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Digital Object Identifier: <http://dx.doi.org/10.13023/ETD.2016.086>

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EVALUATION OF DIET COMPOSITION OF PEDIATRIC CANCER SURVIVORS AS A
NEED FOR NUTRITION COUNSELING

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master
of Science in the College of Agriculture, Food, and Environment at the University of
Kentucky

By:

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Lexington, Kentucky

Director: Dr. Sandra Bastin, PhD, RD, LD

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ABSTRACT OF THESIS

EVALUATION OF DIET COMPOSITION OF PEDIATRIC CANCER SURVIVORS AS A NEED FOR NUTRITION COUNSELING

Prior research has shown that pediatric cancer survivors face a multitude of long-term effects from treatment of their disease. Many of these conditions can be treated or managed through proper nutrition, however patients of the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic do not see a registered dietitian. This study looked at food and drink consumption of the past 30 days by the patient using the NHANES Dietary Screener Questionnaire to see if they met nutrition recommendations as outlined by the *2015-2020 Dietary Guidelines for Americans*. Results from the study found that off-treatment pediatric cancer survivors (n=21) failed to meet dietary recommendations in fruit and vegetable, whole grain, and dairy intake. It was also shown that participants exceeded their limit of added sugars. From these findings it was concluded that pediatric cancer survivors in the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic would benefit from nutrition counseling and education provided by a Registered Dietitian.

KEYWORDS: Pediatric Cancer Survivors, Oncology Nutrition, DanceBlue, Cancer, Obesity

Sean Tyler O'Nan

April 21, 2016

EVALUATION OF DIET COMPOSITION OF PEDIATRIC CANCER SURVIVORS AS A
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Chapter One:

Introduction

In the last 30 years the survival rates for cancer have drastically risen. Cancer research has gathered national attention and funding has increased to provide the needed research for the discovery of a cure. A rare 1% of cancer patients are diagnosed as children, and it is estimated that 12,060 were diagnosed in 2012 (Seigel, R et al, 2012). Due to advances in medicine and different therapies there has been an increase in the chance of survival of pediatric cancer. Cancers diagnosed between the age of 0 to 14 years are generally considered pediatric cancers, though exact age ranges can vary depending on location (Bahadur G, Hindmarsh P, 2000). Thirty years ago 1 in 4 children survived a cancer diagnosis, whereas today the survival rate is closer to 3 in 4 children. In the United States it is estimated that there are approximately 58,510 pediatric cancer survivors, all of whom require special nutritional care due to underlying side effects of their treatments (Seigel, R et al, 2012). Though pediatric cancer survival rates have increased, there is still a lack of medical professionals who are properly educated in nutrition education and medical nutrition therapy for these patients. In a survey conducted in 2010, the results found that medical schools reported a decrease in nutrition courses from 35% in 2000 to 25% in 2008 as well as only 26 of 127 accredited medical schools in the United States having a separate course dedicated to nutrition (Kris-Etherton PM, et al, 2014). Patients in the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic have access to some of the best oncologists in the country, as well as a team of nurses, social workers, child life specialists, school

intervention specialists and others who work tirelessly to provide patients with outstanding levels of care. However, the team lacks a crucial component, a registered dietitian. When a dietitian is needed, they must request for the hospital dietitian to come visit their patient, if they are available.

Pediatric cancer survivors face a multitude of latent side effects to cancer treatment including the dysfunction or impairment of specific organs or organ systems, cognitive impairment, and the risk of secondary cancers (Seigel, R et al, 2012). Patients also frequently experience higher Body Mass Index (BMI) levels, which have been shown to increase the risk of comorbidities such as cardiovascular disease, Type 2 diabetes, and hypertension. Nutrition intervention may be a way to lower the risk for these conditions.

Problem Statement

Due to a lack of medical professionals who have been properly educated on nutrition and dietary intervention, off-treatment pediatric cancer survivors are not receiving proper follow up care to help manage the occurrence of common post-treatment conditions such as obesity, diabetes, and cardiovascular problems.

Purpose Statement

The purpose of this study is to evaluate the diets of current off-therapy pediatric cancer survivors to determine if they are meeting the recommended guidelines as set forth by the *2015-2020 Dietary Guidelines for Americans* in the hopes of combating secondary comorbid conditions. The goal is prove the need for nutrition education and counseling by a registered dietitian for patients in the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic.

Research Questions

1. Do pediatric cancer survivors consume recommended amounts of fruits and vegetables as outlined by the *2015-2020 Dietary Guidelines for Americans*?
2. Are pediatric cancer survivors consuming foods high in added sugars?

Hypotheses

1. Off-treatment pediatric cancer survivors do not consume the proper servings of fruits and vegetables as outlined in the *2015-2020 Dietary Guidelines for Americans*.
2. Off-treatment pediatric cancer survivors consume a diet that contains more than double the recommended daily limit of added sugars.

Objectives

1. Determine if pediatric cancer survivors are meeting the basic nutritional recommendations outlined in the *2015-2020 Dietary Guidelines for Americans*.
2. Determine if current dietary habits of pediatric cancer survivors are putting them at risk for becoming overweight or obese.
3. Prove a need for nutrition counseling for pediatric cancer survivors due to current dietary habits.

Assumptions

All participants were recruited from the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic. Participants are assumed to have little to no knowledge of the nutrition guidelines for cancer survivors and to have never

received any nutrition counseling by a registered dietitian. It is also assumed that all participants completed the Dietary Screener Questionnaire (DSQ) accurately and to the best of their ability.

Justification

Due to the lack of nutrition education available to the pediatric cancer survivors of the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic, patients are often faced with comorbidities such as obesity, diabetes, and cardiovascular disease. These conditions not only increase their risk of developing secondary cancers but also have the chance to prove fatal. This study will provide evidence of current dietary habits of off-treatment pediatric cancer survivors in hopes of providing future patients with proper nutrition education and counseling by a registered dietitian.

Chapter Two:

Literature Review

Cancer Treatments and Side Effects

Cancer treatment varies on the specific type of cancer the child has; the most common of which being forms of chemotherapy and radiation. Chemotherapy works throughout the body in the prevention of new cancer growth by means of killing cancer cells or inhibiting cell growth. By interrupting the growth of cancer cells there is a chance to reduce the risk of the cancer metastasizing, or spreading to other areas in the body. The use of chemotherapy drugs does however have an impact on the patient's body. Common side effects of chemotherapy include fatigue, nausea and vomiting, hair loss, dysgeusia (altered taste), sensitivity to food temperature, and dysphagia (difficulty swallowing). (Lee H, Lee J, 2014). It is important to remember that the drugs will affect each patient differently so side effects can vary in quantity and severity. Radiation therapy is similar to chemotherapy in that it is used to kill cancer cells but differs by targeting only the tumor, not the whole body. Radiation also carries similar side effects such as fatigue, loss of appetite, and hair loss. With both treatments fatigue and aversion towards food can play a large role in the dietary habits of patients and should be monitored to make sure proper nutrition is being achieved.

The side effects to cancer treatment also can create difficulties for cancer survivors and can lead to poor quality of life for these patients (Conlon B, et al. 2014). Though the main fear for cancer survivors would be cancer return or a secondary cancer, they are also likely to face psychosocial challenges and

comorbidities that diminish their health status. Pediatric cancer survivors report that they are often frustrated by the fear of late effects of cancer and how it affects their daily routine (D'Agostino NM, Edelstein K, 2013). Cancer survivors from rural areas might also face additional complications by having a lack of adequate treatment options, limited access to treatment facilities, and no access to survivorship guidelines. This also poses an issue for long-term survivors who may not have the accessibility to reach the follow-up care they need. Studies have also determined that African American and Hispanic/Latino cancer survivors are at increased risk for development of heart disease and diabetes as compared to their Caucasian counterparts (Conlon B, et al. 2014). Surprisingly, another study by Leach, CR et al. found that patients who underwent chemotherapy reported fewer comorbid conditions into survivorship as compared to those who did not receive chemotherapy. With cancer patients struggling to keep comorbidities under control, it is important to look at what recommendations are being made to keep this population healthy.

Cancer Survivor Nutrition

The American Cancer Society (ACS) has published guidelines that pertain specifically to the needs of cancer survivors. These guidelines cover both aspects of nutrition and physical activity. The ACS guidelines, *Nutrition and Physical Activity Guidelines for Cancer Survivors*, focuses on preventing and resolving nutrient deficiencies, achieving a healthy body weight, preserving lean body mass, and reducing side effects related to nutrition, as well as increasing quality of life for cancer survivors (Rock CM, 2012). These guidelines recommend that cancer

survivors get at least 150 minutes of moderate to vigorous activity per week, consume at least five servings of fruits and vegetables each day, and do not smoke (Blanchard CM, Courneya KS, Stein K, 2008). Fruit and vegetable intake is very important when counseling pediatric patients as well as those with chronic diseases such as cancer. Fruit and vegetables are low in caloric content and provide many important vitamins and minerals to help lower cholesterol, promote healthy gastrointestinal (GI) function, aid in the formation of red blood cells (RBCs), prevent infections, heal cuts and wounds, as well as promote iron absorption. Intake of whole grains also provides many benefits to the body by providing a great source of B vitamins used in energy release from carbohydrates, proteins and fats. Grains are also rich in iron, which is used to carry oxygen in the blood. Magnesium and selenium, also found in grains, are important in the formation of bone and helps to protect cells from oxidation, respectively. Patients must also be aware of the benefits of dairy due to its high calcium and vitamin D levels, both of which aid in the formation and maintenance of bone (United States Department of Agriculture, 2016).

Often, patients will have food aversions due to their disease or side effects of treatment. To ensure that proper nutrition is achieved patients should be advised of dietary techniques such as smaller more frequent meals to help them reach an appropriate nutrition status. It is always recommended that patients consume as much of their diet as possible by mouth to maintain proper gastrointestinal function, but in certain situations where a patient may be malnourished due to lack of oral consumption the use of feeding tubes or supplementation may be a necessary

alternative. Vitamin D deficiency has been shown in pediatric cancer patients, commonly in those with acute lymphoblastic leukemia, with links to a lack of sun exposure as well as metabolic effects of the disease (Revuelta Iniesta R et al., 2015). If severe vitamin D deficiency occurs, patients could develop weakened, brittle bones. It is important to note any previous nutrient deficiencies so that consequences can be addressed and behaviors monitored to help limit activities that are likely to increase the risk for specific nutrient shortages. Patients facing nutrient deficiencies should be counseled on the importance of dietary changes to reverse the deficiency. Vitamin and mineral supplementation may be needed but should be discussed with an oncologist first due to controversial data on the effects of supplementation and different forms of cancer treatment (Leser M, Ledesma N, Bergerson S, Trujillo E, 2013).

The *2015-2020 Dietary Guidelines for Americans* was released at the beginning of 2016 and covers material related to daily intake recommendations of particular food groups (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2016). This information serves as an important resource for all who struggle to maintain a healthy diet as well as educate the public on recent findings in the field of nutrition. The five overarching guidelines include (1) following a healthy eating pattern over the lifespan, (2) focusing on variety, nutrient density, and amount, (3) limiting calories from added sugars, saturated fats, and limiting sodium intake, (4) making a shift to healthier food and beverage choices, and (5) supporting healthy eating patterns for all (US Department of Health and Human Services, 2016). These guidelines not only apply to healthy Americans but

can also translate as good recommendations for pediatric cancer survivors. It has been shown that pediatric cancer survivors have not adhered well to these guidelines, but due to the lack of understanding about pediatric cancer survivor nutrition and other resources focusing on malignancies other than pediatric cancer, the 2015 dietary guidelines are a good starting point (Zhang FF, et al, 2015).

Cancer survivors often have different dietary habits when compared to the average person. They might have been placed on special diets, have an aversion to certain foods because of taste, as well as nausea and vomiting due to the side effects of different treatments. It is important for each patient to have a diet tailored to their individual needs, as they will differ by person. It is also important to educate these patients on proper macronutrient consumption. The ACS guidelines recommend that each survivor's daily diet consist of 20-35% fat, 10-35% protein, and 45-65% carbohydrates (Rock CM, 2012). As previously mentioned, each person's diet will be tailored to their particular needs so working with a registered dietitian will be essential for proper dietary monitoring and assessment. Alcohol consumption is another touchy subject when it comes to daily intake, as research on the issue is controversial. Though some studies have shown that alcohol does have benefits to the body, it is recommended that people who have received cancer treatment speak with their oncologist beforehand as alcohol consumption has been linked to certain primary cancers in the throat (American Cancer Society, 2014).

Obesity and Cancer

Weight gain occurs when calorie consumption exceeds calorie expenditure. Excess energy from food is stored in fat cells, or adipocytes. These adipocytes

function not only in energy storage, but also as an endocrine organ. Adipokine secretion can be disturbed in obese individuals and has been shown to have an association with metabolic syndrome, insulin resistance, and cardiovascular disease (Wang P, Mariman E, Renes J, Keijer J, 2008).

Added sugars play a large role in the obesity epidemic as they provide a source of high calories while offering no other nutritional benefits. Half of all added sugars in the American diet come from sugar-sweetened beverages such as soft drinks, fruit drinks, sports drinks, and energy drinks (US Department of Health and Human Services, 2016). Other sources of added sugars include some cereals, baked goods, and desserts, so it is important that dietitians educate patients on how to properly read a nutrition label so they are able to make healthier choices on their own.

Patients who are overweight or obese are also at higher risk for developing comorbidities that could diminish their overall health. High body mass index (BMI) has been linked to cardiovascular disease, type 2 diabetes, hypertension, and development of secondary cancers (American Cancer Society, 2015). It is estimated that 90,000 deaths each year from cancer could be prevented if men and women maintained a healthy weight (Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ, 2003). A study published in *the New England Journal of Medicine* found a strong linear relationship between death rates and increased BMI for all cancers. This same study reported that men with a BMI ≥ 35.0 kg/m² had significantly greater risk of death from cancer compared to their normal weight (BMI < 25.0 kg/m²) counterparts. Similarly, women with BMI ≥ 40 kg/m² were at higher risk of death

from cancer when compared to women of normal weight (Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ, 2003).

Though the exact mechanisms behind the link between obesity and increased risk of death in cancer patients is unknown, some research hints at ways obesity may biologically affect the way cancer treatments work. One hypothesis suggests that there could be differential reactivation of dormant tumor cells with different levels of obesity. This theory is backed up by consistent evidence of a positive association of visceral fat with circulating tumor cells and the spread of lung cancer in animal trials to the observation that growth factor receptors are elevated in obese patients and can be expressed on these circulating tumor cells (Schmitz KH, et al., 2013). Cancer patients who are overweight or obese also give rise to new problems with their treatments. Chemotherapy dosage can be determined by using a patient's current weight, but evidence suggests that doctors often cut back on chemotherapy dosing out of fear of toxicity to the patient (Schmitz KH, et al., 2013).

Cancer survivors often struggle with weight due to the treatments they have undergone, but it must be a priority to help these patients achieve a healthy body weight, which can be aided by healthy dietary adjustments.

Nutrition Interventions for Cancer Survivors

Research has shown that cancer survivors have a high risk of developing comorbid conditions due to treatment side effects. With an estimated 325,000 pediatric cancer survivors living in the United States, the need for nutrition education and diet modification interventions are high (Sadak KT, Connor C, DeLuca H, (2013). An analysis of 1.2 million cancer patient records from the Surveillance

Epidemiological End Results database found that cancer patients die of noncancerous causes at an increased rate as compared to the general public (Stull VB, Snyder DC, Demark-Wahnefried W, 2007). Risks such as these are possibly related to the decreases in exercise and poor dietary quality that is common among the cancer survivor population (Alfano CM, Molfino A, Muscaritoli M, 2013). An article published in *The Journal of Nutrition* discusses a survey completed by survivors and shows an increased interest in healthy eating and physical activity modification interventions post-diagnosis to reduce the risk for a cancer recurrence (Stull VB, Snyder DC, Demark-Wahnefried W, 2007). Other studies have also noted that this period in a patient's life can serve as a "teachable moment" due to their increased willingness to make behavior changes (Hawkins NA, et al, 2010). It was also found in a study conducted by Hawkins, et al. that it is common to see some positive behavior changes in cancer survivors in the years after they were treated. This is partly due to the fear of recurrence, but religion and the sense of a greater purpose in life were also shown to be positive influences. Medical professionals should use this time to educate cancer survivors on the proper guidelines to diet and physical activity to help reduce risk for other diseases as well as increase quality of life.

In a meta-analysis conducted by Sadak et al. (2013) on data for pediatric cancer survivor interventions, it was found that patients were directly affected by the recommendations of oncologists, but that there is a lack of oncology professionals that focus on guiding patients towards making healthy lifestyle adjustments. With this in mind, many interventions draw upon behavioral and

cognitive techniques to help with adverse effects of cancer treatment and they have been shown to decrease stress and improve quality of life in patients (Stoutenberg M et al, 2015). Social Cognitive Theory (SCT) focuses on why people decide to change and maintain their health behaviors. It also looks at how knowledge of health benefits and risks play into a persons willingness to alter their behavior, but reinforces that self-efficacy also helps increase their likelihood to actually change their behaviors. Environmental factors can also impact how barriers and limitations, both actual and perceived, effect motivation and expected outcomes of behavior change. Barriers such as financial trouble and low access to adequate resources, if not taken into account during intervention design, may limit the ability for the program to achieve the desired effect for the participants (Beehler GP et al, 2014). Studies have shown that the use of SCT in the development of a diet modification intervention has been able to produce statistically significant changes in behavior change related to diet quality and weight loss. One meta-analysis found that 6 of the 8 studies reviewed observed self-efficacy as the only factor that resulted in a positive behavior change among participants (Stacey FG, James EL, Chapman K, Courneya KS, Lubans DR, 2014).

Interventions developed for this population should cater to their specific needs and limitations. As travel and distance to treatment clinics becomes an issue, interventions should be tailored to provide better accessibility to survivors. Home based interventions and online progress monitoring help to keep participants on track as well as serve as a constant reminder of the choices they are making both inside and outside of the home. The use of online food records allows participants

the ability to self monitor their intake as well as providing clinicians the chance to evaluate diet quality and adherence of the participants. Using food records also allows participants to track progress toward goals which, if set by the individual, prove to be helpful in adherence as it allows for flexibility in their lifestyle and needs (Lawn S, et al, 2014). When creating a home-based intervention, you must also consider the family environment as it plays a large role in the motivation and adherence to diet and physical activity interventions (Niermann C, Krapf F, Renner B, Reiner M, Woll A, 2014).

A cancer diagnosis used to mean a death sentence, but due to recent advances in medical technology we are able to help increase cancer survival rates. Due to side effects of both the disease and treatment, cancer survivors require special attention when it comes to nutrition and physical activity intervention. It has been shown that survivors are more willing to alter behavior in the hopes of remaining cancer free. On average, cancer survivors die of alternate comorbidities at a higher rate than the general population, but by reducing their risk for these comorbidities they can lead a healthier lifestyle. Home-based nutrition and physical activity interventions that help increase self-efficacy are needed due to low accessibility and high self-motivation for patients; this will help ensure behavior change continues outside the clinical setting.

Screening Tools

Many tools exist for use in evaluating a persons diet. Each varies on the criteria they evaluate, the burden on participants, cost for analysis, and more. Diet quality for this study was best measured using a Dietary Screener Questionnaire

(DSQ) developed for the National Health and Nutrition Examination Survey (NHANES) 2009-2010. This tool was chosen for its low participant burden, easily accessible for both respondent and researcher, and proven reliability and validity when used to evaluate a person's current dietary habits. Validity of questions was determined by comparing results with multiple 24-hour recalls as well as the creation of questions from previous Diet History Questionnaires. The DSQ contains 25 groupings of food and drink, each of which contains questions about specifics of food type, quantity consumed, and frequency of consumption. The first question on the DSQ gathers information on age and sex of the participant. In studies testing the reliability of short dietary screeners it was found that the screeners provide a cheaper and less burdensome way to gather estimates on fruit and vegetable intake (Yaroch AL, et al., 2012). The study by Yaroch AL, et al. explains that it is important to recognize that other methods of diet recall such as food records and 24-hour recalls provide more precise estimates of fruit and vegetable intake due to increased detail and amount of questions asked. Their study also reports that short dietary screeners, such as the DSQ, show adequate reliability.

Summary

Research has shown that pediatric cancer survivors face a multitude of latent side effects of treatment. In the years after their diagnosis, patients have shown increased willingness to lead healthier lives. Often times the fear of cancer recurrence is a motivating factor for change, as well as a belief in a greater purpose. Research has also shown that patients are more receptive of recommendations

made by an oncologist, but that there is a lack of oncologists who focus on promoting positive nutrition-related lifestyle modifications.

It is important during this stage in survivorship that patients are presented with the tools and resources to make them successful in their recovery. Dietitians play a key role in the nutrition assessment of patients both on and off treatment as well as providing education on the benefits of healthy dietary and lifestyle modifications. By working with pediatric cancer survivors on weight loss or weight management they can help promote lifestyle changes to prevent developing secondary cancers and life-threatening comorbidities.

Chapter Three:

Methods

Study Design

This study was conducted during March of 2016 with surveys being completed by off treatment pediatric cancer survivors during their visit to the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic. A cross-sectional survey was used to evaluate participants on their consumption of specific foods and drinks over the previous 30 days. The data were used to predict daily consumption off different items using specially formulated scoring algorithms for the Dietary Screener Questionnaire. Studies on similar screeners have shown that due to cost and time restraints dietary screeners are useful tools when determining gross-level estimates (Yaroch AL, et al., 2012).

Subjects

Participants in this study were recruited from the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic in Lexington, Kentucky. Participants were included if they were currently off-treatment, spoke English, and were 18 years old or older. If a patient was not 18 years of age a parent or guardian was able to fill out the survey for them.

Instrument of Measure

This study used the National Health and Nutrition Evaluation Survey (NHANES) Dietary Screener Questionnaire. The screener was developed by the Risk Factor Assessment Branch of the National Cancer Institute as a quick method for assessing a person's dietary intake on specific variables. A paper version of the

screeners can be found in the appendices. The questionnaire was provided to the participants in a web-based format that allowed for completion on a tablet during their clinic visit. This particular survey was chosen due to the low participant burden of only recalling a 30-day period, a variety of food and drink categories, the option of a web-based format to allow for easy data collection, as well as statistical analysis programming for SAS that was used to estimate predicted daily consumption of specific variables based on participant responses.

The questionnaire consisted of 26 total sections that were roughly broken down into 30 questions based on type of food. Questions were tailored to the participant's usual intake over the past 30 days and some contained multiple parts relating to specifics of the item and frequency of consumption. Intake of fruits and vegetables was estimated using participant responses to questions 9, 12, 13, 14, 15, 16, 18, 19, 20, and 21. Fruits and vegetables provide an important source of micronutrients, phytochemicals, and fiber in the diet. It is encouraged that pediatric cancer survivors consume a variety of fruits and vegetables in different colors to ensure they are receiving a variety of different phytochemicals. Intake regarding added sugars was estimated using responses to questions 3, 8, 10, 11, 26, 27, 28, and 29. Participant consumption of added sugars from sugar-sweetened beverages was estimated using their responses to questions 8, 10, and 11. Added sugar, both from food and drink sources, can provide an excess number of calories into the diet. Consuming a high percentage of calories from added sugars is likely to increase total calorie intake, which could lead to weight gain. Dairy intake was estimated using participant responses to questions 6, 7, 20, 22, and 29. Sources of dairy, such as

cheese, milk, yogurt, and others provided a great source of calcium and other micronutrients such as vitamins A and D. Estimated intake of whole grains by participants was determined using their responses to questions 3, 4, 5, 17, 25, and 30. Whole grains have not been processed and differ from refined grains in that they still retain some of the fiber and other nutrients the refining process removes. Participant's daily intake of calcium and fiber was estimated using responses to all or nearly all questions. Most questions in the survey were used to determine intake of the dietary variables measured in the Table 4.1, excluding questions 23 and 24 which looked at participants intake of both red and processed meats.

Procedure

Approval for this study was gained from the University of Kentucky Institutional Review Board (IRB) before recruitment procedures began. Participants were recruited through verbal contact within the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic. Participants were invited to participate in the study and given both a written and verbal explanation of voluntary participation in the study, study objectives, and a brief rundown of survey questions and procedures. After verbal consent was given, participants completed the web-based format of the DSQ on tablets provided to them. After all surveys were returned, response data was exported and used for evaluation.

Statistical Analysis

The NHANES Dietary Screener Questionnaire results were analyzed using SAS 9.3 statistical analysis software. The software was used by the researcher, in conjunction with scoring algorithms developed for the DSQ, to produce estimates of

daily intake of particular food groups by evaluating participant responses. SAS and the programming provided by the National Cancer Institute research team was used to calculate one sample t-tests to determine if the observed results are significantly different from the values of the *2015-2020 Dietary Guidelines for Americans*. The data were also used to report the mean, minimum and maximum values, and standard deviation of the respondent data.

Chapter 4:

Results

Over the month that surveys were collected, 26 patients of the DanceBlue Kentucky Children’s Hospital Hematology/Oncology Clinic matched the participant criteria and were available during their clinic visit to complete the survey on tablets provided. Four of those patients chose not to participate in the survey. One patient was willing to participate but found it difficult to complete the survey without help. That response was excluded from the final response data. Out of the original 26 that were asked to participate 21 surveys were completed for data analysis. Of those that completed the survey 15 were male and six were female with ages ranging from 5 to 34 years. A significance level of $p < 0.05$ was chosen to give a strong indication that there is a difference between the expected and observed result for each of the t-tests that were run. Confidence intervals (CI) were also calculated to show a 95% chance that the true mean for the population lies between the interval.

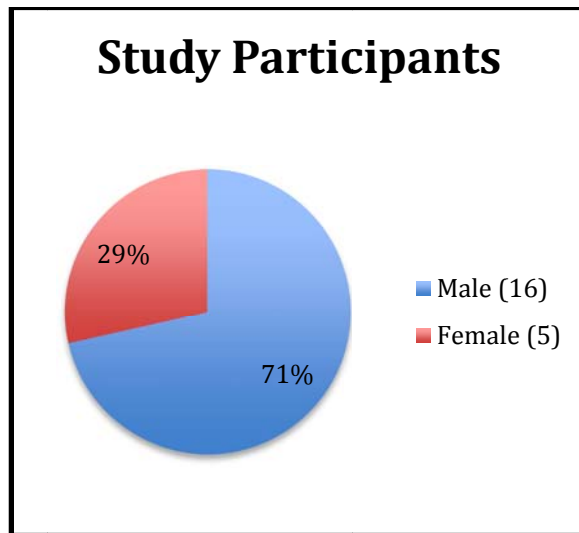


Figure 4.1: Gender of Study Participants

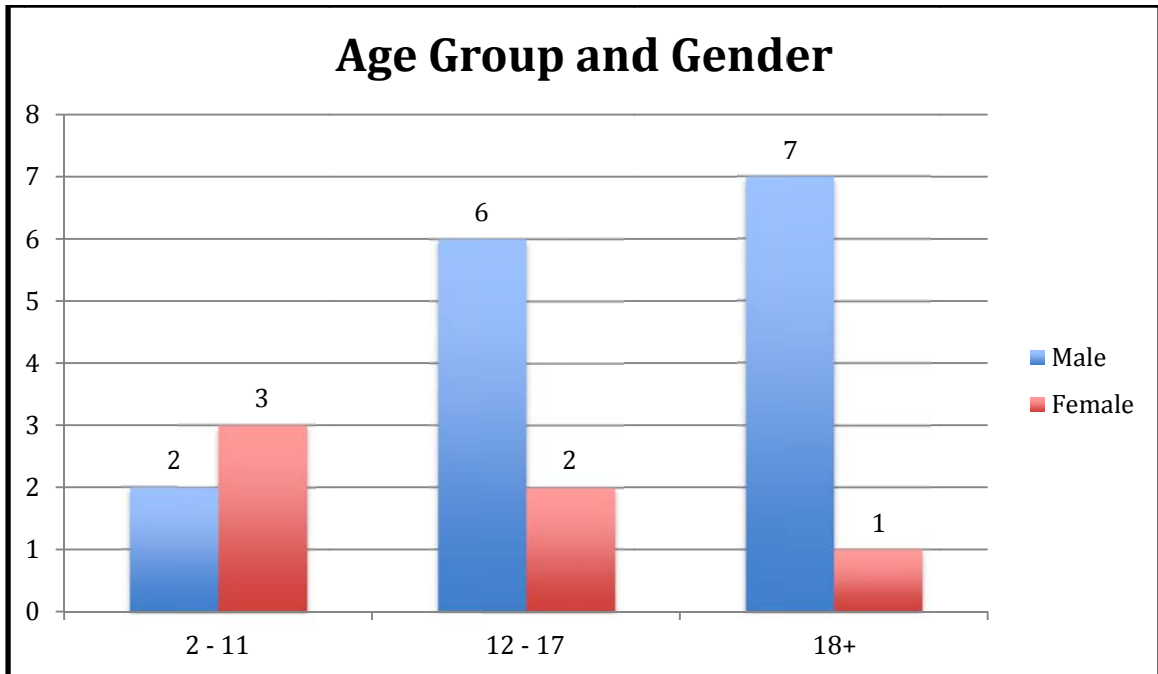


Figure 4.2: Study Participants Broken Down by Age and Gender

When completing the survey most participants were confident in whether or not they had consumed the food or drink in question. There were few instances where participants chose the “I don’t know” option; those responses were recorded as missing data and were not used as a part of the values reported. After looking at the means of each variable from the total number of participants it was found that the mean calcium intake of 1567.19mg/day was the only variable that was meeting recommendations of the dietary guidelines. All other variables either fell short of the recommended daily intake or exceeded daily limits.

Predicted Variable (unit)	N	N Miss	Minimum	Maximum	Mean	Null Value
Daily fiber intake (g)	17	4	11.58	32.47	18.61*	25
Daily calcium intake (mg)	17	4	879.36	3839.59	1567.19*	1300
Daily added sugar intake (tsp)	19	2	6.84	72.83	23.21*	12.5
Daily intake of added sugar (tsp) from sugar sweetened beverages	21	0	0.34	78.59	12.79	12.5
Daily whole grain intake (oz)	18	3	0.10	2.90	0.78*	3
Daily dairy intake (cup)	21	0	0.39	5.50	2.64	3
Daily fruit/veg/legume intake (cup)	20	1	1.43	6.84	3.29*	4.5
Daily fruit/veg/legume minus french fries intake (cup)	20	1	0.45	6.58	3.02*	4.5

Table 4.1: Minimum, Maximum, and Mean of All Participants

* = variables whose p-value < 0.05

When comparing observed means for each of the variables between males and females it is evident that females in this sample were meeting more of the recommendations set forth by the dietary guidelines, but both males and females could use improvement in multiple areas of their diet. When broken down by age and gender no significance was found in daily intake of participants.

Predicted Variable (unit)	N	N Miss	Minimum	Maximum	Mean	Null Value
Daily fiber intake (g)	12	3	11.58	32.47	19.19	25
Daily calcium intake (mg)	12	3	879.36	3839.59	1746.41	1300
Daily added sugar intake (tsp)	14	1	7.71	72.83	27.46	12.5
Daily intake of added sugar (tsp) from sugar sweetened beverages	15	0	0.78	78.59	16.77	12.5
Daily whole grain intake (oz)	12	3	0.10	1.92	0.73	3
Daily dairy intake (cup)	15	0	0.39	5.50	2.88	3
Daily fruit/veg/legume intake (cup)	14	1	1.43	6.84	3.32	4.5
Daily fruit/veg/legume minus french fries intake (cup)	14	1	0.45	6.58	2.99	4.5

Table 4.2: Minimum, Maximum, and Mean for Males Only

Predicted Variable (unit)	N	N Miss	Minimum	Maximum	Mean	Null Value
Daily fiber intake (g)	5	1	14.02	21.99	17.23	25
Daily calcium intake (mg)	5	1	954.45	1218.25	1137.07	1300
Daily added sugar intake (tsp)	5	1	6.84	16.68	11.34	12.5
Daily intake of added sugar (tsp) from sugar sweetened beverages	6	0	0.34	6.49	2.85	12.5
Daily whole grain intake (oz)	6	0	0.18	2.90	0.88	3
Daily dairy intake (cup)	6	0	1.80	2.75	2.28	3
Daily fruit/veg/legume intake (cup)	6	0	2.08	3.85	3.21	4.5
Daily fruit/veg/legume minus french fries intake (cup)	6	0	1.86	3.77	3.09	4.5

Table 4.3: Minimum, Maximum, and Mean for Females Only

A t-test was run for each variable to determine if participants estimated intake of each of the dietary factors met the recommendations of the dietary guidelines. A $p < 0.05$ was used to determine statistical significance. The mean intake of whole grains for pediatric cancer survivors in this study (0.78 ± 0.70) did not meet the recommended 3oz daily serving. This mean of 0.78 (95% CI, 0.43 to 1.13) oz was statistically less than the recommendation, $t(17) = -13.47, p < 0.0001$.

Variable	N	Mean	Std Dev	
Whole grain intake (oz)	18	0.78	0.70	
t-value	df	p-value	95% CI of the Mean	
-13.49	17	<0.0001	0.43	1.13

Table 4.4: T-test for Whole Grain Intake

When looking at the mean intake of fruits, vegetables, and legumes, (3.29 ± 1.46 cups), pediatric cancer survivors in this study were shy of meeting their recommended daily servings of 4.5 cups. The *2015-2020 Dietary Guidelines for Americans* recommends 2.5 cups of vegetables and 2 cups of fruit each day. This

mean of 3.29 (95% CI, 2.61 to 3.97) cups was significantly less than the recommendation, $t(19) = -3.71, p < 0.0015$.

Variable	N	Mean	Std Dev	
F/V/Legume intake (cup)	20	3.29	1.46	
t-value	df	p-value	95% CI of the Mean	
-3.71	19	<0.0015	2.61	3.97

Table 4.5: T-test for Fruit, Vegetable, and Legume Intake

Similar to the results above, data was gathered to determine fruit, vegetable, and legume intake when French fries were not counted as a vegetable. A mean intake of fruits, vegetables, and legumes other than French fries for pediatric cancer survivors in this study (3.02 ± 1.56 cups) did not meet the recommended 4.5 cup daily serving. The mean of 3.02 (95% CI, 2.29 to 3.75) cups was significantly less than the recommendation, $t(19) = -4.26, p < 0.0004$.

Variable	N	Mean	Std Dev	
F/V/Legume intake minus French Fries (cup)	20	3.02	1.56	
t-value	df	p-value	95% CI of the Mean	
-4.26	19	<0.0004	2.29	3.75

Table 4.6: T-test for Fruit, Vegetable, and Legume Intake Minus French Fries

Participants were also asked questions about foods containing added sugars. The mean (23.21 ± 16.29 cups) was nearly double the limit set by the dietary guidelines. The guidelines recommend a diet of less than 10% of calories coming from added sugars, which for a 2000 kcal/day diet is 12.5 tsp of added sugars. A mean of 23.21 (95% CI, 15.36 to 31.07) tsp was found to be statistically significant,

$t(18) = 2.87, p < 0.0103$. A t-test was also run for added sugar intake from sugar-sweetened beverages, but the results were not found to be significant.

Variable	N	Mean	Std Dev	
Added sugar intake (tsp)	19	23.21	16.29	
t-value	df	p-value	95% CI of the Mean	
2.87	18	<0.0103	15.36	31.07

Table 4.7: T-test for Added Sugar Intake

Fiber intake by participants resulted in an observed mean (18.61 ± 6.08 grams) that was lower than the recommended daily intake of 25g/day. The mean of 18.61 (95% CI, 15.48 to 21.73) g was found to be statistically significant, $t(16) = -4.34, p < 0.0005$.

Variable	N	Mean	Std Dev	
Fiber intake (g)	17	18.61	6.08	
t-value	df	p-value	95% CI of the Mean	
-4.34	16	0.0005	15.48	21.73

Table 4.8: T-test for Fiber Intake

Two t-tests were run to predict the daily intake of calcium of pediatric cancer survivors in this study. One was run with a null hypothesis of 1000mg to account for the recommended intake for the minimum and maximum ages in the study. The results for that t-test are found in Table 4.9 listed below. This mean (1567.20 ± 811.00) was found to be above the daily recommendations. The mean of 1567.20 (95% CI, 1150.20 to 1984.20) was statistically significant, $t(16) = 2.88, p < 0.0108$. A t-test was also run with a null hypothesis of 1300mg for the recommended daily intake of the mean age of 16.19. The results found were not significant.

Variable	N	Mean	Std Dev	
Calcium intake (mg)	17	1567.20	811.00	
t-value	df	p-value	95% CI of the Mean	
2.88	16	0.0108	1150.20	1984.20

Table 4.9: T-test for Calcium Intake

The survey also looked at observed values of dairy intake as seen in Tables 4.1-3, however the result were not found to be statistically significant ($p = 0.181$).

Chapter 5:

Discussion

The purpose of this study was to evaluate the diets of off-treatment pediatric cancer survivors to determine if they were meeting recommended dietary guidelines. Participants responded to questions from the Dietary Screener Questionnaire (DSQ) which used those responses to calculate predicted intake of fruits and vegetables, dairy, whole grains, fiber, calcium, and added sugars. The results found that the pediatric cancer survivors in this study were not meeting a majority of their daily recommended levels of each of the dietary factors previously listed.

Fruit, vegetable, and legume intake for this study was measured at a mean of 3.29 cups per day. This falls below the recommended daily intake of 4.5 cups. The *2015-2020 Dietary Guidelines for Americans* recommends the consumption of 2.5 cups of vegetables per day and 2 cups of fruit per day. Due to the scoring algorithms provided by the DSQ and their limited procedures, these values were combined into a total of 4.5 cups per day to be used as the null hypothesis. The study also found the observed mean of fruit, vegetable, and legume consumption when French fries were eliminated from that category to be 3.02 cups. This result leads us to believe that participants were only consuming 0.27 cups of French fries. Though participants are consuming only a small amount of French fries as a part of their diet, they still fall short of their recommended servings of fruits and vegetables. If this trend continues they could begin to see side effects to their diminished vitamin and micronutrient intake. This is especially important for those participants who are children,

adolescents, and young adults as the body used these nutrients for proper growth and development. When comparing the data found in this survey to results of the average population collected from the NHANES 2001-2004 we see that participants in both were not meeting the recommended dietary guidelines. The previous study showed children ages 4 to 8 were under consuming total fruits (62.9% of children) and vegetables (92.0% of children). For participants older than 8 years at least 78.4% were not meeting dietary guidelines for total fruit and vegetables (Krebs-Smith SM, Guenther PM, Subar AF, Kirkpatrick SI, Dodd KW, 2010). This could indicate that pediatric cancer survivors may not be experiencing differences in fruit and vegetable consumption in comparison to those without a pediatric cancer diagnosis, but rather Americans as a whole struggle with meeting recommendations for fruit and vegetable intake.

Dairy consumption also fell short of the dietary guidelines recommended daily intake with a predicted participant mean of 2.64 cups. Though this value was not far from the recommended 3 cups per day and found not to be statistically significant future, patients should still be advised to benefits of proper dairy consumption. Shockingly, participants calcium intake was above both recommended values, though only found to be statistically significant (p -value < 0.0108) when run with a null hypothesis of 1000mg/day. One-sample t-tests were run with null hypotheses of 1000mg and 1300mg. 1000mg was used because that was the recommended value for the minimum age (5) and maximum age (34) or participants in the study. The mean age of 16.19 had a recommended daily calcium level of 1300mg. Considering that leafy greens and dairy products are both good

sources of calcium it is interesting to find that while fruit, vegetable, and legume intake as well as dairy did not meet the daily recommendations, calcium intake did. Since the data did not break down the specific foods eaten from each dietary factor that was tested there is no way to determine what percentage of participant intake came from leafy green vegetables. Similarly to fruit and vegetable intake, these results aligned closely with dairy consumption of individuals without a cancer diagnosis. Studies have shown a decrease in dairy consumption with children and adolescents and a continued downward trend as they age (Dror DK, Allen LH, 2014)

Intake of whole grains in this population also failed to meet guideline recommendations. With a mean estimated intake of 0.78oz per day, they were way below the null hypothesis of 3oz per day. This result did not have reported responses from all participants (n = 18). This means that 3 participants were unsure of their consumption of foods to calculate whole grains consumption using the SAS 9.3 programs provided by the DSQ. Though grains can be found in many cereals, breads, granola bars, etc., these grains are often highly processed and have lost some of their nutrients. It is important to explain to patients why choosing foods with whole grains are a more nutritious option. Foods with whole grains also provide a good source of fiber. Fiber intake was predicted in this study with a mean intake of 18.61g. Again, this result was below the recommended 25g per day. This result was found to be statistically significant (p-value < 0.0005). It is clear that participants in this study are not getting enough whole grains and fiber in their diet, though this could be an issue with education on the benefits of whole grains.

The DSQ also predicted the average daily intake of added sugars from foods and sugar-sweetened beverages based on participant responses. Added sugars provide excess calories without nutritional benefit, which can be detrimental for individuals looking to lose weight or maintain a healthy weight. The *2015-2020 Dietary Guidelines for Americans* recommends that a person consume no more than 10% of their daily calories from added sugars. For the average 2000 kcal/day diet that is frequently used on nutrition labels, this converts to roughly 12.5 tsp of added sugars per day (1 tsp sugar = 16 kcal, $2000 \text{ kcal} \times 10\% = 200 \text{ kcal}$, $200/16 = 12.5$). This study found that participants had a predicted mean intake of 23.21 tsp of added sugars per day; this result was found statistically significant ($p\text{-value} < 0.0103$) for the null hypothesis of 12.5 tsp. This estimates an additional 371.40 kcal added to the diet. Added sugars from sugar-sweetened beverages were estimated from participant responses on the DSQ, but results were not determined to be statistically significant with a mean of 12.79 tsp/day using the null hypothesis of 12.5.

The results found in this study match up with a similar study by Zhang, FF, et al. titled *Comparison of Childhood Cancer Survivors' Nutritional Intake with US Dietary Guidelines*. In that study they used the Healthy Eating Index (HEI)-2010 to look at acute lymphoblastic leukemia (ALL) and lymphoma patients diets at multiple points during the year. With a mean age of 11.7 ($n = 22$) their study found that pediatric cancer survivors had poor adherence to whole fruit and vegetable intake, in particular green vegetables, as well as whole grains being one of the lowest scores of the individual components measured. It was also found that, similar to the results found from the DSQ, participants were observed to have low intake of calcium

(931mg) and fiber (15g). The previous study did find, however, that participants did have a better adherence to dairy consumption, 65-77% of maximum score.

This study confirms the hypotheses that pediatric cancer survivors have poor intake of fruits and vegetables as well as increased consumption of foods containing added sugars per the recommendations of the *2015-2020 Dietary Guidelines for Americans*. This data suggests that patients of the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic would benefit from nutrition education and counseling by a Registered Dietitian.

The first objective of this study aimed to determine if pediatric cancer survivors were meeting the recommendations of the dietary guidelines. Though close in some areas, this study found that participants failed to meet dietary recommendations of daily intake of fruits, vegetables, and legumes, whole grains, fiber, dairy, and added sugars. These results indicate that participants may not be providing themselves with the proper vitamins and minerals necessary to battle other chronic diseases while increasing non-nutritive calories. The second objective intended to determine if current dietary habits of pediatric cancer survivors are putting them at risk for becoming overweight or obese. During data collection it was apparent that some patients were currently struggling with weight issues. The data in this study also back up those observations. As mentioned previously, high consumption of added sugars promotes weight gain through increased intake of calories. The final objective of this study was to determine if pediatric cancer survivors would benefit from nutrition counseling due to current dietary habits. The data collected suggests that participants have multiple areas needing improvement

in their daily diet. Education and tools provided by a dietitian could prove beneficial in increasing intake of fruits and vegetables, whole grains, and dairy while encouraging patients to limit the added sugars. By providing patients with the resources and tools needed to succeed so do the chances of healthy weight loss or weight maintenance.

Though this study did find significant results there were also some limitations. Since this study did not provide a randomized sample and a small sample size (n = 21) we are unable to predict intake for the pediatric cancer survivor population. This study also found a much higher percentage of male participants compared to female participants, 71% to 29% respectively. Also, the DSQ collected data based on the frequency of consumption over the past month but did not look at amounts consumed or any additives in the foods. Other surveys provide these values, but increase participant burden from increased numbers of questions. Since the participants' responses were self-reported there is always a chance of recall error. Though participants were encouraged to fill out the questions to the best of their abilities there was still an option to not answer the question if they were unsure of their actual intake. This might encourage participants to not respond instead of taking time to think about past consumption.

For future research it would be interesting to see how results would differ with a larger sample that is more representative of the general population of pediatric cancer survivors. This would provide a better look at the dietary intake as a whole rather than just a sample of the population. It would also be important to look at how a rural home environment impacts adherence to dietary guidelines

compare to those living in an urban environment. Some rural communities may lack adequate resources for lifestyle modifications while urban environments may provide the resources the population may be unable to access them due to travel or financial restrictions. It would also be beneficial to look at the quantity of food items consumed. This would allow researchers to better estimate intake levels of pediatric cancer survivors as well as determine areas that consistently have insufficiencies.

Chapter 6:

Conclusion

From the results found in this study it is clear that pediatric cancer survivors in the DanceBlue Kentucky Children's Hospital Hematology/Oncology Clinic are not meeting their dietary needs as outlined by the *2015-2020 Dietary Guidelines for Americans*. Patients would benefit from having a Registered Dietitian available to provide adequate nutritional assessment, nutrition counseling and education related to healthy lifestyle modifications and weight loss/maintenance, and follow-up care. Results from this study can be used as a foundation for further research in the areas of diet and nutrition as it relates to pediatric cancer survivors.

These questions are about foods you ate or drank during the past month, that is, the past 30 days. When answering, please include meals and snacks at home, at work or school, in restaurants, and anyplace else.

Mark an to indicate your answer. To change your answer, completely fill the box for the incorrectly marked answer (). Then mark an X in the correct one. Your answers are important.

- How old are you (in years)?

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 years

- Are you male or female?

- Male
 Female

- During the past month, how often did you eat **hot or cold cereals**? *Mark one .*

- Never → **Go to question 4.**
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2 or more times per day

- During the past month, what kind of cereal did you usually eat? – *Print cereal.*

- If there was another kind of cereal that you usually ate during the past month, what kind was it? – *Print cereal, if none leave blank.*

- During the past month, how often did you have any **milk** (either to drink or on cereal)? Include regular milks, chocolate or other flavored milks, lactose-free milk, buttermilk. Please do **not** include soy milk or small amounts of milk in coffee or tea. *Mark one .*

- Never → **Go to question 8.**
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2-3 times per day
 4-5 times per day
 6 or more times per day

- During the past month, what kind of milk did you usually drink? *Mark one .*

- Whole or regular milk
 2% fat or reduced-fat milk
 1%, ½%, or low-fat milk
 Fat-free, skim or nonfat milk
 Soy milk
 Other kind of milk – *Print milk.*

- During the past month, how often did you drink **regular soda or pop** that contains sugar? Do **not** include diet soda. *Mark one .*

- Never
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2-3 times per day
 4-5 times per day
 6 or more times per day

9 During the past month, how often did you drink **100% pure fruit juices** such as orange, mango, apple, grape and pineapple juices? Do **not** include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. *Mark one* .

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you drink coffee or tea that had **sugar** or **honey** added to it? Include coffee and tea you sweetened yourself and presweetened tea and coffee drinks such as Arizona Iced Tea and Frappuccino. Do **not** include artificially sweetened coffee or diet tea.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you drink **sweetened** fruit drinks, sports or energy drinks, such as Kool-Aid, lemonade, Hi-C, cranberry drink, Gatorade, Red Bull or Vitamin Water? Include fruit juices you made at home and added sugar to. Do **not** include diet drinks or artificially sweetened drinks.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you eat **fruit**? Include fresh, frozen or canned fruit. Do **not** include juices.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat a green leafy or lettuce **salad**, with or without other vegetables?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



14 During the past month, how often did you eat any kind of **fried potatoes**, including french fries, home fries, or hash brown potatoes?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any **other kind of potatoes**, such as baked, boiled, mashed potatoes, sweet potatoes, or potato salad?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat refried beans, baked beans, beans in soup, pork and beans or any other type of cooked dried beans? Do **not** include green beans.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **brown rice** or other cooked whole grains, such as bulgur, cracked wheat, or millet? Do **not** include white rice.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, not including what you just told me about (green salads, potatoes, cooked dried beans), how often did you eat **other vegetables**?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you have Mexican-type **salsa** made with tomato?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



20 During the past month, how often did you eat **pizza**? Include frozen pizza, fast food pizza, and homemade pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you have **tomato sauces** such as with spaghetti or noodles or mixed into foods such as lasagna? Do not include tomato sauce on pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any kind of **cheese**? Include cheese as a snack, cheese on burgers, sandwiches, and cheese in foods such as lasagna, quesadillas, or casseroles. Do **not** include cheese on pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **red meat**, such as beef, pork, ham, or sausage? Do **not** include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures. Red meats may also include veal, lamb, and any lunch meats made with these meats.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any **processed meat**, such as bacon, lunch meats, or hot dogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures.

Processed meats are those preserved by smoking, curing, or salting, or by the addition of preservatives. Examples are: ham, bacon, pastrami, salami, sausages, bratwursts, frankfurters, hot dogs, and spam.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

25 During the past month, how often did you eat **whole grain bread** including toast, rolls and in sandwiches? Whole grain breads include whole wheat, rye, oatmeal and pumpernickel. Do **not** include white bread.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

26 During the past month, how often did you eat **chocolate** or any other types of candy? Do **not** include sugar-free candy.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **doughnuts**, sweet rolls, Danish, muffins, pan dulce, or pop-tarts? Do **not** include sugar-free items.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **cookies, cake, pie or brownies**? Do **not** include sugar-free kinds.

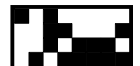
- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **ice cream or other frozen desserts**? Do **not** include sugar-free kinds.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **popcorn**?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



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