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Comparison of Nutrition Education Approaches on Fruit and Vegetable Intake in Older  
Adults

by

Noelle R. Blasch, RDN

Thesis

Submitted to the College of Health and Human Services

Eastern Michigan University

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

in

Human Nutrition

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## Abstract

Most Americans do not consume recommended intakes of fruits and vegetables (F/Vs). Hands-on nutrition education applies social cognitive theory as participants practice preparing F/Vs. This study compared a four-week hands-on nutrition education program (L+HO) with lecture only (L) in older adults with assessments at baseline and weeks four and eight. Twenty-three women over the age of 50 participated in either four, 90-minute weekly L+HO classes ( $n = 14$ ) or four, 40-minute weekly L nutrition education classes ( $n = 9$ ). Vegetable intake significantly increased at four weeks compared to baseline for both intervention groups. Vegetable intake increased at eight weeks compared to baseline but was only significant for the L group. Fruit intake increased for both intervention groups with significance observed only when the groups were combined for the overall impact of nutrition education. Results did not support a greater increase in F/V intake in the L+HO group for various possible reasons.



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## **Chapter 1: Introduction**

### **Overview**

Nutrition education exists in several forms both formal and informal and for varied amounts of time such as one hour or several hours on different days. Determining the optimal style of presentation and length of time to produce positive behavior change would be beneficial. Better understanding the ideal presentation style and length of time would help with the design of nutrition education programs so that they may produce desirable results, such as increasing fruit and vegetable (F/V) consumption. Health benefits can be realized for individuals who increase their F/V intake, which is why it is included in the Centers for Disease Control and Prevention (CDC, 2018) Healthy People 2020 goals.

Increasing F/V intake aligns with the Health People 2020 goals, specifically Nutrition and Weight Status (NWS)-14, increase the contribution of fruits to the diets of the population aged 2 years and older, and NWS-15, increase the variety and contribution of vegetables to the diets of the population aged 2 years and older (Office of Disease Prevention and Health Promotion [ODPHP], 2020). NWS-14 reports a 0.53 cup equivalent of fruits per 1,000 calories as the mean daily intake for the target population from 2005 to 2008. The goal by 2020 was to increase this to 0.93 cup equivalent per 1,000 calories. NWS-15 is split into two specific goals: NWS-15.1, increase the contribution of total vegetables to the diets of the population aged 2 years and older, and NWS-15.2, increase the contribution of dark green vegetables, red and orange vegetables, and beans and peas to the diets of the population aged 2 years and older. NWS-15.1 reports a 0.76 cup equivalent of total vegetables per 1,000 calories as the mean intake for the target population from 2005 to 2008; the goal by 2020 was 1.16 cup equivalent per 1,000 calories. NWS-15.2 reports a 0.29 cup equivalent of dark green

vegetables, red and orange vegetables, and beans and peas per 1,000 calories as the mean daily intake for the target population from 2005 to 2008; the goal by 2020 was 0.53 cup equivalent per 1,000 calories. These goals help support efforts for increasing F/V consumption.

Adequate F/V consumption has health protective benefits. These potential benefits include a reduced risk for cardiovascular disease (Soliman, 2019), cancer, and all-cause mortality (Nicklett & Kadell, 2013). F/Vs are nutrient dense and contain several essential nutrients with specific health benefits (Nicklett & Kadell, 2013). For example, some of the most consumed F/Vs, bananas and potatoes, are rich sources of potassium. Potassium potentially may lower the risk of hypertension, coronary heart disease, heart failure, and end stage renal disease (Stone et al., 2016). In certain cases, potassium has been shown to influence glucose control, limiting the risk of diabetes, and has potential benefits for the skeleton and kidneys (Stone et al., 2016). The adequate intake of potassium for males and females aged 51+ is 4,700 mg daily (US Department of Agriculture, Department of Health and Human Services [USDA, DHHS], 2015). Fruits and vegetables are also rich sources of dietary fiber.

Dietary fiber is a complex group of carbohydrates and can be split into two categories of soluble and insoluble fiber. These fibers are not broken down by digestive enzymes and transit through the digestive system, reaching the colon intact (Padayachee et al., 2017; Soliman, 2019). Soluble fiber may be digested by the colonic bacteria and broken down to short-chain fatty acids (Soliman, 2019). Soluble fiber includes pectin, gums, mucilage extracted from psyllium husk,  $\beta$ -glucan, and fructans, as well as some hemicellulose (Soliman, 2019). Insoluble fiber includes cellulose, some hemicellulose, and lignin, which

pass through the digestive system intact and help with bowel regularity (Padayachee et al., 2017; Soliman, 2019). Both types of fiber are found in F/Vs, and a high intake of fiber from F/Vs may improve bowel health. Insoluble fiber helps with gut motility and soluble fiber aids the health of gut microbial populations (Padayachee et al., 2017). Fiber may also aid in weight management and lower blood cholesterol and glycemic and insulin responses (Padayachee et al., 2017; Soliman, 2019). Fiber is found in plant cell walls and is one of the reasons F/Vs are an integral part of a healthy eating pattern. The dietary guidelines recommend that males aged 51+ consume 28 g of fiber daily, based on 2,000 calories per day, and for females aged 51+ 22.4 g daily, based on 1,600 calories per day (USDA, DHHS, 2015).

Additionally, F/Vs contain many other nutrients (e.g., vitamins, minerals, polyphenols, flavonoids, antioxidants) that can build and maintain health (Padayachee et al., 2017). Table 1 lists the fiber, nutrient, and calorie content of common F/Vs along with common snack food items (Healthline, 2020; Nutritionix, 2020; Padayachee et al., 2017). Simply eating F/Vs in place of other high-calorie foods can lower calorie intake, as F/Vs tend to contain fewer calories, and significantly increase vital nutrient intake. (US Department of Agriculture [USDA], 2015).



**Table 1***Nutrient Content of Common Food Items*

Nutrient content of common food items											
	Per 100 grams (g)					Present in food item					
	Calories	Total dietary fiber (g)	Soluble fiber (g)	Insoluble fiber (g)	Sodium (mg)	Potassium (mg)	Vitamin A	Vitamin C	Vitamin E	Vitamin K	Anti-oxidants
Cucumber	15	0.6	0.1	0.5	2	147	x	x		x	
Celery	18	1.6	0.1	1.5	91	321	x	x		x	x
Lettuce (iceberg, romaine, spinach)	14 to 23	1 to 2			10 to 70	232 to 420	x	x	some types	x	
Onion	40	0.9	0.4	0.5	2.8	156		x			
Tomato	18	1.2	0.1	1.1	5	220	x	x		x	x
Apple	52	2.4	0.7	1.7	1	98	x	x			x
Strawberry	49	2	0.5	1.5	1	138	x	x		x	x
Lentils	115	8			2	365	x		x	x	
Potato chips, 28g	149	0.9			148	335		x			
Chocolate chip cookie, 3" diameter (30g)	148	0.6			93	70					
Ritz Crackers, 9 (29.7g)	144	0.7			261	35.1					

Information compiled from: Healthline. (2020, February). *Healthline: Medical information and health advice you can trust*. <https://www.healthline.com/>; Nutritionix. (2020). *Nutritionix—Largest verified nutrition database*. Nutritionix. <https://www.nutritionix.com/>; Padayachee, A., Day, L., Howell, K., & Gidley, M. J. (2017). Complexity and health functionality of plant cell wall fibers from fruits and vegetables. *Critical Reviews in Food Science and Nutrition*, 57(1), 59–81. <https://doi.org/10.1080/10408398.2013.850652>.

The USDA and DHHS make dietary recommendations to the public every five years. The *2015-2020 Dietary Guidelines for Americans* recommends that adults 51 to 76+ follow a 1,600 to 2,000 calorie diet, with this range accommodating for activity level (USDA, DHHS, 2015). Those who are less active should consume closer to 1,600 calories per day and those who are more active should consume closer to 2,000 calories per day. Within this daily calorie range, individuals should consume 2 to 2.5 cups or equivalent (c-eq) of vegetables and 1.5 to 2 cups or equivalent (c-eq) of fruit per day; see Table 2 (USDA, DHHS, 2015). Cups and ounces can vary depending on the water content of a F/V, and some are airier than others. The c-eq identify amounts of F/Vs with similar nutrient compositions; see Table 3

(USDA, DHHS, 2015). Combining these, the recommendation is 3.5 to 4.5 c-eq of F/Vs daily for those aged 51 and older. Most people do not consume this amount of F/V daily.

**Table 2**

*Recommended F/V Intake for Ages 51 to 76+*

<b>Recommended f/v intake for ages 51 to 76+</b>			
	<b>Sedentary</b>	<b>Moderately Active</b>	<b>Active</b>
<b>Calories per day</b>	<b>1,600</b>	<b>1,800</b>	<b>2,000</b>
<b>Vegetables (c-eq/day)</b>	<b>2</b>	<b>2.5</b>	<b>2.5</b>
dark green (c-eq/week)	1.5	1.5	1.5
red and orange (c-eq/week)	4	5.5	5.5
legumes, beans, peas (c-eq/week)	1	1.5	1.5
starchy vegetables (c-eq/week)	4	5	5
other vegetables (c-eq/week)	3.5	4	4
<b>Fruit (c-eq/day)</b>	<b>1.5</b>	<b>1.5</b>	<b>2</b>

Adapted from USDA, HHS. (2015). *2015-2020 Dietary guidelines for Americans*. [https://www.dietaryguidelines.gov/sites/default/files/2019-05/2015-2020\\_Dietary\\_Guidelines.pdf](https://www.dietaryguidelines.gov/sites/default/files/2019-05/2015-2020_Dietary_Guidelines.pdf)

**Table 3**

*Cup and Ounce Equivalents*

<b>Cup and Ounce Equivalents</b>			
<b>Vegetables</b>	0.5 cup portion of green beans = 0.5 cup equivalent vegetables	1 cup portion raw spinach = 0.5 cup equivalent vegetables	
<b>Fruit</b>	0.5 cup portion of strawberries = 0.5 cup equivalent fruit	0.75 cup portion 100% orange juice = 0.75 cup equivalent fruit	0.25 cup portion raisins = 0.5 cup equivalent fruit

Adapted from USDA, HHS. (2015). *2015-2020 Dietary guidelines for Americans*. [https://www.dietaryguidelines.gov/sites/default/files/2019-05/2015-2020\\_Dietary\\_Guidelines.pdf](https://www.dietaryguidelines.gov/sites/default/files/2019-05/2015-2020_Dietary_Guidelines.pdf)

According to the *2017 Michigan Behavioral Risk Factor Report*, 41% of Michigan adults do not consume fruit daily, and 25.7% do not consume vegetables daily (Michigan Department of Health and Human Services [MIDHHS], 2019). Table 4 illustrates the percentage of older adults in Michigan who consume at least one F/V per day. Of adults aged 55 to 64, 59.7% report consuming at least one serving of fruit per day, as did 61.9% of those 65 to 74 years old and 68.1% of those aged 75+. Notably, 76.5% of adults aged 55 to 64 consumed at least one vegetable per day, as did 77.8% of those 65 to 74 years old and 73.2% of those aged 75 and older (MIDHHS, 2019). These percentages reflect consuming at least one F/V per day, and the target is 3.5 to 4.5 c-eq of F/Vs daily. National data from 2015 show that an average of 12.5% (10.4-14.5%; 95% CI) of adults aged 51 and older report consuming the recommended daily serving of fruit and 9.7% (7.2-12.2%; 95% CI) report consuming the recommended daily serving of vegetables (Lee-Kwan et al., 2017). Like the Michigan data, the national data reflects consumption that deviates from what is recommended. Implementing a nutrition education program to increase F/V consumption, both in Michigan and nationally, may reduce the risk of disease and improve overall health by increasing the intake of vitamins, minerals, fiber, and many other nutrients.

**Table 4***Michigan Adult F/V Intake at Least One Per Day, 2017*

<b>Age</b>	<b>Fruit, at least one per day</b>	<b>Vegetable, at least one per day</b>
55 - 64	59.7%	76.5%
65 - 74	61.9%	77.8%
75+	68.1%	73.2%
Female Only 18 – 75+	62.2%	77.2%

Adapted from MIDHHS. (2019). Health risk behaviors within the state of Michigan—2017 behavioral risk factor survey.  
[https://www.michigan.gov/documents/mdhhs/2017\\_MiBRFS\\_Annual\\_Report\\_Final\\_667126\\_7.pdf](https://www.michigan.gov/documents/mdhhs/2017_MiBRFS_Annual_Report_Final_667126_7.pdf)

Older adults are a particularly vulnerable population; as their overall oral energy requirements decrease, it is important to ensure adequate nutrients are consumed to support health (Bernstein & Munoz, 2016). Reduced organ function, which may begin at age 30 to 40, challenges the body's homeostasis. Nutrient absorption can decrease with reduced organ function, which increases the need for nutrient dense foods (Bernstein & Munoz, 2016). More of the required nutrients need to be made available for the body to absorb recommended amounts due to reduced organ function. A nutrient dense food is high in vitamins, minerals, and potentially many other important nutrients in relation to its caloric content (Brown et al., 2014). A recent meta-analysis indicates that F/V intake at five servings per day is strongly associated with a reduced risk for cardiovascular disease, stroke, and overall mortality and is modestly associated with a reduced cancer rate (Aune et al., 2017). Further, consuming 10 servings of F/Vs daily has an even stronger association with a reduced

risk of all-cause mortality (Aune et al., 2017). Similarly, Nicklett and Kadell (2013) found F/V consumption in older adults to be associated with a reduced probability of chronic disease (e.g., hypertension, coronary heart disease, atherosclerosis, stroke, cancer).

There is a disconnect between recommended intakes of F/Vs and actual intake. The statistics mentioned above show the recommended intakes of F/Vs are not being met despite the science-based research indicating that with proper F/V intake chronic disease rates could be lowered. The studies illustrate the link between F/V intake and the presence and progression of disease. As adults age, they need fewer calories and more vital nutrients, which can be accomplished through consumption of nutrient dense foods, such as F/Vs. Understanding how to help individuals recognize this connection and the benefits offered from F/Vs is key. Nutrition education is often used to bridge this gap. Determining the best method or style of nutrition education that will produce the desired behavior change is needed.

### **Nutrition Education Techniques**

Nutrition education exists in several forms. Individuals can find informal education on the internet, through social media, or from friends and family. Formal nutrition education includes lecture-style (with and without visual backup), hands-on learning, or a combination of lecture-style and hands-on. Both informal and formal education may or may not include handouts. Additionally, duration times can vary from 30 minutes on one day to multiple hours on multiple days. Hands-on nutrition education can be used for a class that meets once or on multiple days. Hands-on nutrition education is active learning, such as taking part in a cooking class, food tasting, gardening, or grocery store tour (Hoffinger, 2017). This type of learning engages multiple senses (touch, taste, smell as well as vision), muscle memory, and

can empower individuals to make behavior changes (Hoffinger, 2017). Determining the optimal style of presentation and length of time to produce the behavior change of increasing F/V consumption would be beneficial.

## **Literature Review**

### **Lecture-Style Nutrition Education**

One way that healthcare practitioners promote healthy behaviors, such as F/V intake, is through education. Lecture-style nutrition education is one way to convey information, either a one-time class or a class that meets regularly for a specified period of time. Lecture-style nutrition education classes held weekly for several weeks have been shown to significantly increase F/V consumption (Hendrix et al., 2008; Turk et al., 2016; Wagner et al., 2016). These studies had weekly meetings from 10 to 16 weeks with an average length of 12.6 weeks. The weekly sessions met for 30 to 60 minutes, averaging 42.5 minutes. The average age of study participants ranged from 32 to 74 years old. Specifically, the Wagner et al. (2016) study had the largest range of ages with a mean age of  $44.7 \pm 12.1$  (mean  $\pm$  standard deviation). The Turk et al. (2016) study was with adults 50+, and the Hendrix et al. (2008) study was with adults 70+. Information covered in these classes included the antioxidant content of F/Vs and their role in the inflammatory process, recommendations on how to incorporate more F/Vs, along with recipe handouts and menus, and a nutrition lecture including a handout of tips and tasks to complete. All three studies recorded positive results with increases in intake and/or knowledge.

### **Nutrition Education via Video and In-home Visits**

Other techniques include using a digital video disk (DVD) for nutrition education paired with an office visit (Krebs et al., 2017) and nutrition education conducted in homes

(Bernstein et al., 2002). While these are less common ways to educate on healthy nutrition, both were successful. The DVD was a pilot study to assess the feasibility and interest of older adults in this form of intervention. The intervention group increased F/V consumption,  $0.18 \pm 1.11$ , and this increase was mostly fruit, while the control group's F/V consumption declined,  $-0.10$  mean;  $1.14$  SD (Krebs et al., 2017). The home-based nutrition intervention included eight home visits, an education booklet, bi-weekly phone contact, and monthly letters for 6 months. Goal setting, rewards, food log recording, role-playing, games, and troubleshooting were included with the home-visit sessions. Self-reported intake of fruits increased by  $1.1 \pm 0.2$ , from 2.8 servings to 3.9 servings per day, and vegetables increased by  $1.1 \pm 0.2$ , from 2.3 servings to 3.4 servings per day (Bernstein et al., 2002). While both methods were successful, the in-home study was more successful likely due to its hands-on style of nutrition education.

### **Hands-on Nutrition Education**

Another technique that is becoming more popular is hands-on nutrition education (Keller et al., 2004; Monlezun et al., 2015; Peters et al., 2014; Pooler et al., 2017; Torrence et al., 2018). This technique of nutrition education has been shown to produce positive behavior change at post-test (Keller et al., 2004; Monlezun et al., 2015; Torrence et al., 2018), as well as in some studies that have followed-up with another questionnaire to determine maintenance of the behavior change beyond the end of the education sessions (Peters et al., 2014; Pooler et al., 2017). The Peters et al. (2014) main behavioral intervention lasted four months, and a positive change in eating habits was maintained with monthly meetings through eight months post main intervention. The Pooler et al. (2017) study showed that participant changes were sustained six months after the six-week intervention.

In the Keller et al. (2004) hands-on study, the participants were men over 65 years-old ( $n = 19$ ), and the study duration was one 2-hour session once a month for eight months. The sessions were held in a senior center in Guelph, Ontario. A written questionnaire was used at the beginning of the study and at the end. Questions covered cooking experience, attitudes towards cooking and trying new foods as well as cooking confidence and basic demographics. At each session, a registered dietitian described the overall menu, discussed new ingredients, and broke the men into groups of two to three to prepare a part of the meal. The dietitian circulated and educated the small groups on the nutritional value of the food they were preparing. They all came together at the end and enjoyed the meal together. Descriptive analysis of the questionnaires showed that for the variable “how to add more fiber to what I eat,” 84.2% of men identified this variable to have developed through the group-enhanced cooking experience. Additionally, this study showed that the majority gained cooking confidence, increased their cooking activities at home, developed healthy cooking skills, and improved cooking variety.

Goldring Center for Culinary Medicine at Tulane University conducted a randomized controlled trial that featured a hands-on teaching kitchen for individuals with type 2 diabetes mellitus (Monlezun et al., 2015). This study compared the nutrition intervention standard of care for individuals diagnosed with type 2 diabetes mellitus, which is one-time medical nutrition therapy from a registered dietitian and referral to an American Diabetes Association-Certified Diabetes Education Class (control group,  $n = 9$ ), to chef, physician, and medical student-led hands-on Mediterranean diet cooking and nutrition classes (treatment group,  $n = 18$ ). The treatment group attended classes held over one-and-half months, and each class contained 30 minutes of education and 90 minutes of hands-on cooking. Biometric



data (HbA1c, systolic and diastolic blood pressures, total cholesterol, triglycerides, low density lipoproteins, high density lipoproteins, heart rate, body mass index, and hypoglycemic agents and insulin) was collected for both groups at baseline and six months. A validated survey assessing dietary habits, attitudes, and competencies for healthy shopping, meal-preparation, eating, and storage was administered at baseline and one-and-half months for both groups, following medical nutrition therapy (control) or the last class (treatment). Results indicated positive trends for the treatment group compared with control for HbA1c reduction, belief in ability to eat the correct portions, and use of nutrient panels to make food choices. The treatment group made significant reductions in diastolic blood pressure ( $p = 0.037$ ) and total cholesterol ( $p = 0.044$ ). Results and feedback from this study are being used to design phase II, a 12-month intervention. At the time these results were published, this program was believed to use the first medical school teaching kitchen.

Using the social ecological approach and hands-on nutrition education, Torrence et al. (2018) utilized the Faithful Families Cooking and Eating Smart and Moving for Health (FFCESMH) program. This program was based on Cooking Matters (CM) and Faithful Families Eating Smart and Moving More (Torrence et al., 2018). Six weekly lessons lasting 90 minutes each were held in 18 churches and four low-income housing developments in a low access to food county in South Carolina. Lessons included nutrition tips, recipes, cooking demonstrations, cooking practice activities, physical activity tips, and a structured time for participants to be physically active. A mobile farmers market was brought to each site during the lesson time. Participant age ranged from under 18 to over 60 ( $n = 176$ ; female 88.45%; 55.9% over age 60). Data were collected using a pre-test survey and post-test survey. Overall cooking confidence significantly increased from baseline to six-week post-

test having a  $p$  value of  $\leq 0.01$ . Confidence in preparing fresh F/Vs also significantly increased with a  $p \leq 0.01$ . This study was successful in increasing and improving individual healthy behaviors and tackling community concerns in low-income, rural areas.

Peters et al. (2014) was a randomized control trial carried out over one year with the first 14 weeks being the most hands-on and intensive. Group (i) followed a whole food, plant-based, macrobiotic eating style ( $n = 22$ ). The next two groups (ii and iii) followed a Food Power eating plan that was based on the American Heart Association recommendations and the 2005 MyPyramid, which replaced foods higher in saturated fat with lower fat foods. At the end of the study, these two groups were combined for the results: moderate fat without (ii) and with (iii) 10 grams of ground flax seed daily ( $n = 49$ ). This study was based on social cognitive theory, and participants were postmenopausal healthy women aged 50 to 72. Questionnaires and phone interviews were used for data gathering. At the start, 14 weekly sessions alternated between behavioral sessions and cooking classes. During the next two months, behavior sessions were held biweekly and included food demonstrations and tastings. During the last six months, the behavior sessions were held monthly. The whole foods group (i) had a significant increase in servings of beans from 0.77 at baseline to 1.98 at adoption (four months) to 1.77 at maintenance (12 months),  $p$  value  $< 0.05$ . The moderate fat group (ii and iii) had a significant increase in vegetable servings (2.24 at baseline, 2.76 at adoption, and 3.17 at maintenance), fruit servings (1.42 at baseline, 2.30 at adoption, and 2.27 at maintenance), and including total F/V servings (3.66 at baseline, 5.06 at adoption, and 5.44 at maintenance), all had a  $p$  value  $< 0.05$ . The results of this hands-on study indicate that significant dietary changes were made during the first four months and were maintained for the next eight months.

Pooler et al. (2017) studied CM classes and food resource management (FRM) skills through hands-on experiences. CM is a nutrition education program based on social cognitive theory, which includes demonstrations and hands-on activities for low-income individuals. The program includes nutrition knowledge, food preparation skills, and FRM skills that teach how to shop for and prepare foods on a budget. Classes were held once a week, for two hours, over six weeks and focused on how to shop for and prepare healthy meals on a budget utilizing hands-on meal preparation, discussions, and a grocery store tour. CM class attendees were given the option to participate in the study in the following states: California, Colorado, Maine, Massachusetts, Michigan, and Oregon. Intervention participants of the study were a mean age 50.6 +/-16.4 and considered low income ( $n = 332$ ; female 90.1%). A comparison group made up of individuals recruited from the same or similar zip codes as study participants from Supplemental Nutrition Assistance Programs; Women, Infants, and Children clinics; community centers; and YMCAs were included ( $n = 336$ ; female 79.8%). A survey was used at the first class (intervention group) or first encounter (comparison group), at three months, and at six months. Changes in three outcome measures; FRM practices scale, FRM confidence scale, and worry that food might run out, were significant at three months and six months. The treatment effect for all three outcomes at three months had a  $p$  value of  $< 0.001$ . At six months, the treatment effect for FRM practices scale had a  $p = 0.002$ , FRM confidence scale had a  $p < 0.001$ , and worry that food might run out had a  $p = 0.020$ . The study indicated a positive impact of including FRM skills and confidence building in nutrition education. At six months post class completion, the improvements continued to be reported.

**Inference**

The health benefits of F/V consumption have been linked with better health outcomes and better quality of life due to the positive relationship between F/V intake and prevention and management of chronic illnesses, disease-specific mortality, and general mortality (Nicklett & Kadell, 2013). According to the DHHS, the average life expectancy of someone born in 2017 is 78.6 years (as cited in Arias & Xu, 2019). In North America, 13% of the population is 65 or older (2014 data), and that is expected to increase to 19% by 2030 (Brown et al., 2014). Determining an effective way to deliver nutrition education that will lead to increased F/V consumption in older adults can lead to better health outcomes.

The literature review supports positive outcomes in healthy behaviors through nutrition education. Various styles of nutrition education were reviewed and included with different study designs. The lecture only studies had an average length of 12.6 class meetings, and the hands-on studies tended to be shorter with an average of 7.3 class meetings. Having fewer meeting times can be more practical and desirable for individuals. In addition, the hands-on learning reported significant health outcomes. Understanding the ideal number of hands-on class meetings that will result in positive health outcomes in the shortest amount of time would be beneficial.

**Theoretical Framework**

The current study was based on social cognitive theory (SCT), also known as social learning theory. This theory is mainly based on “reciprocal determinism,” the interaction between the person, their behavior, and the environment (LaMorte, 2019; Nnakwe, 2018). The theory is belief based and focuses on how events are connected, the consequence of one’s actions (outcome expectation), and one’s competence in their behavior to perform and

influence the outcome (efficacy expectation). Incentive or reinforcement is also used with individuals to support outcomes (LaMorte, 2019; Nnakwe, 2018). A systemic review including 18 studies found that SCT-based interventions with cancer survivors had the potential to produce positive behavior changes (Stacey et al., 2015). The review focused on physical activity and diet quality. Eight studies included diet quality, and six of those eight showed significant improvements (Stacey et al., 2015). Both the Krebs et al. (2017) and Peters et al. (2014) studies used SCT, and a positive change in behavior led to an increase in fruit consumption (Krebs et al., 2017) and eating habits (Peters et al., 2014). The CM program, based on the SCT, was the main method of the Pooler et al. (2017) study, and the Torrence et al. (2018) study used a program partially based on CM. Additionally, the Torrence et al. (2018) study was based on the social ecological model, which aligns with SCT (LaMorte, 2019). The Torrence study increased and improved individual healthy behaviors. The basis of SCT was used when designing the current study, and the studies from the literature review support the potential for positive outcomes when using this theory with hands-on learning.

### **Purpose and Objective**

The current research aims to increase F/V consumption in older adults. Specifically, it aims to determine if four, 90 minute sessions of F/V nutrition education and hands-on food preparation experiences will increase F/V consumption more than four, 40 minute sessions of F/V nutrition education only.

### **Justification and Significance**

This research is significant to the field of dietetics as it may reveal a successful method for increasing F/V consumption in older adults. As adults age, food consumption

typically decreases (Nicklett & Kadell, 2013), which makes it even more important to ensure that the foods being consumed are as nutrient dense as possible, and this includes F/Vs.

Teaching older adults how to prepare F/Vs can lead to increased intake. In addition, research has shown the benefits of F/V consumption and the overall health protective benefits offered (Nicklett & Kadell, 2013; Padayachee et al., 2017). The current study aims to determine if a four-week hands-on intervention has lasting behavior change compared with a lecture-only intervention at four weeks (end of classes) and at one month after the final class. This would be beneficial and significant as a shorter intervention can be more feasible than a longer intervention; as mentioned earlier, lecture-only studies included in the literature review had an average length of 12.6 class meetings, and the hands-on studies tended to be shorter with an average of 7.3 class meetings.

### **Study Question and Hypotheses**

Does a four week hands-on nutrition intervention increase fruit and vegetable intake more than a four week lecture-style nutrition intervention in older adults?

H<sub>0</sub>: There is no significant difference between study groups for an increase in fruit intake.

H<sub>0</sub>: There is no significant difference between study groups for an increase in vegetable intake.

## **Chapter 2: Methods**

This was a quantitative experimental study with an intervention group (lecture +hands-on) and comparison group (lecture-only). Institutional review board approval was obtained from Eastern Michigan University, Human Subjects Review Committee (Appendix A). The primary investigator (PI), a registered dietitian nutritionist, created all class material and instructed all classes. The lecture +hands-on (L+HO) group received F/V nutrition information and experienced hands-on food preparation and sampling during four, 90 minute sessions, once a week for four weeks. The lecture-only (L) group received the same nutrition information during four, 40 minute sessions, once a week for four weeks.

### **Social Cognitive Theory**

SCT was used in the study design for the L+HO classes. Reciprocal determinism, interaction between the individual, their behavior, and environment was followed (LaMorte, 2019; Nnakwe, 2018). For example, individuals attended class where nutrition education was presented, and F/V preparation behaviors were practiced in an environment with their peers. Expectations were addressed by providing education surrounding the health benefits of increased F/V consumption. Self-efficacy was built through hands-on practice with preparing F/Vs in class as well as at home. The study design promoted peer-to-peer and instructor-to-peer learning through observation of preparation methods. Reinforcement is another important aspect of SCT. To promote reinforcement, F/Vs were sampled during class and encouragement was provided to practice skills at home.

## Participants

### Recruitment

Adults aged 50 years and older were recruited from Livonia, Michigan, and the surrounding communities. Recruitment methods included an advertisement in a print and online Livonia-based magazine (*L Magazine*), and flyers were posted and hand delivered to the target population during August and September 2019. The print advertisement in the *L Magazine* was mailed to all Livonia residents and was available at the town's recreation center. Flyers were posted and available at the Senior Center in Livonia and attached to their monthly (August) e-bulletin. Additionally, flyers were dispersed during 20 senior exercise classes at the recreation center at the end of August and beginning of September 2019. Samples of recruitment efforts can be found in Appendix B.

Recruitment efforts included a phone number for interested individuals to call for study screening. Inclusion criteria were adults over the age of 50 residing in Livonia or the surrounding community and fluent in English. Exclusion criteria included the inability to hold or use a knife or other kitchen utensil and those refusing to provide informed consent. The PI established participant eligibility over the phone, through the screening questions found in Appendix C.

### Randomization

Block randomization was used to assign eligible participants to either the L+HO group or the L group. Participant names were listed in an Excel spreadsheet in the order they called to answer the screening questions. To begin, random assignment happened two people at a time for the first 12 people. The first two were assigned to the L group, and the next two were assigned to the L+HO group and so on through the first 12 participants. From there,



participants were randomized into groups generally following that one participant would be placed in the L group and one in the L+HO group. When this pattern could not be followed, due to participant day availability (one of the screening questions), then assignment was based on their availability and maintaining even numbers within both groups as the participant list was systematically worked through. Once the groups were set and the class days identified, participants were called on the telephone and informed of their class day and time.

### **Confidentiality**

Confidentiality was kept by removing individual identifiers and creating two separate computer files, one for identifying information and the other file for data. These computer files were password protected, on a password protected computer, and only linked by a unique study identifier. Hardcopy paperwork was stored in a secure locked location. These files will be kept for a minimum of five years.

### **Informed Consent**

Informed consent was mailed with the pre-test surveys to participants' homes via the United States Postal Service. Participants were instructed to read the informed consent but to wait to sign until their first class. Potential participants willing to take part in the study and prepared to sign the informed consent, were instructed to complete the pre-test at home prior to the first class. The study classes began the week of September 16, 2019, and continued for four consecutive weeks. At the first class, the informed consent was read to the participants and signed by the participants and PI. Participants kept a signed copy, and the PI retained a signed copy in a locked, secure location kept separate from the survey responses (Appendix

D). The completed pre-test survey was collected and stored in a locked, secure location separate from the informed consent.

## **Study Design**

### **General Class Structure**

All classes were held in a room with sinks, countertops, tables, and chairs. The PI was first aid certified; in addition, first aid certified employees were working in the building. Participant privacy was maintained by holding classes in an enclosed room, separate from the main, open areas of the recreation center and only using first names in class. Participants were asked if they had any food allergies. Each week focused on either breakfast, lunch, dinner, or snacks with related nutrition education. A PowerPoint presentation was created for each week; this was presented orally and distributed to all participants in hardcopy with related recipes. All classes began with a brief overview of the prior class with a discussion about F/Vs used at home. At the end of each class, a discussion of other ways to use the target F/Vs took place. Hands-on activities in the L+HO classes used the following common kitchen utensils: fork, knife, spoon, chef's knife, cutting board, measuring cups and spoons, bowl, plate, dish towels, and disinfectant wipes. Use of hands-on tools was explained and supervised.

### **L+HO Class Content-Week 1**

Intervention class one focused on the morning meal. Risk factors for disease in older adults; nutrient needs of older adults; health benefits of including peppers, onions, mushrooms and banana at breakfast; and general food safety were covered. The PowerPoint and recipes (eggs with peppers, onions, mushrooms and toast with peanut butter, banana, cinnamon) can be found in Appendix E. For the hands-on portion, knife skills were reviewed

verbally and using a video (Allrecipes, 2019). The PI washed the F/Vs while participants watched the video and washed their hands. Each participant was given a cutting board and chef's knife to use. The PI demonstrated how to cut each F/V, allowing time between for the participants to cut their F/Vs. Participants cut and placed in a plastic bag the peppers, onions, and mushrooms to use at home with eggs. They cut banana and sampled it on toast with peanut butter and cinnamon.

### **L+HO Class Content-Week 2**

Intervention class two focused on lunchtime. MyPlate and MyPlate for Older Adults 70+; the new nutrition facts label; grocery shopping tips; health benefits of cucumber, tomato, lettuce, and berries; and salad variations were discussed. The PowerPoint and recipes (salad bowl combinations and berry smoothie) can be found in Appendix F. For the hands-on portion, the PI demonstrated how to cut each vegetable, allowing time between for the participants to cut their vegetables. Participants cut cucumber and tomato, then prepared a salad with additional provided items (mixed greens, chickpeas, walnuts, and balsamic vinaigrette dressing) to sample in class. While participants were eating salad, the PI demonstrated how to make a smoothie using frozen mixed berries; the participants sampled the smoothie.

### **L+HO Class Content-Week 3**

Intervention class three focused on suppertime. The importance of water intake; portion sizes; the health benefits of broccoli, legumes, and melon were discussed. Nutritional benefits of these F/Vs were covered as well as including two different vegetables with dinner. The PowerPoint and recipes (broccoli and bean pasta and cucumber melon salsa) can be found in Appendix G. The hands-on portion of the class was spent cutting broccoli and

cantaloupe melon to take home. The PI first demonstrated how to cut the F/Vs, allowing time between for the participants to cut their F/Vs. The PI had already prepared a broccoli, bean, pasta main dish, and cucumber melon salsa for the participants to sample in class.

#### **L+HO Class Content-Week 4**

Intervention class four focused on snacks. The frequency and timing of eating meals and snacks throughout the day; meal planning; and health benefits of celery, carrots, apples, pears, and oranges were discussed. The PowerPoint and snack list can be found in Appendix H. The hands-on portion included cutting celery, carrots, and apple, then sampling them with peanut butter and hummus. The PI first demonstrated how to cut the F/Vs, allowing time between for the participants to cut their F/Vs.

#### **L Classes**

Comparison group classes were 40 minutes each, one class each week, for four classes total. L classes received the same nutrition information that the L+HO classes received, including a hardcopy of the PowerPoint presentations and recipes/snack list. At the beginning of classes two through four, a verbal review of the previous week included a discussion of the participants' experience trying the F/Vs at home. The L group did not experience any hands-on or sampling of the F/Vs. At the end of each class, a discussion of other ways to use the target F/Vs took place (see Table 5 for an overview of class content).

**Table 5**

*Overview of Class Content*

	<b>Length of class</b>	<b>Class 1 - Morning Meal</b>	<b>Class 2 - Lunchtime</b>	<b>Class 3 - Suppertime</b>	<b>Class 4 - Snacks</b>
<b>Intervention Group Class (L+HO)</b>	90 minutes	<p><b>Education:</b> Risk factors for disease and nutrient needs of older adults; Health benefits of peppers, onions, mushrooms, and banana; General food safety</p> <p><b>Recipes:</b> eggs with peppers, onions, and mushrooms and toast with peanut butter, banana, cinnamon</p> <p><b>Video:</b> Knife skills</p> <p><b>Hands-on:</b> Cut peppers, onions, mushrooms, and banana; Taste bananas on toast with peanut butter and cinnamon, take home vegetables to try with eggs</p>	<p><b>Education:</b> MyPlate and MyPlate for Older Adults 70+; New nutrition facts label; Grocery shopping tips; Health benefits of cucumber, tomato, lettuce, and berries</p> <p><b>Recipes:</b> salad bowl combinations and berry smoothie</p> <p><b>Hands-on:</b> Cut cucumber and tomatoes, prepared a salad to sample (provided salad options included mixed greens, chickpeas, walnuts, and balsamic vinaigrette dressing); Smoothie demonstration and tasting</p>	<p><b>Education:</b> Water intake; Portion sizes; Health benefits of broccoli, legumes, and melon</p> <p><b>Recipes:</b> broccoli and bean pasta and cucumber melon salsa</p> <p><b>Hands-on:</b> Cut broccoli, cucumber, and melon to take home; Tasted both pre-prepared recipes in class</p>	<p><b>Education:</b> Frequency and timing of eating; Meal planning and prep; Health benefits of celery, carrots, apple, pear, and oranges</p> <p><b>Recipes:</b> fruit and vegetable snack list</p> <p><b>Hands-on:</b> Cut celery, carrots, and apples; Taste with peanut butter and hummus</p>
<b>Comparison Group Class (L)</b>	40 minutes	<p><b>Education:</b> Risk factors for disease and nutrient needs of older adults; Health benefits of peppers, onions, mushrooms, and banana; General food safety</p> <p><b>Recipes:</b> eggs with peppers, onions, and mushrooms and toast with peanut butter, banana, cinnamon</p>	<p><b>Education:</b> MyPlate and MyPlate for Older Adults 70+; New nutrition facts label; Grocery shopping tips; Health benefits of cucumber, tomato, lettuce, and berries</p> <p><b>Recipes:</b> salad bowl combinations and berry smoothie</p>	<p><b>Education:</b> Water intake; Portion sizes; Health benefits of broccoli, legumes, and melon</p> <p><b>Recipes:</b> broccoli and bean pasta and cucumber melon salsa</p>	<p><b>Education:</b> Frequency and timing of eating; Meal planning and prep; Health benefits of celery, carrots, apple, pear, and oranges</p> <p><b>Recipes:</b> fruit and vegetable snack list</p>

## **Data Collection**

### **Assessment Tools**

A survey was the method used, and the instrument was paper. Paper was used because the study population was 50 and older, and they did not all have access to or were not comfortable with the use of an electronic survey. The survey was divided into four sections: demographics, F/V questions, cooking and shopping questions, and Mediterranean diet questions. Surveys were pilot tested on five people for layout readability and burden of time. They were revised accordingly before being used with study participants. The pre-test contained all four survey sections and was collected at the beginning of the first class, after the informed consent was signed. The initial post-test did not contain the demographic survey but did have the other three sections and was filled out and collected at the end of class four. The one-month post-test contained the same surveys as the initial post-test. This was completed in-person at the Kirksey Recreation Center, over the telephone, and/or mailed to the participant (with the postage paid option to mail it back). Method of one-month post-test completion was determined by participant. The paper survey data was entered by the PI into IBM SPSS software for analyses.

### ***Demographic Survey***

Demographic questions included: gender, age, racial/ethnic background, marital status, living situation, highest school/degree achieved, employment status, yearly income, if they were a Livonia resident, and if they were a member of Kirksey Recreation Center. Due to the small sample size, and to make the statistics more meaningful, some demographic groups were combined in the results. Age was combined to form two groups, and education and income were combined to three groups each.

*Fruit and Vegetable Survey*

The F/V questions were from the National Cancer Institute: National Institutes of Health, (NCI:NIH, 2000) Eating at America's Table Study. This validated survey is in Appendix I. The first and last group of questions, numbers 1-5a, 12-14, focused on the overall intake of F/Vs in the last month. Specific F/V questions, numbers 6-11a, were broken into three times of day (morning, lunchtime and afternoon, and suppertime and evening) with response choices for frequency (monthly, weekly, or daily) and amount (cup). For example, Question 6 reads "Think about all the foods you ate in your morning meal and snacks over the last month. On how many days did you eat **fruit** for your morning meal or morning snacks? Count any kind of fruit – fresh, canned, and frozen. **Do not count** juices." Response options included never (go to question 7), 1-3 days last month, 1-2 days per week, 3-4 days per week, 5-6 days per week, or every day. Question 6a reads "When you ate **fruit** in the morning, what is the **total** amount of **fruit** that you usually ate in a morning?" Response options included less than 1 medium fruit/less than ½ cup, 1 medium fruit/about ½ cup, 2 medium fruits/about 1 cup, or more than 2 medium fruits/more than 1 cup. Appendix I contains the entire F/V survey. Question responses were normalized for data analysis (see Table 6).

**Table 6***F/V Survey Response Normalizing for Data Analysis in F/V Study*

<b>Response Options</b>	<b>Mid Point of Option</b>	<b>Equation Used to Convert to Daily</b>	<b>Times Per Day</b>
<b>Applied to Questions 1 - 5, 12-14</b>			
Never	-	-	0
1-3 times last month	2/month	$2 \div 30$	0.067
1-2 times per week	1.5/week	$1.5 \div 7$	0.214
3-4 times per week	3.5/week	$3.5 \div 7$	0.5
5-6 times per week	5.5/week	$5.5 \div 7$	0.786
1 time per day	-	-	1
2 times per day	-	-	2
3 times per day	-	-	3
4 times per day	-	-	4
5 times per day	-	-	5
<b>Applied to Questions 6 - 11</b>			
Never	-	-	0
1-3 times last month	2/month	$2 \div 30$	0.067
1-2 times per week	1.5/week	$1.5 \div 7$	0.214
3-4 times per week	3.5/week	$3.5 \div 7$	0.5
5-6 times per week	5.5/week	$5.5 \div 7$	0.786
1 time per day	-	-	1
<b>Response Options</b>			<b>Amount</b>
<b>Applied to Question 1a</b>			
Less than 3/4 cup (6 ounces)	-	-	0.5
3/4 to 1 1/4 cup (6 to 10 ounces)	-	-	1
1 1/4 to 2 cups (10 ounces - 16 ounces)	-	-	1.625
More than 2 cups (16 ounces)	-	-	2.5
<b>Applied to Question 2a</b>			
About 1/2 cup	-	-	0.5
About 1 cup	-	-	1
About 2 cups	-	-	2
More than 2 cups	-	-	2.5
<b>Applied to Question 3a</b>			
Small order or less (about 1 cup or less)	-	-	1
Medium order (about 1 1/2 cups)	-	-	1.5
Large order (about 2 cups)	-	-	2



<i>Table 6 continued</i>			
<b>Response Options</b>	<b>Mid Point of Option</b>	<b>Equation Used to Convert to Daily</b>	<b>Times Per Day</b>
Super size order or more (about 3 cups or more)	-	-	3
<b>Applied to Question 4a</b>			
1 small potato or less (1/2 cup or less)	-	-	0.5
1 medium potato (1/2 cup to 1 cup)	-	-	0.75
1 large potato (1 to 1 1/2 cups)	-	-	1.25
2 medium potatoes or more (1 1/2 cups or more)	-	-	1.5
<b>Applied to Question 5a</b>			
Less than 1/2 cup	-	-	0.25
1/2 to 1 cup	-	-	0.75
1 to 1 1/2 cups	-	-	1.25
More than 1 1/2 cups	-	-	2
<b>Applied to Question 6a, 8a, 10a, 12a</b>			
Less than 1/2 cup	-	-	0.25
About 1/2 cup	-	-	0.5
About 1 cup	-	-	1
More than 1 cup	-	-	1.5
<b>Applied to Question 7a, 9a, 11a</b>			
Less than 1/2 cup	-	-	0.25
1/2 to 1 cup	-	-	0.75
1 to 2 cups	-	-	1.5
More than 2 cups	-	-	2.25
<b>Applied to Question 13a</b>			
Less than 1 cup	-	-	0.75
1 to 2 cups	-	-	1.5
2 to 3 cups	-	-	2.5
More than 3 cups	-	-	3.5

### ***Cooking and Shopping Survey***

The cooking and shopping questions were from the National Diet and Nutrition Survey (Food Standards Agency, 2018). The validated survey is in Appendix J. The survey focused on type and availability of cooking and storage facilities, Questions 1 and 2; F/V

shopping habits, Questions 3-8; and cooking skills, Questions 9-13. For example, Question 3 reads “How often do you buy FRESH fruits?” Response options include more than once a **day**, once a **day**, 2 or 3 times a **week**, once a **week**, 2 or 3 times a **month**, once a **month**, every two **months**, or less than every 2 **months**. Question 1 response options were yes or no and were scored one for yes and zero for no. Questions 2 and 11 response choices were to mark all that applied. Confidence in the kitchen was measured through the following two questions: “12. Would you be able to make a complete meal from ready-made ingredients (e.g. ready-made sauces and pasta to make spaghetti)?” and “13. Would you be able to make a main dish from basic ingredients (raw potatoes, raw meat, onions etc.), possibly following a recipe (e.g. shepherd’s pie)?” Answer response choices for both questions were as follows: Yes, with no help at all (3); Yes, with a little help (2); Yes, with a lot of help (1); and No, not at all (0). The number in parenthesis is how each response was scored, a higher number indicates greater confidence. Appendix J contains the entire cooking and shopping survey. Responses to questions were normalized for data analysis (see Table 7).

**Table 7***Cooking and Shopping Survey Response Normalizing for Data Analysis in F/V Study*

<b>Applied to Questions 3-8</b>		
<b>Response Options</b>	<b>Equation Used to Convert to Weekly</b>	<b>Times per Week</b>
More than once a day	$1.2 \times 7$	8.4
Once a day	$1 \times 7$	7
2 or 3 times a week	$2.5 \times 7$	2.5
Once a week	-	1
2 or 3 times a month	$2.5 \div 4$	0.625
Once a month	$1 \div 4$	0.25
Every two months	$1 \div 8$	0.125
Less than every 2 months	$1 \div 12$	0.083
<b>Applied to Question 9</b>		
<b>Response Options</b>	<b>Equation Used to Convert to Daily</b>	<b>Times per Day</b>
Everyday	-	1
Most days (5-6)	$5.5 \div 7$	0.786
Some days (3-4)	$3.5 \div 7$	0.5
One or two days a week	$1.5 \div 7$	0.214
Less than once a week	$.75 \div 7$	0.107
Only for special occasions	$.25 \div 7$	0.036
Never	-	0
<b>Applied to Question 12, 13</b>		
<b>Option</b>		<b>Value</b>
Yes, with no help at all	-	3
Yes, with a little help	-	2
Yes, with a lot of help	-	1
No, not at all	-	0

Note. Questions not addressed here were yes/no (1/0) or marking all that applied.

### ***Mediterranean Diet Survey***

In addition to the Fruit and Vegetable Survey, the Mediterranean Diet Adherence Screening (MEDAS) Questionnaire (Schroder et al., 2011) was also used to assess F/V intake. This survey included questions about following the Mediterranean diet in yes or no

answers and less than or greater than/equal to amounts for intake. Questions focused on olive oil and other fat intake, F/V intake, food sources of protein consumed, sugars, and wine. Not all MEDAS questions were used in the study results as they were not related to the study question. Three of the 14 questions on the survey were included and those questions were as follows: “3. How many vegetable servings do you consume per day? (1 serving: ½ cup cooked, 1 cup raw [consider garnish and side dishes as half a serving])” with response options  $< 2$  or  $\geq 2$ ; “4. How many fruit units (including fresh squeezed or 100% fruit juices) do you consume per day? (1 serving: 1 cup, 8 fl oz)” with response options  $< 3$  or  $\geq 3$ ; “9. How many servings of legumes (beans, black eyed peas) do you consume per week? (1 serving: 1 cup)” with response options  $< 3$  or  $\geq 3$ . To score the MEDAS, the options less than received a zero and greater than/equal to received a one. Scoring the MEDAS in this way allowed for analysis of the percentage in adherence to the Mediterranean diet. Appendix K contains the entire Mediterranean diet adherence survey.

### **Statistical Analyses**

Statistical data analyses were performed using IBM SPSS Statistics software, version 26. The PI entered survey responses utilizing the normalizing tables and ran descriptive statistical tests. Frequencies were run to ensure complete data entry. Chi-square was used to determine whether the participant characteristic distributions were similar for the intervention groups. One-way ANOVA was used to compare the means of the F/V variables between the L+HO group and the L group at pre-test (Timepoint 0), initial post-test (Timepoint 1), and one-month post-test (Timepoint 2). To compute daily F/V intake in cups, frequency questions were multiplied by quantity questions. To ascertain total daily fruit intake, the daily intake of each fruit variable was added together. The same was done for the individual daily vegetable

variables to compute total daily vegetable intake. Data were presented as a mean  $\pm$  standard deviation with  $p$  values noted. Paired  $t$ -tests comparing pre-test to initial post-test (Timepoints 0-1) and pre-test to one-month post-test (Timepoints 0-2) were run for the combined intervention groups and comparing the L+HO group to the L group for F/V variables and purchase frequency variables. Chi-square tests were used to assess the MEDAS survey data. Significant differences were defined as a  $p$  value  $\leq 0.05$ .

## Chapter 3: Results

### Study Participant Characteristics

Twenty-eight individuals responded to the study advertisements and were randomized to one of two groups (L+HO  $n = 15$ , L  $n = 13$ ). Five eligible participants dropped out of the study after randomization. Specifically, three participants decided not to participate prior to study classes beginning, due to not being available on any of the class days, and communicated this to the PI. Two participants did not show up to class, both were called after the first class, one did not respond to the telephone call from the PI and the other stated she would be to class the following week but did not show up. This brought the final study sample size to 23 participants total; the L+HO group had a total of 14 participants, and the L group had nine participants. Due to class size restrictions, the L+HO intervention was provided on two different weekdays, Tuesday ( $n = 7$ ) and Wednesday ( $n = 7$ ). The one L group was held on Mondays, as lecture-style nutrition education does not have a class size restriction. At the first class, participants provided informed written consent to participate in the study.

All participants were female, and most ( $n = 21$ ; 91.3%) were White/Caucasian (Table 8). Due to the small sample size, and to enable for appropriate cell size for statistics, some demographic groups were combined. Age group categories were combined from four (50-59, 60-69, 70-79, 80+) to two age groups (50-69 and 70+). Most (87%) of the women were between the ages of 60-79 years. Education and income also had too many categories for the number of participants enrolled; therefore, both categories were brought down to three groups. The three groups in the education category were high school degree or equivalent, some college but no degree/trade or technical training/associate degree, and bachelor's

degree or graduate degree. The income category was collapsed to reflect three groups: less than \$24,999 to \$49,999, \$50,000 to \$99,999, and \$100,000 or more. Approximately half of all participants ( $n = 13$ ; 56.5%), had a bachelor's or graduate degree. However, in the L group 88.9% held a bachelor's degree or higher compared to 35.7% in the L+HO ( $p = 0.018$ ). Of all participants, 78.3% were retired, and this majority carried over to the L group with 88.9% and the L+HO group with 71.4%. Nineteen (82.6%) of the participants lived in Livonia, with eight (34.8%) being members of the Kirksey Recreation Center, where the study classes took place. All participants reported having access to a kitchen/food preparation area, including a refrigerator, microwave, stove, and oven. Additionally, all participants reported having high confidence in the kitchen at pre-test, with no significant difference between L+HO and L groups for cooking confidence.

**Table 8**

*Characteristics at Pre-test for F/V Study Participants*

	<b>All Participants</b>	<b>Lecture Only</b>	<b>Lecture+ Hands-On</b>
	<b>n / %</b>	<b>n / %</b>	<b>n / %</b>
<b>Gender</b>			
Female	23 / 100	9 / 100	14 / 100
<b>Age</b>			
50-69	12 / 52.2	5 / 55.5	7/50
70-80+	11 / 47.8	4 / 44.4	7/50
<b>Racial and Ethnic Background</b>			
American Indian or Alaskan Native	1 / 4.3	0	1 / 7.1
Black/African American	1 / 4.3	0	1 / 7.1
White/Caucasian	21 / 91.3	9 / 100	12 / 85.7
<b>Marital Status</b>			
Single, never been married	4 / 17.4	2 / 22.2	2 / 14.3
Married or domestic partnership	7 / 30.4	2 / 22.2	5 / 35.7
Widowed	6 / 26.1	2 / 22.2	4 / 28.6
Divorced	6 / 26.1	3 / 33.3	3 / 21.4

Table 8 <i>continued</i>			
	All Participants	Lecture Only	Lecture+ Hands-On
<b>Living Situation</b>			
Apartment	2 / 8.7	1 / 11.1	1 / 7.1
House	19 / 82.6	7 / 77.8	12 / 85.7
Other	2 / 8.7	1 / 11.1	1 / 7.1
<b>Who Lives with you?</b>			
Alone	11 / 47.8	5 / 55.6	6 / 42.9
Family	4 / 17.4	0	4 / 28.6
Roommate	1 / 4.3	1 / 11.1	0
Spouse/Partner	7 / 30.4	3 / 33.3	4 / 28.6
<b>Highest Level of Education*</b>			
High School degree or equivalent (e.g., GED)	2 / 8.7	1 / 11.1	1 / 7.1
Some college but no degree/Trade or technical training/Associate degree	8 / 34.7	0	8 / 57.1
Bachelor's or Graduate Degree	13 / 56.5	8 / 88.9	5 / 35.7
<b>Employment Status</b>			
Part-time	3 / 13.0	1 / 11.1	2 / 14.3
Unemployed	1 / 4.3	0.0	1 / 7.1
Retired	18 / 78.3	8 / 88.9	10 / 71.4
Unable to work	1 / 4.3	0.0	1 / 7.1
<b>Household Income 2018</b>			
No answer provided	3 / 13.0	2 / 22.2	1 / 7.1
Less than \$24,999 - \$49,999	12 / 52.2	4 / 44.4	8 / 57.1
\$50,000 - \$99,999	6 / 26.1	2 / 22.2	4 / 28.6
\$100,000 or more	2 / 8.7	1 / 11.1	1 / 7.1
<b>Live in Livonia?</b>			
No	4 / 17.4	2 / 22.2	2 / 14.3
Yes	19 / 82.6	7 / 77.8	12 / 85.7
<b>Member of Kirksey Recreation Center?</b>			
No	15 / 65.2	7 / 77.8	8 / 57.1
Yes	8 / 34.8	2 / 22.2	6 / 42.9
<b>Confident Making a Meal from Ready-made Ingredients?</b>			
Yes, with a little help	2 / 8.7	1 / 11.1	1 / 7.1
Yes, with no help at all	21 / 91.3	8 / 88.9	13 / 92.9
<b>Confident Making a Meal from Basic Raw Ingredients?</b>			
Yes, with a little help	3 / 13	1 / 11.1	2 / 14.3
Yes, with no help at all	20 / 87	8 / 88.9	12 / 85.7

Note. Tested for between group differences (L+HO and L group) using Chi-square,  $p \leq 0.05$  is considered significant; noted with an asterisk.  $n = 23$ ; L = 9, L+HO = 14



### **Analysis of Fruit Intake**

Fruit intake at individual mealtimes was reported in c-eq, with juice reported separately. This was analyzed for between intervention group differences at the three timepoints: baseline (Timepoint 0), after 4 weeks of intervention classes (Timepoint 1), and one month after the four intervention classes, 8 weeks (Timepoint 2). Additionally, combined daily fruit intake, with and without juice, was assessed. There were no significant differences between intervention groups for the consumption of fruit reported in the morning, with lunch, with dinner, anytime juice, or total daily fruit intake, with and without juice at any timepoint (Table 9).

Examination of the average total daily fruit intake in c-eq by intervention groups resulted in no significant differences from baseline to 4 weeks, and from baseline to 8 weeks, (Table 10) for either the L+HO or the L group. Intervention groups were combined to determine the impact of a 4 week nutrition education intervention, on total daily fruit intake, including juice. Total daily fruit intake, including juice, increased from baseline to 4 weeks,  $p = 0.011$  (Table 11). This significance was not maintained at 8 weeks. Similarly, total daily fruit intake, without juice, increased from baseline to 4 weeks ( $p = 0.012$ ), but that significance was not maintained at 8 weeks. The recommended daily intake of fruit for individuals over the age of 51 is 1.5 to 2 c-eq per day. At baseline, only two participants reported consuming 1.5 or more c-eq of fruit per day; this increased to eight participants after 4 weeks of nutrition education and to six participants one month after the program concluded.

**Table 9**

*Comparison of Between Group Differences for Fruit Variables, Measured in c-eq, by*

*Intervention Groups at Timepoints 0, 1, and 2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0)	0	Initial	1	One-month	2	
		Mean $\pm$ SD	<i>p</i> -value	Post-test (1)	<i>p</i> -value	Post-test (2)	<i>p</i> -value	
				Mean $\pm$ SD				
Juice	L	0.015 $\pm$ .03	0.265	0.067 $\pm$ .16	0.328	0.057 $\pm$ .08	0.369	
	L+HO	0.116 $\pm$ .26		0.187 $\pm$ .33		0.230 $\pm$ .56		
Morning fruit no juice	L	0.393 $\pm$ .49	0.831	0.573 $\pm$ .46	0.219	0.504 $\pm$ .51	0.310	
	L+HO	0.352 $\pm$ .42		0.382 $\pm$ .27		0.343 $\pm$ .20		
Lunch/snack fruit	L	0.202 $\pm$ .27	0.625	0.304 $\pm$ .24	0.759	0.200 $\pm$ .17	0.659	
	L+HO	0.159 $\pm$ .14		0.266 $\pm$ .30		0.240 $\pm$ .25		
Dinner/snack fruit	L	0.105 $\pm$ .19	0.504	0.275 $\pm$ .34	0.668	0.263 $\pm$ .40	0.693	
	L+HO	0.159 $\pm$ .23		0.344 $\pm$ .39		0.212 $\pm$ .19		
Daily fruit, with juice	L	0.714 $\pm$ .53	0.760	1.218 $\pm$ .68	0.901	1.024 $\pm$ .74	0.996	
	L+HO	0.785 $\pm$ .54		1.178 $\pm$ .78		1.026 $\pm$ .89		
Daily fruit, no juice	L	0.699 $\pm$ .53	0.895	1.152 $\pm$ .68	0.613	0.967 $\pm$ .73	0.513	
	L+HO	0.670 $\pm$ .52		0.992 $\pm$ .76		0.796 $\pm$ .48		

Note. Fruit intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2, L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$ .

**Table 10**

*Comparison of Total Daily Fruit Intake, Measured in c-eq, by Intervention Groups Between Timepoints 0-1 and 0-2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
Daily fruit, with juice	L	0.714 $\pm$ .53	1.218 $\pm$ .68	0.060	0.714 $\pm$ .53	1.024 $\pm$ .74	0.284
	L+HO	0.785 $\pm$ .54	1.178 $\pm$ .78	0.097	0.740 $\pm$ .53	1.026 $\pm$ .89	0.346
Daily fruit, no juice	L	0.699 $\pm$ .53	1.152 $\pm$ .68	0.075	0.699 $\pm$ .53	0.967 $\pm$ .73	0.324
	L+HO	0.670 $\pm$ .52	0.992 $\pm$ .76	0.095	0.692 $\pm$ .53	0.796 $\pm$ .48	0.539

Note. Average daily fruit intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2 (0-2), L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$ .

**Table 11**

*Comparison of Total Daily Fruit Intake, Measured in c-eq, for Combined Intervention Groups Between Timepoints 0-1 and 0-2*

Variable	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
Daily fruit, with juice	0.758 $\pm$ .53	1.194 $\pm$ .73	<b>0.011</b>	0.730 $\pm$ .52	1.025 $\pm$ .81	0.154
Daily fruit, no juice	0.681 $\pm$ .51	1.054 $\pm$ .72	<b>0.012</b>	0.695 $\pm$ .52	0.866 $\pm$ .59	0.235

Note. Average daily fruit intake measured in c-eq, mean  $\pm$  standard deviation (SD).  $n = 23$  for Timepoints 0-1. For Timepoints 0-2,  $n = 22$ . Significance is  $p \leq 0.05$  and is bolded.

### Analysis of Vegetable Intake

Vegetable intake at individual mealtimes was reported in c-eq with lettuce, cooked dried beans, tomato sauce, and vegetable soups reported separately. Between group

differences were analyzed at the three timepoints previously defined. Additionally, combined daily vegetable intake, with and without white potatoes and beans, was assessed. At baseline, the L group reported consumption of significantly more lunch/snack vegetables compared to the L+HO group. There was no difference between intervention groups at 4 weeks, but at 8 weeks, the L group reported significantly greater consumption of lunch/snack vegetables (Table 12). Reported morning vegetable intake was also greater in the L group compared to the L+HO group at 4 weeks post intervention.

Analyzing total daily vegetable intake in c-eq for the intervention groups showed trends in increasing vegetable intake. Daily vegetable intake, with white potatoes and beans, was significantly greater ( $p = 0.019$ ) for both L+HO and L groups from baseline to Week 4 (Table 13). When comparing baseline to Week 8, both groups increased intake, but only the L group had a significant increase in daily vegetable intake. Similarly, daily vegetable intake, without white potatoes and beans, significantly increased from baseline to Week 4 and baseline to Week 8 in the L group and from baseline to Week 4 in the L+HO group. The increase in reported intake was not significant from baseline to Week 8 in the L+HO group (Table 13). At baseline, the L group reported an average daily intake of 2 c-eq per day of vegetables, with potatoes and beans, meeting the minimum daily recommendation. At baseline the L+HO reported an average vegetable intake of 1.797 c-eq per day. After 4 weeks of intervention, both groups reported an average intake of more than 2.5 c-eq per day ( $2.896 \pm 1.97$  L+HO group;  $3.126 \pm 2.32$  L group; c-eq per day). One month after the intervention classes ended, the L group maintained a significant increase with an average  $2.950 \pm 1.53$  c-eq per day, and the L+HO group reported an average increase at  $2.389 \pm 1.38$  c-eq per day, which is still in the range of the recommended 2 to 2.5 c-eq per day and was an increase from

baseline (Table 13). When combining both styles of intervention, the reported intake of vegetables with or without white potatoes and beans was significantly increased from baseline to Week 4 and from baseline to Week 8 (Table 14). The recommended daily intake of vegetables for individuals over the age of 51 is 2 to 2.5 c-eq per day. At baseline, seven participants reported a daily intake of vegetables, without potato and beans, at 2 or more c-eq per day; this increased to 13 participants after 4 weeks of nutrition intervention and to 11 participants one month after the program concluded.

**Table 12**

*Comparison of Between Group Differences for Vegetable Variables, Measured in c-eq, by Intervention Groups at Timepoints 0, 1, and 2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0) Mean $\pm$ SD	0 <i>p</i> -value	Initial Post-test (1) Mean $\pm$ SD	1 <i>p</i> -value	One-month Post-test (2) Mean $\pm$ SD	2 <i>p</i> -value
Lettuce salad	L	0.617 $\pm$ .73	0.919	1.051 $\pm$ 1.20	0.519	0.873 $\pm$ .63	0.978
	L+HO	0.589 $\pm$ .56		0.806 $\pm$ .59		0.865 $\pm$ .65	
Cooked Dried Beans	L	0.162 $\pm$ .25	0.318	0.235 $\pm$ .49	0.341	0.144 $\pm$ .23	0.932
	L+HO	0.074 $\pm$ .16		0.102 $\pm$ .13		0.136 $\pm$ .21	
Morning vegetable	L	0.182 $\pm$ .39	0.352	0.320 $\pm$ .28	<b>0.005</b>	0.161 $\pm$ .19	0.474
	L+HO	0.065 $\pm$ .20		0.071 $\pm$ .09		0.111 $\pm$ .14	
Lunch/snack vegetable, no salad, potato, beans,	L	0.347 $\pm$ .30	<b>0.029</b>	0.692 $\pm$ .76	0.268	0.552 $\pm$ .53	<b>0.045</b>
	L+HO	0.134 $\pm$ .14		0.372 $\pm$ .59		0.207 $\pm$ .21	
Dinner/snack vegetable, no salad, potato, beans,	L	0.492 $\pm$ .59	0.814	0.476 $\pm$ .20	0.142	0.786 $\pm$ .58	0.190
	L+HO	0.442 $\pm$ .41		0.857 $\pm$ .72		0.518 $\pm$ .35	
Tomato sauce	L	0.055 $\pm$ .07	0.868	0.067 $\pm$ .08	0.374	0.124 $\pm$ .14	0.209
	L+HO	0.059 $\pm$ .06		0.117 $\pm$ .15		0.069 $\pm$ .06	
Vegetable soups	L	0.158 $\pm$ .25	0.492	0.207 $\pm$ .25	0.400	0.236 $\pm$ .19	0.505
	L+HO	0.231 $\pm$ .24		0.341 $\pm$ .42		0.299 $\pm$ .23	
Daily vegetable, with white potato and beans	L	2.097 $\pm$ 1.87	0.648	3.26 $\pm$ 2.32	0.714	2.950 $\pm$ 1.53	0.337
	L+HO	1.797 $\pm$ 1.18		2.793 $\pm$ 1.94		2.348 $\pm$ 1.33	
Daily vegetable, no white potato and beans	L	1.849 $\pm$ 1.67	0.666	2.814 $\pm$ 1.95	0.760	2.732 $\pm$ 1.36	0.222
	L+HO	1.595 $\pm$ 1.06		2.564 $\pm$ 1.84		2.069 $\pm$ 1.10	

Note. Vegetable intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2, L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$  and is bolded.

**Table 13**

*Comparison of Total Daily Vegetable Intake, Measured in c-eq, by Intervention Groups Between Timepoints 0-1 and 0-2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
Daily vegetable, with potato and beans	L	2.097 $\pm$ 1.87	3.126 $\pm$ 2.32	<b>0.019</b>	2.097 $\pm$ 1.87	2.950 $\pm$ 1.53	<b>0.040</b>
	L+HO	1.797 $\pm$ 1.18	2.896 $\pm$ 1.97	<b>0.019</b>	1.862 $\pm$ 1.21	2.389 $\pm$ 1.38	0.063
Daily vegetable, no potato and beans	L	1.849 $\pm$ 1.67	2.814 $\pm$ 1.95	<b>0.010</b>	1.849 $\pm$ 1.67	2.732 $\pm$ 1.36	<b>0.027</b>
	L+HO	1.595 $\pm$ 1.06	2.651 $\pm$ 1.89	<b>0.020</b>	1.651 $\pm$ 1.09	2.105 $\pm$ 1.14	0.052

Note. Average daily vegetable intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2 (0-2), L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$  and is bolded.

**Table 14**

*Comparison of Total Daily Vegetable Intake, Measured in c-eq, for Combined Intervention Groups Between Timepoints 0-1 and 0-2*

Variable	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
Daily vegetable, with white potato and beans	1.1920 $\pm$ 1.47	2.990 $\pm$ 2.07	<b>0.001</b>	1.963 $\pm$ 1.49	2.629 $\pm$ 1.43	<b>0.004</b>
Daily vegetable, no potato or beans	1.699 $\pm$ 1.31	2.718 $\pm$ 1.87	<b>0.001</b>	1.736 $\pm$ 1.33	2.374 $\pm$ 1.25	<b>0.003</b>

Note. Average daily vegetable intake measured in c-eq, mean  $\pm$  standard deviation (SD).  $n = 23$  for Timepoints 0-1. For Timepoints 0-2,  $n = 22$ . Significance is  $p \leq 0.05$  and is bolded.

Potatoes and beans were analyzed separately from other vegetables as they are starchy and often used as the starch or protein in a meal, respectively. The ideal increase in

vegetables would not come from potatoes. Between intervention group differences for daily potato and bean intake in c-eq were analyzed at each timepoint. There were no significant differences in the mean consumption of potatoes and beans reported between intervention groups at any timepoint (Table 15). Examination of average daily intake of potatoes and beans for the intervention groups resulted in no significant differences from baseline to post-intervention, 4 weeks, and from baseline to 4 weeks post-intervention, 8 weeks (Table 16). Total daily French fries or fried potato intake for combined intervention groups significantly decreased from pre-test to initial post-test at 4 weeks ( $p = 0.015$ ; Table 17). This significance was not maintained at the one month post-test, 8 weeks. The variable, other white potatoes, did not show a significant change at 4 weeks or at 8 weeks. With the combined intervention groups, cooked dried beans had a reported increase in intake from baseline to 4 weeks and from baseline to 8 weeks, but that change was not significant.

**Table 15**

*Comparison of Between Group Differences for Potato and Bean Variables, Measured in c-eq, by Intervention Groups at Timepoints 0, 1, and 2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0)	0	Initial	1	One-month	2
		Mean $\pm$ SD	p-value	Post-test (1) Mean $\pm$ SD	p-value	Post-test (2) Mean $\pm$ SD	p-value
French fries or fried potatoes	L	0.176 $\pm$ .22	0.193	0.121 $\pm$ .24	0.354	0.191 $\pm$ .25	0.900
	L+HO	0.089 $\pm$ .08		0.060 $\pm$ .04		0.063 $\pm$ .05	
Other white potatoes	L	0.086 $\pm$ .08	0.456	0.077 $\pm$ .08	0.467	0.074 $\pm$ .06	0.247
	L+HO	0.117 $\pm$ .10		0.127 $\pm$ .19		0.143 $\pm$ .17	
Cooked dried beans	L	0.162 $\pm$ .25	0.318	0.235 $\pm$ .49	0.341	0.144 $\pm$ .23	0.932
	L+HO	0.074 $\pm$ .16		0.102 $\pm$ .13		0.136 $\pm$ .21	

Note. Daily potato and bean intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2, L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$ .

**Table 16**

*Comparison of Daily Potato and Bean Intake, Measured in c-eq, by Intervention Groups*

*Between Timepoints 0-1 and 0-2*

Variable	Lecture Only (L); Lecture+ Hands-On (L+HO)	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
French fries or fried potatoes	L	0.148 $\pm$ .15	0.092 $\pm$ .16	0.068	0.148 $\pm$ .15	0.163 $\pm$ .19	0.691
	L+HO	0.084 $\pm$ .08	0.053 $\pm$ .03	0.129	0.074 $\pm$ .07	0.063 $\pm$ .05	0.482
Other white potatoes	L	0.140 $\pm$ .15	0.100 $\pm$ .06	0.483	0.140 $\pm$ .15	0.101 $\pm$ .09	0.356
	L+HO	0.150 $\pm$ .12	0.171 $\pm$ .25	0.631	0.157 $\pm$ .13	0.202 $\pm$ .22	0.245
Cooked dried beans	L	0.253 $\pm$ .32	0.339 $\pm$ .64	0.553	0.253 $\pm$ .32	0.229 $\pm$ .30	0.627
	L+HO	0.105 $\pm$ .13	0.146 $\pm$ .17	0.263	0.113 $\pm$ .13	0.190 $\pm$ .28	0.159

Note. Average daily potato and bean intake in c-eq, mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2 (0-2), L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$ .

**Table 17**

*Comparison of Daily Potato and Bean Intake, Measured in c-eq, for Combined Intervention*

*Groups Between Timepoints 0-1 and 0-2*

Variable	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 <i>p</i> -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 <i>p</i> -value
French fries or fried potatoes	0.109 $\pm$ .11	0.068 $\pm$ .10	<b>0.015</b>	0.104 $\pm$ .11	0.104 $\pm$ .13	0.984
Other white potatoes	0.146 $\pm$ .13	0.143 $\pm$ .20	0.917	0.150 $\pm$ .13	0.161 $\pm$ .18	0.711
Cooked dried beans	0.163 $\pm$ .23	0.221 $\pm$ .42	0.310	0.170 $\pm$ .23	0.206 $\pm$ .28	0.347

Note. Average daily potato and bean intake measured in c-eq, mean  $\pm$  standard deviation (SD).  $n = 23$  for Timepoints 0-1. For Timepoints 0-2,  $n = 22$ . Significance is  $p \leq 0.05$  and is bolded.



### Analyses of F/V Intake Through MEDAS Survey

A second survey to assess F/V intake supported the above results. Analysis of the MEDAS survey data, with the intervention groups combined, showed a significant difference in the number of participants consuming two or more servings of vegetables per day at the different timepoints ( $p = 0.016$ ; Table 18). This observation is in agreement with the increase in vegetable intake reported on the Fruit and Vegetable Survey (Tables 13 and 14). The fruit and legume intake data from the MEDAS survey did not show differences in intakes and timepoints (Tables 19 and 20, respectively). Comparing the L+HO and L group, there was no significant difference in intake for fruit, vegetable, or legumes at baseline, Week 4, or Week 8 (data not shown).

**Table 18**

*MEDAS Survey Results for Vegetable Intake with Intervention Groups Combined at Timepoints 0, 1, and 2*

<b>Vegetable Servings Daily</b>		
	<b>&lt; 2 Servings (n/%)</b>	<b>≥ 2 Servings (n/%)</b>
Timepoint 0	15 / 65.2	8 / 34.8
Timepoint 1	10 / 43.5	13 / 56.5
Timepoint 2 <sup>a</sup>	5 / 22.7	17 / 77.3
Note. Vegetable servings per day. Serving = 1/2 cup cooked or 1 cup raw. $n = 23$ , $a = 22$ , $b = 21$ . Chi-square, $p = 0.016$ (significance is $p \leq 0.05$ ).		

**Table 19**

*MEDAS Survey Results for Fruit Intake with Intervention Groups Combined at Timepoints 0, 1, and 2*

<b>Fruit Units Daily</b>		
	<b>&lt; 3 Units (n/%)</b>	<b>≥ 3 Units (n/%)</b>
Timepoint 0 <sup>a</sup>	15 / 68.2	7 / 31.8
Timepoint 1	11 / 47.8	12 / 52.2
Timepoint 2 <sup>a</sup>	12 / 54.5	10 / 45.5
Note. Fruit units per day. Unit = 1 cup or 8 fl oz. $n = 23$ , $a = 22$ , $b = 21$ . Chi-square, no significant $p$ value (significance is $p \leq 0.05$ ).		

**Table 20**

*MEDAS Survey Results for Legume Intake with Intervention Groups Combined at Timepoints 0, 1, and 2*

<b>Legume Servings Weekly</b>		
	<b>&lt; 3 Servings (n/%)</b>	<b>≥ 3 Servings (n/%)</b>
Timepoint 0 <sup>b</sup>	14 / 66.7	7 / 33.3
Timepoint 1	13 / 56.5	10 / 43.5
Timepoint 2 <sup>a</sup>	15 / 68.2	7 / 31.8
Note. Legume servings per week. Serving = 1 cup. $n = 23$ , $a = 22$ , $b = 21$ . Chi-square, no significant $p$ value (significance is $p \leq 0.05$ ).		

### **Analyses of Purchase Frequency for Fruits and Vegetables**

How often F/Vs were purchased was assessed as an increase in F/V intake could be supported by an increase in purchase frequency. There was a significant increase in the weekly purchase of fresh vegetables for the L+HO group from baseline to Week 4 ( $p = 0.040$ ; Table 21). As reported above, the L+HO and L groups each had a significant increase in vegetable intake (Table 13). When intervention groups were combined, the observed

increase in reported purchasing of fresh vegetables was greater, compared to the L+HO group increase, from baseline to Week 4 ( $p = 0.023$ ; Table 22). Purchase frequency of fruit for the intervention groups did not show a significant change at any timepoint (Tables 21 and 22).

**Table 21**

*Comparison of Weekly Purchase of Fresh, Frozen, and Canned F/V in Intervention Groups at Timepoints 0-1 and 0-2*

Variable*	Lecture Only (L); Lecture +Hands-On (L+HO)	Pre-test (0) Mean $\pm$ SD	Initial Post-test (1) Mean $\pm$ SD	0 - 1 $p$ -value	Pre-test (0) Mean $\pm$ SD	One-month Post-test (2) Mean $\pm$ SD	0 - 2 $p$ -value
How Often Buy Fresh Fruit	L	1.208 $\pm$ .75	1.792 $\pm$ 2.02	0.430	1.208 $\pm$ .75	1.292 $\pm$ .70	0.753
	L+HO	1.877 $\pm$ 2.03	1.750 $\pm$ 1.70	0.853	1.944 $\pm$ 2.09	1.317 $\pm$ .86	0.193
How Often Buy Frozen Fruit	L	0.134 $\pm$ .20	0.253 $\pm$ .33	0.372	0.134 $\pm$ .20	0.153 $\pm$ .19	0.779
	L+HO	0.274 $\pm$ .31	0.318 $\pm$ .35	0.612	0.247 $\pm$ .30	0.692 $\pm$ 1.90	0.356
How Often Buy Canned Fruit	L	0.055 $\pm$ .04	0.092 $\pm$ .06	0.104	0.055 $\pm$ .04	0.074 $\pm$ .03	0.169
	L+HO	0.244 $\pm$ .29	0.315 $\pm$ .40	0.257	0.215 $\pm$ .28	0.877 $\pm$ 2.28	0.325
How Often Buy Fresh Vegetables	L	1.000 $\pm$ .59	1.333 $\pm$ .66	0.293	1.000 $\pm$ .59	0.958 $\pm$ .13	0.834
	L+HO	1.176 $\pm$ .76	2.573 $\pm$ 2.77	<b>0.040</b>	1.189 $\pm$ .79	1.683 $\pm$ 1.77	0.334
How Often Buy Frozen Vegetables	L	0.361 $\pm$ .32	0.583 $\pm$ .82	0.283	0.361 $\pm$ .32	0.417 $\pm$ .40	0.406
	L+HO	0.318 $\pm$ .29	0.345 $\pm$ .33	0.671	0.295 $\pm$ .28	0.830 $\pm$ 1.87	0.268
How Often Buy Canned Vegetables	L	0.204 $\pm$ .24	0.129 $\pm$ .19	0.489	0.204 $\pm$ .24	0.148 $\pm$ .19	0.416
	L+HO	0.295 $\pm$ .30	0.253 $\pm$ .29	0.415	0.269 $\pm$ .30	0.915 $\pm$ 2.27	0.338

\*Purchase frequency per week. Mean  $\pm$  standard deviation (SD). L group  $n = 9$  and L+HO group  $n = 14$  for Timepoints 0 and 1. For Timepoint 2 (0-2), L group  $n = 9$  and L+HO group  $n = 13$ . Significance is  $p \leq 0.05$  and is bolded.

**Table 22***Comparison of Weekly Purchase of Fresh, Frozen, and Canned F/V for the Intervention**Groups Combined at Timepoints 0-1 and 0-2*

<b>Variable*</b>	<b>Pre-test (0)</b> Mean $\pm$ <i>SD</i>	<b>Initial</b> <b>Post-test (1)</b> Mean $\pm$ <i>SD</i>	<b>0 - 1</b> <i>p</i> -value	<b>Pre-test (0)</b> Mean $\pm$ <i>SD</i>	<b>One-month</b> <b>Post-test (2)</b> Mean $\pm$ <i>SD</i>	<b>0 - 2</b> <i>p</i> -value
How Often Buy Fresh Fruit	1.615 $\pm$ 1.66	1.766 $\pm$ 1.79	0.759	1.643 $\pm$ 1.69	1.307 $\pm$ .78	0.264
How Often Buy Frozen Fruit	0.219 $\pm$ .27	0.293 $\pm$ .33	0.307	0.201 $\pm$ .26	0.471 $\pm$ 1.47	0.336
How Often Buy Canned Fruit	0.170 $\pm$ .25	0.228 $\pm$ .33	0.133	0.149 $\pm$ .23	0.548 $\pm$ 1.77	0.307
How Often Buy Fresh Vegetables	1.107 $\pm$ .69	2.088 $\pm$ 2.25	<b>0.023</b>	1.112 $\pm$ .71	1.137 $\pm$ 1.39	0.371
How Often Buy Frozen Vegetables	0.335 $\pm$ .29	0.438 $\pm$ .57	0.233	0.322 $\pm$ .29	0.661 $\pm$ 1.45	0.230
How Often Buy Canned Vegetables	0.259 $\pm$ .28	0.205 $\pm$ .26	0.277	0.242 $\pm$ .27	0.601 $\pm$ 1.76	0.361

\*Purchase frequency per week. Mean  $\pm$  standard deviation (*SD*). For Timepoints 0 and 1,  $n = 23$ . For Timepoint 2 (0-2),  $n = 22$ . Significance is  $p \leq 0.05$  and is bolded.

### Chapter 4: Discussion

The aim of this study was to assess whether a 4 week hands-on nutrition intervention would increase older adults' F/V intake more than a lecture-style nutrition intervention. The two null hypotheses were as follows: there is no significant difference between study groups for an increase in fruit intake, and there is no significant difference between study groups for an increase in vegetable intake. Increasing F/V intake may provide health protective benefits through the intake of essential nutrients, reducing the risk for chronic disease and improving overall health (Nicklett & Kadell, 2013; Padayachee et al., 2017; Soliman, 2019; Stone et al., 2016). The 4 week nutrition education intervention, regardless of delivery method (L or L+HO), resulted in an increase in F/V intake that was maintained one month after the intervention classes ended. There was no significant difference between groups, to favor the L+HO group, in F/V intake after 4 weeks of intervention or one month after the intervention concluded, thus failing to reject both null hypotheses.

While there were no significant differences in reported fruit intake between intervention groups at any time point, there was a trend in the reported daily intake of fruit observed at 4 and 8 weeks within each intervention group. Therefore, upon combining both intervention groups, the trend demonstrated a statistically significant increase in reported fruit intake, with or without juice, at 4 weeks but was not maintained at 8 weeks. This improvement, however, did not reach the daily fruit recommendation for those over age 51 of 1.5 to 2 c-eq per day (USDA, DHHS, 2015). At the height of intake, participants reported an average intake of 1.194 cups of fruit or fruit equivalences per day, with juice, at 4 weeks and 1.025 c-eq per day at 8 weeks. While these are increases from the baseline average of 0.744, it is a decrease in intake from Week 4 to Week 8. At both 4 and 8 weeks, approximately one-

third of participants reported meeting the daily fruit recommendation, which is an increase from baseline when only one individual met the daily recommended intake for fruit.

Nutrition education studies that used a lecture-style, recorded DVD, or in-home visits have reported increases in fruit intake (Bernstein et al., 2002; Hendrix et al., 2008; Krebs et al., 2017; Turk et al., 2016; Wagner et al., 2016), but only three observed a significant increase in fruit intake (Bernstein et al., 2002; Hendrix et al., 2008; Turk et al., 2016). The Bernstein et al. (2002) study reported significantly increased fruit intake from 2.8 to 3.9 servings through home visits, phone calls, and monthly newsletters over a 6 month period. This study had 38 participants in the nutrition group, total study sample size was 70, and was mostly White women with an average age of 77.8 years. The Bernstein study used serving sizes from the Food Guide Pyramid; 1 serving of fruit was equal to 1 medium apple, ½ cup chopped fruit (cooked or canned), or ¾ cup fruit juice (United States Department of Agriculture - Food and Nutrition Service [USDA-FNS], 2014). In the Hendrix et al. (2008) study, fruit intake increased from 3.6 to 4.7 servings over a 4 month time period. This was a large intervention study in which the 558 participants were 83% female, 47% White, and a mean age of 75 years. The Hendrix study used the 2005 Dietary Guidelines (DHHS:USDA, 2005) serving sizes; 1 serving equals ½ cup fruit (fresh, frozen, canned), 1 medium fruit, ¼ cup dried fruit, or ½ cup fruit juice. The more recent Turk et al. (2016) study observed a significant increase in the percentage of participants consuming  $\geq 3$  servings of fruit per day, from 22% to 33% over a 12-week time period. This was a smaller study compared to the Hendrix study, but with 118 participants was adequately powered for the observed differences. The participant make-up was likewise similar in that 88% were female and 53% White, with a mean age of 71.7 years. Two of the studies (Hendrix et al., 2008; Turk et al.,

2016) were lecture based and reported significant increases in fruit intake with eight to twelve sessions lasting about 45-minutes each. In the current, much smaller study, there was only a significant increase in reported fruit intake when both styles of nutrition education were combined, suggesting that a larger sample in each group was needed to determine significance between style of nutrition education. Additionally, the current study was 100% female, 91.3% White, and 87% were between the ages of 60-79, which differed only slightly from the demographic profiles of previous studies in this area.

Although fruit was discussed in both intervention groups, and sampled in the L+HO class, the intervention class material focused more on increasing vegetable intake and may be why there was a smaller increase with fruit intake. The emphasis on vegetable intake was because national data reflects that fruit intake is typically more in line with recommendations while vegetable intake lags behind. Specifically, 12.5% of adults aged 51 and older report consuming the recommended daily serving of fruit, but 9.7% report consuming the recommended daily serving of vegetables (Lee-Kwan et al., 2017). Additionally, both F/Vs are nutrient dense; however, fruit contains more natural sugar and therefore more calories (Link, 2017). Focusing on increasing vegetable intake can provide required nutrients with fewer calories.

Reported daily vegetable intake increased more than fruit intake. Both the intervention styles resulted in a significant increase at 4 weeks, compared to baseline, while the significant increase in reported vegetable consumption was only maintained for the L group at 8 weeks. The recommended intake of vegetables for those over the age of 51 is 2 to 2.5 c-eq per day (USDA, DHHS, 2015). At baseline, the L group reported an average daily intake of vegetables, with potatoes and beans, meeting the minimum daily recommendation.

After 4 weeks of intervention, both groups reported an average intake of more than 2.5 c-eq per day. One month after the intervention classes ended, the L group maintained a significant increase and the L+HO group reported an increase which was within the recommended range of 2 to 2.5 c-eq per day, but was not significant. This demonstrates that the study intervention was successful in promoting an increased average daily intake of vegetables, including white potatoes and beans, for all study participants at both post intervention time points to meet recommended intakes.

Significant increases in vegetable intake were found in the literature as well (Bernstein et al., 2002; Hendrix et al., 2008; Peters et al., 2014; Turk et al., 2016). The Bernstein et al. (2002) study reported an increase from 2.3 servings of vegetables at baseline to 3.4 servings per day over a six month period of time. The Bernstein study used serving sizes from the Food Guide Pyramid; 1 serving of vegetables is equal to 1 cup raw leafy vegetables, ½ cup of other vegetables (raw or cooked), or ¾ cup vegetable juice (USDA-FNS, 2014). In the Hendrix et al. (2008) study, a high baseline average intake of 3.8 servings of vegetables daily increased to 4.4 servings, using serving sizes from the 2005 Dietary Guidelines; 1 serving equals ½ cup cut up vegetable (raw or cooked), 1 cup raw leafy vegetable, or ½ cup vegetable juice (DHHS:USDA, 2005). The Turk et al. (2016) study significantly increased the percentage of participants consuming three or more servings of vegetables per day from 15% at baseline to 25% at end of study. Likewise, the current study found that approximately half of the study participants reported consuming the recommended daily vegetable intake at weeks four and eight, which increased from 39% at baseline. The Peters et al. (2014) study demonstrated positive outcomes using a behavioral (SCT) hands-on intervention with older women. This was a year-long hands-on study, had all female



participants ( $n = 71$ ) between that ages of 60-72 from the greater New York City area, and a 4 month intervention period. The current study reports an increase in vegetable intake utilizing a much shorter intervention period, 4 weeks versus 4 months as in the Peters study, while both studies had 100% female participants over the age of 50 and were designed following SCT.

A second survey, MEDAS, of reported daily intake of F/Vs confirmed the vegetable intake findings. MEDAS is a survey to assess dietary intake that aligns with the Mediterranean diet (Schroder et al., 2011). F/Vs are a mainstay in the Mediterranean diet food pattern. With the intervention groups combined, there was a significant increase in daily vegetable intake reported on the MEDAS survey. Having this result reported twice, through two different surveys, strengthens the finding of increased vegetable intake as a result of four weekly nutrition education classes in older females. Another survey used with this study was the cooking and shopping survey that measured F/V purchase frequency.

The intervention classes focused on fresh F/Vs and frozen fruit. Weekly purchase frequency of fresh, frozen, and canned F/Vs was assessed through the Cooking and Shopping survey. There was an observed significant increase in the purchase frequency of fresh vegetables in the L+HO group at the end of the four-week intervention. Of note, the intervention focused on the use of fresh vegetables, where the increase in weekly purchase frequency was reported. The merits of frozen vegetables were discussed in the intervention, and purchase frequency in the data trended up for the intervention groups. The observed purchase frequency of canned vegetables was inconsistent. During the intervention classes, canned vegetables were briefly discussed; however, the focus was fresh vegetables. With fruit, no purchase patterns were observed.

When interpreting the results of this study, several considerations should be kept in mind, including the time of year, participant characteristics, and confidence in cooking skills of the participants at baseline. The baseline survey was completed by participants in early to mid-September, and the 8 week survey was completed in early to mid-November. In Michigan, there is much less fresh, local F/Vs available in November compared with September (Michigan State University [MSU], 2004). The weather in Michigan is much colder in November than in September, emphasizing the seasonal change from summer to fall (Locke et al., 2009). This can lead to differences in the types of F/Vs consumed and purchased. For instance, reported vegetable soup intake increased at each assessment. In November, when the 8 week assessments were completed, the intake of vegetable soup was significantly greater than at the start of the study in September. Eating habits often change with the seasons (Locke et al., 2009), and warm soups are typically consumed more during colder months.

The participant demographics are also important to take into account when interpreting the study findings. Approximately half of the study participants held a bachelor's degree or higher; however, educational attainment was significantly different between the intervention groups with more participants holding a higher degree in the L group compared to the L+HO group. A higher level of educational achievement is linked with positive health outcomes while a lower level of education is associated with low self-reported health and low health literacy (Hamad et al., 2018; Hernandez et al., 2018; van der Heide et al., 2013). The National Library of Medicine (NLM) at NIH defines health literacy as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate decisions” (NIH:NLM, 2004, para. #1). Low health

literacy may be linked with people who have a high school diploma or lower as this group is also more likely to report a poorer health status and are less likely to use preventive care (NIH:NLM, 2004). In a more recent systemic review, an individual's health literacy was found to have a greater correlation to overall health than their age, income, employment, education, or race (Carbone & Zoellner, 2012). There is no one standardized way to measure health literacy; screening using a food label, a reading comprehension test, and a word pronunciation and recognition test are examples of how health literacy has been measured (Carbone & Zoellner, 2012). Understanding the level of health literacy within this sample and factoring that into the study results may make the results more meaningful. Even so, the significant difference in level of education between the intervention groups, with the L group having a significantly higher level of education, may be a factor in the greater increase in vegetable intake for the L group compared with the L+HO group. A larger study sample may have better diversified the intervention groups, and it would have been valuable to understand the participants level of health literacy.

The current study participants were mostly middle-class, while half of the studies reviewed had participants that identified as low-income. Hands-on interventions have been shown to increase F/V intake in low-income communities (Garcia et al., 2016). People with low incomes tend to also have a lower level of education, and both are linked with poor health outcomes (Hamad et al., 2018; van der Heide et al., 2013). According to van der Heide et al. (2013), health literacy is positively correlated with level of education, such that those with higher levels of education often have higher health literacy. People with low health literacy tend to have less knowledge about health (van der Heide et al., 2013) and poor health outcomes (Garcia et al., 2016). The intervention groups in the current study had significant

differences in levels of education and F/V intake. The higher educated L group reported higher intakes of F/Vs, compared with the L+HO group, supporting that health literacy is correlated with education. The demographic make-up of the sample may have impacted the study results.

There is also a link between level of education, gender, and health behaviors. The current study sample was all female. Many of the studies (7 out of 10) included in the literature review had 80% to 100% female participants (Bernstein et al., 2002; Hendrix et al., 2008; Krebs et al., 2017; Peters et al., 2014; Pooler et al., 2017; Torrence et al., 2018; Turk et al., 2016). Women with a higher level of education may be more likely to make health-related changes (Hernandez et al., 2018). For instance, more-educated women with a mean age of 62.5 years at the initial diagnosis of hypertension made more behavior changes than men of comparable age and education level (Hernandez et al., 2018). The current study was all women, and half held college degrees; this sample as a whole is, therefore, more likely to make health changes. A desire for health improvements may have attracted the participants to this study. Self-selection bias is common in nutrition intervention studies, particularly smaller studies (Šimundić, 2013). Additionally, this may be why the L group, which had more highly educated women, reported greater increases in F/V consumption (behavior change). Individuals with higher health literacy, which may be correlated with education level, tend to demonstrate healthier behaviors compared to those with lower health literacy.

The age of study participants is another demographic characteristic to consider. The age of the current study participants was comparable to what was found in the literature on nutrition education for older adults. Six of the studies had participants with a mean age over 50, with nine studies having a mean age above 50 or the majority over the age of 50

(Bernstein et al., 2002; Hendrix et al., 2008; Keller et al., 2004; Krebs et al., 2017; Monlezun et al., 2015; Peters et al., 2014; Pooler et al., 2017; Torrence et al., 2018; Turk et al., 2016).

The current study participants were all over the age of 50, with 87% between the ages of 60-79. Often, confidence in the kitchen and with cooking comes with age, but not always. In the current study, participants reported high cooking confidence at baseline.

The hands-on intervention focused on basic kitchen skills and at baseline the participants reported the ability to make a complete meal from ready-made ingredients and a main dish from basic raw ingredients with little to no help at all. This indicates a high level of cooking confidence. Hands-on activities included with the present study were cleaning, cutting, and tasting common F/Vs, and preparing simple dishes or snacks. The nutritional importance of these F/Vs were discussed, in both intervention groups, in an effort to stress the importance of including these common F/Vs with everyday meals and snacks. Participants verbally expressed surprise at the nutritional value of F/Vs discussed. A review completed by Garcia et al. (2016) supports the positive impact of hands-on classes and behavior change to increase F/V intake. The hands-on activities the L+HO group experienced followed the behavioral theory, SCT.

SCT takes into consideration the individual, their behavior, and the environment (LaMorte, 2019; Nnakwe, 2018). The L+HO classes incorporated SCT (LaMorte, 2019; Nnakwe, 2018) by having interactions between the individual (participant), their behavior (practicing F/V preparation), and having an environment of learning (four weekly nutrition education classes). Four of the studies reviewed included behavioral interventions in their study design as well. Two of the hands-on studies used SCT (Peters et al., 2014; Pooler et al., 2017) and the Krebs et al. (2017) study, that used DVD tapes, also used SCT. Another hands-

on study used the social ecological model, which is similar to SCT (Torrence et al., 2018). While all four studies reported positive outcomes, only one study specifically measured F/V intake and had a sample with demographic characteristics similar to the current study. The Peters et al. (2014) study, discussed above, used a sample of all post-menopausal women who completed 24 sessions of a behavioral intervention to follow a whole-foods diet, a moderate fat diet, or a moderate fat diet with flax seed. These women made significant changes in their diet that were maintained eight months past the intervention end. The Pooler et al. (2017) study participants were low-income, Spanish- and English- speaking adults who were 90.1% female. The study design used cooking classes and a grocery store tour to increase healthy meal preparation behaviors through six weekly classes (Cooking Matters class). Six months after the intervention ended, food resource management practices and confidence had significantly increased (Pooler et al., 2017). Similarly, the Torrence et al. (2018) study participants were 95% Black and 88.4% female, and the study took place in a rural, low-income South Carolina community. The study design had six sessions and included nutrition tips, recipes, cooking demonstrations, cooking practice activities, physical activity tips, and time for physical activity, as well as having a mobile farmer's market at each session. Results of this study showed a statistically significant change in perception of food security, self-efficacy with physical activity and healthy eating, and cooking confidence (Torrence et al., 2018). The Krebs et al. (2017) study had 86 cancer survivors that were 96% female and 81% White. The intervention group was provided a 45-to-90-minute interactive DVD, with three months between pre- and post-test the intervention group reported increased F/V consumption. All four studies reported positive dietary outcomes and behavior changes, including the Peters study showing significance at eight months post main intervention.

Using SCT in the design of the present study is likely to have supported the positive outcomes.

Of note, the positive outcomes in the current study were observed at 4 weeks and at 8 weeks. The length of the current study was four class sessions, once a week with a follow-up survey one month after the end of intervention sessions; this was shorter than what was found in the literature. The lecture-style studies had comparable class lengths; however, they had more sessions, typically two to three times as many (Hendrix et al., 2008; Turk et al., 2016; Wagner et al., 2016). Two of the studies had a significant increase in F/V consumption (Hendrix et al., 2008; Turk et al., 2016), and the Wagner et al. (2016) study, which had 10 sessions, showed an increase in frequency of F/V consumption, but did not meet the recommended number of daily servings. The lecture-style studies reported positive outcomes, similar to the positive outcomes of the current study, but the intervention length of time was longer than the current study intervention. An increase in F/V consumption with a shorter intervention period may be more feasible and desirable for participants and program administrators. In the literature, the class length for hands-on nutrition education was typically between 90 and 120 minutes per session with an intervention period from six-weeks to one-year (Keller et al., 2004; Monlezun et al., 2015; Peters et al., 2014; Pooler et al., 2017; Torrence et al., 2018). Most studies demonstrated improvements in dietary and health outcomes of interest. In the current study, the L+HO group met for 90 minutes, had a 4 week intervention period, and mixed results for F/V intakes with greater increases overall in vegetable intake.

### **Strengths and Limitations**

The current study had several strengths, including 100% participation retention from week to week, improvement in F/V intake after 4 weeks (compared with the longer intervention times found in the literature), SCT used in the study design, and all classes were created and taught by the same RDN. All participants who began classes continued through all 4 weeks, completing the baseline and 4 week assessments. Only one participant did not complete the 8 week assessment. Another strength of the study was the improvement in intake after just 4 weeks of intervention. Other research studies that resulted in increases in F/V intake had longer intervention periods. The current study showed that increases in F/V intake in females over the age of 50 can occur with a 4 week intervention. SCT was also a strength of the current study. The L+HO classes followed SCT with interactions between the participant (individual), practicing F/V preparation in class (behavior), and having an environment of learning. In this setting, SCT contributed to the positive outcomes of the study by creating an environment where the participant could build confidence in F/V preparation and intake, and this behavior was reinforced with guidance from the PI and practicing at home. An additional strength was that all study classes were developed and taught by the same RDN, the PI. The RDN developed rapport with participants that was strengthened with each week of class. Despite these strengths, there were also limitations.

Limitations of this study included the small sample size, all participants were female, and rigid class content. A larger sample size would promote greater statistical power, particularly for the between group analyses. In addition to the small sample size, all participants were female. While this was not intended in the study design, only women responded to the study advertisements. Therefore, the findings are only generalizable to older



adult females. Including males in the study may have led to different results and should be something considered with future research studies. Another limitation was that the class content for the intervention period was not adjusted to take into consideration participants' interest and level of knowledge. At baseline, participants reported having high cooking confidence, and the study classes focused on basic F/Vs and basic knife/kitchen skills. In the future, it would be beneficial to adopt a more flexible class content to enable adjustments based on participants' interests and knowledge levels. The flexible class content approach would require time built in between the submission of baseline assessments and the first nutrition education class. The present study, however, used the first meeting as both baseline assessment and nutrition intervention class one.

### **Future Considerations**

Future studies should consider the population's knowledge and skill set in the study design, as well as the level of health literacy, recruitment of men, and impact of new food preparation and cooking skills. With future studies, it is recommended to survey the target population's knowledge and skills and then develop the intervention utilizing that data. Better understanding of the population through a community needs assessment can help with the design of a more tailored intervention focused on increasing F/V consumption (Boyle, 2017). Additionally, an assessment to understand the participants' level of health literacy would be useful (Carbone & Zoellner, 2012). Considerations could also be made for recruiting men into the study to have a more balanced gender ratio or classes tailored to males. The present study addressed basic F/V and basic knife/kitchen skills; conducting a study to understand the impact of new food preparation techniques and cooking skills should be considered.

### Conclusions

The current study compared two nutrition education styles with the aim to increase F/V consumption in adults over the age of 50. While the study failed to reject both null hypotheses, positive outcomes were observed. Some significance was reported in the L+HO and L groups for increased daily vegetable intake, at 4 weeks and 8 weeks, and greater weekly purchase frequency of fresh vegetables, at 4 weeks. With the intervention groups combined, greater increases and significance were observed. The increase in vegetable intake to within the recommended daily intake, after the 4 week intervention and at 8 weeks, is an important conclusion to recognize. This demonstrates that positive behavior change, increasing vegetable intake and purchase frequency, is possible with a 4 week intervention.

Fruit intake for the L+HO and L group was increased after the 4 week intervention and at 8 weeks but was not significant. With the intervention groups combined, there was a significant increase in daily fruit intake at 4 weeks. The significance in fruit intake, with the groups combined, demonstrates that with a larger sample size greater statistical significance can be observed. Additionally, vegetable intake was focused on more than fruit intake, which may be why the observed increase in fruit was smaller.

Perhaps with a larger sample size, greater statistical significance in the intervention groups would have been observed. Despite the small sample size, this study was significant as it demonstrated that a 4 week nutrition education intervention could significantly increase F/V intake not only at the end of the intervention period but also one month after the intervention concluded. The study results can be used in dietetic practice for planning and implementing nutrition education programs. Using a combination of lecture-style and hands-

on nutrition education has been shown in the literature and in the current study to produce positive outcomes.

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APPENDICES

## Appendix A: Approval Letter

University Human Subjects Review Committee

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Apr 1, 2019 11:38 AM EDT

Noelle Blasch

Eastern Michigan University, School of Health Sciences

Re: Exempt - Initial - UHSRC-FY18-19-283 Comparison of nutrition education approaches on fruit and vegetable intake in older adults.

Dear Noelle Blasch:

The Eastern Michigan University Human Subjects Review Committee has rendered the decision below for Comparison of nutrition education approaches on fruit and vegetable intake in older adults.. You may begin your research.

Decision: Exempt - Limited IRB

Renewals: Exempt studies do not need to be renewed. When the project is completed, please contact [human.subjects@emich.edu](mailto:human.subjects@emich.edu).

Modifications: Any plan to alter the study design or any study documents must be reviewed to determine if the Exempt decision changes. You must submit a modification request application in [Cayuse IRB](#) and await a decision prior to implementation.

Problems: Any deviations from the study protocol, unanticipated problems, adverse events, subject complaints, or other problems that may affect the risk to human subjects must be reported to the UHSRC. Complete an incident report in [Cayuse IRB](#).

Follow-up: Please contact the [UHSRC](#) when your project is complete.

Please contact [human.subjects@emich.edu](mailto:human.subjects@emich.edu) with any questions or concerns.

Sincerely,

Eastern Michigan University Human Subjects Review Committee

## Appendix B: Recruitment

## Increasing Fruit and Vegetable Intake Study

Be part of an important nutrition research study!

- Are you 50 years old or older?
- Do you want to change your habits to consume more fruits and vegetables?

If you answered yes to these questions, then you may be eligible to participate in this nutrition research study.

The purpose of this research study is to compare the effectiveness of two different kinds of nutrition education. Benefits include free nutrition education. The class portion of the study will run once a week for four weeks beginning the week of September 16, 2019. Classes will start at 9:00 am. This study will be conducted at the Kirksey Recreation Center, 15100 Hubbard, Livonia, MI 48154.

If you are interested call Noelle Blasch, RDN (Registered Dietitian Nutritionist) at 734-237-8691 by Tuesday, September 10, 2019. You will be asked to answer screening questions over the phone to establish your eligibility.

Please call Noelle Blasch, RDN for more information, 734-237-8691.



# Increasing Fruit and Vegetable Intake Study

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**Please call Noelle Blasch, RDN for more information, 734-237-8691.**

## Appendix C: Screening Questions

Begin with: This is a research study to learn more about the ways to present nutrition information and how adults learn and apply that information. We will have two groups, both receiving similar information about nutrition and health but how the information is delivered will be different. The study will take place at the Kirksey recreation center one day a week for four weeks. The study begins the week of 9/16/19 and classes end the week of 10/7/19. Potential class days are Monday, Tuesday, Wednesday, and Friday beginning at 9:00 am. Are you available once a week during this time frame? (If yes, continue. If no, thank them for their interest and end call.) There will be a follow-up post-test one month after the classes end, the week of 11/4/19.

1. Name

2. Age

3. Are you able to hold/use a kitchen knife and other kitchen utensils?

4. Are you able to read English and complete a hand-written pre and post-test?

5. What day(s) are you available to come to the recreation center at 9:00 am?

6. Address?

7. Phone number?

## Appendix D: Informed Consent Form

**Informed Consent Form**

Project Title: Comparison of nutrition education approaches on fruit and vegetable intake in older adults.

Principal Investigator: Noelle Blasch, RDN, Masters student

Faculty Advisor: Heather Hutchins-Wiese PhD, RD, School of Health Sciences

**Invitation to participate in research**

You are invited to participate in a research study. In order to participate, you must be 50 years old or older, have the ability to use a knife and other kitchen utensils, and be fluent in English to participate in the educational sessions and complete surveys. Participation in research is voluntary. Please ask any questions you have about participation in this study.

**Important information about this study**

- The purpose of the study is to determine if there is a difference in fruit and vegetable intake after a hands-on nutrition intervention compared to a nutrition lecture in adults aged 50 and older.
- Participation in this study involves attending four classes, held over four weeks, at the Kirksey Recreation Center; completing this informed consent, a pre-test, a post-test, and a second post-test one month after the last class.
- Risks of this study include possible injury from cutting self with knife. Participants in the experimental group will be using a sharp knife to cut fruits and vegetables. You should have experience with and be comfortable using a sharp knife.
- The investigator will protect your confidentiality by storing all study related information in a password protected file on a password protected computer and removing participant identifiers where appropriate.
- Participation in this research is voluntary. You do not have to participate, and if you decide to participate, you can stop at any time.

**What will happen if I participate in this study?**

Participation in this study involves

- Completing this informed consent, a pre-test, post-test, and a second post-test one month after the end of the last class.
- Attending four nutrition intervention classes over four weeks at the Kirksey Recreation Center.
- Possible use of common kitchen utensils.



You will be assigned by chance (like the flip of a coin) to one of two groups. One group will receive nutrition instruction and the other group will receive the same nutrition instruction and additionally participate in hands-on food preparation activities. You or the investigator cannot choose your group. You have an equal chance (1 out of 2) of being assigned to either study group.

**What types of data will be collected?**

We will collect information about you (typical demographic information) and your food intake, focusing on fruit and vegetable intake.

**What are the expected risks for participation?**

There are no psychological risks to participation. The primary risk of participation in this study is a potential of cutting self with a knife and loss of confidentiality.

Some of the pre- and post-test questions are personal and may make you feel uncomfortable. You do not have to answer any questions that make you uncomfortable or that you do not want to answer. If you are upset, please inform the investigator.

**Are there any benefits to participating?**

Possible benefits of participating in this study include increasing your fruit and/or vegetable intake.

**How will my information be kept confidential?**

We will keep your information confidential by storing it in a password-protected computer file on a password protected computer and remove participant identifies where appropriate.

We plan to publish the results of this study. We will not publish any information that can identify you.

We will make every effort to keep your information confidential, however, we cannot guarantee confidentiality. Other groups may have access to your research information for quality control or safety purposes. These groups include the University Human Subjects Review Committee, federal and state agencies that oversee the review of research, including the Office for Human Research Protections and the Food and Drug Administration. The University Human Subjects Review Committee reviews research for the safety and protection of people who participate in research studies.

If, during your participation in this study, we have reason to believe that elder abuse or child abuse is occurring, or if we have reason to believe that you are at risk for being suicidal or otherwise harming yourself or others, we must report this to authorities as

required by law. We will make every effort to keep your research information confidential. However, it may be required by law that we have to release your research information. If this were to occur, we would not be able to protect your confidentiality.

The investigators will ask you and the other people in the group to use only first names during the nutrition intervention sessions. The investigators will also ask you not to tell anyone outside of the group about anything that was said during the group session. However, we cannot guarantee that everyone will keep the discussions private.

### **Storing study information for future use**

We will store your information to study in the future. Your information will be labeled with a code and not your name. Your information will be stored in a password-protected or locked file.

We may share your information with other researchers without asking for your permission, but the shared information will never contain information that could identify you.

### **What are the alternatives to participation?**

The alternative is not to participate. You do not have to participate in this research study. You may choose not to participate.

### **Are there any costs to participation?**

There is no cost to participate in this study.

### **Will I be paid for participation?**

You will not be paid to participate in this research study.

### **What happens if I am injured while participating in the research?**

If you are injured as a result of participating in this study, we will assist you in getting necessary medical treatment. You or your insurance company will be responsible for the cost. Eastern Michigan University does not provide any form of compensation for injury.

### **Study contact information**

If you have any questions about the research, you can contact the Principal Investigator, Noelle Blasch, RDN, at [nblasch@emich.edu](mailto:nblasch@emich.edu) or by phone at 734-237-8691. You can also contact Noelle Blasch's adviser, Heather Hutchins-Wiese PhD, RD, at [hwiese1@emich.edu](mailto:hwiese1@emich.edu) or by phone at 734- 487-6631.

For questions about your rights as a research subject, contact the Eastern Michigan University Human Subjects Review Committee at [human.subjects@emich.edu](mailto:human.subjects@emich.edu) or by phone at 734-487-3090.

### **Voluntary participation**

Participation in this research study is your choice. You may refuse to participate at any time, even after signing this form, without repercussion. You may choose to leave the study at any time without repercussion. If you leave the study, the information you provided will be kept confidential. You may request, in writing, that your identifiable information be destroyed. However, we cannot destroy any information that has already been published. If you are randomized into the nutrition information only group then you will be offered the hands-on portion once this study is complete.

### **Statement of Consent**

I have read this form. I have had an opportunity to ask questions and am satisfied with the answers I received. I give my consent to participate in this research study.

\_\_\_\_\_  
Name of Subject

\_\_\_\_\_  
Signature of Subject

\_\_\_\_\_  
Date

I have explained the research to the subject and answered all their questions. I will give a copy of the signed consent form to the subject.

Noelle R. Blasch  
\_\_\_\_\_  
Name of Person Obtaining Consent

\_\_\_\_\_  
Signature of Person Obtaining Consent

\_\_\_\_\_  
Date

Appendix E: Class 1

# Morning Meal

Class 1  
Created By: Noelle R. Blasch, RDN

1

### Risk Factors for Disease in Older Adults

	Dietary Risk Factors						Nondietary Risk Factors				
	high fat diet	excessive alcohol intake	low complex carbohydrate/fiber	low vitamin or mineral intake	high sugar intake	high intake of salty or pickled foods	Genetics	Age	Sedentary lifestyle	Smoking and tobacco use	Environmental contaminants
Cancers	?	X	X	X		X	X	X	X	X	X
Hypertension	X	X		X		X (salt sensitive people)	X	X	X	X	X
Diabetes (Type 2)	X		X				X	X	X		
Osteoporosis		X		X			X	X	X	X	
Atherosclerosis	X		X	X			X	X	X	X	X
Obesity	X	X	X		X				X		
Stroke	X		X				X	X	X	X	X
Diverticulosis	X		X	X				X	X		
Dental and oral diseases				X	X		X			X	

(Bernstein & Munoz, 2016)

2

### Overview

- Nutrient needs
- Health benefits of peppers, onions, mushrooms, bananas
- General food safety
- Related recipes

3

### Changes in Aging that Affect Nutrient Needs

Change in body comp of physiologic function	Impact on nutrient requirements	Change in body comp of physiologic function	Impact on nutrient requirements
Decreased muscle mass	Decreased need for energy	Decreased calcium bioavailability	Increased need for calcium and vitamin D
Decreased bone density	Increased need for calcium and vitamin D	Decreased efficiency in metabolic use of vitamin B <sub>6</sub>	Increased need for vitamin B <sub>6</sub>
Decreased immune function	Increased need for vitamin B <sub>6</sub> , vitamin E and zinc	Increased oxidative stress	Increased need for beta-carotene, vitamin C, and vitamin E
Increased gastric pH	Increased need for vitamin B <sub>6</sub> , folic acid, calcium, iron, and zinc	Increased levels of homocysteine	Increased need for folate, vitamin B <sub>12</sub> , and vitamin B <sub>6</sub>
Decreased skin capacity for cholecalciferol synthesis	Increased need for vitamin D	Decreased vitamin absorption	Increased need for food choices with high vitamin nutrient density
Increased wintertime parathyroid hormone production	Increased need for vitamin D	Decreased gastric motility	Increased need for fiber and water

(Bernstein & Munoz, 2016)

4

### Health Benefits of Bell Peppers

Serving Size	3.5 oz (100 g) raw bell peppers
Calories	31 kcal
Water	92%
Protein	1 grams
Carbs	6 grams
Sugar	4.2 grams
Fiber	2.1 grams
Fat	0.3 grams

- Vitamin C – 169% RDI in 1 medium sized pepper
- Vitamin B<sub>6</sub> – specifically pyridoxine which is needed to form red blood cells
- Vitamin K1 – phyloquinone, for blood clotting and bone health
- Potassium – linked with heart health
- Folate (Vitamin B<sub>9</sub>) – many functions in body
- Vitamin E – antioxidant vital for healthy nerves and muscles
- Vitamin A (beta-carotene, pro-vitamin) – the body converts the beta-carotene to Vitamin A

(Amarson, 2019)

5

### Health Benefits of Onions

Serving Size	3.5 oz (100 g) raw onions
Calories	40 kcal
Water	89%
Protein	1.1 grams
Carbs	9.3 grams
Sugar	4.2 grams
Fiber	1.7 grams
Fat	0.1 grams

- Vitamin C – antioxidant needed for immune function and maintenance of skin and hair
- Folate – vitamin B<sub>9</sub> – important for cell growth and metabolism; water-soluble
- Vitamin B<sub>6</sub> – helps form red blood cells, located in many foods
- Potassium – important for heart health and may lower blood pressure

(Bjarnadottir, 2019)

6

### Health Benefits of Mushrooms

Serving Size	1 cup, chopped white mushroom
Calories	15 kcal
Protein	2.2 grams
Carbs	2.3 grams
Sugar	1.4 grams
Fiber	0.7 grams
Fat	0 grams

- B vitamins – B<sub>2</sub> (riboflavin), B<sub>9</sub> (folate), B<sub>1</sub> (thiamin), B<sub>3</sub> (pantothenic acid), B<sub>5</sub> (niacin) – assist the body getting energy from food and help build red blood cells
- Vitamin D
- Minerals - selenium, potassium, copper, iron, and phosphorus
- Fiber – specifically beta-glucans – may improve insulin resistance and blood cholesterol levels
- Choline – aids with sleep, muscle movements, learning, and memory; helps in cell membrane structure, transmission of nerve impulses, aids proper fat absorption, and reduces chronic inflammation

(Waite, 2017)

### Health Benefits of Bananas

Serving Size	1 medium sized banana (100 g)
Calories	89 kcal
Water	75%
Protein	1.1 grams
Carbs	22.8 grams
Sugar	12.2 grams
Fiber	2.6 grams
Fat	0.3 grams

- Potassium – can lower blood pressure when elevated and is good for heart health
- Vitamin B<sub>6</sub> – can provide up to 33% of the Daily Value in one medium banana
- Vitamin C – abundant in many fruits
- Resistant Starch – fermented by bacteria to form butyrate in the large intestine, may have beneficial effect on gut health
- Pectin – another fiber – some is water-soluble and that type increases as the banana ripens
- Both resistant starch and pectin regulate the rise in blood sugar levels after a meal

(Armarson, 2019)

7


8

### General Food Safety


- Clean - Wash hands and surfaces often.
- Separate - Don't cross-contaminate.
- Cook - Cook to the right temperature. (see separate slide)
- Chill - Refrigerate promptly. (see separate slide)

**CHECK YOUR STEPS: FOUR SIMPLE STEPS TO FOOD SAFETY**


Step 1




Step 2



Step 3



Step 4



("Keep Food Safe! Food Safety Basics." 2016)

#### SAFE COOKING TEMPERATURES

as measured with a food thermometer

GROUND MEAT & MEAT MIXTURES	Internal temperature
Beef, Pork, Veal, Lamb	160 °F
Turkey, Chicken	165 °F
<b>FRESH BEEF, PORK, VEAL &amp; LAMB</b>	145 °F
with a 3 minute rest time	
<b>POULTRY</b>	
Chicken & Turkey, Whole	165 °F
Poultry Parts	165 °F
Duck & Goose	165 °F
Stuffing (cooked alone or in bird)	165 °F
<b>HAM</b>	
Fresh (raw)	160 °F
Pre-cooked (to reheat)	140 °F
<b>EGGS &amp; EGG DISHES</b>	
Eggs	Cook until yolk & white are firm
Egg Dishes	160 °F
<b>SEAFOOD</b>	
Fin Fish	145 °F
or flesh is opaque and separates easily with fork	
Shrimp, Lobster & Crabs	Flesh pearly & opaque
Clams, Oysters & Mussels	Shells open during cooking
Scallops	Milky white or opaque & firm
<b>LEFTOVERS &amp; CASSEROLES</b>	165 °F

(Nutrition, 2019)

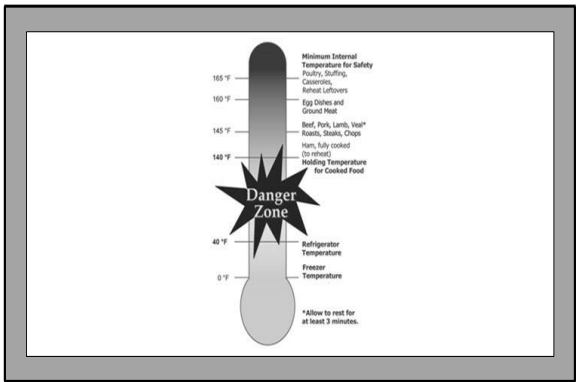
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#### USDA Cold Storage Chart

These time limit guidelines will help keep refrigerated food safe to eat. Because freezing keeps food safe indefinitely, recommended storage times for frozen foods are for quality only.

Product	Refrigerator (40°-41°)	Freezer (0°-1°)
Eggs		
Fresh, in shell	3 to 5 weeks	Don't freeze
Hard-boiled, in shell	1 to 3 weeks	Don't freeze well
Liquid Pasteurized Eggs, Egg Substitutes	3 to 4 days	Don't freeze well
Unopened	10 days	1 year
Full milk Vanillin-Flavored Products		
8 to 12 oz. cans, with & without salt	3 to 5 days	Don't freeze well
Hot Dogs	1 week	1 to 2 months
Unopened package	2 weeks	1 to 2 months
Unopened package	3 to 5 days	1 to 2 months
Unopened package	2 weeks	1 to 2 months
Beef or Sausage	7 days	1 month
Beef, ground	1 to 2 days	1 to 2 months
Chicken, turkey, pork, beef	1 to 2 days	1 to 2 months
Ham, turkey and other Cured Meats	1 to 2 days	1 to 2 months
Hamburger, ground beef, meat, veal, pork, lamb, & sausage	1 to 2 days	3 to 4 months
Fresh Beef, Veal, Lamb, Pork	1 to 2 days	3 to 4 months
Steaks	3 to 5 days	6 to 12 months
Chops	3 to 5 days	4 to 6 months
Roasts	2 to 5 days	4 to 12 months
Fresh Fishery		
Chickens or turkeys, whole	1 to 2 days	1 year
Southern	1 to 2 days	9 months
Lean Fish (Atlantic, haddock, cod, salmon, tuna, etc.)	1 to 2 days	6 to 8 months
Fatty Fish (salmon, tuna, etc.)	1 to 2 days	2 to 3 months
Leftovers		
Cooked meat or poultry	3 to 4 days	2 to 6 months
Uncooked meat, poultry, fish or seafood	1 to 2 days	2 to 3 months
Cheese, soft	2 to 3 days	1 to 2 months
Ice Cream	1 to 2 months	1 to 2 months

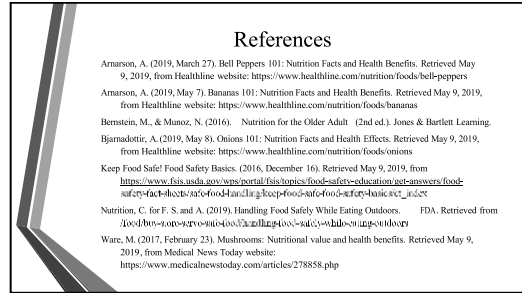


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14

## Very Veggie Scramble

Servings: 2

Ingredients:

- ½ cup Bell Pepper, chopped
- ¼ cup Onion, chopped
- ½ cup Mushrooms, chopped
- 2 tsp. Butter flavored Olive Oil
- 4 Large Eggs
- ¼ cup 1% Milk
- Black Pepper to taste



This Photo by Unknown Author is licensed under CC BY-NC-

Directions:

Heat olive oil in pan. Sauté peppers, onion, mushrooms until tender. Beat eggs, milk, black pepper together in a bowl. Add egg mixture to pan and scramble with vegetables. Enjoy!

Alternate Directions:

*Cut recipe in half, serves one person.* Whisk eggs, milk, oil and black pepper in a microwave safe bowl. Add the vegetables and mix well. Microwave on high heat, uncovered for one (1) minute. Stir/whisk with fork. Microwave an additional one (1) minute. Enjoy!

Nutrition Facts	
2 servings	
<b>Serving size 1/2 of recipe</b>	
Amount per serving	
<b>Calories</b>	<b>221</b>
	% Daily Value
Total Fat 14g	22%
Saturated fat 4g	20%
<i>Trans</i> fat 0g	
Monounsaturated fat 7g	
Polyunsaturated fat 2g	
Cholesterol 373mg	124%

Sodium 165mg	7%
Total Carbohydrates 7g	2%
Dietary fiber 1g	6%
Total sugar 4g	
Includes 0 grams added sugars	
Protein 15g	30%
Vitamin A	19%
Vitamin C	33%
Calcium	18%
Iron	11%

**Peanut Butter Toast with Banana**

Servings: 1

Ingredients:

1 slice, Whole Wheat Bread

2 Tbsp. Peanut Butter

1 medium Banana

½ tsp. Cinnamon; optional



Directions:

Toast bread as desired. Spread peanut butter on toast. Slice banana and place on top of peanut butter. Sprinkle with cinnamon as desired. Enjoy!

<b>Nutrition Facts</b>	
1 serving	
<b>Serving size 1</b>	
Amount per serving	
<b>Calories</b>	<b>364</b>
% Daily Value	
Total Fat 17g	27%
Saturated fat 3g	17%
<i>Trans</i> fat 0g	
Monounsaturated fat 8g	
Polyunsaturated fat 5g	
Cholesterol 0mg	0%
Sodium 214mg	9%
Total Carbohydrates 44g	15%
Dietary fiber 7g	29%
Total sugar 20g	
Protein 12g	
Vitamin A 2%	
Vitamin C 15%	
Calcium 17%	
Iron 10%	




Appendix F: Class 2

## Midday Meal (Lunch)


Class 2  
Created By: Noelle R. Blasch, RDN

1


### Overview




MyPlate and MyPlate for Older Adults 70+



Nutrition Facts Label and Grocery Shopping Tips



Health Benefits of cucumber, tomato, lettuce, berries

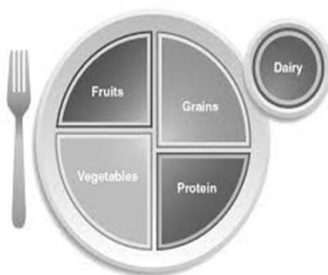


Recipes

2

### MyPlate

- Fruits
- Vegetables
- Protein
- Grains
- Dairy



(\*ChooseMyPlate™ n.d.)

ChooseMyPlate.gov

3

### MyPlate for Older Adults



**Fruits & Vegetables**  
Whole fruits and vegetables are rich in important nutrients and fiber. Choose fresh and vegetables with deeply colored flesh. Choose canned varieties that are packed in their own juices or low-sodium.

**Healthy Oils**  
Liquid vegetable oils and soft margarine provide important fatty acids and more fat-soluble vitamins.

**Herbs & Spices**  
Use a variety of herbs and spices to enhance flavor of foods and reduce the need to add salt.

**Fluids**  
Drink plenty of fluids. Fluids can come from water, tea, coffee, soups, and more and vegetables.

**Grains**  
Whole grain and fortified foods are great sources of fiber and B-vitamins.

**Dairy**  
Fat free and low-fat milk, cheese and yogurt provide protein, calcium and other important nutrients.

**Protein**  
Protein rich foods provide more important nutrients. Choose a variety including meat, beans, fish, soy, meat and poultry.

Remember to Stay Active!

Tufts University Nutrition Scientists Provide Updated MyPlate for Older Adults™ 2016

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#### Old Label

Nutrition Facts	
Serving Size 60g (1/2 cup)	
Amount Per Serving	
Calories 110	Calories from Fat 20
Total Fat 2.5g 4%	
Saturated Fat 1.5g 8%	
Trans Fat 0g	
Cholesterol 5mg 2%	
Sodium 20mg 1%	
Total Carbohydrate 21g 7%	
Dietary Fiber 2g 8%	
Sugars 14g	
Protein 1g	
Vitamin A 2%	Vitamin C 2%
Calcium 2%	Iron 2%

#### New Label

Nutrition Facts	
Serving Size 60g (1/2 cup)	
Amount per serving	
Calories 110	
Total Fat 2.5g 3%	
Saturated Fat 1.5g 8%	
Trans Fat 0g	
Cholesterol 5mg 2%	
Sodium 20mg 1%	
Total Carbohydrate 21g 8%	
Dietary Fiber 2g 7%	
Total Sugars 14g	
Includes 8g Added Sugars 16%	
Protein 1g	
Vitamin D 0mg	0%
Calcium 15mg	2%
Iron 0mg	0%
Potassium 90mg	2%

(\*Download nutrition facts label clipart Nutrition facts label Food," n.d.)

5

### Grocery Shopping Tips

- Eat with the season
- Check for store coupons and sales
- Make a list and stick to it
- Frozen or canned can be good options
- Buy small amounts of fresh produce
- If on sale, then buy frequently purchased non-perishable items in bulk
- Savings can be found with store brands
- Purchase whole produce to save money; Purchase cut/prepared produce to save time
- Plan meals over a week or month

("10 Tips," 2015)




6

### Health Benefits of Cucumbers

Serving Size:	1.5 ounce (300-gram) unpeeled, raw
Calories	45 kcal
Water	96%
Protein	2 grams
Carbs	11 grams
Sugar	5.1 grams
Fiber	2 grams
Fat	0 grams

- **Vitamin C** – 14% of RDA
- **Vitamin K** – 62% of RDA
- **Magnesium** – 10% of RDA
- **Potassium** – 23% of RDA
- **Manganese** – 12% RDA




(Link, 2017)

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### Health Benefits of Tomato

Serving Size:	200 grams, raw, small
Calories	18 kcal
Water	95%
Protein	0.9 grams
Carbs	3.9 grams
Sugar	2.6 grams
Fiber	1.2 grams
Fat	0.2 grams


- **Vitamin C, Potassium, Vitamin K1** – (phyloquinone), **Folate (B9)**
- **Fibers** – 87% are insoluble, hemicellulose, cellulose, lignin
- **Lycopene** – red pigment and antioxidant; mostly in skin
- **Beta carotene** – antioxidant (yellow or orange color); converted to vitamin A in body
- **Naringenin** - found in skin; research links with decreased inflammation
- **Chlorogenic Acid** – antioxidant compound, may lower blood pressure in those with elevated levels



(Bjarnadottir, 2019)

8

### Health Benefits of Lettuce





<b>Iceberg Lettuce</b>	<b>Romaine Lettuce</b>	<b>Spinach</b>
<ul style="list-style-type: none"> <li>• Low in calories, sugar, and fat</li> <li>• Considerable amount of vitamin A and K</li> <li>• High water content</li> <li>• Some calcium, potassium, vitamin C, folate</li> </ul> <p>(Butler, 2017a)</p>	<ul style="list-style-type: none"> <li>• 8 calories for 1 shredded cup, 0.1 gram of fat</li> <li>• Low fiber, 1 gram</li> <li>• High in calcium, phosphorus, magnesium, and potassium</li> <li>• Good source of vitamin C, K, folate, and beta carotene as well as many other nutrients</li> </ul> <p>(Butler, 2017b)</p>	<ul style="list-style-type: none"> <li>• 23 calories for 3.5 ounces; 0.4 gram of sugar and fat</li> <li>• High in insoluble fiber</li> <li>• Outstanding source of vitamin A, C, and K I as well as folic acid, calcium, and iron</li> <li>• Other nutrients include potassium, magnesium, vitamin B6, B9, and E</li> <li>• Health benefits include improved oxidative stress, eye health, blood pressure, and cancer prevention</li> </ul> <p>(Gunnars, 2019)</p>

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### Health Benefits of Berries

- Packed with antioxidants that keep free radicals in check
- Blood sugar and insulin levels may improve
- Good source of insoluble fiber; slows the movement of food through the GI tract, reducing hunger and helping you feel full longer
- Contain vitamin C, K1, manganese, copper, folate
- May reduce chronic inflammation decreasing the risk of heart disease
- May help prevent LDL cholesterol from being oxidized or damaged therefore lowering cholesterol levels which may lower the risk of heart disease
- Ellagic acid may help protect collagen (decrease wrinkling and skin aging) in skin exposed to sun
- Antioxidants may protect against cancer tumor growth
- Improved endothelial cell function (lining of blood vessels) leads to improved functioning of the arteries

(Spritzler, 2014)

10

## Recipes

See separate handout.



11

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Download nutrition facts label clipart Nutrition facts label Food. (n.d.). Retrieved July 10, 2019, from KissClipart website: <https://www.kissclipart.com/nutrition-facts-label-clipart-nutrition-facts-label-g3p5uo/>

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12



## HOW TO: SALAD COMBOS!

### The Base



Kale



Iceberg



Cos



Red Oak Lettuce



Baby Spinach



Mesclun Greens



Rocket

### Add Extra Greens



Edamame



Avocado



Cucumber



Microgreens



Broccoli

### Pop of Colour



Radish



Grated Carrot



Capsicum



Tomato

### Add the Crunch



Walnuts



Pumpkin Seeds



Quinoa



Sesame Seeds



Almonds



Apple



Pomegranate Seeds

### Protein Power!



Grilled Chicken



Grilled Fish



Egg



Beans, Chickpeas & Lentils

## Tossed Salad

Serving: 1

Ingredients:

- 1 cup Romaine lettuce, chopped
- 1 cup Spinach
- ½ medium tomato, chopped
- 1/3 cucumber (100 grams), sliced
- ½ cup chickpeas, canned, rinsed
- 16 grams (~1/2 ounce) walnuts
- 2 Tbsp. Balsamic Vinaigrette dressing



Directions:

Wash lettuce and spinach, place in bowl. Top with remaining ingredients and toss to combine. Enjoy!

<b>Nutrition Facts</b>	
1 serving	
<b>Serving size 1</b>	
Amount per serving	
<b>Calories</b>	<b>317</b>
	% Daily Value
Total Fat 13g	20%
Saturated fat 1g	6%
<i>Trans</i> fat 0g	
Monounsaturated fat 2g	
Polyunsaturated fat 9g	
Cholesterol 0mg	0%
Sodium 317mg	13%
Total Carbohydrates 42g	14%
Dietary fiber 7g	29%
Total sugar 17g	
Protein 10g	20%
Vitamin A	108%
Vitamin C	38%
Calcium	6%
Iron	21%
Potassium 383mg	11%

## Berry Smoothie

Servings: 2

Ingredients:

1 ½ cups 1% milk

1 medium/small banana, sliced

1 ½ cups mixed berries, frozen

¾ cup plain Greek yogurt



Directions:

Place all ingredients in blender, cover. Process until smooth. If desired, add honey for greater sweetness (keep in mind this adds calories too).

Nutrition Facts	
2 serving	
<b>Serving size 2</b>	
Amount per serving	
<b>Calories</b>	<b>224</b>
	% Daily Value
Total Fat 2g	3%
Saturated fat 1g	6%
<i>Trans</i> fat 0g	
Monounsaturated fat 0g	
Polyunsaturated fat 0g	
Cholesterol 10mg	3%
Sodium 109mg	5%
Total Carbohydrates 40g	13%
Dietary fiber 6g	25%
Total sugar 28g	
Protein 14g	28%
Vitamin A	10%
Vitamin C	26%
Calcium	35%
Iron	4%
Potassium 566mg	16%


Appendix G: Class 3

# Supper or Evening Meal


Class 3  
Created By: Noelle R. Blasch, RDN

1


## Overview




Water Intake



Portion Sizes





Health Benefits of  
broccoli, legumes,  
melon



Recipes

2






## Water Intake

- **Benefits:**
  - Maintain normal body temperature
  - Lubricate and cushion joints
  - Protect spinal cord and other tissues
  - Rid body of waste through urination, perspiration, and bowel movements
  - Prevent dehydration that can cause unclear thinking and mood changes
- **Tips for drinking more water:**
  - Carry a water bottle with you when away from home
  - Freeze some freezer-safe water bottles to have ice-cold water with you when away from home
  - Drink water in place of sugar-sweetened beverages
  - Choose water when eating out
  - Add a wedge of lemon, lime, cucumber, watermelon, etc. to water for a refreshing taste

("Water & Nutrition | Drinking Water | Healthy Water | CDC," 2018)

3





## Water Intake (continued)

- Minimum daily intake 1700 mL (57.5 ounces or 7 – 8oz glasses of water)
- Thirst mechanism declines with age
- Make a plan to drink water throughout the day
- Increasing fruit and vegetable intake will increase water intake


(Faes, Spigt, & Olde Rikkert, 2007)

4




## Portion Sizes

- **Daily intake recommendation:**
  - Vegetables ~ 2 - 3 cups
  - Fruit ~ 1 ½ - 2 cups
  - Grain ~ 5 - 8 ounces
  - Dairy ~ 3 cups, low-fat
  - Protein ~ 5 - 6 ½ ounces
- **Serving Size** ~ Standard amount of food; can be used to compare items; example: 1 cup or ounce
- **Portion Size** ~ How much is served or how much is eaten



("Serving and Portion Sizes," 2019)

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## Portion Size Equivalents

- ½ Cup Equivalent of Vegetables =
  - 1 cup uncooked spinach
  - 6 baby carrots
  - ½ cup cooked kidney beans
  - ½ cup broccoli florets
  - ½ large pepper (3 inch diameter, 3 ¾ inch long)
  - ½ cup cooked green beans


- ½ Cup Equivalent of Fruit =
  - 1 small piece of fruit, such as a 2 inch peach or large plum
  - ¼ cup dried fruit
  - 1/8 medium melon
  - ½ cup 100% orange juice
  - ½ medium grapefruit
  - ½ cup grapes

("Know Your Food Groups," 2019)

6



### Health Benefits of Broccoli




Serving Size:	1 Cup (91 grams)
Calories	31 kcal
Water	89%
Protein	2.5 grams
Carbs	6 grams
Sugar	1.5 grams
Fiber	2.4 grams
Fat	0.4 grams

- Vitamin C—antioxidant, immune function and skin health
- Vitamin K1— blood clotting and possibly bone health
- Folate (B9)— normal tissue growth and cell function
- Potassium—blood pressure control and heart disease prevention
- Manganese and Iron
- Many antioxidants and plant compounds for better health

(Bjarnadottir, 2019)

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### Health Benefits of Legumes




Serving size:	1 cup, boiled Pinto Beans	1 cup (198 grams), cooked Lentils	1 cup (177 grams) cooked Black Beans
Calories	245 kcal	230 kcal	277 kcal
Protein	15 grams	18 grams	15 grams
Fat	1 gram		1 gram
Carbs	45 grams	40 grams	41 grams
Fiber	15 grams	16 grams	15 grams
Iron	20% DV	37% DV	20% RDI
Calcium	8% DV		
Magnesium	21% DV	17% DV	30% RDI
Phosphorous	25% DV	10% DV	24% RDI
Potassium	21% DV	16% DV	17% RDI
Folate	74% DV	90% DV	64% RDI

- Also contain zinc, copper, manganese, selenium, and vitamins B1, B6, E, and K
- May aid in weight loss (protein/fiber content)
- May promote heart health (lower LDL cholesterol, raise HDL cholesterol, reduced blood pressure and inflammation)
- Low glycemic index food that can help with Type 2 Diabetes

(Gunnars, 2019), (Hill, 2018), (Leech, 2019)

8

### Health Benefits of Melon



Serving Size:	Honeydew	Cantaloupe
3.5 ounces (100 grams)		
Calories	36 kcal	34 kcal
Water	90%	90%
Fat	0 grams	0 grams
Carbs	9 grams	8 grams
Protein	1 gram	1 gram
Fiber	1 gram	1 gram
Vitamin A	1% DV	68% DV
Vitamin C	30% DV	61% DV

- Low in calories, loaded with vitamins, minerals, and antioxidants
- Rich in plant polyphenols
- Contain the antioxidant superoxide dismutase which may help repair skin from sun exposure

(Shoemaker, 2019)

9

## Recipes

See separate handout.

10

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## Broccoli Bean Pasta



Servings: 6 (main dish)

Ingredients:

- |   |   |
|---|---|
| 1 - 16 ounce package whole wheat rotini pasta | Pepper to taste                         |
| 1 ½ cups chicken broth, low sodium            | 1 can black beans, drained and rinsed   |
| 2 ½ cups chopped fresh spinach                | 1 ½ cups frozen chopped broccoli        |
| 1/2 cup chopped red onion                     | 1 can diced tomatoes, no sodium         |
| 2 cloves garlic, chopped                      | 2 ounces freshly grated Parmesan cheese |
| 1/2 teaspoon cayenne pepper                   |   |

Directions:

1. Bring a large pot of water to a boil. Add rotini, and cook for 8 to 10 minutes, or until al dente; drain.
2. In a large saucepan over medium heat, bring the chicken broth to a boil. Reduce heat, and mix in spinach, onion, garlic, cayenne pepper, and pepper. Stir in the black beans and broccoli. Continue to cook and stir 5 to 10 minutes.
3. Stir the tomatoes into the saucepan, and continue cooking 10 minutes, or until all vegetables are tender. Serve over the cooked pasta. Garnish with Parmesan cheese.

Nutrition Facts	
6 servings	
<b>Serving size 1</b>	
Amount per serving	
<b>Calories</b>	<b>352</b>
	% Daily Value
Total Fat 5g	7%
Saturated fat 2g	9%
<i>Trans</i> fat 0g	
Monounsaturated fat 1g	
Polyunsaturated fat 0g	

Cholesterol 10mg	3%
Sodium 420mg	18%
Total Carbohydrates 64g	21%
Dietary fiber 14g	54%
Total sugar 4g	
Protein 20g	39%
Vitamin A 34%	
Calcium 34%	
Iron 24%	
Vitamin C 38%	



### Cucumber Melon Salsa



Servings: 7

Ingredients:

- 1 English cucumber, finely diced
- 1 ½ cups fresh cantaloupe, finely diced
- 2 tsp. extra-virgin olive oil
- 1 tsp. jalapeno, seeded and minced
- 1 Tbsp. lime juice
- 1 tsp. lime zest

- ¼ cup red onion, chopped
- ½ Roma (plum) tomato, chopped
- ½ bunch cilantro, coarsely chopped
- 1 pinch salt
- 1 pinch ground black pepper

Directions:

In a large serving bowl, lightly mix together the cucumbers, cantaloupe, olive oil, jalapeno pepper, lime juice, lime zest, red onion, tomato, cilantro, salt, and pepper. Cover the bowl and chill in the refrigerator for at least 2 hours to let the flavors blend. Stir before serving and enjoy!

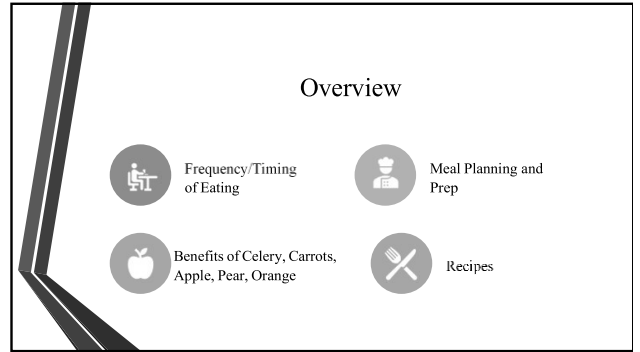
Serving suggestions – serve with fish or chicken; may also be eaten with whole grain tortilla chips.

Nutrition Facts	
7 servings	
<b>Serving size 1/2 cup</b>	
Amount per serving	
<b>Calories</b>	<b>56</b>
	% Daily Value
Total Fat 2g	3%
Saturated fat 0g	
<i>Trans</i> fat 0g	
Monounsaturated fat 1g	
Polyunsaturated fat 0g	
Cholesterol 0mg	0%
Sodium 31mg	1%
Total Carbohydrates 10g	3%
Dietary fiber 2g	
Total sugar 6g	
Protein 1g	3%
Vitamin A 35%	
Calcium 5%	
Iron 3%	
Vitamin C 88%	

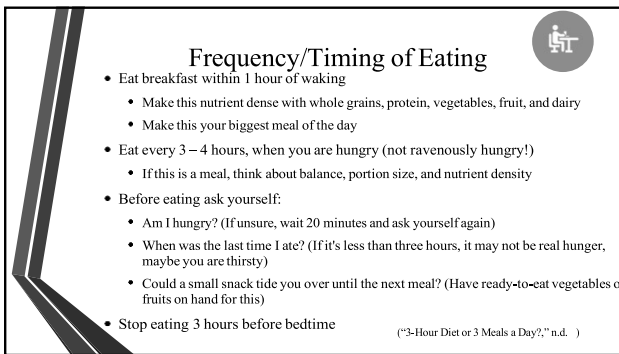
Appendix H: Class 4



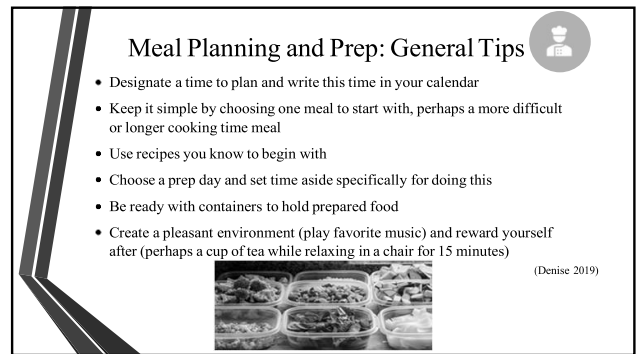
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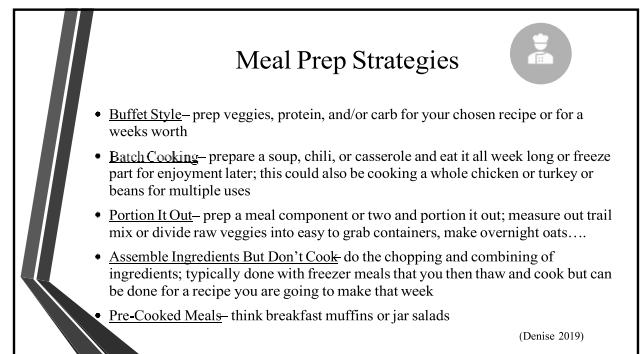
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4




5




6

### Health Benefits of Celery




- Contains vitamin C, beta carotene, flavonoids, plus 12 other antioxidants
- Celery and celery seeds contain about 25 anti-inflammatory compounds
- Supports healthy digestion with pectin-based polysaccharides (may decrease ulcers in stomach and improve the lining of the stomach); contains soluble and insoluble fiber (5 grams per cup); 95% water
- Vitamin A, K, C, potassium, folate, low glycemic index
- Can help neutralize acidic foods due to the magnesium, iron, and sodium content



(Butler, 2016)


7

### Health Benefits of Carrots



Serving Size:	100 grams Carrots
Calories	41 kcal
Water	88%
Protein	0.9 grams
Carbs	9.6 grams
Sugar	4.7 grams
Fiber	2.8 grams
Fat	0.2 grams


- Beta Carotene–Vitamin A - important for growth, development, and immune function; absorbed better when carrots are cooked
- Biotin—helps with fat and protein metabolism
- Vitamin K1, Potassium, Vitamin B6
- Carotenoids– antioxidant linked with better immune function, reduced risk of heart disease and some cancers



(Bjarnadottir, 2019)


8

### Health Benefits of Apples



Serving Size	Raw, unpeeled, medium size apple (100 grams)
Calories	52 kcal
Water	86%
Protein	0.3 grams
Carbs	13.8 carbs
Sugar	10.4 grams
Fiber	4 grams
Fat	0.2 grams


- Good source of **vitamin C and potassium**, contains many other nutrients in small amounts
- High in **antioxidant plant compounds** – Quercetin, Catechin, Chlorogenic acid
- **Research links** apple consumption to weight loss, blood sugar control (diabetes), reduced cholesterol (heart disease), and cancer protection for the lungs and colon



(Amarnson, 2019b)

9

### Health Benefits of Pears




Serving Size:	Medium sized pear (178 grams)
Calories	101 kcal
Protein	1 gram
Carbs	27 grams
Fiber	6 grams
Vitamin C	12 % of DV
Vitamin K	6% of DV
Potassium	4% of DV
Copper	16% of DV

- **Polyphenol antioxidants** – protects against oxidative damage – up to 6 times more in the skin than the flesh
- Contains both **soluble and insoluble fiber** – promotes bowel regularity by softening and bulking up stool
- **Lutein and Zeaxanthin** found in green pear skin – necessary to keep vision sharp
- **Flavonoid antioxidants** help fight inflammation and reduce risk for heart disease and diabetes
- **Anticancer effect** from anthocyanin and cinnamic acid – may help protect against lung, stomach and bladder cancer as well as breast and ovarian cancers
- May help with **weight loss** due to low calories, high water and fiber content

(Wartenberg, 2019)


10

### Health Benefits of Oranges



Serving Size	½ a large orange (100 grams)
Calories	47 kcal
Water	87%
Protein	0.9 grams
Carbs	11.8 carbs
Sugar	9.4 grams
Fiber	2.4 grams
Fat	0.1 grams

- Good source of **vitamin C, thiamin (B1), folate (B9), and potassium** among others
- **Bioactive antioxidant plant compounds** – carotenoids and phenolics
- **Citric Acid and Citrates** (sour taste) – may help prevent kidney stone formation
- Help prevent **anemia** when consumed with iron rich foods (vitamin C and citric acid help with the absorption of iron)



(Amarnson, 2019a )

11



## Recipes

See separate handout.

12

## References

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## Snack List

Choose nutrient dense foods within your calorie range that will help you to maintain energy and meet your food group serving goals! Remember to eat a variety of fruits and vegetables including all the different colors. Snacks below range from about 150 – 300 calories.

- One medium apple with 1 tablespoon peanut butter
- One medium pear with 1-ounce cheese
- One cup tri-colored veggies (carrots, celery, sugar snap peas, cherry tomatoes, red pepper, cucumber, cauliflower, orange pepper, broccoli, etc.) with 1-2 tablespoons ranch dressing, hummus, or peanut butter for dipping
- One whole grain toaster waffle with ½ cup blueberries and 2 tablespoons Greek yogurt
- Fruit smoothie: 1 cup low-fat milk, ½ cup frozen berries and ½ banana, blend together
- One 6-inch whole grain tortilla with ¼ cup black beans and 2 tablespoons fresh salsa
- Six ounces (¾ cup) plain Greek yogurt with ½ cup berries and ¼ cup granola
- Trail mix: mix 20 almonds, ¼ cup raisins, and ¼ cup sunflower seeds (about ½ cup)
- Tortilla chips (follow package serving size) with ¼ cup salsa
- Salad: 2 cups mixed greens with ½ cup mandarin oranges, 1 tablespoon sliced almonds and 1 tablespoon dressing
- Mini-sandwich: Whole-grain dinner roll or 1 slice of whole grain bread with 1 slice turkey, mustard, tomato, lettuce, onion



Appendix I: Fruit and Vegetable Survey

*Instructions:*

- Think about what you usually ate last month.
- Please think about ALL the fruits and vegetables that you ate last month. Include those that were:
  - Raw and cooked,
  - Eaten at snacks and at meals,
  - Eaten at home and away from home (restaurants, friends, take-out), and
  - Eaten alone and mixed with other foods.
- Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had.
- If you mark “Never” for a question, follow the “Go to” instruction.
- Choose the best answer for each question. Mark (fill in oval) only one response for each question.

1. Over the last month, how many times per month, week, or day did you drink **100% fruit juice**, such as orange, apple, grape, or grapefruit juice? **Do not count** fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all mealtimes and between meals.

○	○	○	○	○	○	○	○	○	○
Never <b>(Go to Question 2)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

1a. Each time you drank **100% juice**, how much did you usually drink?

○	○	○	○
Less than 3/4 cup (less than 6 ounces)	3/4 to 1 1/4 cup (6 to 10 ounces)	1 1/4 to 2 cups (10 to 16 ounces)	More than 2 cups (more than 16 ounces)

2. Over the last month, how often did you eat **lettuce salad (with or without other vegetables)**?

○	○	○	○	○	○	○	○	○	○
Never <b>(Go to Question 3)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

2a. Each time you ate lettuce salad, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
About 1/2 cup	About 1 cup	About 2 cups	More than 2 cups

3. Over the last month, how often did you eat **French fries or fried potatoes**?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to Question 4)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

3a. Each time you ate **French fries or fried potatoes**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Small order or less (About 1 cup or less)	Medium order (About 1 1/2 cups)	Large order (About 2 cups)	Super Size order or more (About 3 cups or more)

4. Over the last month, how often did you eat **other white potatoes**? Count **baked, boiled, and mashed, potato salad, and white potatoes that were not fried.**

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to Question 5)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

4a. Each time you ate **these potatoes**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 small potato or less (1/2 cup or less)	1 medium potato (1/2 to 1 cup)	1 large potato (1 to 1 1/2 cups)	2 medium potatoes or more (1 1/2 cups or more)

5. Over the last month, how often did you eat **cooked dried beans**? Count **baked beans, bean soup, refried beans, pork and beans,** and **other bean dishes**.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to Question 6)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

5a. Each time you ate **these beans**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	1/2 to 1 cup	1 to 1 1/2 cups	More than 1 1/2 cups

Now, divide your waking hours into three time periods:

- **MORNING**
- **LUNCHTIME AND AFTERNOON**
- **SUPPERTIME AND EVENING**

Please think about the foods you ate during each of those time periods over the last month.

**MORNING**

6. Think about all the foods you ate at your morning meal and snacks over the last month. On how many days did you eat **fruit** for your morning meal or morning snacks? Count any kind of fruit – fresh, canned, and frozen. **Do not count** juices.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 7)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day



6a. When you ate **fruit** in the morning, what is the **total** amount of **fruit** that you usually ate in a morning?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1 medium fruit	1 medium fruit	2 medium fruits	More than 2 medium fruits
<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	About 1/2 cup	About 1 cup	More than 1 cup

7. Think about all the foods you ate at your morning meal and morning snacks. On how many days did you eat **vegetables** for your morning meal or morning snacks?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 8)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day

7a. When you ate **vegetables** in the morning, what is the **total** amount of **vegetables** that you usually ate in a morning?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	1/2 to 1 cup	1 to 2 cups	More than 2 cups

**LUNCHTIME AND AFTERNOON**

8. Think about all the foods you ate at lunchtime and for your afternoon snacks last month. On how many days did you eat **fruit** at lunchtime or for your afternoon snacks? Count any kind of fruit – fresh, canned, and frozen. **Do not count** juices.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 9)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day

8a. When you ate **fruit** at lunchtime or for your afternoon snacks, what is the **total** amount of **fruit** that you usually ate then?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1 medium fruit	1 medium fruit	2 medium fruits	More than 2 medium fruits
<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	About 1/2 cup	About 1 cup	More than 1 cup

9. Think about all the foods you ate at lunchtime and for your afternoon snacks. On how many days did you eat **vegetables** at lunchtime or for your afternoon snacks?

**DO NOT COUNT:**

- Lettuce salads
- White potatoes
- Cooked dried beans
- Vegetables in mixtures, such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc.
- Rice

**COUNT:** All other vegetables – raw, cooked, canned, and frozen

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 10)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day

9a. When you ate **vegetables** at lunchtime or for your afternoon snacks, what is the **total** amount of **vegetables** that you usually ate then?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	1/2 to 1 cup	1 to 2 cups	More than 2 cups

**SUPPERTIME AND EVENING**

10. Think about all the foods you ate at suppertime and for you evening snacks last month. On how many days did you eat **fruit** at suppertime or for your evening snacks? Count any kind of fruit – fresh, canned, and frozen. **Do not count** juices.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 11)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day

10a. When you ate **fruit** at suppertime or for your evening snacks, what is the **total** amount of **fruit** that you usually ate then?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1 medium fruit	1 medium fruit	2 medium fruits	More than 2 medium fruits
<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	About 1/2 cup	About 1 cup	More than 1 cup

11. Think about all the foods you ate at supper and for your evening snacks. On how many days did you eat **vegetables** at supper or for your evening snacks?

**DO NOT COUNT:**

- Lettuce salads
- White potatoes
- Cooked dried beans
- Vegetables in mixtures, such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc.
- Rice

**COUNT:** All other vegetables – raw, cooked, canned, and frozen

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to question 12)</b>	1-3 days last month	1-2 days per week	3-4 days per week	5-6 days per week	Every day

11a. When you ate **vegetables** at supper or for your evening snacks, what is the **total** amount of **vegetables** that you usually ate then?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1/2 cup	1/2 to 1 cup	1 to 2 cups	More than 2 cups

**These last few questions ask about how often you ate particular foods at any time of the day.**

12. Over the last month, how often did you eat **tomato sauce**? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never <b>(Go to Question 13)</b>	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

12a. Each time you ate **tomato sauce**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
About 1/4 cup	About 1/2 cup	About 1 cup	More than 1 cup

13. Over the last month, how often did you eat **vegetable soups**? Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never (Go to Question 14)	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

13a. When you ate **vegetable soup**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than 1 cup	1 to 2 cups	2 to 3 cups	More than 3 cups

14. Over the last month, how often did you eat **mixtures that included vegetables**? Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 times per day	5 or more times per day

**Thank you very much for completing this form.**

Reference: (National Institutes of Health, Eating at America’s Table Study, Quick Food Scan, 2000)

Appendix J: Cooking and Shopping Survey

*Instructions:* Mark (fill in oval) for the best answer to each question. Select only one answer, unless directed otherwise.

**Cooking and Storage Facilities**

1. Do you have a kitchen or a dedicated food preparation or cooking area?

<input type="radio"/>	<input type="radio"/>
Yes	No

2. Which, if any, of these items do you have regular access to? Mark all that apply.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refrigerator	Freezer (excluding freezer compartment at top of fridge.)	Microwave oven	Gas or Electric stove	Oven	None

**Shopping Habits**

3. How often do you buy FRESH fruits?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

4. How often do you buy FROZEN fruits?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

5. How often do you buy CANNED fruits?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

6. How often do you buy FRESH vegetables?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

7. How often do you buy FROZEN vegetables?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

8. How often do you buy CANNED vegetables?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More than once a <b>day</b>	Once a <b>day</b>	2 or 3 times a <b>week</b>	Once a <b>week</b>	2 or 3 times a <b>month</b>	Once a <b>month</b>	Every two <b>months</b>	Less than every 2 <b>months</b>

**Cooking Skills**

9. How often do you prepare a main meal for yourself (or yourself and others) in your household?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every day	Most days (5-6)	Some days (3-4)	One or two days a week	Less than once a week	Only for special occasions	Never

10. Which, if any, of the following cooking techniques do you feel confident about using? Mark all that apply.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Boiling	Steaming or poaching	Frying	Stir frying	Grilling	Oven baking or roasting	Stewing/ braising/ casseroling	Microwaving	None of these

11. Which, if any, of the following foods do you feel confident about cooking? Mark all that apply.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Red meat	Chicken	White fish (cod, haddock)	Oily fish (herring, mackerel, salmon)	Pulses (like split peas, lentils)	Dry pasta
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Rice	Potatoes	Fresh green vegetables (cabbage, spinach, broccoli)	Root vegetables (carrots, parsnips)	None of these	

12. Would you be able to make a complete meal from ready-made ingredients (e.g. ready-made sauces and pasta to make spaghetti)?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yes, with no help at all	Yes, with a little help	Yes, with a lot of help	No, not at all

13. Would you be able to make a main dish from basic ingredients (raw potatoes, raw meat, onions etc.), possibly following a recipe (e.g. shepherd's pie)?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yes, with no help at all	Yes, with a little help	Yes, with a lot of help	No, not at all

**Thank you very much for completing this form.**

Reference: (National Diet and Nutrition Survey (NDNS), Program Documentation, Interviewer Schedule, n.d.)



Appendix K: Mediterranean Diet Survey

<b>We would like to ask you a few questions about your diet</b>	<b>Check the box that best applies</b>	
1. Do you use olive oil as main culinary fat?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2. How many tablespoons of olive oil do you consume in a given <u>day</u> (including oil used for frying, salads, out-of-house meals, etc.)?	<3 <input type="checkbox"/>	≥4 <input type="checkbox"/>
3. How many vegetable servings do you consume per <u>day</u> ? (1 serving: ½ cup cooked, 1 cup raw [consider garnish and side dishes as half a serving])	<2 <input type="checkbox"/>	≥2 <input type="checkbox"/>
4. How many fruit units (including fresh squeezed or 100% fruit juices) do you consume per <u>day</u> ? (1 serving: 1 cup, 8 fl oz)	<3 <input type="checkbox"/>	≥3 <input type="checkbox"/>
5. How many servings of red meat, hamburger, or processed meat products (ham, sausage, etc.) do you consume per <u>day</u> ? (1 serving: 2-3 ounces)	<1 <input type="checkbox"/>	≥1 <input type="checkbox"/>
6. How many servings of butter, margarine, or cream do you consume per <u>day</u> ? (1 serving: 1 tablespoon)	<1 <input type="checkbox"/>	≥1 <input type="checkbox"/>
7. How many sugar sweetened beverages or carbonated beverages do you drink per <u>day</u> ?	<1 <input type="checkbox"/>	≥1 <input type="checkbox"/>
8. Do you drink wine? How many glasses of wine do you drink per <u>week</u> (1 glass: 3 oz)? <input type="checkbox"/> Yes <input type="checkbox"/> No	<7 <input type="checkbox"/>	>7 <input type="checkbox"/>
9. How many servings of legumes (beans, black eyed peas) do you consume per <u>week</u> ? (1 serving: 1 cup)	<3 <input type="checkbox"/>	≥3 <input type="checkbox"/>
10. How many servings of fish or shellfish do you consume per week? (1 serving: 2-3 ounces)	<3 <input type="checkbox"/>	≥3 <input type="checkbox"/>
11. How many times per week do you consume commercial sweets or pastries (not homemade), such as cakes, cookies, biscuits, or custard?	<2 <input type="checkbox"/>	≥2 <input type="checkbox"/>
12. How many servings of nuts (including peanuts) do you consume per week? (1 serving: ¼ cup), 1 oz)	<3 <input type="checkbox"/>	>3 <input type="checkbox"/>
13. Do you prefer to eat chicken, turkey, or rabbit meat instead of veal, pork, hamburger, or sausage? Are you a vegetarian or vegan? <input type="checkbox"/> Yes <input type="checkbox"/> No	Yes <input type="checkbox"/>	No <input type="checkbox"/>
14. How many times per <u>week</u> do you consume boiled vegetables, pasta, rice, or other dishes with a sauce of tomato, garlic, onion, or leeks without meat sautéed in olive oil?	<2 <input type="checkbox"/>	≥2 <input type="checkbox"/>