

UNDERSTANDING INFLUENCES ON FRUIT AND VEGETABLE CONSUMPTION
AMONG WIC PARTICIPANTS

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ABSTRACT OF THESIS

Introduction: Fruit and vegetable consumption is associated with numerous health benefits, however many Americans do not consume the recommended amounts. The Women, Infants, and Children (WIC) program is one of the USDA's nutrition assistance programs designed to promote health among participants. A main goal of the WIC program is to increase fruit and vegetable consumption.

Objective and Methodology: The purpose of this project was to determine fruit and vegetable intake and barriers for consumption among participants in the WIC program. Data was collected through a one-time survey distributed to participants during their WIC appointment. A total of 139 surveys were collected and used in the analyses.

Results: The results showed that 92 participants (66%) were not meeting recommendations for daily fruit consumption and 119 participants (86%) were not meeting recommendations for daily vegetable consumption. Thirty six participants (27%) reported they were not meeting recommendations for daily fruit consumption, but indicated they thought they were eating adequate amounts. Thirty nine participants (28%) reported they were not meeting recommendations for daily vegetable consumption, but indicated they thought they were. Eighty five participants (61%) listed at least one barrier affecting their fruit and vegetable consumption. The most commonly reported barriers included spoilage of produce before having the chance to eat it, cost, and family dislike.

Conclusion: A large percentage of WIC participants are not meeting recommendations for daily fruit and vegetable consumption. Over 25% of participants indicated they thought they were meeting recommendations, but were not, suggesting that a knowledge deficit exists about the daily recommended intakes. Over 60% of participants reported at least one barrier for not consuming as many fruits and vegetables as they wanted to, indicating that interventions to overcome barriers may improve intake.

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CHAPTER 1: INTRODUCTION

Adequate fruit and vegetable consumption is associated with numerous health benefits including decreased risk of many chronic diseases. According to the Dietary Guidelines for Americans 2010, daily consumption of two and a half cups of vegetables and two cups of fruit is associated with a reduced risk of cardiovascular disease and many cancers. Despite the numerous health benefits of fruits and vegetables, many Americans do not meet the recommended two and a half cups vegetables per day and two cups of fruits per day (U.S. Department of Agriculture, 2010).

According to the State Indicator Report on Fruits and Vegetables, 2013, the United States national average daily intake of vegetables and fruit is 1.6 servings and 1.1 servings per day, respectively. Also, 37.7% of Americans reported consuming fruit less than once a day and 22.6% of Americans report consuming vegetables less than once a day (Centers for Disease Control and Prevention, 2013). On average, fruit and vegetable consumption has remained fairly consistent over the past five years, but there is variability based on age and gender. Children aged 2-12 years, males aged 18-34 years, and females aged 18-54 years have increased fruit intake by at least 5% since 2004, while men and women aged 65 years and over have decreased their intake by nearly 10% since 2004 (Produce for Better Health Foundation, 2010).

Since 1991, the Produce for Better Health Foundation, a nonprofit organization partnering with the Centers for Disease Control and Prevention (CDC), has been promoting public health by motivating Americans to eat more fruits and vegetables. Examples of these industry government collaborative initiatives include the 5-A-Day

program and most currently, the Fruits and Veggies-More Matters. Despite these initiatives, estimated intakes remain below the recommended amounts.

The United States Department of Agriculture (USDA) also works to improve eating and lifestyle behaviors to reduce diet related health problems among Americans. Each year, the USDA nutrition assistance programs serve one in five Americans, and provide increased access to food and nutrition education to low income populations (Altman, 2008). The nutrition assistance programs include SNAP (Supplemental Nutrition Assistance Program), SNAP-ED (Supplemental Nutrition Assistance Program Nutrition Education), WIC (Women, Infants and Children Nutrition Program), WIC Farmer's Market Nutrition Program, Child Nutrition Programs including the National School Lunch Program, School Breakfast Program, Summer Food Service Program and the Child and Adult Care Food Program (Altman, 2008).

In 2005, Nutrition assistance programs provided about 10 billion dollars in support of fruit and vegetable consumption. These funds supported the purchase and distribution of fruits and vegetables to schools, food banks, and for participants' purchases through WIC and the Farmer's Market Nutrition Program (Altman, 2008). These programs play a crucial role in promoting healthy eating by utilizing current recommendations from the Dietary Guidelines for Americans and the MyPlate food guidance system. Additionally, nutrition education is promoted through Food Distribution Programs, which provide food and nutrition assistance to eligible individuals, families, and institutions by providing USDA commodities (Altman, 2008).

The Special Supplemental Nutrition Program for Women, Infants and Children (WIC) is one of the USDA's nutrition assistance programs. WIC is designed to promote

and maintain the health of nutritionally at-risk pregnant, breastfeeding and postpartum women; infants, and children. WIC provides nutrition and breastfeeding education, supplemental nutritious foods, and referrals to other health services (Wisconsin Department of Health Services, 2013). Many WIC participants have financial and other challenges perceived as barriers to healthy eating and a main objective for WIC nutrition education is increasing fruit and vegetable intake. On October 1, 2009, changes to the WIC food package were implemented that aligned WIC foods with the 2005 Dietary Guidelines for Americans and infant feeding practice guidelines of the American Academy of Pediatrics (Altman, 2008). The changes included the addition of fruits and vegetables in the food package for women and children, and for infants six to 12 months old.

The purpose of this project was to determine current fruit and vegetable intake and perceived barriers to fruit and vegetable consumption among participants in the WIC program. Several studies reporting fruit and vegetable intake among WIC participants have been published, however none of the studies evaluated perceived barriers to fruit and vegetable consumption. Therefore, this study aimed to identify barriers to better understand the challenges the WIC population faces with meeting recommendations for fruit and vegetable intake. Findings may facilitate the development of more effective interventions to increase fruit and vegetable intake among WIC participants based on reported barriers.

Research Statement

This research project sought to identify current fruit and vegetable intake and perceived barriers to fruit and vegetable consumption among participants in the WIC program.

Subproblems

Do WIC participants know what the current recommendations for fruit and vegetable intake are?

Limitations

A limitation was the number of survey respondents.

Delimitations

Delimitations of the research include that subjects were participants in the WIC program. An additional delimitation is that the survey location was limited to three WIC clinics in Wisconsin, which were not representative of the entire national WIC population. The time frame of data collection was four weeks, from April 14, 2014 to May 12, 2014, and thus survey respondents were limited to those participants who visited the clinic within that time frame.

Assumptions

The main assumption is that subjects completed the survey in an honest manner.

Definitions

1. SNAP – Supplemental Nutrition Assistance Program – commonly known as “food stamps”, SNAP offers nutrition assistance to millions of eligible, low-income individuals and families.
2. SNAP-ED – Supplemental Nutrition Assistance Program Nutrition Education – provides nutrition education from the current Dietary Guidelines for Americans and MyPlate to persons eligible for SNAP.
3. CDC BRFSS - Behavioral Risk Factor Surveillance System - In 1984, the Centers for Disease Control and Prevention (CDC) established the Behavioral Risk Factor Surveillance System. CDC developed a standard questionnaire, which states use to provide data that could be compared across states. Initial topics included smoking, alcohol use, physical inactivity, diet, hypertension, and seat belt use. BRFSS became a nationwide surveillance system in 1993 and states continue to use BRFSS to address urgent and emerging health issues.
4. 5 A-Day project in England – Initiative in England to increase consumption of fruit and vegetables by increasing awareness and knowledge, to change attitudes and beliefs, and increase access of fruits and vegetables.

CHAPTER 2: THE LITERATURE REVIEW

Introduction

Chronic diseases are the leading causes of death and disability worldwide and incidence of these diseases continues to increase rapidly in most regions of the world.

According to the Centers for Disease Control and Prevention (CDC), heart disease is the leading cause of death for both men and women in the United States. One in every four deaths, or 600,000 people, is from heart disease every year. Overweight and obesity, along with poor diet, are major factors that increase risk for developing heart disease.

The CDC recommends lowering blood pressure and cholesterol to reduce the risk of heart

disease, primarily by following a diet low in sodium, total fat, saturated fat, and cholesterol, and abundant in fruits and vegetables (CDC, 2014).

Cancer is the second most common cause of death in the United States. About 585,720 Americans are expected to die from cancer in 2014, almost 1,600 individuals every day. The World Cancer Research Fund has estimated up to one third of cancer cases that occur in developed countries are related to overweight or obesity, physical inactivity, and/or poor nutrition, and could be prevented (American Cancer Society, 2014). Strategies aimed at reducing these chronic diseases have targeted certain risk factors such as smoking, and highfat consumption. Less attention has been focused on consumption of fruit and vegetables. This is of increasing importance as traditional plant based diets rich in fruit and vegetables are being replaced with convenience foods that are rich in calories, high in fats and sugar, and are low in complex carbohydrates (Lock et al., 2005).

Inadequate intake of fruit and vegetables is estimated to cause around 14% of gastrointestinal cancer deaths, about 11% of ischemic heart disease deaths, and about 9% of stroke deaths worldwide (World Health Organization, 2014). The World Health Organization (WHO) conducted a study to estimate the global burden of disease attributable to low consumption of fruit and vegetables (Lock et al., 2005). The study reported that increasing consumption of fruit and vegetables to the recommended intake could reduce the worldwide burden of ischemic heart disease and ischemic stroke by about 31% and 19%, respectively. For stomach and esophageal cancer, the potential reduction in disease by an increased fruit and vegetable intake was 19% and 20%,

respectively. The WHO concluded that fruit and vegetable intake is a significant determinant of disease burden in both developed and developing regions, especially for cardiovascular disease (Lock et al., 2005).

Based on the high incidence of chronic diseases and the role of fruits and vegetables in prevention of these diseases, it is important to evaluate strategies focusing on promotion of fruits and vegetables. The purpose of this literature review is to critically analyze interventions to increase fruit and vegetables. Additionally, reports on the reasons and barriers why individuals are not consuming the recommended amount of fruits and vegetables on a daily basis will be explored. To begin, background on more specific health benefits of fruits and vegetables will be discussed. Current recommended intake and estimated intake of fruits and vegetables in the United States, along with methodology for the assessment of fruit and vegetable intake will also be discussed.

Background

Fruits and vegetables provide a variety of health benefits, including lowering risk of heart disease, cancer prevention, and gastrointestinal health benefits (reference a major review/meta-analysis on this topic here). Recommendations for daily consumption of fruits and vegetables are determined by the United States Department of Agriculture (USDA), and are based on age, sex and level of physical activity. The current USDA food guidance system to promote fruit and vegetable intake is MyPlate, which demonstrates the components of a healthy plate. Despite previous public health promotion efforts to increase fruits and vegetables, current intake remains below the recommendations cite.

Health benefits of fruit and vegetable consumption

The health benefits of fruit and vegetable consumption are far reaching, including the reduction of chronic diseases. There is strong evidence that adequate consumption of fruits and vegetables can lower the risk of heart disease and stroke. Much of the evidence comes from the Harvard-based Nurses' Health Study and Health Professionals Follow-up Study, which includes health and dietary habits of almost 110,000 men and women followed for 14 years (Harvard School of Public Health, 2014). The results showed the higher the average daily consumption of fruits and vegetables, the lower the chances of developing cardiovascular disease. Participants who averaged eight or more servings of fruit and vegetables per day were 30 percent less likely to have had a heart attack or stroke, compared with participants with intakes of less than 1.5 servings per day (Harvard School of Public Health, 2014). Add a sentence about the mechanism (is it the fiber? Is it the phytochemicals? The displacement of other food?)

Research on the relationship between fruit and vegetable intake and cancer is not as clear as it is with heart disease and stroke. Conflicting information about the benefits of fruits and vegetables on cancer prevention may be because some types of fruits and vegetables may protect against certain types of cancers (reference review on this). The mechanism behind the potential protection may be related to the antioxidant component of fruits and vegetables (Liu, 2003). The relationship between fruit and vegetable consumption and cancers of the lung, colon, breast, cervix, esophagus, oral cavity, stomach, bladder, pancreas, and ovary was studied in an epidemiologic review of 156 studies (Liu, 2003). Consumption of fruit and vegetables was found to have a significant

protective effect in 128 of 156 studies reviewed. Cancer risk for most cancer sites was twice as high in persons whose intake of fruits and vegetables was low compared to those with high intake. Significant protection of fruit and vegetable consumption was found in 24 of 25 studies for lung cancer. Fruit was significantly protective in cancers of the esophagus, oral cavity, and larynx. There was a significant protective effect of fruit and vegetable intake for cancers of the pancreas and stomach in 26 of 30 studies, and in 23 of 38 studies for colorectal and bladder cancers.

Fruits and vegetables are a good source of fiber, of which intake is strongly associated with reduced chronic disease (reference- look up and just find the largest most recent meta analysis or review on fiber intake and disease). Dietary Reference Intakes are 25 grams of fiber per day for adult women and 38 grams per day for adult men, while usual intake of dietary fiber in the United States is about 15 grams per day. According to the position paper on fiber from the Academy of Nutrition and Dietetics, high-fiber diets provide bulk, are more satiating, and have been linked to lower body weights ([J Am Diet Assoc, 2008](#)). Fiber can help reduce symptoms of irritable bowel syndrome and can relieve or prevent constipation (reference). Diverticulitis, an inflammation of the intestine, is a common disorder of the colon (Harvard School of Public Health, 2014). In study of male health professionals with a long-term follow-up, eating dietary fiber, particularly insoluble fiber, was associated with about a 40 percent lower risk of diverticular disease (Aldoori et al., 1998).

Estimated intake of fruits and vegetables in the United States

Current recommendations from the USDA for daily consumption of fruit and vegetables vary based on age, sex and level of physical activity. Two and a half cups of vegetables per day is a general recommendation for women 19-50 years old, while three cups of vegetables per day is recommended for men 19-50 years old. Two cups of fruit per day is recommended for women 19-30 years old, 1.5 cups for women 31- 50 years, and Two cups of fruit per day for men 19-50 years old. Educational charts indicating recommended intakes based on age and sex for all food groups, including fruits and vegetables, are available on choosemyplate.gov for the general public to determine their individual recommendation (U.S. Department of Agriculture, Choosemyplate.gov, 2014).

In 2011, the USDA released MyPlate to replace MyPyramid as a visual representation of the 2010 Dietary Guidelines for Americans . MyPlate includes a visual icon (Appendix A) with half of the plate divided for fruits and vegetables making the recommendation easy to understand. The half-your-plate concept aims to help individuals make fruits and vegetables the focal point of the meal to better meet the recommendations. The current recommendations for fruit and vegetable intake are supported as good sources of under consumed nutrients, such as vitamins A, C and K, potassium, fiber and magnesium. In addition, the association of fruit and vegetables with decreased risk of numerous chronic diseases along with their relatively low calorie content are added health benefits supporting the recommendations for intake (Produce for Better Health Foundation, 2014).

According to the State Indicator Report on Fruits and Vegetables, 2013, the United States national average daily intake of vegetables is 1.6 servings per day and average fruit intake is 1.1 servings per day. Also, 37.7% of Americans reported

consuming fruit less than once a day and 22.6% of Americans reported consuming vegetables less than once a day (Centers for Disease Control and Prevention, 2013). Despite numerous efforts to develop new messages and programs to promote intake, current intake of fruits and vegetables remain below the recommendations. This is the main reason why more effective promotion efforts remain a priority to effectively increase fruit and vegetable intake.

Could you add Wisconsin related data? The state should have those data either on their DHS website or search for WI in the CDC reports.

Assessment of fruit and vegetable consumption

Epidemiological research on the association between intake of fruit and vegetables and risk of chronic diseases, and public health research to create nutrition interventions require valid methods to measure fruit and vegetable intakes (Agudo, 2004). A major challenge to nutritional research is correctly measuring dietary intake in a free-living population. Assessment tools used in the field are self-reported. These include the food frequency questionnaire and the 24-hour diet recall. The reliability of memory and capture of real intake remain a main concern. Other potentials for error include the structure of the questionnaire, the timeframe recalled, the order of the questions, and ability to quantify amounts of foods, either through visual aids or by memory. An additional challenge includes honesty and accuracy of self-reported intake due to the influence of social desirability, which may be especially true for fruit and vegetables. Participants may over-report consumption in order to appear favorably, since increased intake of these foods is promoted as part of a healthy diet (Agudo, 2004).

The introduction of nutritional biomarkers has added value to nutrition assessment methods. Nutritional biomarkers are components in the blood or urine that can be used to estimate nutrient intake and provide objective validation of dietary assessments. Common biomarkers to reflect dietary intake of fruits and vegetables include measurement of plasma vitamin C and plasma concentrations of carotenoids. Collecting tissue or blood for biomarker measurement is more expensive than?? and involves medical testing and biohazardous samples, which may not always be feasible depending on the type of research being conducted (Medical Research Council, 2014). Each method of dietary assessment has distinctive features with advantages and disadvantages depending on the purpose of the study. Validating assessment methods by comparing with a reference method, if possible, is a way to increase accuracy of dietary assessments (Agudo, 2004).

A study by Bensley, Van Eenwyk, and Bruemmer B. A. (2003) assessed the influence of adding portion size information to food frequency questionnaires. Two identical sets of questions were used for the study, but one set of questions included definitions of serving sizes based on the United States Food and Drug Administration definitions. Twenty six percent of participants reported they ate at least five portions of fruits and vegetables per day without the portion size definition, and 50% reported eating at least five portions of fruits and vegetables per day when the question included a definition of portion size. According to these results, omitting portion size information may lead to underestimation of fruit and vegetable consumption.

A 2000 study from the American Association of Cancer Research looked at the precision and bias of food frequency based measures of fruit and vegetable intakes

(Kristal et al., 2000). The study compared two commonly used food frequency questionnaires, the “5 A Day” method and the summation method. The 5 A Day method uses two summary questions to capture consumption of most fruits and vegetables, “how often do you eat a serving of fruit (not including juices)” and, “how often do you eat a serving of vegetables (not including salad and potatoes)”. These questions are usually asked alone as a short food frequency questionnaire or can be extracted from items included in a longer food frequency questionnaire. The summation method asks the respondent to add the frequencies of fruit and vegetable consumption in a comprehensive food frequency questionnaire (Kristal et al., 2000).

Bias and precision were presented from three large studies that collected a food frequency questionnaire and one alternative measure such as food records, dietary recalls, or serum carotenoids. The primary finding was that the 5 A Day method tended to underestimate total fruit and vegetable intake when compared with methods based on dietary recalls or food records. There were no differences in the precision of the 5 A Day method and the summation method and both methods more precisely measured fruit intake versus vegetables. The authors concluded that food frequency based measures of fruit and vegetable intake have limitations due to their inaccurate measure of intake. They recommended whenever possible, studies should include additional measures, such as dietary recalls or biomarkers of fruit and vegetable intake (Kristal et al., 2000).

Deciding which method of dietary assessment to use depends largely on available time and resources, and the type of study. The articles presented for this literature review rely primarily on self-reported dietary assessment methods as do many articles for nutrition research. Being aware of the limitations of dietary assessment methods is

important when considering the results of a study. Despite the difficulty in assessing dietary intake, there are ways to make the assessments more reliable, such as adding portion size information and validating the questionnaires (Agudo, 2004).

Interventions to increase fruit and vegetable consumption

According to the CDC's Guide to Increase the Consumption of Fruits and Vegetables, the number one strategy is to promote food policy councils as a way to improve the food environment at state and local levels (CDC, 2011). This includes providing support to governments on how to develop programs to improve local food systems, with the goal to increase access to affordable fruits and vegetables. Food policy councils have supported program initiatives such as community and school gardens, farmers' markets and the Farmers' Market Nutrition Program, Farm-to-school/institution programs, and promotion of locally grown foods. These initiatives are implemented with the goal of increasing individual access to fruits and vegetables, which is a necessary step in influencing consumption (CDC, 2011). The New York City Health Department is one example of a local program that has launched several public health nutrition initiatives to assist with making fresh produce more available through their own farmers' market program (NYC Department of Health, 2010).

Strategy number five from the CDC's Guide to Increase the Consumption of Fruits and Vegetables includes starting or expanding Community Supported Agriculture (CDC, 2011). Community Supported Agriculture (CSA) is a way for consumers to buy local, seasonal produce directly from a farmer. Consumers purchase a share from the farmer and receive a box of seasonal produce each week throughout the farming season. There are numerous advantages for both the farmer and the consumer for being a part of

CSA. The consumer receives fresh produce every week at an affordable cost, is exposed to new vegetables along with new ways of cooking, and can develop a relationship with the farmer to learn more about how food is grown (Local Harvest, 2014). In some communities, this access to fresh produce may be the only access individuals have within a reasonable distance. Although there is limited evidence showing CSA increases fruit and vegetable intake, increased access to fruits and vegetables may lead to increased consumption (CDC, 2011). The articles presented in this review are evaluations of interventions to promote fruit and vegetable intake. The strategies developed by the New York City Health Department will be discussed in more detail along with a study evaluating the effectiveness of a CSA program.

Can you say something about CSAs in Wisconsin? It is relatively big here, at least in south central WI and south western WI.

New York City Health Department efforts to increase fruit and vegetable consumption

The New York City Health Department is one example of a local program that has developed several initiatives to assist with making fresh foods more accessible in the city's low income communities. Residents of low income neighborhoods often have limited access to large grocery stores and instead have to rely on fast food restaurants and corner stores with limited selections of fresh foods. These neighborhoods have high rates of obesity and diabetes associated with limited access to nutritious foods (NYC Department of Health, 2010). The efforts from the New York City Health Department to make fresh foods more available include providing zoning and tax incentives to attract supermarkets to these neighborhoods, working with small corner stores to have and promote more healthful foods, and developing other retail outlets such as mobile produce

stands and farmers' markets. There are nearly 60 farmers' markets in New York City's high need neighborhoods accepting food stamps for the purchase of fresh fruits and vegetables, which generally are priced lower than at nearby grocery stores. A recent survey of three South Bronx farmers' markets found they matched or exceeded nearby supermarkets for value (NYC Department of Health, 2010).

The Health Department developed the Health Bucks program in the South Bronx in 2005, which distributes two dollar coupons that can be used for fresh fruits and vegetables at participating farmers' markets. The Bucks are distributed through community based programs and at the markets themselves. The program includes an additional incentive for food stamp recipients: recipients who spend five dollars of food stamps at a participating farmers' market receive an additional two dollar Health Bucks coupon that can be redeemed for fruits and vegetables. In 2009, the City distributed more than 110,000 Health Bucks to low-income New York residents, generating 220,000 of sales of fresh, local produce. The Health Bucks incentive dramatically increased food stamps spending at farmers' markets. The average food stamps sales per day at the Midwood/Cortelyou Road Greenmarket without Health Bucks was \$48.09 per day and with Health Bucks increased to \$205.83 per day, and sales at the Inwood Greenmarket increased from \$196.39 without Health Bucks per day to \$426.77 food stamp sales per day with Health Bucks. Also, survey data from the 2009 market season indicated that more than 90% of farmers' market customers reported buying more fruits and vegetables because of the Health Bucks incentive. Although the actual consumption of fruits and vegetables in these neighborhoods has not been studied, the increased access in these

New York communities is a great step in promoting intake (NYC Department of Health, 2010).

Community Supported Agriculture (CSA)

A pilot feasibility study by D'Agostino, Dupuis, Fish, and Quandt, (2013) tested whether a program providing a CSA share and education about food purchasing and food preparation would be associated with increased fruit and vegetable household inventory and consumption in low income, minority families. Considerable disparities in fruit and vegetable consumption exist by region, race and income, together with similar disparities in health outcomes and disease prevalence. Two main reasons for the disparities in fruit and vegetable consumption include food availability and transportation to reach larger food stores (Quandt et al., 2013). Suggestions to decrease the disparity of access to healthy foods include direct-to-consumer efforts, such as farmers' markets, mobile produce trucks, community gardens, and CSA shares. CSA allows community residents to purchase local food directly from a farmer where shareholders receive a box of produce each week (Quandt et al., 2013).

This study was conducted from May 2012 to September 2012, to test the feasibility of the Farm Fresh Healthy Living Program. The program was developed, administered, and evaluated by a partnership of University researchers, a community nonprofit agency and a noncertified organic farm. Participants were clients of a nonprofit community action agency in Forsyth County, North Carolina. The agency conducts programs focused on financial self-sufficiency and housing to help families with household incomes below 200% of the federal poverty guidelines. Eligibility criteria included being female, ≥ 18 years old, head of the household with at least one minor

child, and able to speak and understand English. Agency personal produced a list of 93 eligible clients, which were randomized by researchers into a control and intervention groups. All subjects were recruited to participate in research “designed to learn more about foods families in the agency’s programs eat, where they get these foods, and some of the factors involved in their choosing these foods.” The intervention group was told about the CSA program, while the control group was not (Quandt et al., 2013).

The Farm Fresh Healthy Living Program provided the intervention families with a CSA share, including 12 to 15 pounds of fruit and vegetables, once a week for 16 weeks. The boxes also contained at least two simple recipes to utilize the week’s produce. Boxes were available for pick up every Thursday between 12:00pm and 6:00pm and late pick-ups were accommodated with advanced notice as possible. The intervention group was also offered five evening education sessions including three cooking classes, a tour of the participating farm, and a grocery store tour with a dietitian targeting healthy eating on a budget. Participants in intervention and control groups were interviewed by telephone before the study and again at follow up after the program ended (Quandt et al., 2013).

Home availability of fruits and vegetables were measured using a checklist including 14 fruits and 25 vegetables. Fruit and vegetable intake was measured using the CDC’s Behavioral Risk Factor Surveillance System (BRFSS), which includes four questions asking the number of times in the past week a respondent consumed fruit, dark green vegetables, orange vegetables, or other vegetables. Additional data from intervention participants included their report of barriers to program participation, quality of food received, future willingness to provide partial payment for the program, and overall program assessment. Process data was also collected including the number of

times produce was picked up during the program, and the number of classes and events attended. Demographic characteristics of the intervention and control groups were compared by using counts and percentages. Differences were assessed by chi-square, Fisher exact, and t tests, as appropriate (Quandt et al., 2013).

Twenty-five women were recruited for each group, and 23 control and 21 intervention group members were able to be contacted at follow up. Participants' ages ranged from 24 to 60 years old, and most were African American and unmarried. Education level ranged from high school graduate or general educational diploma, to graduate degree. No significant differences were observed between groups at baseline (Quandt et al., 2013).

Intervention group participants picked up the produce an average of 9.2 (standard deviation (SD) = 4.58) of 16 weeks. They attended an average of 1.2 (SD = 1.32) of the 5 events. There was a significant increase in the number of fruits and vegetables in home inventory for the intervention group, compared with the control group. Fruit and vegetable consumption was 16.7 servings/week for the control group at baseline and 16.4 servings per week at the follow up. For the intervention group, baseline intakes were 16 servings per week and 18.7 servings per week at follow up ($p = 0.17$). There was no significant increase in fruit and vegetable consumption in the intervention group compared with the control group, however the results trended with the intervention group having higher intakes (Quandt et al., 2013).

Seventeen of the 21 intervention participants reported challenges to picking up the produce box, with eight reporting work schedules, four reporting transportation, and four reporting forgetting as the most common challenges. Distance, health issues, and out-of-

town travel were also reported challenges. Similar challenges were listed for availability to attend the evening sessions, with night classes and family activities conflicting with participation. It was noted the community agency was unable to contact many participants with reminders due to contact information changing frequently. All intervention participants reported that they would be willing to pay 10 dollars per week for a produce box in the future. Fifteen (71%) were willing to pay 15 dollars per week, eight (38%) were willing to pay 20 dollars per week, and 3 (14%) were willing to pay 25 dollars per week. Of the nine participants who reported receiving WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) or SNAP (Supplemental Nutrition Assistance Program) benefits, seven reported they would be willing to use these benefits for the produce (Quandt et al., 2013).

Overall, 20 of 21 intervention participants stated that if the program were offered again, they would participate. All 21 participants responded positively to the open ended question, “what did you think of the program?” Responses included enjoying the variety provided and opportunity to eat foods that were too expensive to purchase at the grocery store, the opportunity for children to try new foods, and the enhanced flavor of local produce. Participation could be improved by locating the program in agencies that offer family activities, such as community centers, daycares or after school care centers. Better adapting the produce box to participants’ preferences and size of family could make the program more effective as well (Quandt et al., 2013). The greater number of fruits and vegetables in intervention participants’ households suggests that the intervention increased fruits and vegetables available to families. A larger sample size or a more

precise dietary intake method may have shown a significant effect on fruit and vegetable consumption. The above study can be significantly condensed and edited.

Accommodations were made for participants' schedules for picking up the produce, but these efforts may have been insufficient due to the life situations of low-income women, which may account for participants picking up the produce an average of nine of 16 weeks. Many women worked multiple jobs, lacked flexibility in their workplace, depended on multiple buses to travel to the pick-up point and struggled with the produce box on the bus. Similar issues prevented full participation in other studies as well (Andreatta, Rhyne, & Dery, 2008; Devine et al., 2006). Proposed program changes include overcoming the problems of maintaining participation, increasing sustainability, and targeting outcome evaluation. Although participants reported enjoying and using most foods, whether these foods are regularly eaten or displaced should be further investigated (Quandt et al., 2013).

Limitations of this study included a small sample of clients of a single agency, receiving food from one CSA program, which indicates results may not represent other populations. Outcomes were measured by self-reported values rather than by more detailed dietary intake measures or by household inventory observations. Also, not all possible explanatory factors, such as location of fruit and vegetable pick up site from participants' homes were measured. Strengths include a well-matched control group from the same population. Also, the statistical analysis adjusted for confounding variables, including education and self-efficacy for fruit and vegetable consumption. An additional study strength includes utilizing process measures to assist in developing solutions that will be implemented in a follow-up intervention (Quandt et al., 2013).

Analysis of interventions designed to increase fruit and vegetable intake

The global strategy on Diet, Physical Activity and Health of the WHO urges healthier lifestyles to prevent the threat of chronic diseases by encouraging consumption of more fruits and vegetables. Survey data from the Food and Agriculture Organization (FAO) suggests most populations are not meeting current recommendations for fruit and vegetable intake, and suggest more effective methods to promote dietary changes.

Previous reviews of literature suggest that the majority of interventions that promote fruit and vegetable intake increases consumption short term (Pomerleau, Lock, Knai, & Mckee, 2005)

Pomerleau et al. (2005) presented a systematic review of the evidence on the effectiveness of interventions and programs promoting fruit and vegetable consumption,. The systematic analysis of the literature reviewed all studies on free-living individuals, not acutely ill, where the change in fruit and vegetable consumption was measured with at least a three month follow up, and with a control group, for eligibility.

Fourteen databases were searched for the earliest record to April 2004. The appropriateness and quality of each article was assessed independently by two assessors, where differences between assessors' results were resolved by discussion and if necessary, consultation with a third reviewer. Studies considered to be of poor quality were excluded from the review (Pomerleau et al., 2005).

A total of 3,499 studies were identified; 306 of these reported on interventions designed to increase fruit and/or vegetable intake. Of these, 228 studies did not meet eligibility criteria, and another? eight were rated as methodologically weak. The

remaining 70 articles reported results of 60 independent studies, 44 of these were among adults. Among the latter? 44 studies examined, 72.7% were in the United States, 15.9% in Europe, 6.8% in Asia, and 4.5% in the Western Pacific. Most included at least 500 participants, both genders, and a follow up time of at least six months. Most studies used personal counseling or education with or without other interventions, and dietary intakes were collected mainly by food frequency questionnaires (Pomerleau et al., 2005). The results are presented below, organized by type of intervention.

In general population interventions, three of four studies showed increased consumption of fruits and vegetables ranging from an additional 0.2 to 0.6 servings per day, after using individual counseling, face-to-face or telephone counseling, printed documents, or social marketing techniques. The other study evaluated “5 a-Day” projects in England, which showed no increase in intake in the intervention group after one year. However, it appeared to have prevented decrease in consumption against national trends compared with the control group. Three studies in community-based settings showed larger effects than general population interventions, increasing consumption by approximately 0.7 to 1.4 servings per day. One intervention showed that culturally sensitive self-help material with telephone motivational interviewing was more effective than the same material with one telephone call (an additional 0.99 serving per day), or than standard nutrition education materials (an additional 1.12 servings per day) (Pomerleau et al., 2005).

In supermarket based interventions, and promotion and activities to encourage sales, there was no significant effect on fruit and vegetable consumption. However, a computer based individualized education program demonstrated a significant effect of

approximately an additional 1.3 servings per day after eight to ten months (Pomerleau et al., 2005). Interventions in other study settings used personalized education approaches along with a range of other activities, mainly printed materials that were tailored or non-tailored. Eight of the nine interventions in health care settings reported positive findings with effects ranging from an increase in servings to 0.5 to 1.4 serving per day. Three studies delivered computer tailored information; one study showed the largest effect with an increase in fruit by 1.1 serving per day using weekly communication over 6 months with an interactive computer-based counseling voice system. An additional computer based intervention suggested that printed computer-tailored information was slightly but not significantly more effective, than non-tailored information. Differences with the control group ranged from an additional 0.6 to 0.8 servings per day. The last computer tailored study showed no significant difference between printed tailored and non-tailored information (Pomerleau et al., 2005).

Face-to-face individual or group counseling had positive effects ranging from an increase in average fruit and vegetable servings of 0.62 to 1.4 servings per day. The greatest effect was observed in a study that used the brief negotiation method, a technique to motivate behavior change, and the least effect was in a study examining the effect of behavioral counseling versus non behavioral counseling.

All five trials focusing on low income adults increased fruit and vegetable intake. Four reported an effect ranging from approximately an additional 0.42 to 1.1 servings per day. The other study showed an increased vegetable intake of 2.5 servings per day in individuals who received educational materials targeting reduction of dietary fat,

compared with no significant increase in those receiving general nutrition education materials (Pomerleau et al., 2005).

Studies among individuals with pre-existing health problems had greater overall effects than those targeting other populations. An intervention using only prompt sheets was the only study with no significant effects. The other studies reported effects ranging from additional servings of 0.27 to 4.9 servings daily; two studies only showing increased effect for fruit. The highest effects were demonstrated in individuals with cardiovascular risk factors (additional 3.9 to 4.2 serving per day) or suspected infarction (additional 4.9 servings per day) (Pomerleau et al., 2005).

This review systematically analyzed a variety of interventions to promote and increase fruit and vegetable intake in adults. Many of the interventions had positive effects, despite the challenges in making dietary changes. The greatest effects were seen among individuals at higher risk of disease. This most likely shows enhanced motivation to improve dietary habits, and it may be beneficial to consider these trials separately from studies targeting the general population in the future. For all studies combined, fruit and vegetable intake increased from about 0.1 to 1.4 servings per day for healthy adults. Studies utilizing more individualized education were slightly more effective than non-individualized information. Printed individualized information and individualized computer based information appeared to be a suitable alternative to face to face or telephone contact, which are easier and less expensive approaches (Pomerleau et al., 2005).

A strength of this review was the number of articles compiled and results presented from a variety of fruit and vegetable intervention studies. Comparing

numerous types of interventions with their results can help determine which type of intervention will be most appropriate for each population, while taking into account resources available. The review clearly identified how the studies were chosen and why a study would be excluded, (Pomerleau et al., 2005).

Limitations for the study include the possibility some studies may have been missed, such as studies published in other languages and recent unpublished studies. Another limitation was that several studies were excluded, including some national or large scale promotion interventions, due to this study only utilizing articles with a control group, which is a strength as well. Also, dietary intakes were self-reported, which increased potential for error and inaccurate estimation of intake. In addition, the studies were not blinded, which increased potential for measurement bias with a possible overestimation of effect sizes (Pomerleau et al., 2005).

This review showed previous interventions aimed at increasing fruits and vegetables have had modest success, but also identified the need to determine what influences individual dietary intakes of fruit and vegetables. Individualized counseling by face to face contact or telephone contact have been effective, but based on resources available, printed or computer based individualized interventions may be effective options with less cost and need for professional? time. The findings of this review including the effectiveness of interventions for increasing fruit and vegetables, and the need to further explore the influences for choosing fruits and vegetables are both important factors to research further (Pomerleau et al., 2005).

Summary of interventions for increasing fruit and vegetable access and consumption

The New York City Health Department has had success increasing access to fruit and vegetables in low income neighborhoods as shown by the increase in food stamp spending for produce at local farmers' markets with their Health Bucks program (NYC Department of Health, 2010). Despite the increased purchasing of fruits and vegetables, actual consumption has not been studied. Also, the CSA program significantly increased participants' inventory of fruits and vegetables in their homes, which indicates successfully increasing access to fresh foods. However, they did not see a significant increase in intake of fruits and vegetables, which may be attributed to challenges picking up the produce or due to small sample size of the study (Quandt et al., 2013). Both of these interventions increased access to fresh foods, but it is not known if they increased consumption. Transportation appeared to still be a challenge with the CSA program. The distance of the produce pick up point to participants' home was not discussed, but potentially a more central pick up location or the possibility of a home delivery system may help overcome this concern with the CSA program. The review article presented above found a range of increases in fruit and vegetable consumption, with the largest increase in those with a pre-existing health concern (Pomerleau et al., 2005). This shows a different motivation may be present for individuals when they are faced with a concern for their health. They also found that individualized printed or computer based interventions can be suitable alternatives to face to face or telephone counseling, depending on available resources.

Determinants of barriers influencing fruit and vegetable consumption, will be the next step needed for creating more effective nutrition interventions. The reasons for not consuming adequate servings of fruits and vegetables that previous research studies have

identified include high cost, lack of time, low socioeconomic status, and inaccessibility to fresh fruits and vegetables (Kratt et al., 2000; Siega-Riz and Popkin, 2001; Pomerleau et al, 2005). It has also been demonstrated that there is a wide variability of barriers for different ethnicities, age groups and income levels (Ammerman et al., 2008).

Understanding barriers for fruit and vegetable consumption will better tailor nutrition interventions to assist individuals in meeting recommendations.

Barriers and facilitators to fruit and vegetable consumption

In a qualitative study, Ammerman et al. (2008), aimed to determine the factors affecting fruit and vegetable consumption among African American, Hispanic, and Caucasian populations. Their study consisted of 12, ninety-minute focus groups ranging from nine to 16 participants, . The groups were conducted in North Carolina (n=81) and Connecticut (n=66) to account for differences between rural and urban environments. Focus groups were separated by ethnicity (Caucasian, Hispanic, and African American) and two focus groups were conducted for each ethnicity in each state. For Caucasian and African American participants, they held separate groups for ages 18-49 years and those 50 years and older . Hispanic participants were separated into two groups by degree of acculturation rather than age. An expert panel of public health researchers and health educators reviewed questions and created a rigorous focus group guide. The questions were divided into four groups: general determinants, perceived barriers, enablers, and knowledge and attitudes (Ammerman et al., 2008).

The common facilitators of fruit and vegetable consumption across all groups included family traditions, health benefits and advice by physicians. Although many participants reported not eating enough fruits and vegetables, it was commonly

understood they are recommended for a healthy diet. Participants expressed that it was especially important to consume fruits and vegetables if they had children at home. African American and Hispanic groups discussed the importance of eating fruits and vegetables as children to develop a liking for them. The African American group reported family physicians as the most important source of information on healthy diets and described their church community as a supporting environment for learning about healthy eating (Ammerman et al., 2008).

The most common barriers among all the groups were cost, inaccessibility and time. Lack of energy and preparation time, along with high spoilage rate of fruits and vegetables were also commonly mentioned barriers across all groups. Some barriers were unique to specific ethnic groups. For example, African Americans noted that grocery stores were inaccessible and home gardens were not prevalent. Hispanic immigrants to the USA have found fruits and vegetables to be less accessible than in their country of origin, and lack of familiar fruits and vegetables and tools for traditional preparation also limited consumption. A specific barrier mentioned by Caucasian participants was the fear of consuming fruits and vegetables that might be contaminated with pesticides (Ammerman et al., 2008).

There were some differences among the age groups as well. Participants under age 50 years reported fruits and vegetables costing more than other food items as a barrier, while the greater than 50 age group found as the transition away from home gardens to higher prices in grocery stores a barrier. The less than 50 age group stated fast food as a large barrier to fruit and vegetable intake due to long working hours and the desire for convenience. The younger group also reported a more distal concern over the

need to consume more fruits and vegetables and a lack of cooking skills decreasing their ability to prepare vegetables (Ammerman et al., 2008).

The study found that the health benefits of fruits and vegetables are well understood by the subjects; however, many of the subjects reported not meeting the recommendations for intake. The primary individual barriers were high cost of produce, perceived lack of time due to long working hours, and inaccessibility to many fruits and vegetables. Variations to barriers were also seen based on ethnicity and age, African Americans described their church communities as good settings for being educated about healthy eating, which the authors concluded should be utilized for future interventions. The authors concluded there is a need to improve availability and access to fresh fruits and vegetables, especially for African American and Hispanic populations. The most common reported barriers for fruit and vegetable consumption included high cost, perceived lack of time, and inaccessibility to many fruits and vegetables. Creating interventions and education focused on these barriers, while taking into account ethnicity and age, is a first step to increase fruit and vegetable intake (Ammerman et al., 2008).

A limitation included the inclusion of only two Spanish speaking focus groups from each study site which may have provided insufficient variability to draw comparisons between different Hispanic groups in the USA. An additional limitation was that some questions in the focus group may have led participants to agree to a barrier or facilitator to fruit and vegetable consumption they would not have thought of otherwise (Ammerman et al., 2008). Also, the moderator of each focus group matched the race of the group, except in one state of the African American group thus creating a difference in

the procedure between the groups that potentially could have affected the answers due to the comfort level of the participants in that group.

The present study reported results including comments from participants which is beneficial, however this is a subjective way of collecting data and makes it more difficult to analyze and find correlations. The study did not mention the original number of participants recruited and also did not specify any blinding of the study. The study did however discuss the development of the focus groups, included the questions asked by the moderators, and included actual statements collected from the participants. This study contributes to the overall knowledge on the topic because it identified numerous barriers to fruit and vegetable consumption and suggestions for designing interventions to overcome these barriers. By dividing the groups by ethnicity and age, it even further identified specific reasons for not meeting recommendations and reasons the participants believed consuming fruit and vegetables was important. Focusing programs on what is important to participants and also addressing common perceived barriers should assist with making nutrition education more effective.

Fruit and vegetable consumption before and after a healthy eating campaign

Pollard, Miller, Woodman, Meng, and Binns (2009) aimed to provide information about self-reported knowledge, attitudes and behaviors regarding fruit and vegetable intake in Western Australia prior to and after a healthful eating campaign. The “Go for 2&5” fruit and vegetable campaign was implemented from 2002 to 2005 to give the message that adults should eat two servings of fruit and five servings of vegetables every day. The Department of Health in Western Australia conducted four Nutrition

Monitoring Surveys via telephone to adults between 1995 and 2004. The study utilized this telephone survey data from 2,854 adults in Perth from the Nutrition Monitoring Surveys conducted in 1995, 1998, 2001, and 2004. Three telephone surveys were conducted before the campaign and one after the campaign. Participants were randomly selected by a computer generated process, except in 2004 when the numbers were randomly selected from the electronic Perth telephone directory. Within each household the person aged 18 to 64 years was selected. The questionnaires used for the telephone surveys contained between 107 and 120 open ended questions regarding fruit and vegetable consumption, dietary changes/barriers to increasing fruit and vegetables, and awareness of fruit and vegetable recommendations (Pollard et al., 2009).

Data was analyzed with Stata Software version 9.2. Samples were weighted with inverse probability to match each sample to the Perth metropolitan age and gender population estimates. Binary outcomes were assessed with the survey estimation commands (SVY) for binary logistic regression and reported as odds ratios (ORs) with 95% confidence intervals (CIs). Count outcomes were assessed with either the SVY Poisson or negative binomial regression models and reported as incidence rate ratios (RRs) with 95% CIs. Reported associations between each outcome variable in 1995 & other years in which the survey was conducted were adjusted for age and gender. Education and income were also included and significant when $P < .05$ according to the Wald Statistic (Pollard et al., 2009).

The percentage of participants correctly stating the recommended intake for fruit as two servings per day increased from 23.8% in 1995 to 52.7% in 2004. In 2004, respondents were three times more likely to say they should eat two servings of fruit per

day than they were in 1995 (OR = 3.66; 95% CI = 2.85, 4.70; $P < .001$). The percentage of participants correctly stating the recommended intake for vegetables as five servings per day, increased from 30.1% in 1995 to 64.3% in 2004. In 2004, respondents were four times more likely to know the minimum recommended five servings of vegetables than they were in 1995 (OR = 4.50; 95% CI = 3.49, 5.80; $P < .001$). However, there were only slight changes in the percentage of respondents who actually attempted to increase fruit intake over the past year across the surveys: 39.4% reported they attempted to increase fruit intake in 1995, 39.3% attempted to increase in 1998, 36.2% attempted to increase in 2001, and 40.7% attempted to increase fruit intake in 2004. Only about one third of respondents reported they had attempted to increase vegetable intake over the previous year: 33.8% reported they attempted to increase vegetables in 1995, 30.5% attempted to increase in 1998, 29.3% attempted to increase in 2001, and 33.5% attempted to increase vegetable intake in 2004. Women were more likely than men to have attempted to increase both fruits and vegetables and attempts to increase intake decreased with age (Pollard et al., 2009).

There were no significant changes in mean fruit consumption between 1995 and 2004. Women consumed 20% more pieces of fruit than men on the day before the survey (RR = 1.20; 95% CI = 1.09, 1.32; $p < .001$), participants with higher education consumed more pieces (RR=1.11; 95% CI=1.06, 1.17; $p < .001$), and higher income participants had greater intake (RR=1.06; 95% CI=1.00, 1.11; $p = .036$). Actual consumption of vegetables decreased over the survey period; participants consumed 12% fewer cups of vegetables in 2004 than in 1995 (RR= 0.88; 95% CI = 0.82, 0.96; $P = .003$). Also, more respondents had no vegetable intake on the day before the survey in both 2001 and 2004 than in 1995.

One-third of participants reported already eating enough fruit and two-thirds of participants reported eating enough vegetables; the main reason reported for not increasing intake. There was an increase in the proportion of respondents reporting barriers for fruit and vegetable consumption from 1995 to 2004. The most common barriers included perceived lack of variety, poor quality, lack of time and effort to prepare, and difficulty changing habits (Pollard et al., 2009).

Overall, respondents were more likely in 2004 than in 1995 to correctly identify two servings of fruit and five servings of vegetables per day as the recommended intake. However, this knowledge did not translate to actual consumption; fruit consumption remained the same and vegetable consumption in 2004 was less than in 1995. Perceived adequacy of vegetable intake (59.3%) and/or fruit intake (34.5%), and insufficient time for vegetable preparation (14.3%) were the main barriers. The results show knowledge of the recommended intake for fruit and vegetables increased following the Go for 2&5 campaign; however this knowledge did not change actual consumption of fruit and vegetables. Perceptions of the adequacy of current intake and time should be considered when designing nutrition interventions (Pollard et al., 2009).

Limitations of the study included the self-report of fruit and vegetable intake and the reported intake as cups eaten on the day before the survey. Generally, combining 24 hour food recall and semi-quantified food frequency is recommended versus just one type of diet assessment. Also, the study mentioned they did not distinguish between the standard serving size of a half cup of cooked vegetables and one cup salad vegetables. The authors did not specify how the surveys were conducted by interviewers and did not include the survey questions. An additional limitation is that the surveys were not

specifically designed to evaluate the Go for 2&5 campaign. It is not possible to say if the program was the reason for the changes over the study period or if the changes were due to passage of time or other factors, but the similarity of findings between the surveys before the campaign and the changes reported after are of interest. Strengths for the study included the large sample size and length of study period.

This study presented commonly reported barriers to consuming fruit and vegetables from a large sample of participants over a long time period. The main reason for not increasing intake was participants falsely believing they were already consuming adequate amounts of fruit and vegetables. This indicates that more effort should be made at explaining the recommended intake including serving sizes and types of fruit and vegetables. The possibility of the Go for 2&5 campaign increasing the ability to report the recommended intake, but not increasing actual intake is of interest. This suggests that more emphasis should be placed on why increasing fruit and vegetables is beneficial along with practical suggestions for achieving the recommended intake, versus just stating the recommended amounts.

Anticipated versus actual barriers for increasing fruit and vegetables

John and Ziebland (2004) recruited 40 participants from the Healthy Life Project (HELP) to identify the anticipated and actual barriers to eating more fruit and vegetables. These participants were randomized to a nurse led primary care intervention or ? to increase fruit and vegetables. The intervention group was advised to eat at least five portions of fruit and vegetables per day. Self-reported intake from questionnaires showed a significant average increase in fruit and vegetable consumption

by 1.4 daily portions after the six month trial; (John et al., 2002). The qualitative study for this report discussed the barriers to increase fruit and vegetables that participants reported before and after participation in the trial (John & Ziebland, 2004).

The intervention began with a 25 minute interview using the brief negotiation method, a technique to motivate behavior change. Participants described current eating patterns, an action plan for increasing fruits and vegetables, and were asked about any barriers that they anticipated. They were given educational materials including topics such as eating on a budget, storage and preparation, recipes, and ideas for eating out. Six months later, at the follow up interview, participants were asked again to describe any barriers they experienced. Both intervention and follow up interviews took place at the health center and were audio taped for transcription. Within two weeks of the follow up appointment, participants were contacted by telephone and asked to participate in a semi-structured interview. These interviews took place in the participants' homes and encouraged the participants to discuss experiences more openly without a pre-conceived set of questions. The semi-structured interviewer was not involved in the delivery of the intervention and asked the participants to describe barriers without being prompted by examples of barriers, to lessen the effect of leading questions (John & Ziebland, 2004).

Sections of the intervention and the six month follow up appointments where barriers were discussed were transcribed, along with a full transcription of the semi structured interview. These were entered separately into the software NUD*IST for organization, coding and analysis (QSR NUD*IST, version 4; Stage Publications Software). A unique code was assigned to each section of text where a barrier to eating more fruit and vegetables was mentioned and the data was reviewed. The results were

discussed as types of barriers anticipated at the intervention appointment, and those reported at the follow up appointment and semi-structured interview collected after the end of the trial. Four individual case studies were also presented to show how anticipated and experienced barriers differed and the implications for interventions (John & Ziebland, 2004).

. Half of the respondents (19 of 40) anticipated a barrier at the intervention, 17 of 40 reported they experienced a barrier at the six month follow up, and at the semi-structured interview two weeks later, 35 out of 40 reported a barrier. All the anticipated barriers in the beginning of the trial were also reported at the end of the trial. The most common barriers included household preferences including reluctance of male partners and children to..., the additional time required to prepare fruit and vegetables, cost, and lack of access. Some barriers were not anticipated but were reported when subjects attempted to increase intake, such as traveling or disruption of daily routine (John & Ziebland, 2004).

One of the four case study participants reported the reluctance of her partner and children as barriers at the intervention appointment, then added cost and time as barriers at the six month follow up appointment, and reported all prior barriers plus resistance to being told what to do and being lazy at the semi-structured home interview. A second case study participant who did not anticipate any barriers in the intervention appointment, reported time as a barrier at the six month follow up and reported time and traveling as barriers at the semi structured home interview. The last two case study participants reported anticipated barriers and added additional barriers at both the last two follow up visits, that included forgetting to include hard changing habits, cost, limited winter

selection, dislike of fruit and vegetables, and lack of access to shops (John & Ziebland, 2004).

The most intractable barriers reported in this study included high cost and lack of access to fruit and vegetables. Interventions for increasing intake among people on low incomes or in socially deprived neighborhoods may need additional incentives or delivery schemes to improve intake. Children and other family member dislike of fruit and vegetables was an additional common barrier identified in this study; therefore approaches that involve the whole household may increase success in increasing intake. All but three of the respondents in this qualitative study described at least one barrier to increasing fruit and vegetables, however three quarters (29 out of 40) reported that they succeeded in increasing their intake. In the main trial, John et al., 2002, the reports of increased intake were accompanied by significant changes in blood pressure and serum antioxidants. While it cannot be concluded why the intervention was successful, factors including a simple, positive message to increase consumption to five portions per day and that the action plan was developed by preferences of the participant may have been contributing factors. This qualitative study showed participants working toward increasing fruit and vegetable consumption adapted their initial plan due to identified barriers once attempting to change. These findings support the need for health interventions with flexibility rather than fixed goals that may not be attainable for everyone (John & Ziebland, 2004).

A major strength of this study includes the semi-structured interview with an interviewer who was not involved in the intervention. The fact that this interview did not have a pre-set list of questions allowed the respondent to discuss their thoughts in

detail without leading questions. This interview also took place in the participants' homes, which may have been more comfortable for them. Limitations of the study included the small sample size.

Summary of articles discussing barriers to fruit and vegetable consumption

The three articles reviewed above on barriers to fruit and vegetable intake had a few differences. Ammerman et al. (2008) and John and Ziebland (2004) conducted in-person interviews while Pollard et al. (2009), conducted telephone surveys. Similar results were reported across the three studies, with inaccessibility to fruit and vegetables and lack of time for preparation identified as major barriers in all three studies. The high cost of fruits and vegetables was reported as a major barrier in two out of the three studies. Other barriers were the high spoilage rate of fresh produce, perceived adequacy of current intake, and family members not accepting the change.

Ammerman et al. (2008) identified barriers of different ethnicities and age groups, whereas the other studies did not account for these differences. Different barriers were reported across ethnicities and age groups, which should be taken into account when designing interventions. With the other two studies not separating groups by age, a large variability of barriers identified may be present. For instance, some participants reported family members' food preferences as a barrier to consuming more fruit and vegetables. However, this type of barrier would only be relevant to individuals with children in the home. Ammerman et al. (2008) also talked about facilitators for consumption, which is important to be aware of to emphasize reasons why increasing fruit and vegetable consumption is important to each individual.

Ammerman et al. (2008) found that most participants were aware of the health benefits of consuming fruit and vegetables, whereas Pollard et al. (2009), found that additional education on the benefits of consumption may be beneficial. This was seen in the Pollard et al. (2009) study after implementation of the “Go for 2&5” campaign which was designed to share the message to eat two servings of fruit and five servings of vegetables every day. The number of participants that correctly reported the recommended daily intake of fruit and vegetables increased after the campaign, however actual consumption of fruit and vegetables did not increase. The reason that actual intakes did not increase may have been due to numerous other barriers besides an awareness of recommendations and the associated health benefits. From the reviewed literature, the usefulness of focusing interventions on health benefits is unclear and should be decided on an individual basis. Other barriers such as cost,....and...may play a larger role as determinants of fruit and vegetable intake. Interventions designed tothus may be more helpful.

Suggestions for overcoming barriers

Overcoming inaccessibility to fruit and vegetables can be done by continued promotion of local farmers’ markets and potentially expanding the Health Bucks program in other areas than New York City. The Health Bucks program, where food stamp participants receive an additional two dollars to spend at farmers’ markets when they spend five dollars of food stamps at farmers’ markets, more than doubled food stamp spending at farmers’ markets in New York City (NYC Department of Health, 2010). This indicates increased food stamp money being spent on fruits and vegetables versus

other food items in grocery stores. An incentive program similar to this expanded to other areas could have large success in increasing access and consumption of fruits and vegetables.

A modified CSA program could also have success in increasing access to fruits and vegetables in low income populations. A CSA program with lower costs, convenient pick up locations and pick up times, and a potential delivery system could be effective based on the challenges found in the article testing the CSA program (Quandt et al., 2013). Promotion of home gardening, including garden development and maintenance tips, could be effective at increasing access to fresh foods at a low cost. This is an area of limited research, but the feasibility seems promising. The limited space of urban home environments may be a challenge, but education on small space gardening in containers may overcome this challenge.

There is limited research available specifically looking at interventions to overcome the barrier of lack of time for fruit and vegetable preparation. A few suggestions include focusing education on easy tips for preparing fresh foods, including pre-slicing fresh fruits and vegetables, pre-packing them into portioned containers, preparing meals in advance, and easy recipe ideas. More promotion and education on shopping on a budget, including purchasing sale items, utilizing coupons, choosing in season produce, choosing canned or frozen fruit and vegetables when limited selection of fresh is available, and buying whole foods versus pre-cut and pre-prepared foods, are all suggestions to lower cost of fruit and vegetables.

Conclusion

After reviewing interventions, along with reported challenges to consuming fruits and vegetables, it is clear that the influences affecting intake are complex . There were similarities in commonly reported barriers for consuming fruit and vegetables among all the studies reviewed. Addressing the main barriers of time and inaccessibility will be an important step to make nutrition interventions more effective.

Interventions addressing inaccessibility to fresh fruits and vegetables among low income populations are already being implemented with variable effectiveness. Taking into account the challenges identified from interventions along with commonly reported barriers, brings practical suggestions for reconsidering the interventions. Developing practical incentives, such as the Health Bucks program and a modified CSA with more convenient access, are two interventions based on previous research that could be effective at overcoming the barrier of inaccessibility. More research is needed for practical, effective ways to help individuals overcome lack of time as a perceived barrier to increase fruit and vegetable intake.

Focusing public health messages on the ways to access quality fruit and vegetables and tips for easy preparation may help increase awareness of these two commonly reported barriers. Also suggested from the study John & Ziebland, is the need for individualized interventions based on the client's needs and desires for change, while considering ethnicity and age (Ammerman et al., 2008). Public health messages and interventions are important to increase consumption on a national level. However, on a smaller level, interviewing individuals to determine their own struggles and designing tailored interventions to overcome these challenges would be the most effective way to increase consumption among individuals due to the multiple influences on fruit and

vegetable intake. You need a sentence or more to transition the reader from this to what you are going to be doing in your study. (Especially noted the need to improve intake among low-income and children, since you are working in a WIC population).

CHAPTER 3: METHODOLOGY

The purpose of this cross-sectional study was to determine current fruit and vegetable intake, perceived adequacy of current intake, and barriers for fruit and vegetable consumption among participants in the WIC program. Approval from Mount Mary University's Institutional Review Board (IRB) was obtained to conduct a survey with participants of three Milwaukee WIC clinics.

Recruitment

WIC participants at three different clinics in Wisconsin were offered an opportunity to enroll in the study by completing a questionnaire during their monthly WIC clinic appointment. Inclusion criteria included WIC program eligibility, English

speaking, and attendance at appointments at the participating clinics during the recruitment period. Exclusion criteria included not income eligible for WIC and non-English speaking. Recruitment took place over four weeks, from April 14, 2014 to May 12, 2014.

Questionnaire

The questionnaire used in this study (Appendix B) was developed based on the questionnaire used in the Food Attitudes and Behaviors (FAB) study (National Cancer Institute, 2007). The FAB study was sponsored by the National Cancer Institute and the purpose of the survey was to evaluate a variety of factors related to fruit and vegetable consumption. The question adapted from the FAB survey was about barriers to fruit and vegetable intake. Two additional questions were adapted from surveys provided by Dr. Marilyn Townsend of the University of California – Davis, which had been researched and evaluated for effectiveness in two previous studies (Townsend, M.S. & Kaiser, L.L., 2005 & Townsend, M.S. & Kaiser, L.L., 2007). These questions utilized pictures to assist participants in estimating fruit and vegetable intake in cups per day. Three Registered Dietitians working at the WIC clinic reviewed the questionnaire, and the questionnaire was modified based on their feedback. The questionnaire was pretested over a three day period with five WIC clients . No changes were made after pre-testing the questionnaire, since the questions were answered as intended and participants indicated comprehension.

Did I miss who the participants were, moms or kids? What were ages?

Study Protocol

WIC staff members explained the study and offered the questionnaire to the participants who met inclusion criteria. Staff was instructed at a staff meeting on the procedure for offering participation to eligible participants and collecting the study after completion. Eligible and consenting subjects completed the questionnaire prior to their meeting with a nutritionist. The nutritionist collected the completed surveys, or allowed time to complete the survey, and asked the participants if they had any questions and/or concerns. Who obtained consent?

Data Analysis

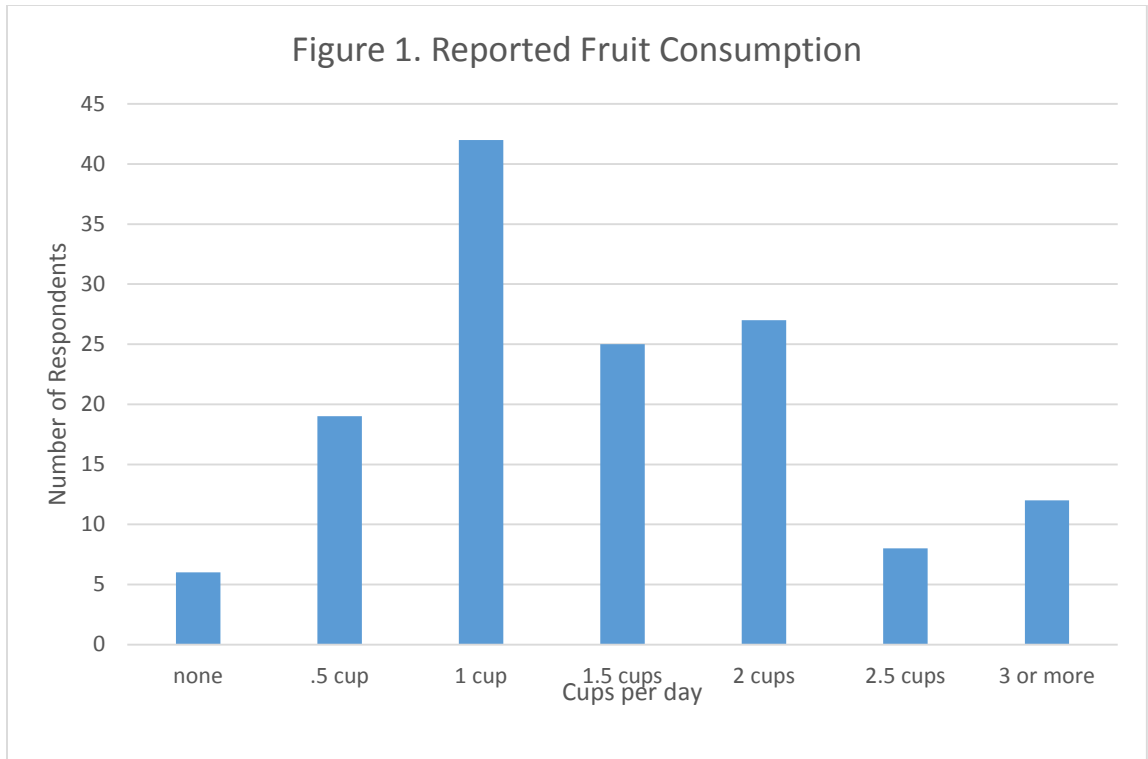
Data analysis was completed by tallying responses and presenting them as frequencies, using Excel (version).

CHAPTER 4: RESULTS

The purpose of this study was to assess fruit and vegetable consumption and perceived barriers to consumption of WIC participants. An estimated total of 1,415 participants went to the three WIC clinics over the four week study period and a total of 139 surveys were collected. This indicates that 9.8% of participants that attended WIC during the study period enrolled in the study.

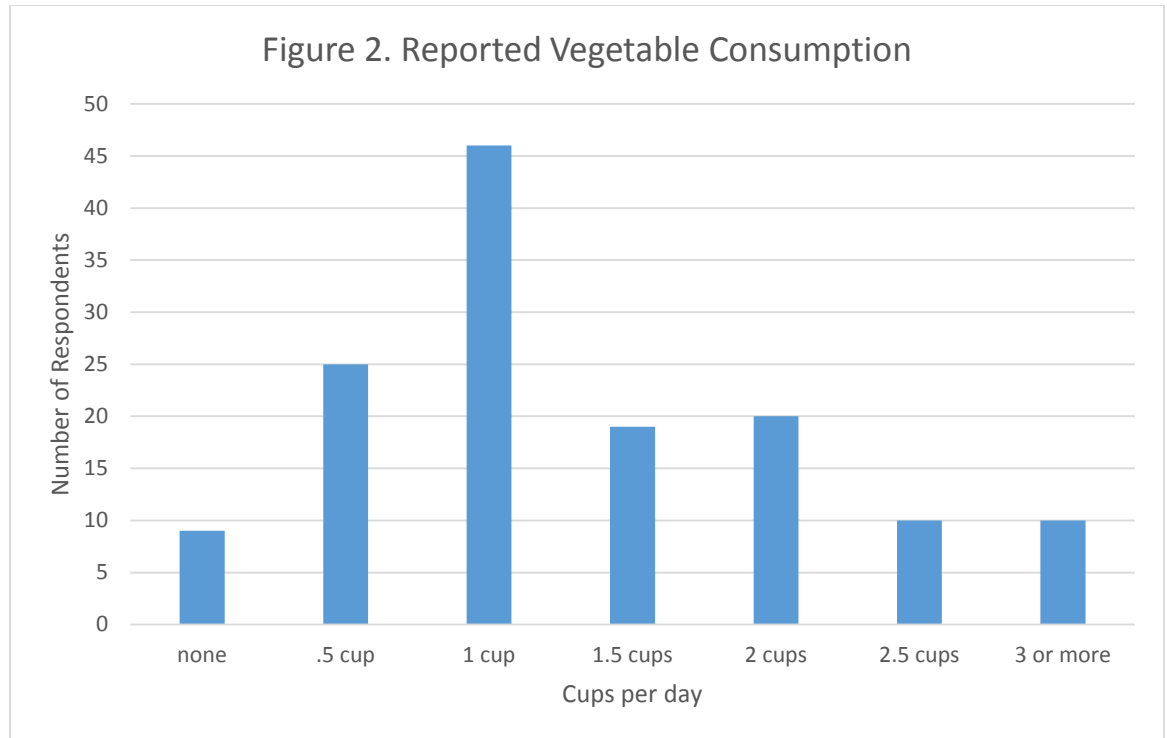
Fruit Consumption

Six participants (4.3%) reported consuming no fruit on a daily basis, 19 participants (13.7%) reported consuming 0.5 cup, 42 (30.2%) reported consuming 1 cup, 25 (18%) reported consuming 1.5 cups, 27 (19%) reported consuming 2 cups, 8 (5.8%) reported consuming 2.5 cups, and 12 (8.6%) participants reported consuming 3 or more cups of fruit per day. Based on the recommendation from the Dietary Guidelines for Americans to consume 2 cups fruit per day, 92 participants (66.2%) were not meeting recommendations for daily fruit consumption (Figure 1).



Vegetable Consumption

Nine participants (6.5%) reported consuming no vegetables on daily basis, 25 participants (18%) reported consuming 0.5 cup, 46 (33.1%) participants reported consuming 1 cup, 19 (13.7%) participants reported consuming 1.5 cups, 20 (14.4%) participants reported consuming 2 cups, 10 (7.2%) participants reported consuming 2.5 cups, and 10 (7.2%) participants reported consuming 3 or more cups vegetables per day. Based on the recommendation from the Dietary Guidelines for Americans to consume 2.5 cups vegetables per day, 119 participants (85.6%) are not meeting recommendations for daily vegetable consumption (Figure 2).

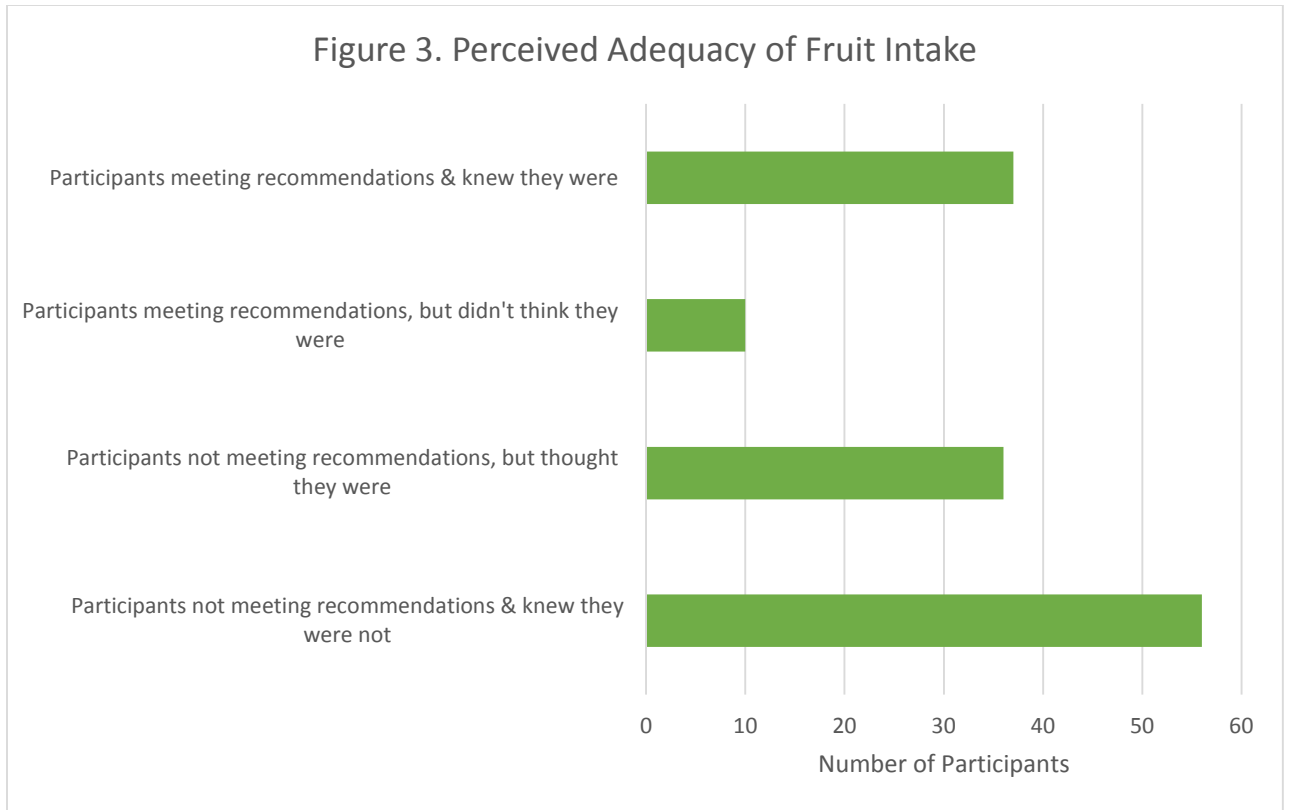


Perceived Adequacy of Intake

Should be a sentence between headings

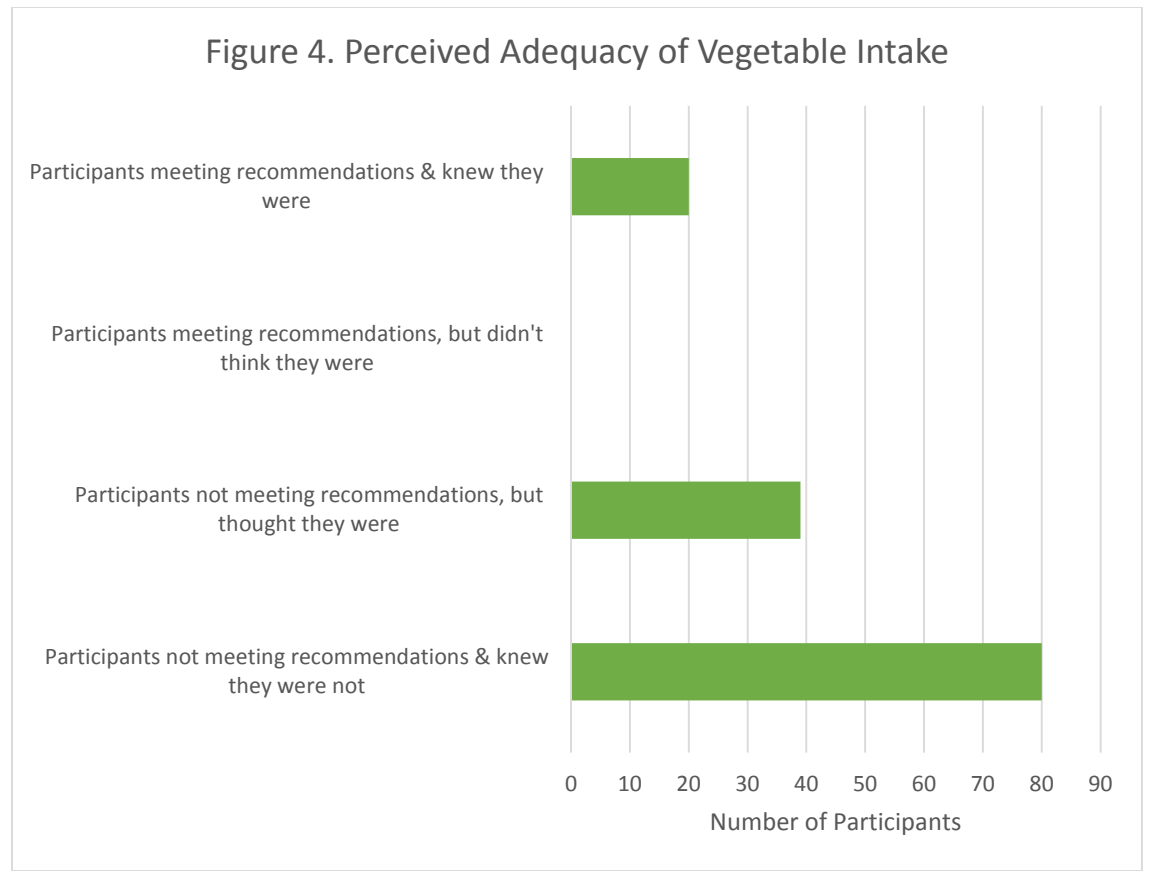
Fruit Intake

Fifty-six participants (40.3%) indicated they were not meeting recommendations for fruit and indicated that knew they were not (Figure 3). Thirty-six participants (26.5%) indicated they were not meeting recommendations, but thought they were meeting the recommendation for fruit intake. XX (%) participants were meeting recommendations for fruit intake, but of these only XX (%) knew they were.



Vegetable Intake

Eighty participants (57.5%) were not meeting recommendations for vegetables and knew they were not, while 39 participants (28%) indicated they were not meeting recommendations, but thought they were. XX (%) participants indicated that they were meeting the recommendations for vegetables, and of these, XX indicated they knew they were (Figure 4).



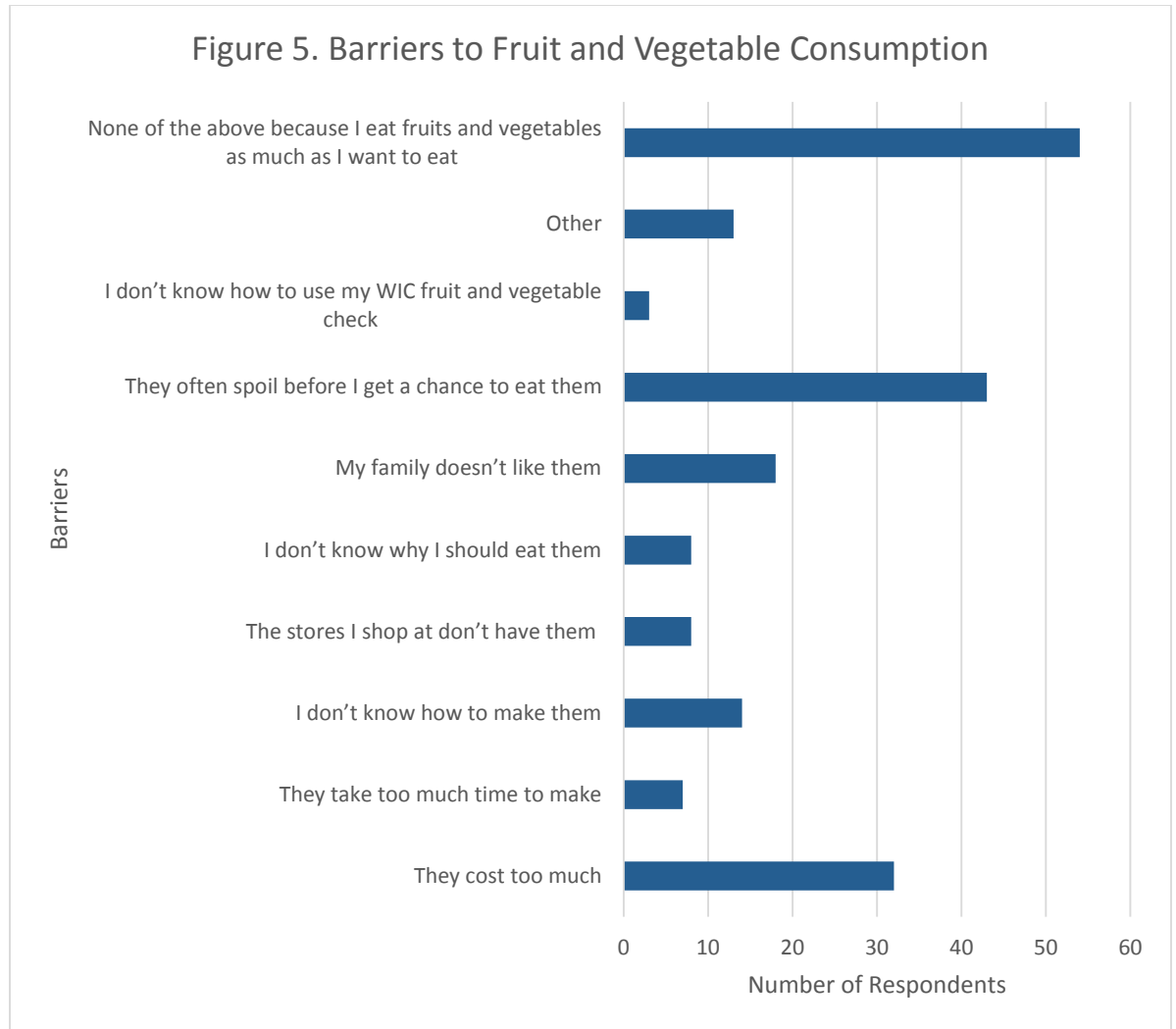
Fruit and Vegetable Intake

Sixteen participants (11.5%) were meeting daily recommendations for both fruits and vegetables and all indicated they knew they were consuming the recommended amount. Out of the 16 people meeting recommendations for both fruits and vegetables, five listed barriers for not eating more?.

Barriers to Consumption

Eighty five participants (61.2%) listed at least one barrier for not consuming as many fruits and vegetables as they wanted to. Forty three participants (30.9%) reported they often spoil before I get a chance to eat them, 32 participants (23%) reported they cost too much, 18 participants (12.9%) reported my family doesn't like them, 14 participants (10%) reported I don't know how to make them, 13 participants (9.4%) reported "other" barriers, 8 participants (5.8%) reported the stores I shop at don't have them, 8 participants (5.8%) reported I don't know why I should eat them, 7 participants (5%) reported they take too much time to make, and 3 participants (2.2%) reported I don't know how to use my WIC fruit and vegetable check (Figure 5).

The responses the participants reported as "other" include, dislike of the taste of fruits and vegetables (n = 4, 2.9%), 2 participants (1.4%) poor appetite, 1 participant (0.7%) allergies to fruit, 2 participants (1.4%) unsure how much to eat, 3 participants (2.2%) family members eat them before they have a chance, and 1 participant (0.7%) take vitamins instead. 54 participants (38.8%) reported no barriers because they were able to eat fruits and vegetables as much as they wanted to.



CHAPTER 5: DISCUSSION

Results from this study revealed that a large percentage of WIC participants at three clinics in Wisconsin are not meeting recommendations for fruit and vegetable intake. National CDC surveys indicate that 67% of adults are not meeting recommendations for fruit and 73% are not meeting recommendations for vegetables (Produce for Better Health, 2014). Data from national surveys is consistent with findings in the present study of 66.2% of participants not meeting recommendations for fruit and 85.6% not meeting recommendations for vegetables. The percentage of participants not meeting vegetable recommendations was higher in the present study than found in national studies. Additionally, over 25% of participants indicated they thought they were meeting recommendations, but actually were not.

The top three most common barriers to fruit and vegetable consumption found in this study included spoilage, cost, and dislike. Previous research addressing barriers to intake found lack of time, inaccessibility, and high cost as the largest barriers. High cost was the second most common barrier in the present study with 32 participants (23%) reporting that they cost too much. Lack of time and inaccessibility were not as common answers in this study with 7 participants (5%) reporting produce taking too much time to prepare and 8 participants (5.8%) reporting the stores they shop at not stocking them.

The Ammerman et al. (2008) study found high spoilage rate commonly mentioned as a barrier, similar to the current study.. The study by John and Ziebland found that 35 of 40 participants reported the barriers to fruit and vegetable intake being household preferences, lack of time, high cost and lack of access. Household preference was the third most common barrier in the current study.

Pollard et al., 2009, found the largest barrier as perceived adequacy of current intake. One-third of participants reported eating enough fruit already and two-thirds of participants reported already eating enough vegetables, which was the main reason for not increasing intake. This finding is similar to the current study based on the high percentage of participants indicating they thought they were meeting daily fruit and vegetable intake recommendations, but actually were not. Twenty seven percent of participants reported not meeting recommendations for fruit intake and they thought they were consuming recommended amounts, and 28% of participants reported not meeting recommendations for vegetable intake but thought they were. A knowledge deficit about adequate intake may exist and if people falsely believe they are consuming enough fruits and vegetables, it is more likely that they would not attempt to increase their intake or report they are having any problems with consumption.

Interventions to increase fruit and vegetable intake have focused on improving access to fruits and vegetables. This has been done through promotion and incentives with farmer's markets to purchase fruits and vegetables, through public health messages, and community supported agriculture. However, access to fruits and vegetables was not a major limitation found in this study with only 8 participants (5.8%) reporting that the stores they shop at not having them. Since this study was among WIC participants, who receive a monthly check for fruits and vegetables, the barrier of access was not seen in this study. The WIC program alone is able to help with the barrier of access to fruits and vegetables through the monthly check.

There are some limitations to this study. The first limitation includes that the assessment of fruit and vegetable intake was self-reported. Self-reported intake allows

for higher potential for error due to the unreliability of memory along with the influence of social desirability. Another limitation is that this study was conducted among a specific population of three WIC clinics in Milwaukee, WI, so data is not representative of the entire National WIC population. The sample size of 139 participants was larger than anticipated, though, and is considered a strength of this study.

Recommendations for WIC to overcome identified barriers

Fruits and vegetables spoiling before having the chance to eat them was identified as the most common barrier causing inadequate consumption. To help overcome this barrier the WIC nutritionist could create educational materials, such as a handout or display board highlighting ways to decrease spoilage. Suggestions could include buying canned and frozen fruits and vegetables without added sugar or salt. Recipes and tips for using frozen fruits and vegetables could be available to help ensure they are consumed. Preserving techniques could also be discussed such freezing and canning fresh fruits and vegetables before they spoil. An additional way to reduce spoilage is to educate participants about pre-slicing and preparing fresh fruits and vegetables to ensure they are available as a quick snack.

The second most commonly identified barrier to consuming fruits and vegetables was high cost. A cost comparison showing the cost of common snacks foods, potato chips and cookies, and comparing them to the cost of a bag of baby carrots or a bunch of bananas may be a visual to show the true cost of these items and that fresh fruits and vegetables don't have to be expensive. Counseling participants to buy produce in season, buying produce that is on sale, and choosing less expensive options of produce

are examples of decreasing costs. Planning shopping trips and utilizing lists and coupons can help consumers stay within a pre-planned budget and decrease food costs. Utilizing farmer's markets to buy local, in season produce is generally less expensive than grocery stores and preserving produce from the summer months to utilize in winter is another example of decreasing costs.

Other family members not eating fruits and vegetables was identified as the third most common barrier for inadequate consumption. Sharing family friendly recipes with new ways of serving fruits and vegetables may help make them more desirable to children. Also discussing child friendly preparation techniques where all family members can get involved in cooking may help increase consumption among all family members. Involving children in home gardens may be a fun way for increasing acceptance of fruits and vegetables, along with decreasing costs. All these ideas can be shared with WIC participants during their visit, along with copies of recipes to share.

Education about recommended intakes of fruits and vegetables is needed based on the large percentage of participants indicating they believed they were meeting recommended intakes, but were not. Assessment of current intake is generally a part of the counseling session and further discussion about recommendations and why adequate intake is important may be beneficial. If participants know how much is recommended along with why, this should help motivate them to increase their intake. As the discussion progresses, the nutritionist can determine what information appears to be most beneficial to help the participant increase intake. Even asking, what do you think would be most helpful for you to include more fruits and vegetables into your diet, could offer much insight to see how the participant feels about increasing their consumption. The

most commonly identified barriers are a good start to focus education and handouts to increase consumption, however challenges are very individualized and determining each individual's challenge will be most beneficial and focusing interventions accordingly.

Recommendations for further research

This research project targeted a specific population of three WIC clinics in Milwaukee, Wisconsin. A recommendation for further research is to conduct a similar study utilizing subjects from the general population to see if the same barriers are identified. It would be especially interesting to see if the barrier of access was also seen in the general population over the WIC population. Another idea for future research is to re-survey the same population after new interventions have been implemented to show whether the new interventions were successful at decreasing barriers and increasing intake.

Conclusion

A large percentage of WIC participants are not meeting recommendations for fruit and vegetable consumption. Numerous barriers to achieving adequate intakes were identified. There is a knowledge deficit about the daily recommendations for consumption among these participants. The data collected about the challenges individuals face to include fruit and vegetables in their diet provides insight for implementing more effective interventions to increase fruit and vegetable intake among

WIC participants. Further research utilizing a variety of participants, in addition to the WIC population, would allow the results to be more representative of the entire population.

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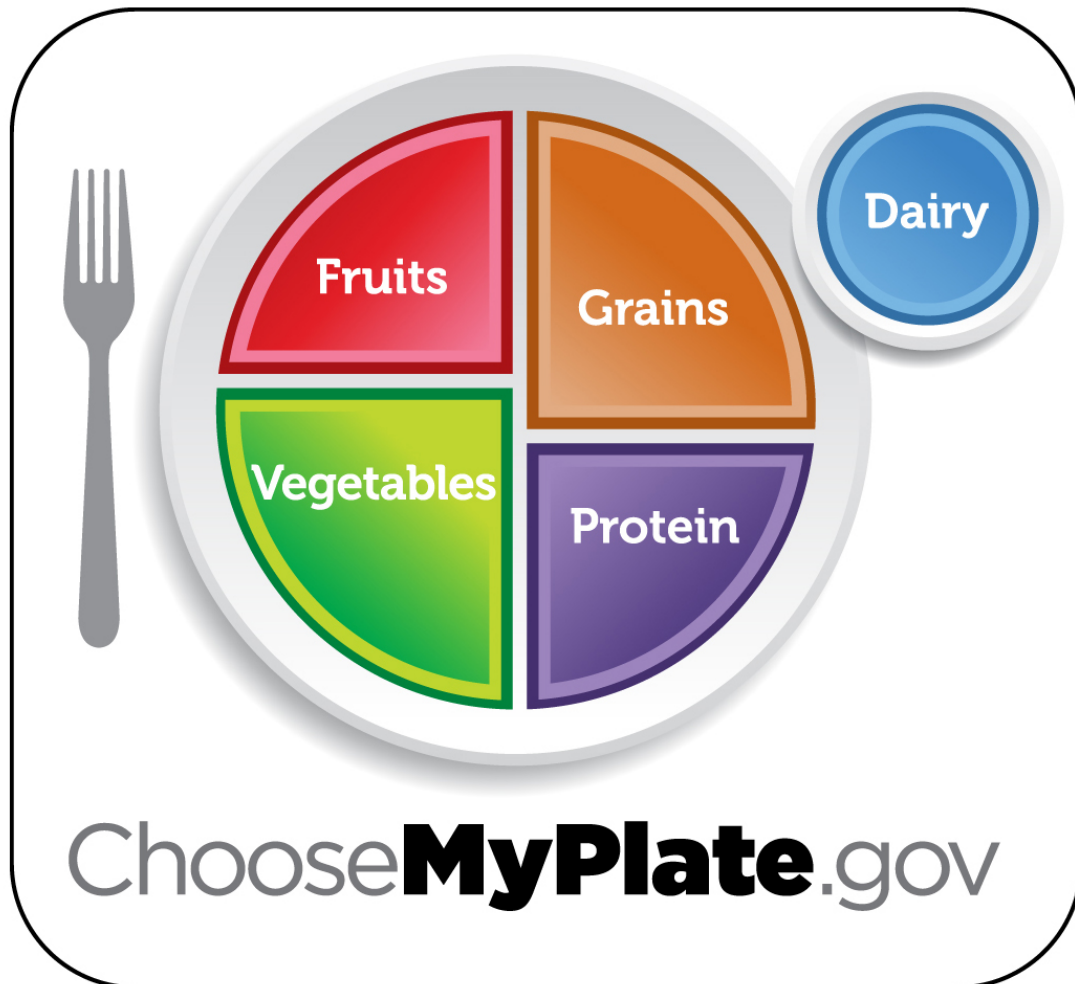
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APPENDIX A:
MyPlate Icon



APPENDIX B: Survey

1. Fruit: How much do you eat each day? Please choose one answer.



2. Vegetables: How much do you eat each day? Please choose one answer.



I don't see these pick boxes under the fruit

3. Do you think you eat the daily recommended amount of fruit?

YES NO

4. Do you think you eat the daily recommended amount of vegetables?

YES NO

For question 5, please circle UP TO THREE REASONS:

5. I don't eat fruits and vegetables as much as I want to because...

- a. They cost too much
- b. They take too much time to make
- c. I don't know how to make them
- d. The stores I shop at don't have them
- e. I don't know why I should eat them
- f. My family doesn't like them
- g. They often spoil before I get a chance to eat them
- h. I don't know how to use my WIC fruit and vegetable check
- i. Other: please list _____
- j. None of the above because I eat fruits and vegetables as much as I want to eat

APPENDIX C:

Consent form

Wee Care WIC



3882 N. Teutonia Ave.
Milwaukee, WI 53206
414-449-8460

5825 W. Capitol Dr.
Milwaukee, WI 53216
414-449-8470

4630 W. North Ave.
Milwaukee, WI 53208
414-873-8801

Consent to Participate in Fruit and Vegetable Intake Research Survey

The goal of this survey is to find out current fruit and vegetable intake and thoughts and feelings toward eating fruits and vegetables. Participation in this survey is completely voluntary and you may withdraw from participation at any time. Participating or declining the survey will not change WIC benefits in any way. Taking the survey will take on average no more than five minutes and will require no additional follow up. Information will be anonymous and will be kept confidential.

Findings from this survey will be used to develop new nutrition education to increase fruit and vegetable intake among WIC participants. Nutrition education can be created to help overcome the reasons for not consuming fruit and vegetables as found in the survey. There is no direct benefit of participating in this survey, although participation may indirectly improve the health of participating women, infants and children by providing information that will direct the development of more effective nutrition education.

Thank you for your participation!

Any questions or concerns please contact Beth Teunissen at 414-449-8470 or Megan Baumler, Mount Mary University, 414-443-3659.

