamps were awarded to the participant and could only be used to purchase surplus food (48,49). Between the years of 1939 and 1943, the program reached approximately 20 million people but was discontinued because “the conditions that brought the program into being – unmarketable food surpluses and widespread unemployment – no longer existed” (49). Between 1961 and 1964, a pilot FSP was created and by 1964 the program was made permanent (48,49). Since then the program has undergone expansion, legislation, cutbacks, reform, the addition of the Electronic Benefit Transfer (EBT) card, and a name change to SNAP (49).

The Thrifty Food Plan (TFP) is a basis for calculating maximum food stamp allotments and shows how limited resources can be used to attain a healthful and nutritious diet (50). This plan is made up of fifteen market baskets based on age, gender, the 2005 Dietary Guidelines for Americans, the 2005 MyPyramid Food Guidance System, and food prices paid by low-income individuals (50). The individual market baskets are combined to form a household market basket

which determines the maximum allotment to supplement a low-income household food budget (50).

Over 72,000 households and 180,000 people in Utah receive SNAP benefits each month (51). In order to be eligible for the SNAP, a household income must be at or less than 130% of the poverty level and countable resources must be less than \$2,000, or less than \$3,000 if at least one person in the household is over 60 years of age or disabled (52).

WIC originally began as a pilot program in 1972 and was made permanent in 1975 as an effort to prevent malnutrition among low-income mothers and children (43). It is based on the assumption that early intervention programs prevent further medical and developmental problems (53). Eligibility to participate in WIC is based on nutrition risk, residency, category, and income (53). Nutrition risk suggests that an individual has medical-based or dietary-based conditions. Medical- and dietary- based conditions may include anemia, underweight, overweight, or a history of poor pregnancy outcomes or pregnancy complications. In addition, participants must meet the category requirements which include pregnant or breastfeeding mothers and infants and children up to five years of age. In order to meet the income guidelines, a person must be at or below 185% of the poverty level.

When WIC was originally created in 1974, 88,000 women, infants, and children in the US participated. In 2009 that number had increased to 9.3 million (54). Almost half of all infants and one-quarter of the children ages 1-4 years in the United States participate in WIC (53). The WIC food packages were changed in 2009 to include whole grains, solid baby foods, low-fat dairy foods, and FV (54). In the state of Utah, any type of FV can be redeemed whether it is fresh, frozen, or canned (54).

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APPENDIX B: Methods

METHODS

Participants and Study Design

A convenience sample of low-income households with at least one child under the age of 18 years of age living in the household was recruited for this study (n=49). Low-income was defined as $\leq 185\%$ of the poverty level, which is dependent upon the number of people in the household and annual income (Figure 1) (1). If participants received benefits from a government food assistance program (i.e., WIC, SNAP) they automatically qualified for the income requirements of the study. College students were excluded from this study because they likely represented temporary low-income status and could introduce bias in that their experiences with food assistance programs and/or education level might differ from low-income non-students. In addition, participants were required to live in permanent housing in which household food could be stored. This excluded all low-income individuals and families without a home-base. Participants were recruited via posting flyers at a local food bank and WIC clinic, and by word-of-mouth. Data collection began in May 2011 and concluded in September 2011. 57 households participated in this study; however, eight were excluded from data analysis because only three of

Figure 1: Household Annual Income Levels ($\leq 185\%$ of the poverty level) by household size.

Household Size	Annual Income ($\leq 185\%$ Poverty Level)
1	$\leq \$20,035.50$
2	$\leq \$26,954.50$
3	$\leq \$33,873.50$
4	$\leq \$40,792.50$
5	$\leq \$47,711.50$
6	$\leq \$54,630.50$
7	$\leq \$61,549.50$
8	$\leq \$68,468.50$
For each additional member, add	\$3,740

the four inventories were completed. The Brigham Young University Institutional Review Board approved this research study.

Food Inventory Protocol

Usability of data collection instruments was confirmed in two practice households. Researchers were trained prior to study implementation to standardize data collection and to determine inter-rater reliability. Training took place during four different sessions in which researchers were taught to work in partnerships and also received individual instruction and feedback. Researchers were trained extensively on scale use, how to properly weigh foods, accurately estimating container and can sizes, categorizing FV inventoried, and the difference between as purchased (AP) and edible portion (EP) weights. AP is defined as the amount of food before processing. The AP weight can change during processing due to removal of peels, stems, skins, or canning liquid. The resulting weight is called the edible portion (EP). EP is the amount of food available for eating after preparation and/or cooking (2). A convenience sample (n=4) was used to finalize training, ensure usability of study methods, and determine inter-rater reliability. Raters received an inter-rater reliability score for each subcategory recorded: citrus fruit (0.97), other whole fruit (0.99), 100% fruit juice (0.99), dark green vegetables (0.92), orange vegetables (0.81), dry beans and peas (1.00), starchy vegetables (0.99), and other vegetables (0.84). Throughout data collection, researchers met weekly to discuss problems encountered and to answer any questions so data collection methods would remain standardized.

A pilot study (n=10) was conducted among low-income households meeting the study eligibility criteria to predict an appropriate sample size. Household food inventories were conducted once a week in each household over a four-week period by trained researchers. Prior to the first visit, participants were asked about their usual grocery-shopping pattern: if they went

grocery-shopping once a month, bi-monthly, weekly, or multiple times a week. Participants were requested to continue their usual shopping pattern, and if they were planning on shopping the week of a researcher visit, they were requested to shop within 1-2 days prior to the visit. This request was made as an attempt to measure the peak household food availability after a grocery-shopping trip.

Signed consent was obtained upon the arrival of the first visit. The participants were asked to point out all areas of the house where food was stored. Researchers prompted additional locations for food commonly forgotten, such as basements, garages, and storage rooms. FV in the household in any form (fresh, canned, frozen, dried, or 100% juice) were recorded, including foods found in leftover storage containers. According to the USDA MyPyramid recommendations, legumes are counted as vegetables after the daily protein recommendation has been met (3). Since legumes can be measured as vegetables in some cases, the researchers chose to include these items in the food inventories. The weights of all FV were recorded during the inventory. Weights of unopened, packaged FV were recorded from the package label. Packaged, opened FV or those without a label (e.g., fresh FV, home-canned FV) were weighed by researchers and the container size, if present, was recorded. FV were weighed in pounds and ounces on a calibrated, portable scale brought by researchers into each household. Weights were recorded to the nearest 0.125 oz. FV mixed with meats, grains, dairy, or those used as condiments or seasonings were not measured (e.g., berries and yogurt, meat and vegetable stew, dried hot peppers, or pickle relish). Cereal, rice, and pasta were also inventoried to minimize participant bias. During the final household food inventory visit, sociodemographic data were collected and participants were asked to fill out the 18-item USDA Food Security scale (4). Inventories lasted about 30-45 minutes on average, ranging from 10-90 minutes. No

changes in the data collection protocol described above were required after conducting the pilot study, therefore the same methods were used with the study sample and the pilot data were included in the final analysis. A sample size calculation conducted from the pilot data and was determined to be 50 households in order to detect a mean difference of 4 to 4.5 cups between time points.

At the week 4 inventory, a survey was given which consisted of an 18-item USDA Food Security Scale, 20 demographic questions, and 76 questions used to assess perception of FV availability. The 76 questions used a Likert-scale to assess participants' perception of how their household FV inventory changed over a four-week period. These questions were based on formative information collected from qualitative focus groups (5). Participants in these focus groups reported that they spent more of their food budget on healthier foods like fruits, vegetables, and beans at the beginning of the month compared to the end of the month. In addition, the focus groups reported using more non-perishable food storage (canned goods) when food supply was low at the end of the month. The questions were also developed using the Social Cognitive Theory. This theory, first known as the Social Learning Theory, was renamed by Bandura and asserts that behavior is the product of personal, behavioral, and environmental influences (6). These constructs (i.e. personal, behavior, and environment) were analyzed for reliability and received a Cronbach's α score of 0.84, 0.79, and 0.63, respectively. The behavior and personal constructs indicate excellent reliability; environment indicates good reliability (7). The information collected from the 76 perception questions was not analyzed in this master's thesis.

Participants were compensated up to \$50 for participating in the one-month study. This amount was summed as follows: participants received \$10 per week during weeks 1, 2, and 3 of

the one-month period. For week 4, participants received \$20 for the final home food inventory and completion of the survey given at that time. For the pilot study, an additional \$10 was given for the second administration of the survey. All compensation was given at the end of the one-month period. If a home food inventory was unable to be completed for one week, no compensation was given for that week.

Data Analysis

Descriptive statistics, including frequencies and means, were used to analyze the sociodemographic data. For the USDA Food Security Scale, responses of “yes,” “often true,” “sometimes true,” and three or more days of cutting meal sizes or not eating the whole day were coded as affirmative. The sum of affirmative responses provided the household’s raw score. Raw scores were classified as the following: 0 = high food security, 1-2 = marginal food security, 3-7 = low food security, and 8-18 = very low food security (4). For the purposes of this study, high food security and marginal food security were categorized as food secure, while low food security and very low food security were categorized as food insecure. Participants reported the employment status of all adults in their household: full-time employment, part-time employment, unemployed and looking for a job, unemployed but not looking for a job, retired, or a homemaker. The highest employment status in the household was determined by summing the number of total households with at least one adult with a full-time job. The households that did not fit this criterion but had at least one adult in a part-time job were then summed. The remaining households were categorized as unemployed. All households were counted only once.

Researchers classified the weights of inventoried FV as EP or AP upon collecting data in participants’ households. All weights, whether they were AP or EP, were converted into edible cups obtained from the USDA Food and Nutrition Service’s *Food Buying Guide for Child*

Nutrition Programs, 2001 (8). For example, one pound of unpeeled bananas (AP) converts to 0.64 pounds of peeled, edible banana (EP), and is approximately 1.75 cups of sliced banana (8). When converting the AP weights to EP weights, the EP weight used was the most common edible form for a particular food, as determined by a Registered Dietitian. As an example, the EP weight for frozen fruits was the drained, thawed weight; the EP weight for canned kidney beans was the drained, heated weight; fresh carrots were converted to cups of peeled, edible, fresh carrots. Mixed FV were categorized as other fruits or other vegetables (e.g., mixed tomatoes with beans were placed in the subcategory “other vegetables” rather than “dry beans and peas”). According to MyPyramid, two cups of raw, leafy greens equates to one cup of vegetables (9). Likewise, one-half of a cup of dried fruit equates to one cup of fruit (10). Therefore, all measured cups of raw, leafy greens were divided by two and cups of dried fruit were multiplied by two to obtain accurate servings of FV available within the households. In addition, before collected weights of FV were converted to edible cups, container weights were subtracted to obtain the actual weight of each food. For each size of container recorded during the inventories, an average of 1-3 containers of the same size and type (e.g., plastic, glass, aluminum) was used for this subtraction calculation.

For this study, variety was measured in two different ways. First, variety was measured according to the number of subgroups found in the home. One study concluded that variety was best measured by analyzing the extent to which diets are composed of 22 food subgroups from the five major Food Guide Pyramid groups (dairy, fruit, vegetables, grains, and meat/proteins). They concluded that variety could be measured using subgroups to predict dietary quality (11). In the present study, we used a similar method to evaluate variety through the use of subgroups. The subgroups chosen for our study were those defined by MyPyramid (Figure 2) (12,13). Fruit

Figure 2: Fruits and vegetables, according to subgroup

Vegetables:

Dark Green Vegetables	Orange Vegetables	Dry Beans and Peas	Starchy Vegetables	Other Vegetables
Bok choy Broccoli Collard greens Dark green leafy Kale Lettuce Mesclun Mustard greens Romaine lettuce Spinach Turnip greens Watercress	Acorn squash Butternut squash Carrots Hubbard squash Pumpkin Sweet potatoes	Black beans Black-eyed peas Garbanzo beans (chickpeas) Kidney beans Lentils Lima beans (mature) Navy beans Pinto beans Soy beans Split peas Tofu White beans	Corn Green peas Lima beans (green) Potatoes	All other vegetables recorded

Fruits:

Citrus Fruits	Other Whole Fruit:	100% Fruit Juice
Grapefruit Lemons Limes Oranges	Apples Apricots Avocado Bananas <i>Berries:</i> Strawberries Blueberries Raspberries Cherries Grapes Kiwi fruit Mangoes <i>Melons:</i> Cantaloupe Honeydew Watermelon <i>Mixed fruits:</i> Fruit cocktail Nectarines	Any fruit juice in which the label reports it is made from 100% fruit juice

was subcategorized into 100% fruit juice, citrus fruit, and other fruit. Vegetables were subcategorized into dark green vegetables, orange vegetables, legumes, starchy vegetables, and other vegetables. Second, variety was measured by summing the number of different kinds of FV in the home. Two studies described variety by counting the frequency of the different kinds of FV found in the home (14,15). We took a similar approach to variety by counting the kinds of FV within the home. Each type of fruit or vegetable (fresh, frozen, canned, dried, 100% fruit juice) was sorted according to its kind (e.g., fresh apples, applesauce, and 100% apple juice were considered to be one kind of fruit: apple). In our study, however, more specificity of items was collected. In addition to counting the physical presence and frequency of a specific kind of fruit or vegetable within a household, we also obtained the edible amount present in the home, thus linking variety to household availability.

The proposed hypotheses were to measure changes from the time when most economic resources and disposable income were available for purchasing food versus the time when least economic resources were available for purchasing food. However, reporting of financial information including wages, other sources of income, expenditures, and bills was problematic in that some participants provided information that was deemed unreliable (e.g., no expenditures reported in the household over a one-month period) or failed to provide any information. Thus, a proxy was used. Specifically, each household inventory measurement was separated into the week with the highest number of inventoried FV (HFV), the second-highest number of inventoried FV (SFV), the third-highest number of inventoried FV (TFV), and the least number of inventoried FV (LFV). ANOVA analyses were used to determine the difference between kinds of FV between HFV all other weeks. The kinds of FV were also sorted by each week into

the ten most-frequently inventoried fruits across households and the ten most-frequently inventoried vegetables across households.

Edible cups of each inventoried fruit or vegetable was used to calculate how many days into the future at 100% of the MyPyramid FV serving recommendations each household could continue using the inventoried amount of food in their home at each time point measured. Since children ages two to twelve have lower calorie needs and MyPyramid serving size recommendations in comparison to adults, an adult equivalent factor was created to account for this difference. The MyPyramid Food Intake Pattern Calorie Levels were averaged for sedentary to moderately active children aged 2-12 and expressed as a percentage of 2,000 kilocalories (16,17). This adult equivalent factor was 0.73. The factor for adults and children aged 13 and older was 1.0. This technique has been similarly used in a household food inventory study evaluating household nutrient intake based on household food availability (17). MyPyramid adult serving size recommendations (Figure 3) based on a 2,000 kilocalorie diet are: total fruits (2 cups/day), total vegetables (2.5 cups/day), dark green vegetables (3 cups/wk), orange vegetables (2 cups/wk), legumes (3 cups/wk), starchy vegetables (3 cups/wk), and other vegetables (6.5 cups/wk). Using the adult equivalent factor for children aged 2-12, the

Figure 3: Serving recommendations based on a 2000 kcal diet and .73 adult equivalent factor.

2000 Kcal Recommendations:	.73 Equiv. Recommendations:
Fruit: 2 cups/day	Fruit: 1.5 cups/day
Vegetable: 2.5 cups/day	Vegetable: 1.8 cups/day
Dark green: 3 cups per week	Dark green: 2.2 cups per week
Orange: 2 cups per week	Orange: 1.5 cup per week
Legumes: 3 cups per week	Legumes: 2.2 cup per week
Starchy: 3 cups per week	Starchy: 2.2 cups per week
Other: 6.5 cups per week	Other: 4.7 cups per week

MyPyramid serving size recommendations are: total fruits (1.5 cups/day), total vegetables (1.8 cups/day), dark green vegetables (2.2 cups/wk), orange vegetables (1.5 cups/wk), legumes (2.2 cups/wk), starchy vegetables (2.2 cups/wk), and other vegetables (4.7 cups/wk). Although fruit was categorized into citrus, 100% juice, and other fruit (as defined by MyPyramid), no recommendations for MyPyramid fruit subgroups currently exist, so only the total fruit per day recommendation was used to measure days into the future of fruit in the household.

The total amount of edible FV servings in the study sample was divided by recommended number of adult equivalent servings in the household to calculate the adequacy of each household's FV inventory. The adult equivalent factor was also used to determine how many days into the future specific types of FV (fresh, frozen, canned, dried, 100% fruit juice) in the home could provide 100% of the recommendations for total fruits and total vegetables. Because the data were non-normally distributed, log- transformations were used. As some households inventoried had foods unavailable in one or more MyPyramid subgroup categories, a constant number of one was added to the cups of food variable prior to log-transformation. ANOVA was used to determine the differences between time points in the number of days into the future FV could last in the household based on the total household equivalent. The means were back-transformed at each time point (HFV, SFV, TFV, LFV) to determine days into the future at 100% of the recommendation. Tukey-adjusted p-values and confidence intervals were used to determine significance of differences between weeks. To account for multiple comparisons bias, the level of significance was set at $p < 0.01$.

One of the interesting observations during data collection was the frequency of spoiled/inedible FV in households. Although the degree of freshness was not recorded during the study, it was an interesting finding. Research assistants could not objectively judge whether

the spoiled FV were considered to be inedible to the participants, and so they were still recorded in the inventories. This suggests that our findings may be an over-estimation of actual edible FV within the household.

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APPENDIX C: Recruitment Flyer

Are you currently living in a house, apartment, condo
or some other kind of housing unit?



Do you have at least one child under the age of 18
living with you?

Then you may qualify for a research study!



We are conducting a study to find out what types of foods are found in family households and what families like to eat. A team of researchers will visit your home once a week for four weeks to make a list of some of the foods you have on hand in your home. In addition, you will be asked to take a survey at the end of the study.

Participants will receive \$50 for taking part in this
one-month study.

**If you are interested please contact Annie Wells at
801-473-7740 or email at BYUfoodstudy@gmail.com**

This study is being conducted by Rickelle Richards and Annie Wells from the Department of Nutrition, Dietetics,
and Food Science at Brigham Young University.

APPENDIX D: Telephone Screening for Research Eligibility

Pilot Study and Actual Study

TELEPHONE SCREENING FOR RESEARCH STUDY ELIGIBILITY: Pilot Study

Date: _____

Thank you for your interest in our research study. My name is Annie Wells, a graduate student from the Department of Nutrition, Dietetics and Food Science at Brigham Young University and I am working with Dr. Rickelle Richards, a faculty member in our department. We are conducting a study to find out what types of food are found in family households.

Before I tell you about the study in more detail, can I ask you a few questions to see if you are eligible for this study? This screening is voluntary and will take about 5-10 minutes. All responses are confidential. May I proceed?

Screening Questions

- 1) Do you have at least one child living with you under the age of 18?
 - No → *Not eligible*
 - Yes
- 2) Are you a university or college student?
 - No
 - Yes → *Not eligible*
- 3) Is any other adult in your household a university or college student?
 - No → *If no, skip to question 4.*
 - Yes → *If yes, then ask: Is it a spouse or partner?*
 - No
 - Yes → *Not eligible*
- 4) Are you currently on any type of food assistance program, like WIC or Food Stamps?
 - Yes → *If yes, skip to question 5.*
 - No → *If no, then ask:*
 How many people are in your household? _____
 Does your household earn less than _____ in a year?

Household Size	Annual Income (≤185% Poverty Level)
1	≤ \$20,035.50
2	≤ \$26,954.50
3	≤ \$33,873.50
4	≤ \$40,792.50
5	≤ \$47,711.50
6	≤ \$54,630.50
7	≤ \$61,549.50
8	≤ \$68,468.50
For each additional person, add	\$3,740

- 5) Do you currently live in Utah County?
 No —→ *Not eligible*
 Yes
- 6) Are you currently living in an apartment, condo, or house?
 No —→ *Not eligible*
 Yes
- 7) Can you both speak and read English?
 No —→ *Not eligible*
 Yes

Eligibility:

- No —→ *If no, then say:* From the information you have given me so far, it looks like you are not eligible for this study; however, there may be other studies conducted in the future that you might be eligible for. Thank you for your time and have a nice day.
- Yes —→ *If yes, then say:* From the information you have given me so far, it looks like you are eligible for this study.

Let me tell you about the study in a little more detail:

As I mentioned before, we are conducting a study to find out what types of foods are found in family households and what families like to eat. In this study, a team of researchers will visit your home once a week for five weeks, for a total of five visits. During the first four visits, researchers will make a list of the foods you have on hand in your home and ask you a few questions about your household. Each of these visits should last about 30 min to 1 hour. At the fourth visit, you will be asked to complete a survey about the foods in your home and information about your household. At the fifth and final visit you will be asked to complete a second survey about foods in your household. You will receive up to \$60 for participating in the five-week study. This money will be given the final week (week 5). By agreeing to take part in this study, you agree to take part in the five researcher home visits, the survey given the fourth week, and the second survey one week later (week 5).

Risks and Benefits: There are no benefits to you and your family in taking part in this research study. The risk in taking part in this study is that researchers will be entering your house and will be making a list of the foods you have on hand in your home. This may make you feel uncomfortable.

Confidentiality: All information collected will be kept private, in a locked file cabinet in Dr. Rickelle Richards' office. Only Dr. Rickelle Richards and Annie Wells will have access to the collected information. The information collected may be published. You and your family's privacy will be protected and will not be identified in anyway. No individual information will be released.

Are there any other questions that I can answer for you?

- No
- Yes

Would you be interested in taking part in this study?

- No —→ *If no, then say:* Thank you for your time and have a nice day.
- Yes —→ *If yes, then say:* Thank you for being willing to participate, I need to ask just a few more questions to get you signed up for this study.

For this study, we would like for our visits to be within a day or two of your major shopping trip. How often do you have a major grocery shopping trip? (*Read*)

- Once a month —→
When are you planning your next shopping trip? _____
Would you mind shopping on that day for the duration of the study?
- Twice a month —→
When are you planning your next shopping trip? _____
Would you mind shopping on that day for the duration of the study?
- Once a week —→
What day of the week do you usually shop? _____
Would you mind continuing to shop on that day for the duration of this study?
- Other: _____
Would you be willing to choose a day that is as close to your regular schedule as possible to shop for the duration of this study?

Which of these days and times will work for you? —→ (*Proceed to schedule appointment*).

I will need to get your contact information so that we can make these visits:

Name: _____

Phone number/E-mail: _____

Home Address: _____

TELEPHONE SCREENING FOR RESEARCH STUDY ELIGIBILITY: Actual Study

Date: _____

Thank you for your interest in our research study. My name is Annie Wells, a graduate student from the Department of Nutrition, Dietetics and Food Science at Brigham Young University and I am working with Dr. Rickelle Richards, a faculty member in our department. We are conducting a study to find out what types of food are found in family households.

Before I tell you about the study in more detail, can I ask you a few questions to see if you are eligible for this study? This screening is voluntary and will take about 5-10 minutes. All responses are confidential. May I proceed?

Screening Questions

- 1) Do you have at least one child living with you under the age of 18?
 - No → *Not eligible*
 - Yes
- 2) Are you a university or college student?
 - No
 - Yes → *Not eligible*
- 3) Is any other adult in your household a university or college student?
 - No → *If no, skip to question 4.*
 - Yes → *If yes, then ask: Is it a spouse or partner?*
 - No
 - Yes → *Not eligible*
- 4) Are you currently on any type of food assistance program, like WIC or Food Stamps?
 - Yes → *If yes, skip to question 5.*
 - No → *If no, then ask:*
 How many people are in your household? _____
 Does your household earn less than _____ in a year?

Household Size	Annual Income (≤185% Poverty Level)
1	≤ \$20,035.50
2	≤ \$26,954.50
3	≤ \$33,873.50
4	≤ \$40,792.50
5	≤ \$47,711.50
6	≤ \$54,630.50
7	≤ \$61,549.50
8	≤ \$68,468.50

- 5) Do you currently live in Utah County?
 No —→ *Not eligible*
 Yes
- 6) Are you currently living in an apartment, condo, or house?
 No —→ *Not eligible*
 Yes
- 7) Can you both speak and read English?
 No —→ *Not eligible*
 Yes

Eligibility:

- No —→ *If no, then say:* From the information you have given me so far, it looks like you are not eligible for this study; however, there may be other studies conducted in the future that you might be eligible for. Thank you for your time and have a nice day.
- Yes —→ *If yes, then say:* From the information you have given me so far, it looks like you are be eligible for this study.

Let me tell you about the study in a little more detail:

As I mentioned before, we are conducting a study to find out what types of foods are found in family households and what families like to eat. In this study, a team of researchers will visit your home once a week for four weeks, for a total of four visits. At each visit, researchers will make a list of the foods you have on hand in your home. Each visit should last about 30 min to 1 hour. At the fourth and final visit, you will be asked to complete a survey about the foods in your home and information about your household. You will receive up to \$50 for participating in the one-month study. This money will be given the final week (week 4). By agreeing to take part in this study, you agree to take part in the four researcher home visits as well as the survey given at the very last home visit.

Risks and Benefits: There are no benefits to you and your family in taking part in this research study. The risk in taking part in this study is that researchers will be entering your house and will be making a list of the foods you have on hand in your home. This may make you feel uncomfortable.

Confidentiality: All information collected will be kept private, in a locked file cabinet in Dr. Rickelle Richards' office. Only Dr. Rickelle Richards and Annie Wells will have access to the collected information. The information collected may be published. You and your family's privacy will be protected and will not be identified in anyway. No individual information will be released.

Are there any other questions that I can answer for you?

- No
- Yes

Would you be interested in taking part in this study?

- No —→ *If no, then say:* Thank you for your time and have a nice day.
- Yes —→ *If yes, then say:* Thank you for being willing to participate, I need to ask just a few more questions to get you signed up for this study.

For this study, we would like for our visits to be within a day or two of your major shopping trip. How often do you have a major grocery shopping trip? (*Read*)

- Once a month —→
When are you planning your next shopping trip? _____
Would you mind shopping on that day for the duration of the study?
- Twice a month —→
When are you planning your next shopping trip? _____
Would you mind shopping on that day for the duration of the study?
- Once a week —→
What day of the week do you usually shop? _____
Would you mind continuing to shop on that day for the duration of this study?
- Other: _____
Would you be willing to choose a day that is as close to your regular schedule as possible to shop for the duration of this study?

Which of these days and times will work for you? —→ (*Proceed to schedule appointment*).

I will need to get your contact information so that we can make these visits:

Name: _____

Phone number/E-mail: _____

Home Address: _____

APPENDIX E: Consent Forms

Pilot Study and Actual Study

STATEMENT OF INFORMED CONSENT: Pilot Study

This research study is being conducted by Dr. Rickelle Richards, PhD, MPH, RD, and graduate student Annie Wells, RD, from the Department of Nutrition, Dietetics, & Food Science at Brigham Young University. We are conducting a study to find out what types of foods are found in family households and what families like to eat. You were invited to take part in this study because you have a child less than 18 years of age living with you, currently receive or are eligible for one or more government food assistant programs (e.g., WIC, Food Stamps), and live in permanent housing in Utah County.

In this study, a team of researchers will visit your home once a week for five weeks, for a total of five visits. During the first four visits, researchers will make a list of the foods you have on hand in your home and ask you a few questions about your household. Each of these visits should last about 30 min to 1 hour. At the fourth visit, you will be asked to complete a survey about the foods in your home and information about your household. At the fifth and final visit you will be asked to complete a second survey about foods in your household. By agreeing to take part in this study, you agree to take part in the five researcher home visits, the survey given the fourth week, and the second survey one week later (week 5).

Benefits

There are no benefits to you and your family in taking part in this research study. However, results from this study will provide valuable information about how households who are currently receiving or who are eligible for food assistance programs can be better served by these programs.

Risks

The risk in taking part in this study is that researchers will be entering your house and will be making a list of the foods you have on hand in your home. This may make you feel uncomfortable.

Compensation

You will receive up to \$60 for participating in the five-week study. This amount will be summed as follows: You will receive \$10 per week during weeks 1, 2, and 3 of the five-week period. For week 4 you will receive \$20 for the final researcher home food visit in addition to completing the survey that will be given to you at that time. You will receive an additional \$10 for completing a second survey one week later (week 5).

All compensation will be given at the end of the five-week period. If a researcher home visit is unable to be completed for one week, no compensation will be given for that week.

Confidentiality

All information collected will be kept confidential in Dr. Rickelle Richard's secured lab. Only Dr. Rickelle Richards and Annie Wells will have access to the collected information. The information

collected may be published. You and your family's privacy will be protected and will not be identified in anyway. No individual information will be released.

Participation

Participation in this research study is voluntary and you have the right to withdraw at any time or refuse to participate entirely without affecting any present or future relations with Brigham Young University or any community public program.

Questions about the Research/Rights as Research Participants

If you have questions regarding this study as a research participant, you may contact Dr. Rickelle Richards, PhD, MPH, RD at 801-422-6855, rickelle_richards@byu.edu, or Annie Wells at 801-473-7740, byufoodstudy@gmail.com from the Department of Nutrition, Dietetics, & Food Science at Brigham Young University, S-233 ESC, Provo, UT 84602.

If you have questions or concerns about this research study and would like to talk to someone other than the researchers, please contact Dr. Lane Fischer, PhD, Chair of the Institutional Review Board for Human Subjects, A-285 ASB, Brigham Young University, Provo, UT 84602 at (801) 422-1461 or e-mail at irb@byu.edu.

By signing below, you indicate you understand the process involved in this study. I have read, understood, and received a copy of the above consent and desire of my own free will to participate in both the five researcher home visits and the two surveys.

Signature: _____

Date: _____

Signature of Investigator: _____

Date: _____

STATEMENT OF INFORMED CONSENT: Actual Study

This research study is being conducted by Dr. Rickelle Richards, PhD, MPH, RD, and graduate student Annie Wells, RD, from the Department of Nutrition, Dietetics, & Food Science at Brigham Young University. We are conducting a study to find out what types of foods are found in family households and what families like to eat. You were invited to take part in this study because you have a child less than 18 years of age living with you, currently receive or are eligible for one or more government food assistant programs (e.g., WIC, Food Stamps), and live in permanent housing in Utah County.

In this study, a team of researchers will visit your home once a week for four weeks, for a total of four visits. At each visit, researchers will make a list of the foods you have on hand in your home. Each visit should last about 30 min to 1 hour. At the fourth and final visit, you will be asked to complete a survey about the foods in your home and information about your household. By agreeing to take part in this study, you agree to take part in the four researcher home visits as well as the survey given at the very last home visit.

Benefits

There are no benefits to you and your family in taking part in this research study. However, results from this study will provide valuable information about how households who are currently receiving or who are eligible for food assistance programs can be better served by these programs.

Risks

The risk in taking part in this study is that researchers will be entering your house and will be making a list of the foods you have on hand in your home. This may make you feel uncomfortable.

Compensation

You will receive up to \$50 for participating in the one-month study. This amount will be summed as follows: You will receive \$10 per week during weeks 1, 2, and 3 of the one-month period. For week 4 you will receive \$20 for the final researcher home visit in addition to completing the survey that will be given to you at that time.

All compensation will be given at the end of the one-month period. If a researcher home visit is unable to be completed for one week, no compensation will be given for that week.

Confidentiality

All information collected will be kept confidential in Dr. Rickelle Richard's secured lab. Only Dr. Rickelle Richards and Annie Wells will have access to the collected information. The information collected may be published. You and your family's privacy will be protected and will not be identified in anyway. No individual information will be released.

Participation

Participation in this research study is voluntary and you have the right to withdraw at any time or refuse to participate entirely without affecting any present or future relations with Brigham Young University or any community public program.

Questions about the Research/Rights as Research Participants

If you have questions regarding this study as a research participant, you may contact Dr. Rickelle Richards, PhD, MPH, RD at 801-422-6855, rickelle_richards@byu.edu, or Annie Wells at 801-473-7740, byufoodstudy@gmail.com from the Department of Nutrition, Dietetics, & Food Science at Brigham Young University, S-233 ESC, Provo, UT 84602.

If you have questions or concerns about this research study and would like to talk to someone other than the researchers, please contact Dr. Lane Fischer, PhD, Chair of the Institutional Review Board for Human Subjects, A-285 ASB, Brigham Young University, Provo, UT 84602 at (801) 422-1461 or e-mail at irb@byu.edu.

By signing below, you indicate you understand the process involved in this study. I have read, understood, and received a copy of the above consent and desire of my own free will to participate in both the four researcher home visits and the survey.

Signature: _____

Date: _____

Signature of Investigator: _____

Date: _____

APPENDIX F: Inventory Protocol Sheet

Inventory Protocol Sheet

Week 1

1. Preparation for appointment
 - a. Confirm household address/directions based on screening information
 - b. Materials and Supplies – see “Materials Checklist 1.4.11.docx”
2. Arriving at households
 - a. Introduce researchers
 - b. Have participant sign consent form**
 - c. Ask participant the questions on the “Participant Questionnaire”.
3. Conducting Food Inventories:
 - a. Ask participant to identify all of the areas in the house that store food. Begin in the kitchen and then continue to the other areas of the house.
 - b. One researcher will say the information aloud while the other researcher records the information on the “Food Inventory Tracking Sheet”.

Food inventory

Using the scale

- a. Zero the scale before anything is weighed, making sure to zero the scale with the container if that will contribute to the weight. To zero the scale: hold down the “Mode/Tare” button and wait until the scale reads 0.
- b. Confirm that the scale unit of measurements is in pounds and ounces. To change: press the “Mode/Tare” button until “lbs” or “oz” reads in the top of the screen.

Using the Food inventory Tracking Sheet

- a. Name of food
 - i. Record the name of all fruits and vegetables.
 1. For fruits and vegetables only, record what category the fruit or vegetable is in, whether it be:
 - a. Fresh
 - b. Frozen
 - c. Canned
 - d. Dried
 - e. 100% juice
 - ii. Record the name of all cereals, pastas, and rice.
 - iii. We will not be recording any foods that are considered to be “leftovers”. This is described below (d. Actual weight → iii → Container → a.).
 - ii. Record the name of all cereals, pastas, and rice.
 - iii. We will not be recording any foods that are considered to be “leftovers”. This is described below (d. Actual weight → iii → Container → a.).
- c. Package/Can weight

- i. Record a weight in this column if the package/can remains *unopened* AND has a store or cannery *label*.
 - ii. Record the weight specified on the package/can in pounds and ounces.
 - d. Actual weight
 - i. Record the weight (in pounds and ounces) in this column for all items that are either opened and/or fail to have a store or cannery label (this could include home-canned goods).
 - ii. Weights will be measured on the scale in pounds and ounces.
 - iii. Record how the food was weighed:
 - 1. Can #:
 - a. Refer to the “Can size” document to identify the can number.
 - b. If can size is still in question, use the ruler to identify the dimensions, compare to dimensions on “Can size” document and proceed to identify can number.
 - 2. Container:
 - a. Mark this box if the fruit or vegetable is in a leftover or storage container. Use only fruits and vegetables that are not combined with other ingredients (i.e. one kind of fruit or vegetable only). If the fruit or vegetable is combined with any other ingredients or food (or even any other kind of fruit or vegetable), it is considered a leftover and should not be measured.
 - b. Indicate the size of the storage container (1 cup, 2 cups, etc.).
 - 3. Bag/box
 - 4. Jar size:
 - a. Refer to the “Can size” document to identify jar size.
 - b. If jar size is still in question, use the ruler to identify the dimensions, compare to dimensions on “Can size” document and proceed to identify jar size.
- e. What form the food is in, whether it be AP or EP
 - i. AP = as purchased. This is the weight before any preparation.
 - ii. EP = edible portion. Weight after preparation – removal of skins, peels, stems, canning liquid, etc.
- b. When finished ask if there is any food in the garage, basement, or freezer that the participant may not have thought of previously.

Week 2

Protocol is the same as week 1, except that the participant will not sign a consent form.

Week 3

Protocol is the same as the previous week (week 2).

Week 4

Protocol is the same as the previous week, except that the participant will be given a survey upon researcher arrival.

1. Preparation for appointment
 - a. Confirm household address/directions based on screening information
 - b. Materials and Supplies – see “Materials Checklist 1.4.11.docx”
2. Arriving at households
 - a. Introduce researchers
 - b. Provide participant with the survey and answer any questions participant may have.**
 - c. Ask participant the questions on the “Participant Questionnaire”.
3. Conducting food inventories as specified previously.

If at any time you feel your safety compromised, inform the participant that you were supposed to confirm your arrival and forgot. Call Dr. Richards’ cell phone (801-615-9676) and tell her that you have arrived. If there is no answer, continue as if there was an answer. After getting off the phone, tell the participant that you are very sorry but are needed suddenly and will contact them in the near future to set up another appointment. For this participant, we will call and inform them that the study design changed and will proceed to give the survey over the phone.

APPENDIX G: Materials Checklist

Materials Checklist

Documents:

- Consent Form (*week 1 only*)
- Participant Survey (*week 4 only*)
- Food Inventory Tracking Sheet
- Participant Questionnaire
- Can/jar size photo document
- Protocol Sheet

Other:

- Scale
- Ruler
- Clipboard
- 2 Gel pens
- Hand sanitizer
- Foodservice gloves
- Cleaning wipes
- AAA batteries

APPENDIX H: Food Inventory Tracking Sheet

Household ID# _____

Date _____

Week # _____

Food Inventory Tracking Sheet

Name of Food	Category (Fruits and Vegetables Only)	Package/Can weight (Store label + unopened)	Actual weight	What form is the food?*
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP
	<input type="checkbox"/> Fresh <input type="checkbox"/> Frozen <input type="checkbox"/> Canned <input type="checkbox"/> Dried <input type="checkbox"/> 100% Juice	<input type="text"/> lbs <input type="text"/> oz	<input type="text"/> lbs <input type="text"/> oz <input type="checkbox"/> Can # _____ <input type="checkbox"/> Jar size _____ <input type="checkbox"/> Container _____ <input type="checkbox"/> Bag	<input type="checkbox"/> AP <input type="checkbox"/> EP

* AP = the amount of food before processing
 EP = the amount of food available for eating after preparation
 and/or cooking: removal of peels, stems, skins, canning liquid, etc.

APPENDIX I: Participant Questionnaire

Household ID# _____
Date _____
Week # _____

Participant Questionnaire

- 1) When was your last **major** shopping trip? _____

- 2) Are you currently on any type of food assistance program, like WIC or Food Stamps?
 - No —→ *If no, skip to question 4.*
 - Yes —→ *If yes, continue to question 3.*

- 3) Did your household receive any SNAP (food stamps) or WIC benefits in the last 7 days?
 - No —→ *If no, continue to question 4.*
 - Yes —→ *If yes, was it Food Stamps and/or WIC?*
 - WIC
 - Food Stamps (SNAP) —→ *If so, how much? \$_____*

- 4) Did your household receive any type of income (other than food assistance programs, if applicable) in the last 7 days?
 - No —→ *If no, continue to question 5.*
 - Yes —→ *If so, how much? \$_____*

- 5) Did your household have any major expenses in the last 7 days, such as rent or a car payment?
 - No —→ *Questionnaire is complete.*
 - Yes —→ *If so, how much? \$_____*

APPENDIX J: Can Sizes

Can Sizes



6Z
202 x 308
Tomato paste (6 oz.)



8Z
211 x 300
Tomato sauce, mandarin oranges (8 oz.)



No. 1
211 x 400
Condensed soups, tomato paste (10.5 - 12 oz.)



No. 300
300 x 407
Beans, chili, tomatoes (14-16 oz.)



No. 303
300 x 406
Principal size for f/v (16-17 oz.)



No. 2
307 x 409
Juice, pineapple and apple slices, tomatoes (20 oz. or 18 fl. oz.)



No. 2 cylinder
307 x 512
Jumbo can of beans (26-27 oz.)



No. 2.5
401 x 411
Fruit, tomatoes, sauerkraut, pumpkin (27-29 oz.)



No. 3 cylinder
404 x 700
F/v juices, some vegetables (51 oz. or 46 fl. oz.)



No. 10
602 x 700
Institutional sized f/v (6.5 lbs. - 7 lbs.)

Dimensions: The first number of the three digits represents the number of whole inches. So, in a 303 can, the first "3" represents 3 inches (7 1/2 cm); the final two numbers represent sixteenths of an inch. So, in 303, the "03" part at the end represents 3/16ths of an inch (4.7 mm.) So the total size of the can is 3 3/16 inches.

APPENDIX K: Survey



Household Food Survey

2011

Brigham Young University Department of Nutrition, Dietetics, and Food Science

Thank you for doing this household food survey! It will help us learn more about the foods families in Utah like to have in their homes. There is no right or wrong answer. Please just tell us what you really think.

If you have any questions, please ask and we'll be happy to help you!

Questions 1-40 are about your experience with food. Mark whether you strongly disagree, disagree, feel neutral, agree, or strongly agree with the following statements. Please circle one response.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Price limits the amount of fruit I buy for my household.	1	2	3	4	5
2. Price limits the different kinds of fruits I buy.	1	2	3	4	5
3. Fresh fruit costs more than other forms of fruit (canned, frozen).	1	2	3	4	5
4. It is cheaper to buy fruits during the summer.	1	2	3	4	5
5. I buy canned or frozen fruits when they are on sale.	1	2	3	4	5
6. I feel stressed about the amount of money I have to buy fruits.	1	2	3	4	5
7. If I had more money to buy food, I would buy more fruit.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8. Having different kinds of fruit in my house is important to me.	1	2	3	4	5
9. Eating fruit is good for my household's health.	1	2	3	4	5
10. My household has fruits in our home because they are good for our health.	1	2	3	4	5
11. I buy the fruits that I know my child(ren) will eat.	1	2	3	4	5
12. I want my child(ren) to try different kinds of fruit.	1	2	3	4	5
13. If I have fruits available at home, my household will eat them.	1	2	3	4	5
14. I do not buy fresh fruits because they end up being wasted (thrown away).	1	2	3	4	5
15. It is hard to buy fruits instead of snack foods, like chips and sweets.	1	2	3	4	5
16. It is hard for me to have different kinds of fruits in my household.	1	2	3	4	5
17. Stores where I shop sell different kinds of fruits.	1	2	3	4	5
18. I choose foods that are not good for my household's health because they are cheaper than healthier foods.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19. My household does not have certain foods on hand at home because of allergies.	1	2	3	4	5
20. Storage space limits the amount of food I have on hand at home.	1	2	3	4	5
21. I sacrifice eating food so my child(ren) can have it.	1	2	3	4	5
22. Price limits the amount of vegetables I buy for my household.	1	2	3	4	5
23. Price limits the different kinds of vegetables I buy.	1	2	3	4	5
24. Fresh vegetables cost more than other forms of vegetables (canned, frozen).	1	2	3	4	5
25. It is cheaper to buy vegetables during the summer.	1	2	3	4	5
26. I buy canned or frozen vegetables when they are on sale.	1	2	3	4	5
27. I feel stressed about the amount of money I have to buy vegetables.	1	2	3	4	5
28. If I had more money to buy food, I would buy more vegetables.	1	2	3	4	5
29. Having different kinds of vegetables in my house is important to me.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
30. Eating vegetables is good for my household's health.	1	2	3	4	5
31. My household has vegetables in our home because they are good for our health.	1	2	3	4	5
32. I buy the vegetables that I know my child(ren) will eat.	1	2	3	4	5
33. I want my child(ren) to try different kinds of vegetables.	1	2	3	4	5
34. If I have vegetables available at home, my household will eat them.	1	2	3	4	5
35. I do not buy fresh vegetables because they end up being wasted (thrown away).	1	2	3	4	5
36. It is hard to buy vegetables instead of snack foods, like chips and sweets.	1	2	3	4	5
37. It is hard for me to have different kinds of vegetables in my household.	1	2	3	4	5
38. Stores where I shop sell different kinds of vegetables.	1	2	3	4	5
39. Using coupons for food helps me save money.	1	2	3	4	5
40. Planning a menu for meals helps me save money.	1	2	3	4	5

For questions 41-47, we will use the terms "most money (MM)" and "least money (LM)." These are defined as follows:

Most money (MM) = the time(s) of the month when you have the most money (from paychecks, WIC, food stamps, or other sources of income) to buy food.

Least money (LM) = the time(s) of the month when you have the least money to buy food.

Please think of these definitions when answering questions 41-47. For each question, please circle one response.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
41. I have more food in my home when I have MM compared to when I have LM.	1	2	3	4	5
42. I rely on food from the food bank more when I have LM than when I have MM to feed my household.	1	2	3	4	5
43. I skip more meals when I have LM compared to when I have MM.	1	2	3	4	5
44. My children skip more meals when I have LM than when I have MM.	1	2	3	4	5
45. It is hard for me to have enough fruits for my household when I have LM.	1	2	3	4	5
46. It is hard for me to have enough vegetables for my household when I have LM.	1	2	3	4	5
47. I rely on food I have stored in my home more when I have LM than when I have MM to feed my household.	1	2	3	4	5

For questions 48-50, the term "other people" refers to people who you care about, such as friends or family.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
48. I learned how to stretch food throughout the entire month from other people.	1	2	3	4	5
49. I learned how to have different kinds of fruits on hand at home from other people.	1	2	3	4	5
50. I learned how to have different kinds of vegetables on hand at home from other people.	1	2	3	4	5

The next set of questions will ask you about **food storage practices in your home**. Food storage is defined as follows:

Food Storage = food set aside for emergency situations or food set aside to supply your household with food if other food is not available. Some people refer to this as "stocking up" on food.

Please think of this definition when answering the following set of questions. For each question, please circle one response.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I have enough space (cupboard, freezer, shelf, and/or floor space) to have food storage.	1	2	3	4	5
2. I know how to can or preserve food.	1	2	3	4	5
3. Having food storage is important to me.	1	2	3	4	5
4. It costs too much to buy food storage.	1	2	3	4	5

5. Do you currently have food storage in your home?

¹ Yes ———> If yes, answer questions Sa-5j.

² No ———> If no, skip to page 9, question 1.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5a. Having food storage helps me save money.	1	2	3	4	5
5b. Having foods in my food storage that my household will eat is important to me.	1	2	3	4	5
5c. It is hard to know what kinds of foods to put in my food storage.	1	2	3	4	5
5d. It is easy to build up my food storage.	1	2	3	4	5
5e. I buy food storage when food items are on sale.	1	2	3	4	5
5f. I use food I obtain from the food bank as my food storage.	1	2	3	4	5
5g. I have food storage so that I am prepared for an emergency.	1	2	3	4	5
5h. When I have food storage at home, I feel less worried about an emergency.	1	2	3	4	5
5i. When food is low, I rely on my food storage to provide food for my household.	1	2	3	4	5
5j. If I had more money, I would buy more food storage.	1	2	3	4	5

For the next set of questions, please check one response.

1. Realistically, about how many weeks or months could your household reasonably survive using only the food and food supply you currently have in your house?

- ¹ less than one week
² one week
³ two weeks
⁴ three weeks
⁵ a month
⁶ two to three months
⁷ four to six months
⁸ seven to eleven months
⁹ a year or more
¹⁰ don't know

2. Excluding long-term food storage, about how many weeks or months could you continue eating your typical diet/meal without going to the grocery store?

- ¹ less than one week
² one week
³ two weeks
⁴ three weeks
⁵ a month
⁶ two to three months
⁷ four to six months
⁸ seven to eleven months
⁹ a year or more
¹⁰ don't know

3. Overall, the quality of food at the stores where I shop is:

- ¹ Excellent
² Very Good
³ Good
⁴ Fair
⁵ Poor

The next set of questions is about **WIC and Food Stamp use**.
For each question, please check the box or circle one response.

4. Are you currently using WIC?

- ¹ Yes ———→ *If yes, answer questions 4a-4b.*
² No ———→ *If no, skip to page 10, question 5.*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4a. Using WIC helps me stretch my food dollar.	1	2	3	4	5
4b. WIC helps me add foods to my food storage during the month.	1	2	3	4	5

5. Are you currently using food stamps?

- ¹ Yes ———→ *If yes, answer questions 5a-5d.*
² No ———→ *If no, skip to page 11, question 1.*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5a. Using food stamps helps me stretch my food dollar.	1	2	3	4	5
5b. My household receives enough food stamps to last the entire month.	1	2	3	4	5
5c. Food stamps help me buy a variety of foods.	1	2	3	4	5
5d. If I have extra food stamp money, I "stock up" on food (or buy food storage).	1	2	3	4	5

For these statements, please mark whether the statement was often true, sometimes true, or never true for you/your household in the last 30 days.

1. In the last 30 days, I (we) worried whether my (our) food would run out before I (we) got money to buy more.
 - ¹ Often true
 - ² Sometimes true
 - ³ Never true
 - ⁴ Don't know

2. In the last 30 days, the food that I (we) bought just didn't last, and I (we) didn't have money to get more.
 - ¹ Often true
 - ² Sometimes true
 - ³ Never true
 - ⁴ Don't know

3. In the last 30 days, I (we) couldn't afford to eat balanced meals.
 - ¹ Often true
 - ² Sometimes true
 - ³ Never true
 - ⁴ Don't know

4. In the last 30 days, did you (you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?
 - ¹ Yes → If yes, in the last 30 days, how many days did this happen? _____ days
 - ² No
 - ³ Don't know

5. In the last 30 days, did you ever eat less than you felt you should because there wasn't enough money for food?
 - ¹ Yes
 - ² No
 - ³ Don't know

6. In the last 30 days, were you ever hungry but didn't eat because there wasn't enough money for food?
 - ¹ Yes
 - ² No
 - ³ Don't know

7. In the last 30 days, did you lose weight because there wasn't enough money for food?
 - ¹ Yes
 - ² No
 - ³ Don't know

8. In the last 30 days, did you (you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?
 - ¹ Yes → If yes, in the last 30 days, how many days did this happen? _____ days
 - ² No
 - ³ Don't know

9. In the last 30 days, I (we) relied on only a few kinds of low-cost food to feed my (our) child/the children because I was (we were) running out of money to buy food.

- ¹ Often true
² Sometimes true
³ Never true
⁴ Don't know

10. In the last 30 days, I (we) couldn't feed my (our) child/the children a balanced meal, because I (we) couldn't afford that.

- ¹ Often true
² Sometimes true
³ Never true
⁴ Don't know

11. In the last 30 days, my (our) child was/the children were not eating enough because I (we) just couldn't afford enough food.

- ¹ Often true
² Sometimes true
³ Never true
⁴ Don't know

12. In the last 30 days, did you ever cut the size of your child's/any of the children's meals because there wasn't enough money for food?

- ¹ Yes
² No
³ Don't know

13. In the last 30 days, did your child/any of the children ever skip meals because there wasn't enough money for food?

- ¹ Yes
² No
³ Don't know

→ *If yes, in the last 30 days, how many days did this happen? _____ days*

14. In the last 30 days, was your child/were the children ever hungry but you just couldn't afford more food?

- ¹ Yes
² No
³ Don't know

15. In the last 30 days, did your child/any of the children ever not eat for a whole day because there wasn't enough money for food?

- ¹ Yes
² No
³ Don't know

*The next set of questions is about you and your household.
 Please fill in the blank or check the box that applies.*

1. How old are you? _____ years.

2. Are you a male or a female?

- ¹ Male
² Female

3. How would you best describe yourself with respect to race? Check all that apply.

- ¹ African American (Black)
- ² American Indian
- ³ Asian
- ⁴ Caucasian (White)
- ⁵ Hispanic
- ⁶ Other, please specify: _____

4. What is your current employment status?

- ¹ Employed for pay in a full-time job
- ² Employed in a part-time job
- ³ Unemployed and looking for work
- ⁴ Retired
- ⁵ A homemaker
- ⁶ Unemployed but not looking for work

5. In general, how would you describe your diet?

- ¹ Extremely healthy
- ² Very healthy
- ³ Somewhat healthy
- ⁴ Very unhealthy
- ⁵ Extremely unhealthy

6. In general, how would you describe your health?

- ¹ Excellent
- ² Very Good
- ³ Good
- ⁴ Fair
- ⁵ Poor

7. What is your current religious affiliation?

- ¹ No religious affiliation
- ² Catholic
- ³ Latter-Day Saints (LDS/Mormon)
- ⁴ Protestant
- ⁵ Some other affiliation
- ⁶ Don't know

8. What is your household yearly income?

- ¹ Less than \$5,000
- ² \$5,001-\$9,999
- ³ \$10,000-\$19,999
- ⁴ \$20,000-\$39,000
- ⁵ Greater than \$40,000

9. What is the highest level of formal education in your household?

- ¹ Have not completed high school
- ² Received high school diploma or GED
- ³ Some college or technical school
- ⁴ 4-year college, university degree or advanced degree

10. Do you own a home, townhouse, condo, etc.?

- ¹ Yes
- ² No

11. Do you rent an apartment, townhouse, condo, etc.?

- ¹ Yes
- ² No

12. Other than yourself, are there any adults (anyone 18 years and older) living in your household?

- ¹ Yes —————> *If yes, answer question 12a.*
- ² No —————> *If no, skip to page 18, question 13.*

12a. Besides you, what is the employment status of other adults (anyone 18 years and older) in your home?

Other adult (not you) #1 is currently:

- ¹ Employed for pay in a full-time job
- ² Employed in a part-time job
- ³ Unemployed and looking for work
- ⁴ Retired
- ⁵ A homemaker
- ⁶ Unemployed but not looking for work
- ⁷ Don't know

Other adult (not you) #2 is currently:

- ¹ Employed for pay in a full-time job
- ² Employed in a part-time job
- ³ Unemployed and looking for work
- ⁴ Retired
- ⁵ A homemaker
- ⁶ Unemployed but not looking for work
- ⁷ Don't know

Other adult (not you) #3 is currently:

- ¹ Employed for pay in a full-time job
- ² Employed in a part-time job
- ³ Unemployed and looking for work
- ⁴ Retired
- ⁵ A homemaker
- ⁶ Unemployed but not looking for work
- ⁷ Don't know

13. What is the total number of people living in your household? _____

14. Please indicate the age and gender of each person, aged 2 and older, who are living in your household:

	Gender	Age
Person 1:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 2:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 3:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 4:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 5:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 6:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 7:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 8:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 9:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 10:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 11:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 12:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 13:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 14:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old
Person 15:	<input type="checkbox"/> ¹ Male <input type="checkbox"/> ² Female	_____ years old

15. Do your children get free or reduced school meals?

- ¹ Yes
- ² No

16. Do you get food assistance from a source other than food stamps and/or WIC (such as church, food pantry, etc.)?

- ¹ Yes → If yes, please specify: _____.
- ² No

17. Do you get financial assistance from any other source than from a job?

- ¹ Yes → If yes, please specify: _____.
- ² No

18. Where are the top three places you shop for groceries? *Please write the store name(s) on the lines below:*

- I shop most often at _____.
- I shop second most often at _____.
- I shop third most often at _____.

19. Does anyone in your household currently smoke?

- ¹ Yes → If yes, how much is spent on cigarettes every week? \$ _____.
- ² No

20. Does anyone in your household drink alcohol?

- ¹ Yes → If yes, how much is spent on alcohol every week? \$ _____.
- ² No

End of Survey

Thank you for your participation!



APPENDIX L: IRB Study Approval

Institutional Review Board
for Human Subjects



Brigham Young University
A-285 ASB Provo, Utah 84602
(801) 422-3841 / Fax: (801) 422-0620

January 20, 2011

Rickelle Richards
S-233 ESC
Campus Mail

Re: Changes in fruit and vegetable household food inventory among low-income families over a one-month period of time.

Dear Ann Wells

This is to inform you that Brigham Young University's IRB has approved the above research study.

The approval period is from 1-20-2011 to 1-19-2012. Your study number is X110025. Please be sure to reference this number in any correspondence with the IRB.

Continued approval is conditional upon your compliance with the following requirements.

1. A copy of the 'Informed Consent Document' approved as of 1-20-2011 is enclosed. No other consent form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.
2. All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB.
3. The enclosed recruitment advertisement has been approved. Advertisements, letters, Internet postings and any other media for subject recruitment must be submitted to IRB and approved prior to use.
4. A few months before this date we will send out a continuing review form. There will only be two reminders. Please fill this form out in a timely manner to ensure that there is not a lapse in your approval.

If you have any questions, please do not hesitate to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "Sandee M.P. Munoz".

Lane Fischer, PhD, Chair
Sandee M.P. Munoz, Administrator
Institutional Review Board for Human Subjects