PINK AND DUDE CHEFS: IMPACT OF A NUTRITION AND CULINARY EDUCATION PROGRAM WITH MIDDLE SCHOOL STUDENTS IN AN AFTERSCHOOL SETTING

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ABSTRACT

Pink and Dude Chefs: Impact of A Nutrition and Culinary Education Program with Middle School Students in an Afterschool Setting

Jessie Bierlich-Wesch

The epidemic of adolescent obesity has become one of the greatest public health concerns in the United States. Approximately 20.5% of adolescents of both sexes aged 12-19 years are considered obese. Higher rates of obesity are evident in ethnic minority and lower income status children with the highest prevalence among Hispanic/Latino and Black populations. The causes for obesity are multifactorial in nature and highlight disparities nationwide. These factors include socioeconomic status, education, environment, availability and access to fresh fruits and vegetables, and behavior patterns. Successful intervention methods that have reduced the impact of adolescent obesity have incorporated nutrition knowledge and culinary skill building into afterschool programs.

Pink and Dude Chefs, a 12-lesson nutrition education and culinary skills afterschool program targeted toward middle school students, aims to improve nutrition knowledge and dietary behavior in low income and minority populations. Based off of evidence-based curriculum, the program focuses on culinary fundamentals while incorporating nutrition lessons about macronutrients, micronutrients, label reading, kitchen safety, and USDA guidelines. Research assistants from California Polytechnic State University, San Luis Obispo and Vanderbilt University in Tennessee, were trained to implement each lesson.

The program took place at Mesa Middle School in Arroyo Grande, CA; Shandon, CA; and two sites in Nashville, TN from Spring 2014 to Fall 2014. Thirty-two middle school students participated in the study aged 11-14 years. Questionnaires were used to measure fruit and vegetables preferences, nutrition knowledge, and fruit and vegetable intake.

Results indicate that participants' fruit and vegetable preferences, nutrition knowledge and fruit and vegetable intake all increased. However, statistical significance was only achieved with nutrition knowledge, likely due to small sample size. If programs such as Pink and Dude Chefs show promise for decreasing risk for obesity, the public health impact could improve long-term health outcomes for adolescents and mitigate obesity related consequences.

Keywords: Adolescent obesity, nutrition education, culinary nutrition intervention, after-school program, fruit and vegetable intake

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CHAPTER 1

Literature Review

Adolescent Obesity

Obesity is considered one of the greatest public health concerns in the United States. Currently, 17% of children and one-third of the US adult population are obese (Ogden, Carroll, Kit, & Flegal, 2014). The prevalence of obesity in adolescents, defined as those between the ages of 12-19 years, in the United States increased from 5% to 21% between 1980 and 2012 (Ogden, Carroll, Kit, & Flegal, 2012). Higher rates of obesity are evident in ethnic minority and lower socioeconomic status children, with highest prevalence among Hispanic/Latino and Black populations (Kumanyika & Grier, 2006).

The causes of obesity are multifactorial in nature, meaning that a number of inter-related factors contribute to its risk (Warise, 2009). These factors include socioeconomic status, education, environment, availability and accessibility to fresh fruits and vegetables, and behavioral patterns. Targeting prevention efforts to impact behavior change in adolescence and intervention methods that focus on healthy eating and nutrition education have shown promise for reducing childhood obesity (Barlow & Expert Committee, 2007).

Measurement and Classifications of Obesity for Adolescents

Obesity is indirectly assessed by calculating body mass index (BMI: weight in kilograms divided by height in centimeters squared) and comparing it to sex and age specific percentiles (Barlow & Expert Committee, 2007). Obesity in adolescence is defined as being at the 95th percentile or above for BMI, whereas overweight is defined as having a BMI at or above the 85th percentile to the 95th percentile for the same sex and

age (Table 1) (Barlow & Expert Committee, 2007). BMI is the most commonly used indicator for obesity since it is strongly associated with body fat status (Flegal et al., 2009). The benefits of using BMI are that it is inexpensive, fast, and easily calculated. Its simplicity and cost-effectiveness make it the most widely accepted tool for assessing nutritional status (Barlow & Expert Committee, 2007). The drawback of using BMI is that it does not measure body fat composition directly but has been shown to be an accurate proxy in the general population (Barlow & Expert Committee, 2007)

Table 1: Weight status categories for children and adolescents according to the CDC growth charts (CDC, 2009).

Weight Status	Percentile Range
Underweight	$< 5^{th}$ percentile
Normal (healthy weight)	5^{th} percentile to $<85^{th}$ Percentile
Overweight	85^{th} percentile to $<95^{th}$ percentile
Obese	$\geq 95^{th}$ percentile

Prevalence of Adolescent Obesity

Adolescence is a high-risk period for obesity. Results from a national 2011-2014 study showed that 20.5% of adolescents of both sexes 12-19 years had the highest prevalence of obesity when compared to children 6-11 years (17.5%), and children 2-5 y (8.9%) (Figure 1) (Ogden et al., 2014). Excess body weight at an early and formative age has been shown to have a strong correlation with subsequent risk for obesity and poor health status into adulthood (Cunningham, Kramer, & Narayan, 2014). Results from a longitudinal study among children between the ages of 5 and 14 years old showed that the incidence of obesity was four times higher among those who had been overweight at the age of 5 years in comparison to children who were normal weight at that age

(Cunningham, Kramer, & Narayan, 2014). This study also showed several significant disparities between different racial/ethnic groups along with the National Health and Nutrition Examination Survey (NHANES) estimates of obesity rates within those populations (Kumanyika & Grier, 2006).

At the state level, obesity rates for adolescents aged 10-17 years in California remain a steady 15.1% (Ogden et al., 2014). In San Luis Obispo County, 32.2% of children in grades 5-9 are classified as overweight or obese compared to 38% at the state level (Babey, Hastert, Wolstein, & Diamant, 2010). These statistics, especially among racial/minorities, are inconsistent with Healthy People 2020 objectives of less than 14.5% obesity rate for children 2-19 years (Healthypeople.gov, 2014), indicating a strong need for interventions targeting obesity risk among this age group.

Tennessee is currently ranked as the fourth highest state for adolescent obesity, with 21% of those aged 10-17 years classified as obese (Levi, Rayburn, Segal, & Martin, 2015). In Davidson County, 29% of adolescents are classified as obese, a problem that disproportionately impacts racial/ethnic minorities (CDC, 2013).

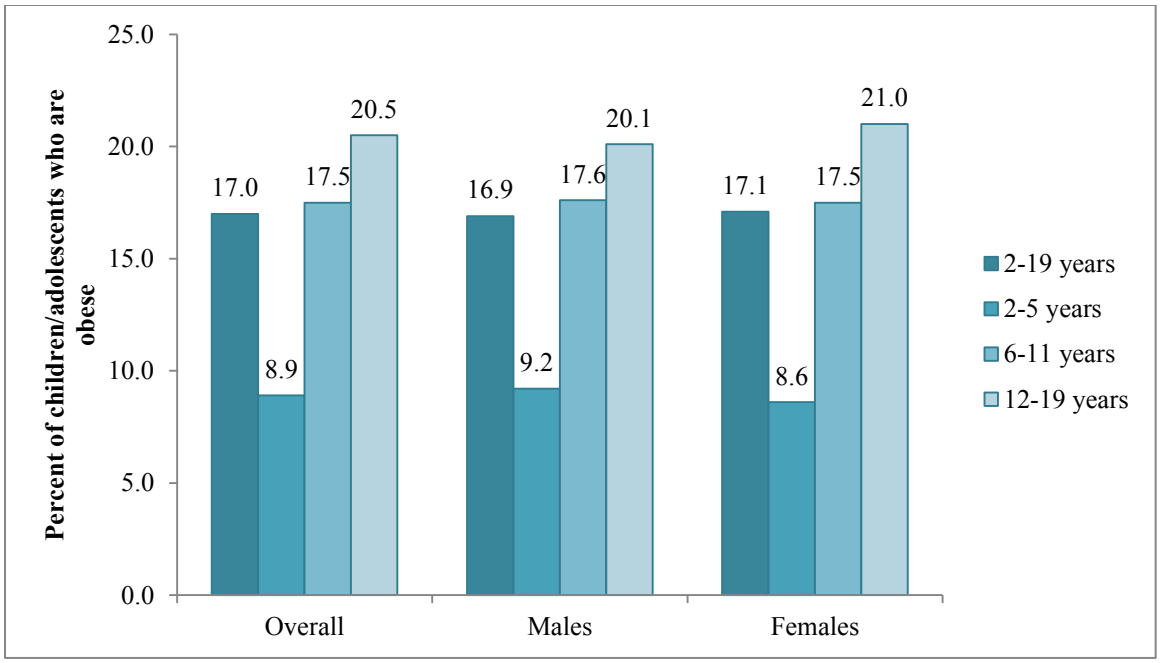

Figure 1: Prevalence of obesity among youth aged 2-19, by sex and age: United States 2011-2014. Adapted from (CDC/NCHS, National Health and Nutrition Examination Survey, 2011–2014).

Racial/Ethnic Disparities

In the United States, there are significant disparities in obesity among different racial/ethnic groups. Figure 2 shows the prevalence of obesity by sex and race/ethnicity, indicating a higher percentage of obesity among Hispanic/Latino boys and among Black girls. The prevalence of obesity between age groups and race/ethnicity is seen in Figure 3 and shows a higher percentage of obesity in Black (23.8%) and Hispanic/Latino (26.1%) 6-11 year olds, and a higher percentage of 12-19 year old obese White (19.6%) and Asian (11.1%) adolescents (Ogden et al., 2012). In a longitudinal study by Cunningham, Kramer, and Narayan (2014), authors found that the prevalence of obesity increased by 65% between kindergarten and eighth grade for White children, 50% among Hispanic/Latino children, and nearly 120% among Black children. These differences between race/ethnicity may be partially explained by 'upstream' factors that influence and contribute to obesity. Notably, socioeconomic and educational status, geographic

factors, and dietary behavior, all influence obesity etiology (Minges, Chao, Nam, Grey, & Whittemore, 2015).

Among adolescents ages 12-17 years old in California, 28.6% of Black and 19.7% Hispanic/Latino adolescents are obese compared to 9.4% White adolescents (Levi, Rayburn, Segal, & Martin, 2015). When stratified by sex and race/ethnicity, the prevalence of obesity in a representative, cross-sectional study of 2,038 California adolescents was consistent with national data showing that Hispanic/Latino and Black male adolescents had higher levels of obesity compared to their White peers ($p<0.001$) (Rodriguez et al., 2010). For girls, prevalence of obesity was higher in White adolescents compared to Hispanic/Latino peers ($p<0.001$) (Rodriguez et al., 2010).

There is less data available for populations in Tennessee. Among all adolescents in Tennessee, about 41% of the Black population is overweight/obese and 32% of the White population is obese (Levi, Rayburn, Segal, & Martin, 2015). In 2013, 23.6% Hispanic/Latino 9th graders were classified as obese (95% CI 14.5-36.0), 19.7% of Black 9th graders were classified as obese (95% CI 16.4-23.4), and 15% of White 9th graders were classified as obese (95% CI 13.0-17.2) (CDC, 2013). In Tennessee, obesity tends to be higher in male ethnic/racial groups compared to females (Warise, 2009). Overall, for 9th graders, 21% male adolescents were considered obese compared to 13.7% of female adolescents that were considered obese (CDC, 2013). This data represents the disparities, specifically with minority populations, and introduces how socioeconomic status can be an influential factor for adolescent obesity (Warise, 2009).

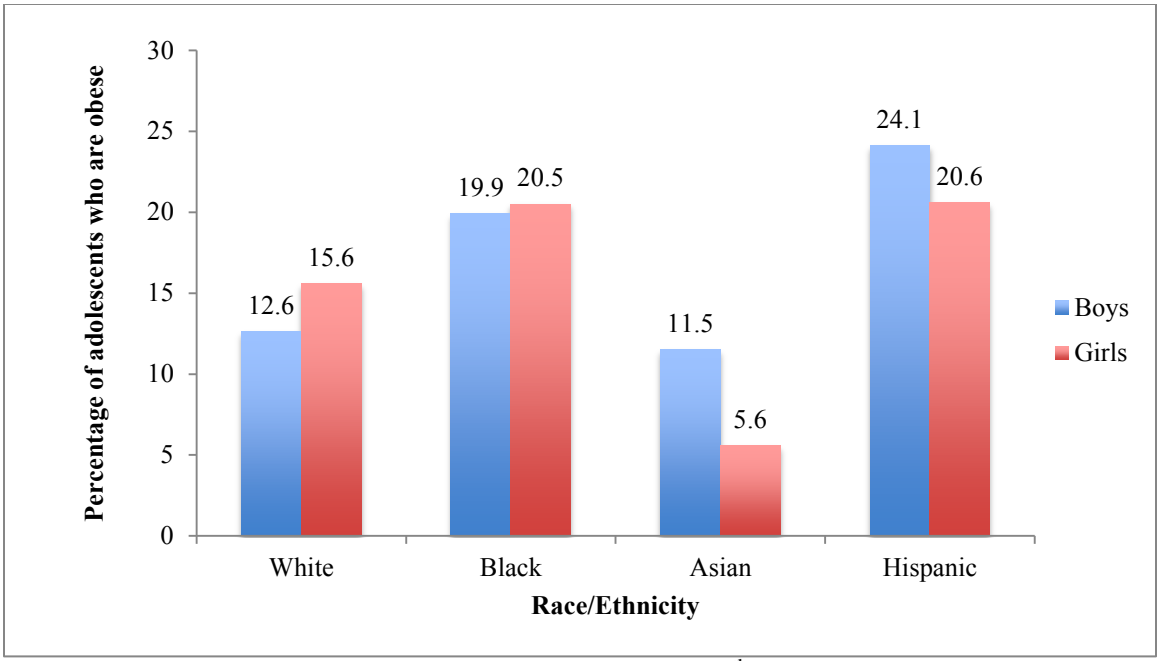

Figure 2: The prevalence of adolescent obesity (BMI>95th percentile) aged 2-19y by sex and race/ethnicity. Adapted from (Ogden et al., 2012).

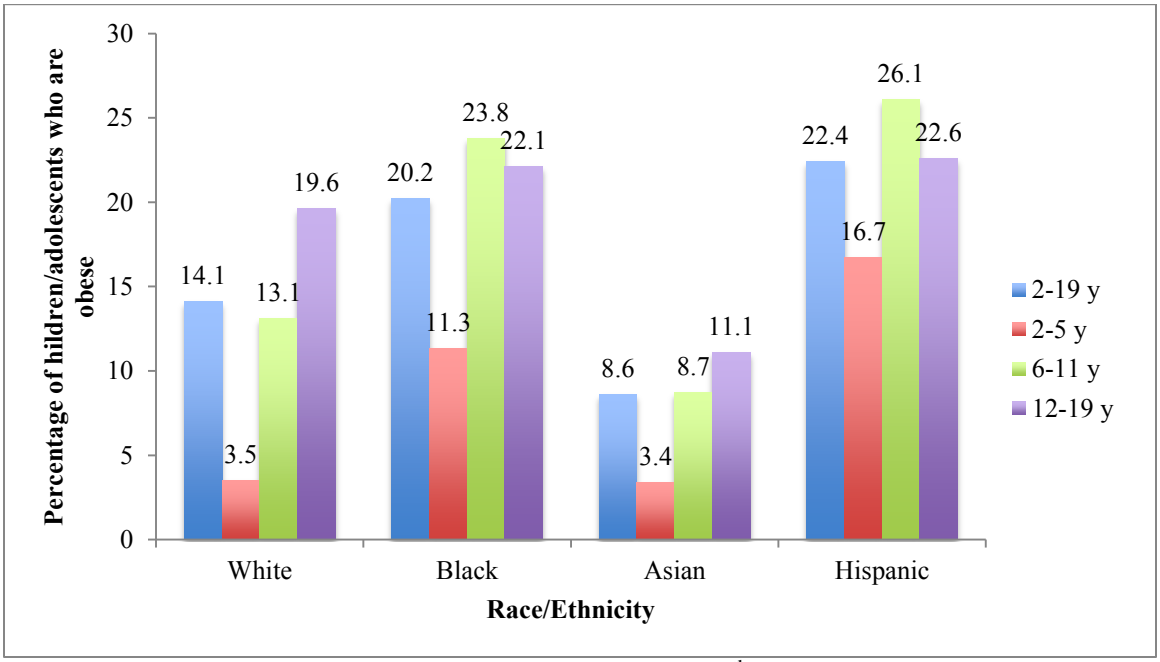

Figure 3: The prevalence of adolescent obesity (BMI>95th percentile) aged 2-19y by age group and race/ethnicity. Adapted from (Ogden et al., 2012).

Socioeconomic Status and Education Disparities

Socioeconomic status and obesity consistently show an inverse relationship (Sobal & Stunkard, 1989). A representative prospective cohort study by Cunningham, Kramer, and Narayan (2014) concluded that children in the wealthiest 20% of families had a lower prevalence of obesity (7.4%) whereas the highest percentage (15.4%) was among the poorest quintile. Another study among 6,110 children aged 6-18 years showed that low-income children were at a higher risk for obesity (OR=1.4, 95% CI 1.1-1.9) when compared to higher income children (OR=0.7, 95% CI 0.5-0.9) (Wang & Beydoun, 2007).

Early life socioeconomic status has a lasting impact on obesity throughout the life course (Baum & Ruhm, 2009). An analysis of the National Longitudinal Survey of Youth (NLSY), examined how body weight and obesity change with age through middle adulthood, examining SES differences and disparities (Baum & Ruhm, 2009). Researchers found that low SES individuals had an increase of 4.3 (SD 8.4) percentage points in obesity prevalence compared to higher SES individuals and were predicted to have a BMI 0.74 (SD 1.39) kg/m^2 above peers with medium SES (Baum & Ruhm, 2009). This pattern of disparities widened with age, showing an increase of 0.04 kg/m^2 per year (0.80kg/m^2 over 20 years) and by 0.41 percentage points per year (8.2 points over 20 years) (Baum & Ruhm, 2009). Disparities between obesity prevalence and SES similarly apply to education level, whereby those with lower education tend to be more obese compared to those with higher education (Kim, Ham, Jang, Yun, & Park, 2014).

In a study by Baum and Ruhm, (2009), maternal education level was the proxy for childhood SES since mothers are influential in establishing their child's health behaviors

and eating habits. The study found that every additional year of maternal education after high school was associated with a reduction of 0.20kg/m^2 (1.2 percentage points) in children's BMI (Baum & Ruhm, 2009). In 2007, 30% of children with parents who did not complete high school were classified as obese and were 3.0 times more likely to be obese compared to children with parents who had a college degree (Singh, Siahpush, & Kogan, 2010). Eighty-one percent of the population in California and 84% of the population in Tennessee has at least a high school diploma compared to the national average of 86% of population (US Census Bureau, 2014). In a study that assessed the Southern Appalachian region of the United States, results indicated that male adolescents that had a mother or father with a high school education or less had a higher likelihood of obesity (OR 1.79, 95% CI 1.05-1.83) (Wang, Slawson, Relyea, Southerland, & Wang, 2014).

In 2001, adolescent obesity was 70% higher for those with families living below the poverty line compared to adolescents living above the poverty line (Babey, Hastert, Wolstein, & Diamant, 2010). From 2003-2007, adolescents 10-17 years from low-income, low-education, and higher unemployment households had a 10% increase in obesity (Singh, Siahpush, & Kogan, 2010a). In another study, girls 10-17 years were 19.2% more likely to become obese living in lower SES neighborhoods than girls 10-17 years living in higher SES neighborhoods (Singh, Siahpush, & Kogan, 2010b). In 2007, In a study by Singh, Kogan, and Dyck (2007), adolescents 10-17 years living in households below the federal poverty level had 69% higher odds of being obese (OR=1.69, 95% CI 1.41-2.03) than adolescents living in households exceeding 400% of the federal poverty level. This study also found after adjusting for race/ethnicity, there

was an inverse association with household income and adolescent obesity with the highest prevalence in the South and Midwest states (Singh, Kogan, & Dyck, 2007). Although education, low-income, and low SES are important predictors with adolescent obesity, specifically with Black and Hispanic/Latino populations, geographic disparities should also be taken into consideration to help identify intervention methods (Singh, Siahpush, & Kogan, 2010b).

Geographic Disparities

Every state in the US has an obesity prevalence rate of 20% or more with three states having a prevalence rate of 35% or greater (CDC, 2014). In general, states in the southeastern region of the U.S. have higher prevalence rates than other regions (Wang & Beydoun, 2007). Mississippi, South Carolina, Louisiana and Tennessee have a 21% or higher prevalence of obesity for adolescents aged 10-17 years and are considered to have the highest obesity rates compared to all US states for that age group (Levi, Rayburn, Segal, & Martin, 2015). In addition, adolescents living in rural working-class, and mixed ethnic urban areas are 30% more likely to be obese when compared to adolescents living in suburbs, independent of individual SES, age, and ethnicity (Wang & Beydoun, 2007). In the same age group, Singh, Kogan, and Dyck (2007), found that there were twice the odds of becoming obese in the southern states (adjusted prevalence >18.3%, combined OR >2.0, 95% CI 1.49-3.16) than in any other region of the United States (adjusted prevalence = 10.4%). They also found that after controlling for age, gender, race/ethnicity, household composition, place of residence, poverty status, physical activity, social capital, neighborhood safety, and TV viewing, adolescents had 47% higher odds and 19.7% obesity prevalence (OR 1.47, 95% CI 1.17-1.83) in Eastern

Southcentral states compared to the Mountain states (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada) (Singh, Kogan, & Dyck, 2007). For the Pacific states there was 24% higher odds (OR 1.24, 95% CI 0.90-1.71) for being obese and a 11.5% obesity prevalence compared to Mountain states, where obesity prevalence is 9.8% (Singh, Kogan, & Dyck, 2007). These findings indicate the complex issue of assessing regional landscapes in an effort to reduce adolescent obesity nationwide (Wang & Beydoun, 2007).

Some of the principal reasons for geographic disparities include availability of fresh fruits and vegetables at local stores and affordable healthy food (Levi, Rayburn, Segal, & Martin, 2015). Levi, Rayburn, Segal, and Martin (2015) found that low-income and minority families have limited access to affordable nutritious food. Nationwide, 29 million people do not have access to a grocery store within one mile of their home for urban neighborhoods and 10 miles for rural neighborhoods (Ploeg et al., 2012). In a study by Zenk et al. (2009), daily fruit and vegetable intake increased by 0.69 servings when a grocery store was in proximity to surrounding neighborhoods. When the study sample was stratified according to race/ethnicity, Hispanic/Latinos ate 2.20 more serving of fruits and vegetables per day ($p=0.01$), compared to White and Black populations (0.38 servings, $p=0.47$), when a large grocery store was in their neighborhood ($p=0.01$) (Zenk et al., 2009). In comparison, Hispanic/Latinos ate 1.84 fewer servings of fruits and vegetables compared to the White and Black populations when there was a convenience store located in their neighborhood ($p=0.016$) (Zenk et al., 2009).

Food insecurity is also a common barrier to eating healthy and is defined as the inability to afford or have access to food for everyone in household to live a healthy and

active lifestyle (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). In 2014, 19.2% of children under age 18 years were food insecure with 26% of the Black population and 22% of the Hispanic/Latino population among very low insecure populations (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). Regional food insecurity patterns are consistent with regional obesity rates and show that populations in the southern states are 15.1% food insecure compared to 13.1% of the western state populations that are food insecure (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). This may suggest that food insecurity increases risk for obesity, but causal factors and mechanisms remain to be determined (Townsend, Peerson, Love, Achterberg, & Murphy, 2001). Geographic differences in the built environment and policy at state level are crucial in future research with geographic disparities and adolescent obesity (Singh, Kogan, & Dyck, 2007).

Impact of Obesity

The impact of obesity is evident at the individual and population levels. These life-long health and economic impacts are partially due to the lasting consequences of obesity in childhood and during adolescence. Results of a retrospective cohort study found among study subjects who were obese during their adolescence, 75% of the subjects were obese as adults (OR 28.3, 95% CI 5.0-53.5) (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). In a longitudinal study, overweight five year old children were four times more likely to become obese as adolescents when compared to normal weight 5 year olds (31.8% vs. 7.9%) (Cunningham, Kramer, & Narayan, 2014). These results suggest that obese children are more likely to remain obese throughout their lifespan, indicating the need for intervention methods to target personal and public level domains to mitigate obesity for future generations (Rooney, Mathiason, & Schauberger, 2011).

Individual-level impact

Physical Consequences

There are a number of physical consequences associated with obesity in adolescence (Daniels, 2006). In 2012, the most prevalent conditions among obese youth were: metabolic syndrome, heart disease, and type II diabetes (Kelsey, Zaepfel, Bjornstad, & Nadeau, 2014), which are all closely linked to obesity.

Metabolic syndrome, a diagnosis of having three or more biochemical and physiological abnormalities associated with the developments of cardiovascular disease and type 2 diabetes, is increasingly diagnosed among adolescents who have excess fat (Alberti et al., 2009; Weiss et al., 2004). Of the factors associated with metabolic syndrome, the greatest correlation is seen with increased BMI scores, insulin resistance, and fasting glucose (Weiss et al., 2004). In a 2004 study on obese children and adolescents 5-20 years old by Weiss et al. (2004), researchers found that with every increased unit in BMI, the risk of metabolic syndrome increased (OR 1.55, 95% CI 1.16-2.08). This pattern was similar with risk of insulin resistance (OR 1.12, 95% CI 1.07-1.18) (Weiss et al., 2004). A representative cross-sectional study by Cook, Weitzman, Auinger, Nguyen, and Dietz (2003) among 2,430 adolescents aged 12-19 years, 4.2% had metabolic syndrome (95% CI 2.9-5.4), which was more common in males (6.2%, 95% CI 3.7-8.6) than females (2.1%, 95% CI 0.9-3.3). Importantly, researchers found that 41% of the adolescents in the study had at least one of the risk factors for metabolic syndrome and 14.2% had two or more risk factors (Cook et al., 2003). These risks increase the likelihood of diabetes and heart disease starting in adolescence and into adulthood (Daniels, 2006).

According to Berenson, Dietz, Freedman, and Srinivasan (1999), it is estimated that three out of five adolescents that are obese have at least one additional risk factor for heart disease such as high cholesterol and/or high blood pressure. Overweight teens are more likely to be overweight/obese as adults and develop hypertension, high cholesterol, and have increased levels of triglycerides, insulin, and glucose compared to their normal weight peers ($p<0.01$ to $p<0.001$) (Srinivasan, Bao, Wattigney, & Berenson, 1996). Children are also increasingly diagnosed with early symptoms of atherosclerosis, hardening of the arteries, with about 50% of obese youth forming fatty streaks at an early age (Daniels, 2006). The Bogalusa Heart study, a community-based study of cardiovascular disease risk, found that overweight and obese 5-17 year olds were two times more likely to have an elevated level of total cholesterol and higher diastolic blood pressure, three times more likely to have higher lower-density lipoprotein cholesterol (LDL), seven times more likely to have higher triglycerides, and 12.6 times more likely to have a higher fasting insulin level (95% CI 10-16) compared normal weight 5-17 year old (Berenson, Dietz, Freedman, & Srinivasan, 1999). These at risk children are also 50% more likely to develop fatty liver disease and have gastrointestinal complications due to obesity. (Daniels, 2006).

Until 1990, type-2 diabetes mellitus, non-insulin dependent diabetes, was rare in children aged 2-19 years but by 1994 it had become a lot more common (Pinhas-Hamiel et al., 1996). From 1992-1994, newly diagnosed cases of type-2 diabetes in children aged 2-19 years increased from 2% to 16%, and accounted for 33% of newly diagnosed cases for adolescents aged 10-19 years (Pinhas-Hamiel et al., 1996). In 2009, the overall prevalence of type-2 diabetes in adolescents 10-14 years was 0.46 per 1,000 (95% CI

0.20 to 0.26), with the highest prevalence seen in American Indian (1.20, 95% CI 0.96-1.51), Black (1.06, 95% CI 0.93-1.22), and Hispanic/Latino populations (0.79, 95% CI 0.70-0.88) (Dabelea et al., 2014). Moreover, current research has found nearly 24% of newly diagnosed type-1 diabetes patients are overweight/obese and 85% of type-2 patients are overweight/obese (American Diabetes Association, 2000).

Some of the long term effects of obesity and diabetes were examined in the Bogalusa Heart Study, which found that 2.4% of overweight adolescents, classified as those with a BMI greater than the 75th percentile, had a higher risk for developing type-2 diabetes by 30 years of age compared to those in the study who were at a normal BMI range (Srinivasan, Bao, Wattigney, & Berenson, 1996). A study in 2010 by Imperatore et al. (2012) generated population projection models that estimated type-2 diabetes would increase from 0.27 per 1,000 adolescents in 2010 to 0.75 per 1,000 adolescents by 2050. It also predicted that this 178% increase in type-2 diabetes would be the highest among Black adolescents (1.63 per 1,000) and the lowest among White adolescents (0.28 per 1,000) (Imperatore et al., 2012). These projections reveal the magnitude of adolescent obesity and detrimental physical effects it has at the individual level (Imperatore et al., 2012).

In addition to disproportionate morbidity, the outcomes of physical consequences associated with obesity have also shown to be interrelated with psychological consequences such as mental health issues and decreased self-confidence (Daniels, 2006).

Psychological Consequences

The psychological impact of childhood obesity may be just as damaging as the physical consequences (Daniels et al., 2005). Adolescence is a time for developing

important social skills that cope with peer pressure and the transition from childhood into adulthood (WHO, 2015). Obesity can be a limitation for developing adequate social skills and coping mechanisms for adulthood by putting one at risk for issues with positive body image, self esteem, social isolation or anxiety, and depression (Pulgarón, 2013).

Obese youth are more likely to experience depression, anxiety, and self-confidence issues compared to non-obese peers (Daniels, 2006). Adolescence is a critical time for developing a positive body image, self-efficacy, and gaining acceptance of peers (Must & Strauss, 1999).

A study using data from the National Health and Nutrition Examination Survey (NHANES) found the relationship between obesity and depression inconsistent between subgroups (Merikangas et al., 2012). Results from Merikangas et al. (2012) showed that after adjusting for sex, age, race/ethnicity, and poverty status, depression was not significantly associated with obesity out of the 4,150 adolescents in the study (adjusted OR 1.6, 95% CI 0.9-2.9). However, male adolescents with major depressive disorder had nearly three times the risk for obesity (adjusted OR 2.7, 95% CI 1.1-1.7) compared to those without major depressive disorder, whereas among female adolescents, this pattern was less evident (adjusted OR 1.3, 95%CI 0.6-2.7) (Merikangas et al., 2012). Among stratified analysis, Black adolescents had higher odds for being obese and depressed (adjusted OR 3.1, 95% CI 1.1-8.3) compared to White (adjusted OR 1.9, 95% CI 0.8-4.3) and Hispanic/Latino adolescents (adjusted OR 1.7, 95% CI 0.8-3.5) (Merikangas et al., 2012). These findings suggest further exploration within subgroups of adolescents is necessary to fully understand the correlating factors of depression and obesity and to mitigate consequences associated with depression (Merikangas et al, 2012).

In another study on obese adolescents by Britz et al. (2000), the most common psychological disorder was social phobia (21.3%), which was suggested to stem from the subject's obesity. Normal and overweight girls have been shown to have "fear of fatness" which has been described among girls as young as 5 years of age (Must & Strauss, 1999). This fear is associated with peer pressure, media, and it creates a skewed body image (Daniels et al., 2005). Approximately 70% of adolescent girls have tried losing weight, which indicates a negative association with their body image and early patterns of disordered eating (Moses et al, 1989). A 2000 National Longitudinal Survey of Youth showed that by 13 to 14 years of age, 14% of obese boys, 37% of obese Hispanic girls, and 34% of obese white girls were at $\leq 10^{th}$ percentile of global self esteem levels compared to non-obese peers (Strauss, 2000). The study also reported that children with lower self-esteem showed higher rates of sadness, loneliness, and expressed nervous tendencies (Strauss, 2000).

The psychological and physical consequences of obesity contribute to the overarching issue of the public health impact of obesity, which also places a significant economic burden on families and society.

Population-Level Impact

The economic burden of obesity is mainly driven by increased risks of chronic disease (Daniels, 2006). Indirect costs of obesity are associated with workforce productivity or in the case of adolescents, school productivity and absences associated with school, while direct costs are associated with medical care (Lehnert et al., 2013).

Using pooled data from the 2001-2003 Medical Expenditure Panel Survey (MEPS), a national survey of non-institutionalized civilian population in the United

States, Finkelstein and Trogdon (2008) found that overweight adolescents incur about $270 more in medical spending annually than normal weight adolescents. In a study by Hampl, Carroll, Simon, and Sharma (2007), researchers evaluated expenditures on how many emergency room visits, inpatient, outpatient, primary care, same day surgery, and laboratory use based on blood tests ordered for 8,404 children aged 5-18 years. Results of this study showed that emergency room and primary care visits were the same for normal weight, overweight, and obese categories; however, obese and overweight subjects had higher use of laboratory services compared to healthy weight peers (obese adjusted OR 5.49, 95% CI 4.65-6.48; overweight adjusted OR 1.25, 95% CI 1.06-1.47) (Hampl, Carroll, Simon, and Sharma, 2007). Researchers also found that after adjusting for inflation, the average annual health care costs among obese subjects were $172 (95% CI $138-206) compared to $28 for overweight and normal weight peers (95% CI $2-54) Hampl, Carroll, Simon, and Sharma, 2007). A study by Trasande and Chatterjee (2009), analyzed data from the MEPS and found that children aged 6-19 years during both years of the survey who were obese had $194 higher outpatient expenditures (97.5% CI $116-338), $114 higher prescription drug expenditures (97.5% CI $34-182), and $12 higher (97.5% CI $3-32) emergency room visits compared with normal/underweight children (Trasande & Chatterjee, 2009).

The majority of obesity related expenditure in adolescents does not occur until adulthood (Finkelstein and Trogdon, 2008). Currently the economic burden of obesity is $200 billion a year, equating to nearly 20% of the US national healthcare expenditure. (Cawley and Meyerhoefer, 2012). The combined medical costs of treatment for preventable diseases are estimated to increase by $48-66 billion/year in the United States

by 2030 (Wang et al., 2011). Healthcare expenditures due to comorbidities associated with childhood obesity sum approximately $14 billion annually (Trasande and Chatterjee, 2009).

The economic and public health impact of obesity are unsustainable at their current levels. In order to mitigate these consequences, there is a need for obesity prevention programs targeted at the crucial developmental stage of adolescence when obesity risk is relatively high compared to other age groups.

Determinants of Obesity

Physiologically, obesity is a result of energy consumed exceeding energy expended, leading to weight gain via excess fat accumulation due to this imbalance. However, the determinants of obesity comprise an exceedingly complex array of inter-related factors. Recent research suggests that socioeconomic status and education, social and environmental influences, and behavioral factors contribute most significantly to adolescent obesity (Story, Neumark-Sztainer, & French, 2002).

The discussion below summarizes these key influences on obesity, setting the stage for a subsequent description of approaches to prevention.

SES/Education

Educational Influences

Head of household education level and socioeconomic status (SES) influences childhood obesity prevalence (Wang and Beydoun, 2007). Figure 4 shows the prevalence of obesity among 2-19 year olds by sex and the educational level of their parents/head of household. In households with higher education, there was a lower prevalence of childhood obesity, whereas in households with lower education, there was higher

prevalence (National Center for Health Statistics, 2011). A similar trend was also shown in another study by Bethell et al. (2009) who found that lower household income and education were associated with higher prevalence of overweight and obesity among Black and Hispanic/Latino children.

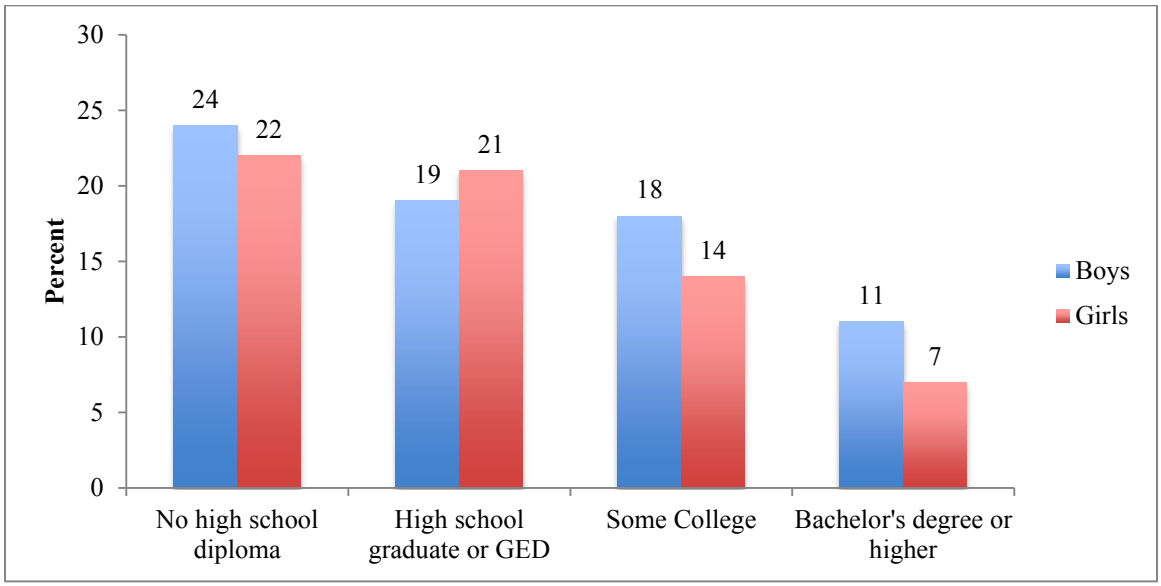

Figure 4: Percent of obesity among children aged 2-19 years by sex of child and education level of parent/head of household from 2007-2010. (Adapted from National Center for Health Statistics, 2011).

Socioeconomic factors that contribute to risk of obesity involve differences in dietary intake and patterns of physical activity at different levels of SES (Fradkin et al., 2014). Households with lower socioeconomic status may have fewer resources and less access to healthier foods, neighborhood factors such as playgrounds, and educational resources on preventing or reducing obesity (Gordon et al., 2006). Parents of higher SES may be able to provide a healthier diet for their children and engage them in organized sports for physical activity, whereas lower SES parents are more likely to live in neighborhoods with less access to fresh fruits and vegetables, more access to fast food, and less disposable income for afterschool activities (Fradkin et al., 2014).

Demographic Influences

In the United States, the prevalence of obesity is evident across all racial/ethnic groups of adolescents, but in Hispanic and Black communities, there are disproportionately higher rates of obesity compared to White communities (CDC, 2014). A cross sectional study using national representative data from 8th, 9th, and 10th graders found higher levels of obesity promoting behaviors such as breakfast skipping, low intake of fruits and vegetables, and higher levels of sedentary activity in Black and Hispanic adolescents compared to White adolescents, independent of socioeconomic status (Delva, Johnston, & O'Malley, 2007). In a New York study by Kaufman & Karpati (2007) where 31% of Latino population is obese and exceeds the state's 24% obesity rate, authors explored the sociocultural roots of childhood obesity and observed how low-income Latino families' food practices and the larger political and economic practices that affect them. One of the families interviewed stated that their life experiences emphasized how food practices demonstrated competing ideas about parenting, obesity, and their child's weight gain (Kaufman & Karpati, 2007). This suggests the prevalence of obesity among certain racial/ethnic populations arises from a series of inter-related issues that form the sociocultural roots of obesity.

Food Availability and Accessibility

Access to healthy nutritious foods has an impact on food choices (Levi et al., 2015). The accessibility of foods refers to a family having adequate resources to purchase nutritious foods at a nearby grocery store (Story, Neumark-Sztainer, & French, 2002). Government benefit programs including WIC and Food Stamps offer assistance for families that are below the poverty level to purchase nutritious food. These food program

benefits are generally dispersed at the beginning of the month, allowing families have to have more flexibility with their food choices, which tends to leave families with fewer choices and a reliance on cheaper, high fat, processed foods near the end of the month (Kaufman & Karpati, 2007). Families often rely on convenience stores or fast foods when grocery stores are not nearby, which tend to be more expensive (Kaufman & Karpati, 2007). These stores are often used for basic staples; milk, cheese, bread, juice, chips, and soda and have limited availability of fresh fruit and vegetables (Kaufman & Karpati, 2007). In a 2005 cross sectional survey study on adolescents aged 12-18 years by Ding et al. (2012), researchers found that fruit and vegetable intake was positively correlated with availability of fruit and vegetables in the home ($r=0.22$-0.34), the availability of healthy foods in the home ($r=0.15$-0.27), and was negatively correlated with less healthy food in the home ($r=-0.17$ to -0.18). This study also found that family income was associated with greater availability of healthier foods in their household compared to low-income populations who had less availability ($\beta=0.23$ to 0.47, $p<0.01$) (Ding et al., 2012).

With these studies in mind, improving the availability of healthy foods in low-income communities and making healthy food more accessible and affordable is an important public health strategy for reducing obesity and obesity related diseases (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009).

Social and Environmental Factors

Social Influences

A study in 2010, by Larson, Wall, Story, and Sztainer (2013), surveyed 2,793 9-12th grade adolescents in Minnesota to identify the most important peer influences, or peer pressure, with weight status. The study found that peer influence on physical activity

was associated with higher BMI z-scores (p=0.039) (Larson, Wall, Story, & Neumark-Sztainer, 2013). The study also found that overweight male adolescents tended to have more friends who were also overweight (p<0.001) (Larson, Wall, Story, & Neumark-Sztainer, 2013). In another study, Salvy, Romero, Paluch, and Epstein (2007) examined peer influence on lean and overweight pre-adolescent girls aged 8-12 years and their snack habits as a function of the co-eaters' weight status. Results of this study concluded that when overweight/obese participants were paired together to eat a snack with one another, a pair of overweight/obese girls ate more calories compared to when paired with a normal weight peer (p<0.01) (Salvy, Romero, Paluch, & Epstein, 2007). These studies suggest that peers influence adolescent dietary intake, peer weight is influential among adolescents with higher BMI, and it is important to recognize differences in social environments when working with youth (Trogdon, Nonnemaker, & Pais, 2008).

Environmental Factors

Environmental factors such as sidewalks, bike lanes, lit pathways for walking, and community parks can influence risk for obesity, as can poor built environments with lack of adequate facilities for community programming. Among adolescents living in neighborhoods with the least favorable socioeconomic conditions, 20% of adolescents aged 10-17 years were considered obese after adjusting for age, sex, and covariates (Singh, Siahpush, & Kogan, 2010b). After adjusting for just age and sex, adolescents who live in unsafe neighborhoods had 61% higher odds of being obese than adolescents living in safe neighborhoods (OR 1.61)(Singh, Siahpush, & Kogan, 2010b).

The urban environment, which includes parks and recreational open spaces, encourages opportunities for exercise and influences physical activity, reducing risk for

obesity (Wolch et al., 2011). In a longitudinal study by Wolch et al. (2011), researchers used data from a Southern California Children's Health Study (CHS) cohort of 3,173 children aged 9-10 years, and found similar results to Duncan's study. Researchers found 20% of adolescents did not have access to recreation facilities within 10km of their home and almost 30% did not have access to recreation facilities within 5km of their home (Wolch et al., 2011). The results from the study also concluded that for boys and girls aged 9-10 years at the beginning of the study who had access to recreation facilities within 10km of their home and park space showed a reduction in BMI after the eight year follow up (recreation facilities BMI for male and female adolescents: -1.44, 95% CI -0.67 to -2.21; park space BMI for male and female adolescents: -0.14, 95% CI -0.67 to -2.21) (Wolch et al., 2011).

Built environment studies indicate the importance of recognizing environmental factors associated with adolescent obesity. In order to reduce obesity, intervention methods designed to increase recreational facilities, public space, and safer neighborhoods need to be taken into consideration in order to influence positive behavior choices (Wolch et al., 2011).

Behavioral Factors

Fruit and vegetable intake has been associated with a reduced risk of obesity and obesity related diseases, however, fewer than 1 in 10 Americans meet the recommended daily intake of about 2 cups fruits and 3 cups vegetables (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). In a study by Kimmons, Gillespie, Seymour, Serdula, & Blanck, (2009), authors used two non-consecutive days of 24-hour dietary recall from 2003-2004 NHANES survey to analyze fruit and vegetable intake among adolescents

(12-18 years of age). Their results showed that 0.9% of adolescents met the recommendations for fruit and vegetable intake with fried potatoes and tomato products being the primarily vegetables consumed (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). The median intake for fruit was 0.51 cups/day with only 6.2% of adolescents in the study consuming the recommended intake for fruit (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). In another survey study by Keihner et al (2013), when fruits and vegetables were available to eat in the home, adolescents reported eating 0.7 cups more fruit and two-thirds cups more of vegetables when the vegetables were cut-up and ready to eat. These studies indicate the importance of encouraging fruit and vegetable consumption in and outside the home (Keihner et al, 2013).

Eating Behaviors and Food Choices

There are several factors that influence eating behavior and food choices in adolescents (Story, Neumark-Sztainer, & French, 2002). Meal and snack patterns are influenced by psychosocial factors such as beliefs, food preferences, and self-efficacy (Story, Neumark-Sztainer, & French, 2002).

A cross sectional study in Australia during 1993 studied the relationships between specific beliefs and behaviors with food choices on 902 adolescents aged 12-20 years (Nowak & Büttner, 2003). Researchers concluded that nutrition knowledge was influential in helping adolescents reduce high fat foods and fast foods to lose weight (Nowak & Büttner, 2003). Male students who were watching their weight and were concerned with fat content in foods ate less high fat and fast foods compared to male peers who were not concerned with their weight ($n=245$, $p=0.0022$) (Nowak & Büttner,

2003). Students who were concerned with fat, sugar, and salt also ate those food less often compared to those who were less concerned with what food they ate ($p=<0.0001$). In another international cross sectional study on nutrition knowledge, by Grosso et al. (2013), researchers found that, among 445 students aged 4-14 years, nutrition knowledge was positively associated with pasta/rice, fish, fruit and vegetable intake, and negatively associated with sweets, snacks, fried foods, and sugar sweetened beverages (all $p<0.004$). Those with higher nutrition knowledge scores were less likely to have two or more snacks daily (OR=0.89, 95% CI 0.83-0.97) and also less likely to spend more than three hours a day doing sedentary activities (OR=0.92, 95% CI 0.86-0.99) (Grosso et al., 2013). Overall, a positive association was seen with nutrition knowledge and healthier nutrition behavior, suggesting that nutrition knowledge is an important target for health education and improving dietary habits of adolescents (Grosso et al., 2013).

Preferences

Childhood eating habits are strongly patterned by food preferences (Birch & Fisher, 1998). Repeated experience with food can enhance an adolescent's preference for those particular foods through associative conditioning (Birch & Fisher, 1998). A 2003 study in Illinois by Fisher and Birch (1995), children aged 3-5 years were evaluated whether their preferences for high fat foods were determinants of their fat intakes. Results of the study concluded that children with high fat intake were more likely to have a strong preference for high fat foods compared to children with low fat intakes ($r=0.054$, $p<0.05$) (Fisher & Birch, 1995). This suggests that children's food preferences are persuasive determinants of macronutrient intake (Fisher & Birch, 1995) and that

intervening at earlier or formative stages of childhood may impact longer term healthy eating habits through developing preferences for these foods.

Food Preparation/Culinary Skill Building

Dramatic changes in family lifestyles and parent work schedules have led to a decrease in home-cooked meals (Lichtenstein AH & Ludwig DS, 2010). Monsivais, Aggarwal, & Drewnowski (2014), conducted a population based survey among 1,319 adults on how many hours a day they spent cooking meals at home with or for their family. The results showed that those who spent the least amount of time on food preparation tended to be working adults who had a reliance on convenience foods/fast foods, and significantly more money spent on food outside of the home (Monsivais, Aggarwal, & Drewnowski, 2014). Individuals that spent a greater amount of time on food preparation had a higher quality of diet that included more vegetables, salads, fruits, and fruit juices (Monsivais, Aggarwal, & Drewnowski, 2014).

In a study by Larson, Story, Eisenberg, and Neumark-Sztainer (2006) adolescents consumed a higher percentage of fruit, vegetables, fiber, folate, and vitamin A when they helped prepare family meals. The study also showed that out of 3,699 adolescents aged 11-18 years, females had lower carbonated beverage intake ($p<0.01$) and male adolescents had lower intakes of fried foods ($p<0.01$) when they helped with food preparation (Larson, Story, Eisenberg, & Neumark-Sztainer, 2006). In a study by Woodruff and Kirby (2013), food preparation frequency was positively associated with self-efficacy for cooking ($r=0.854$, $p<0.001$) for those aged 12-14 years. Adolescent participants also reported that they helped prepare or make food with family members (82%) and wished they could be more involved (Woodruff & Kirby, 2013). These studies

indicate the benefits of youth involvement in food preparation to increase in self-efficacy, independence, and healthier dietary behaviors.

Approaches to Prevent and Treat Adolescent Obesity

There have been several different approaches to prevent and treat adolescent obesity. Some of the theoretical approaches that have been used as a basis for adolescent obesity prevention and treatment programs are the Social Cognitive Theory and the Health Belief Model. Each addresses perceptions about beliefs, norms, and barriers, while acknowledging environmental factors, observations, and fostering self-efficacy (Glanz et al, 2008). Theory-driven research is helpful to address different perspectives and incorporate diverse constructs that have been shown to clarify or predict certain behaviors (Achterberg & Miller, 2004). Observing how adolescent preferences and dietary behavior change throughout the life course and with increasing independence may be helpful for designing interventions (Achterberg & Miller, 2004).

Food and Nutrition Related Afterschool Programs

Due to their flexibility in terms of programming, organization, and approach, afterschool-based healthy eating programs provide a great opportunity to enhance student learning, improve social skills, and promote health (Veugelers & Fitzgerald, 2005). As such, after school nutrition and culinary programs are key to addressing gaps in student learning and may be helpful adjuncts to broader programs and policies to stem adolescent obesity.

Most programs and policies aimed at reducing obesity emphasize scratch meal preparation and increasing exposure to, education about, and consumption of fruits and vegetables. Fruits and vegetables serve as healthy substitutes for high-caloric foods and

increase fiber intake (Field, Gillman, Rosner, Rockett, & Colditz, 2003). In a prospective cohort study that assessed whether the intake of fruits and vegetables were associated with change in BMI among adolescents aged 9-14 years, Field, Gillman, Rosner, Rockett, and Colditz (2003), found there were few associations between change in z-scores of BMI and total fruit and vegetable intake in either boy or girl adolescents during a three year follow-up. Bes-Rastrollo et al, (2006) showed that increased fiber, fruit, and vegetable intake prevented excess weight gain among adults, but other studies suggest that this inverse association may be relatively weak and is unclear among children (Ledoux, Hingle, & Baranowski, 2011), suggesting longer-term studies are needed. However, most studies agree that increasing fruit and vegetable consumption, whether it is associated with weight gain or not, is protective of longer-term chronic disease outcomes such as cancer and cardiovascular disease (Block, Patterson, & Subar, 2009; Ness & Powles, 1997), providing compelling evidence for promoting healthy dietary patterns that include increasing fruit and vegetable consumption (Field, Gillman, Rosner, Rockett, & Colditz, 2003; Ledoux, Hingle, & Baranowski, 2011; Rolls, Ello-Martin, & Tohill, 2004;).

Several afterschool nutrition education and culinary skills programs emphasize the importance of fruit and vegetable consumption, incorporate cooking skills, and educational lessons on food and nutrition. The success of these programs depends on the intervention method and execution of the program while targeting specific nutritional risk behaviors, such as increasing fruit and vegetable consumption, and developing nutrition related skills (Dake, Fahlman, Martin, & McCaughtry, 2008).

Nutrition Education Focused

The Michigan Model's eight-week, once weekly, class called "What's Food Got to Do With It?" addressed health concerns and contained critical components related to nutrition knowledge (Dake, Fahlman, Martin, McCaughtry, 2008). Each of the hour-long lessons focused on nutrition related material such as contents and benefits of food groups, reading food labels, body image, eating based on the food groups, and tips eating in restaurants/school cafeteria (Dake, Fahlman, Martin, McCaughtry, 2008). In a study (n=407) using a pre/post assessment quasi-experimental design, results showed that the intervention groups were more likely to eat fruits (change in mean scores: 2.48 to 3.25, SD 1.8 to 0.7 respectively, $p= 0.047$), vegetables (change in mean scores: 1.11 to 2.03, SD 1.1 to 1.2 respectively, $p=0.018$), and increased their nutrition knowledge by 17% ($p<0.01$) compared to a control group of middle school students that received no intervention (Dake, Fahlman, Martin, McCaughtry, 2008).

Active Generations, another example of a nutrition education focused project, was a program that was developed from various evidence-based programs targeted toward third, fourth, and fifth graders for obesity prevention by incorporating physical activity and nutrition education (Werner, Teufel, Holtgrave, & Brown, 2012). Each participant completed a pre/post survey at the beginning and end of the program, assessing whether their physical activity level, fruit and vegetable intake, and self-efficacy changed. The results showed that students increased their fruit and vegetable intake, read more food labels on food packaging, reported greater confidence participating in physical activities and increased their understanding with which food group they should be limited with eating (ie, fats, oils, and sweets) ($p <0.05$ for all) (Werner, Teufel, Holtgrave, & Brown,

2012). This program showed that by reinforcing lessons taught in school and utilizing the national Health Education Standards (NHES) as a guideline, students were able to learn responsible health behaviors and put those behaviors into practice (Werner, Teufel, Holtgrave, & Brown, 2012).

A pilot afterschool nutrition program called The CATCH Kids Club, an adaptation of CATCH (Coordinated Approach to Child Health) a school-based program focusing on health promotion and early prevention of cardiovascular disease, evaluated program outcomes of 157 children in kindergarten through 5th grade at 16 different schools in Austin and El Paso, Texas (Kelder et al., 2005). Each session, the nutrition education component of the program was incorporated into a snack and introduced participants to tasty and healthful foods, emphasizing fruits and vegetables (Kelder et al., 2005). As a result of the program, after five 3-week sessions, nutrition knowledge increased compared to the reference group (increase pre- to post- mean score: 3.4 to 12.68, $p=0.08$) and after the program ended, participants reported that they gained more experience with the snack/nutrition component due to the hands-on learning approach of making simple snacks (Kelder et al., 2005). For El Paso alone, there was a significant increase in nutrition knowledge from pre- to post-survey ($p=0.04$) (Kelder et al., 2005). Results of this program suggest that afterschool programs can be an effective way to increase nutrition knowledge, but results were mixed and further research is needed for larger scale evaluation (Kelder et al., 2005).

Culinary Focused

Incorporating hands-on methods with education can reinforce learning and increase positive behaviors (Horodynski, Hoerr, & Coleman, 2004). Intervention

methods that encompass nutrition education and culinary skills aim to enhance an overall understanding of fundamentals of cooking and healthy eating. The term culinary nutrition is a fusion of nutrition and food science, paired with culinary skills that bridge the gap between both fields (Condrasky and Hegler, 2010). Educating adolescents on cooking gives them a sense of where ingredients come from, fundamentals of preparation techniques, and teaches about portion sizes, among other benefits related to the intersection of food and nutrition (Condrasky and Hegler, 2010).

Cooking Up Fun, an afterschool nutrition education and culinary program targeting low-income adolescents aged 9-15 years in New York, was designed to support healthful eating and skill building through recipe creation, kitchen safety, and nutrition choices (Thonney & Bisogni, 2006). The program contained six sessions where participants worked together in small groups along with an instructor for about 90 minutes (Thonney & Bisogni, 2006). The program's fundamentals were youth-centered learning, where the instructor plans the first lesson and then guides participants through the process of planning the cooking sessions for subsequent lessons (Thonney & Bisogni, 2006). In 2002, evaluation of the program revealed participants gained selected skills knowledge and behaviors related to culinary skills, yet no statistical data was given from the published article (Thonney & Bisogni, 2006).

Los Angeles (LA) Sprouts, a 12-week program that targeted Latino youth focused on gardening, nutrition, and cooking to teach students about dietary intake and health (Gatto, Ventura, Cook, Gyllenhammer, & Davis, 2012). The sample size of this study was 104 fourth and fifth grade students (70 controls, 34 LA Sprouts) with the mean age of 9.7 years (Gatto et al., 2012). Results from LA Sprouts showed that

participants had an overall increase in vegetable preference (increase of 1.8 points versus a decrease in 1.3 points for controls, p=0.06) but not for fruit (Gatto et al., 2012). For the overweight and obese sub sample, there was a 2.1 point increase in preference scores out of a possible 8 for vegetables compared to controls (p=0.009) (Gatto et al., 2012). Each group of participants filled out a questionnaire about attitudes and perceptions, pre- and post-intervention (Gatto et al., 2012). The LA Sprouts group, compared to those in the control group, were more likely to respond that the vegetables they grew tasted better than those from the store (85.9% mean change, <0.05) (Gatto et al., 2012). Post hoc analysis also concluded that reductions in weight were correlated with an increase in vegetable preferences (r=0.30, p=0.09) and obtaining fiber from fruit (r=0.31, p=0.08) in the LA Sprouts group (Gatto et al., 2012). In another LA Sprouts study, participants had significant reduction in BMI z-scores (0.1-vs 0.04-point decrease, respectively, P=0.01) and waist circumferences compared to the control group (-1.2 cm vs. no change, p<0.001) (Gatto, Martinez, Spruijt-Metz, & Davis, 2015). Dietary fiber intake also improved for LA Sprouts participants compared to the control group (+3.5% vs. -15.5%, p=0.04) (Gatto, Martinez, Spruijt-Metz, & Davis, 2015). LA Sprouts showed that garden-based cooking and nutrition programs can influence positive outcomes for food preferences, attitudes, and may be effective as a pediatric obesity prevention program (Gatto et al., 2012).

Another example of a culinary intervention program comes from Smyth County, Virginia. Smyth County has one of the highest rates of obesity and food insecurity in the state of Virginia (McFarland, 2014). Virginia childhood obesity rate is 28% and in Smyth County it is 34.6% (McFarland, 2014). Virginia Youth Obesity Prevention Project

attempts to mitigate childhood obesity by developing relationships with schools to promote healthy lifestyles by increasing cooking class offerings in schools and introducing healthier foods. The classes are called "Teen Cuisine," which aims to educate teens on nutritious foods and shows them how to select, prepare, and taste nutritious foods that are inexpensive. The content of the six lessons include preparing and tasting healthy recipes while encompassing key topics such as MyPlate, reviewing key nutrients, label reading and comprehension, portion sizes, eating out tips, reducing "bad fat," food safety, meal planning, following recipes, and measuring ingredients properly. A pre/post survey of 140 teens showed that 63% youth adopted one or more food selection behavior(s) consistent with the 2010 Dietary Guidelines, 50% improved by eating more vegetables (not including fries), 43% ate more fruits, 49% improved in eating more whole grains, 50% increased confidence measuring ingredients, 41% increased confidence following a recipe, 42% increase in drinking nonfat or 1% milk, 38% increased their daily physical activity to at least one hour and 35% increase their hand washing before eating (McFarland, 2014).

Food Club, an afterschool 20-week program for 11-13 year olds in the UK, was designed to teach culinary skills and promote healthier diets to participants and their families (Hyland, Stacy, Adamson, & Moynihan, 2006). The qualitative study results revealed that Food Club was a feasible approach for adolescents to develop culinary skills and a way to address barriers through educational initiatives. Most participants felt they learned an adequate amount of kitchen skills and gained confidence in the kitchen. Some of the participants reported that their diets changed by eating more fruits and salads, but overall the outcomes of this program for an overall healthier diet were limited

and had little effect on the family's dietary habits (Hyland, Stacy, Adamson, & Moynihan, 2006).

The Oklahoma Cooperative Extension Service had a program that provided cooking classes and education on how to prepare and cook fruits and vegetables, how to incorporate more fruits and vegetables into the diet, basic nutrition, cooking methods, and food safety for adults and adolescents (Brown & Hermann, 2005). Each class was designed to have a hands-on experience with taste tests, recipes, and evaluation methods for each of the 8 classes for 2 months. The results of a questionnaire from 229 youth participants showed that the amount of fruit servings per day increased significantly ($p < 0.0001$) from 1.1 servings to 2.3 servings per day. For vegetables, there was a significant increase from 1.4 to 2.4 servings per day ($p < 0.001$). There was a 39% increase in youth who ate two fruit servings per day, a 25% increase in three vegetable servings per day, and a 38% increase in hand washing behavior before eating and preparing food (Brown & Hermann, 2005).

Overall, using the approach of nutrition education in combination with culinary skills has shown to increase fruit and vegetable intake and increase overall health (Brown & Hermann, 2005). However, many questions remain regarding the methodology and programmatic approach of combined nutrition education and culinary skills training efforts. For example, it is not known how programs affect fruit and vegetable preferences, and whether these changes act in unison with fruit and vegetable intake and nutrition knowledge. Research examining the impact of comprehensive, evidence-based curricula among high-risk adolescents from low-income populations has been conducted, addressing several conspicuous gaps in the literature.

Pink and Dude Chefs

Pink and Dude Chefs (PDC), a program of the Center for Solutions Through Research in Diet and Exercise (STRIDE) specifically targets childhood obesity prevention and focuses on afterschool nutrition education and culinary skills training for adolescents aged 11-14 years. The program is designed for low-income populations and aims to improve culinary self-confidence and increase positive nutrition knowledge and behavior. Each session starts with approximately one hour of a nutrition education topic followed by an hour of culinary skill and recipe development in a kitchen. Phase one of the program, "Let's Get Started," focuses on fundamentals of cooking and culinary skills training, whereas phase two, "Around the World," incorporates the same fundamentals as phase one, but focuses on international cuisine. Each phase is based on a once-weekly 2-hour class meeting over the period of 12 weeks, although the timing and organization is intentionally flexible to best suit each organization's needs.

Built on an evidence-based curriculum, PDC has conducted many cohorts since 2008 including sites in Arroyo Grande, Oceano, and Carpinteria, California as well as other sites around the country (some in progress). Cohorts have shown increases in culinary confidence (n=29, p=0.005; Chessen, 2009), increase in fruit preferences (n=22, p=0.01) (Sheehan, 2013), and a 15% increase in the participants' correct responses to nutrition knowledge (n=29, p=0.025), (Chessen, 2009).

The initial goals of the first cohorts were to address the importance of diet quality related to health and wellness through basic culinary skills (Chessen, 2009). The first cohorts in 2009, located in Oceano and Arroyo Grande, California, tested the feasibility of implementing a culinary skills program that had an accessible location, fulfilled the

overall interest in the community/adolescents of that community, and fulfilled the needs of the community (Chessen, 2009). In this study, Chessen (2009) concluded that the repetition of new foods, such as fruits and vegetables, helped participants overcome barriers with a particular food and/or taught them how to use those ingredients in different way than what they were accustomed to (Chessen, 2009). As a result of this program, students improved their diet quality by overcoming barriers with particular foods and were able to improve their confidence toward preparing meals for themselves and their family (Chessen, 2009).

In 2013, another set of cohorts was implemented in Arroyo Grande and Carpinteria, California. Sheehan's focus was specifically on the curriculum related to obesity prevention, behaviors, barriers to healthy eating, culinary skills and confidence, and nutrition knowledge (Sheehan, 2013). Mean culinary confidence score, nutrition knowledge, and vegetable preferences pre-and post-survey increased but did not achieve statistical significance ($p=0.9$, $p=0.1$, and $p=0.5$ respectively, $n=23$). For fruit preferences, however, there was a 70% increase in preference for all fruits and most vegetables after participation in the program with the highest increase for cherries ($n=22$, $p=0.03$) and tangerines ($n=22$, $p=0.02$) (Sheehan, 2013).

Phase two (Around the World curriculum) of PDC was implemented during Fall 2013 and Winter 2014 in Arroyo Grande, California and focused on the outcomes of a multicultural theme to enhance knowledge and skill building (Lockhart, 2014). Lockhart's results indicated a significant increase in nutrition knowledge ($n=16$, $p<0.0001$), significant increase in cooking skills ($n=16$, $p=0.02$), and a decrease in outcome expectancies related to eating fruit and vegetables from pre- to post-intervention

(n=16, mean change -0.056, p=0.52) (Lockhart, 2014). Univariate results showed nutrition knowledge was most strongly and positively affected (n=16, $p<0.0001$) with overall nutrition knowledge related to USDA MyPlate increasing significantly after participation in the program (Lockhart, 2014). In addition, the majority of the participant's family members stated that they had more confidence in their child to select and prepare family meals (Lockhart, 2014).

The overall goal the PDC program is to empower youth by providing them with nutrition and cooking skills necessary to prepare and consume healthy foods in an effort to stem the tide of obesity. In conjunction with other policy and in-school efforts, PDC and similar afterschool programs may offer effective long-term strategies to mitigate the obesity problem nationwide.

Conclusion

Adolescent obesity has a wide range of health and economic consequences. Intervention strategies using a multifactorial approach with special considerations for a wide range of socio-economic factors seem to be most effective (Kumanyika & Grier, 2006). In addition, these programs may help improve or prevent obesity related risk factors when targeted toward minority and low-income communities who are at highest risk (Kumanyika & Grier, 2006).

Adolescence is a key period of physical and mental growth, cognitive development, creation of self-confidence, and independence (WHO, 2015a). As adolescents become more independent and make their own dietary choices, programs that focus on nutrition knowledge or culinary skills have shown some promise. However, programs combining both nutrition education and culinary skills development are most

promising for building self -efficacy, nutrition knowledge, and culinary skills (Dake, Fahlman, Martin, & McCaughtry, 2008; Chessen, 2009; Sheehan, 2013; and Lockhart, 2014).

Research Questions and Hypothesis

The aim of this study is to examine the effectiveness of an afterschool Pink and Dude Chef's program targeted toward middle school participants in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee.

Research question #1: How does participation in the Pink and Dude Chefs program impact fruit and vegetable preferences among boy and girl participants aged 11-14 y in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

- Research hypothesis #1: Participation in Pink and Dude Chefs increases fruit and vegetable preferences

Research question #2: How does participation in the Pink and Dude Chefs program impact nutrition knowledge among boy and girl participants aged 11-14 y in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

- Research hypothesis #2: Participation in Pink and Dude Chefs increases nutrition knowledge

Research question #3: How does participation in the Pink and Dude Chefs program impact fruit and vegetable intake among boy and girl participants aged 11-14 y in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

- Research hypothesis #3: Participation in Pink and Dude Chefs increases fruit and vegetable intake.

CHAPTER 2

Materials and Methods

Program Development

Site Locations

Pink and Dude Chefs (PDC) sessions ran from April 2014 to December 2014 at various locations. Data collection was conducted at two sites in the Central Coast region of California and two sites in Nashville, Tennessee. In California, data was collected at Mesa Middle School in Arroyo Grande and Shandon Elementary School in Shandon, while in Nashville, data was collected from two cohorts within the Northwest YMCA afterschool program in collaboration with Vanderbilt University. Each site had an area for classroom instruction and a kitchen for the cooking portion of the program equipped with kitchen utensils and appliances. Every week prior to the lessons, a staff member did grocery shopping for each lesson and each site qualified to collect ingredients through a food donation establishment. The food donation establishment allowed for flexibility with each site's budget when planning for various lessons/recipes. Qualifying criteria allowed for goods to be offered to the program at a minimal or no cost.

California Cohorts

Arroyo Grande, CA has a population of 17,716 with 77% of the population being White, 14% Hispanic, 5% Asian, 4% other (U.S. Census Bureau, 2013). Mesa Middle School was chosen as a study site based on previous PDC research with their afterschool organization, Bright Futures.

Shandon, CA is a small agricultural town that has a population of 1,295 people with approximately 54% of the population being White, 31% Hispanic, 10% Black, and

5% multiracial (U.S. Census Bureau, 2013). This location was chosen based on previous relationships with STRIDE and YMCA throughout the county.

Tennessee Cohorts

The Northwest YMCA was the site location for both cohorts in Nashville Tennessee, located in in Davidson County. Approximately 644,014 people live in Nashville with 61% of the population being White, 28% Black, and 10% Hispanic, and 1% other (U.S. Census Bureau, 2013). Collaborators at Vanderbilt University selected this site based on location and an ongoing partnership.

Online Training

Instructors at each site completed the online training course in preparation for implementation of the PDC program at their respective sites. Two instructors, one graduate student and one YMCA staff member, were trained in California and one instructor, a graduate student, was trained in Tennessee. The training course included videos to help familiarize new instructors with lesson outcomes, culinary techniques, and fundamentals of nutrition regardless of the viewer's culinary skill level or nutrition background. Each online lesson focused on a particular nutrition objective such as fats, carbohydrates, or proteins that coincided with a recipe. Online training videos demonstrated various techniques used in some of recipes to showcase a particular skill that would be focused on during the lesson. The online training also provided ideas on how to set up the kitchen for each lesson by setting up an area for participants to gather ingredients for their recipes, how to set up a group or individual station, and how to perform demonstrations to students in a large group. Training focused on the importance of participant "goal sheets" being turned in every week to show parents/guardians what

each student learned and skills that were developed, with the intention of involving household members as peripheral participants. Every online training lesson included a set of quizzes at the end of each lesson to help reinforce training objectives. After completing the online training course, which was required, instructors received a certificate of completion endorsing their readiness to lead PDC classes. Handouts and lesson materials were available online and in an instructor manual that was sent to instructors at each site. Instructor manuals included lesson plans, kitchen procedures, and recipes. They also had access to materials, instructional videos, and other materials throughout the duration of the course.

Support staff

Research assistants provided support to the instructors during the classroom and kitchen portions of each lesson. At the California sites, PDC undergraduate research assistants were trained through an elective course, (KINE 290) Health Ambassadors at Cal Poly San Luis Obispo, and completed along with the PDC instructor, the National Institutes of Health (NIH) Protecting Human Subjects Research Certification. Every lesson had about one volunteer for every four students.

In Tennessee, the PDC instructor and research assistants consisted of Vanderbilt's Peabody College graduate and doctoral students for each session. Every lesson had approximately one volunteer for every four participants.

This intervention study was not controlled and participants chose to enroll in the PDC afterschool program.

Program Implementation

Participants and Recruitment

Recruitment of participants for the California cohorts was done through Bright Futures and YMCA after school programs. Announcements were made to students at school and they were able to sign up through each after school program. In some cases, some of the participants signed up late and came in the second or third week of classes. This was due to either absence of school, outside-school commitments, or being enrolled in another afterschool activity and wanting to switch into the PDC program after it had already started.

In Arroyo Grande, word of mouth between the participants who previously participated helped the recruitment process. Each participant voluntarily enrolled in the program and signed an informed assent. For the Tennessee cohorts, the YMCA's Obesity Prevention Specialist recruited participants who attended the YMCA afterschool and attend I.T. Creswell Middle School. Participant ages at each site ranged from 11-14 years old.

Program Timeline

Table 2 shows the site locations and program timelines.

Table 2: Site locations and program length.

Site	Start	End	Day(s) Lessons Implemented and Duration
Arroyo Grande	September, 2014	November, 2014	Twice a week for two hours each day
Shandon	September, 2014	December, 2014	Once a week for two hours
Nashville, Northwest YMCA	April, 2014	June, 2014	Once a week for two hours
Nashville, Northwest YMCA	September, 2014	November, 2014	Once a week for two hours

Curriculum

Classroom Lessons

Participants were provided PDC workbooks that included lesson handouts, activities, and nutrient guidelines. The workbooks also included recipes for each lesson and weekly goal sheets.

The PDC program was designed to implement 12, two hour lessons with each lesson having approximately 40 minutes of lecture, 40 minutes of kitchen instruction and cooking, and the remaining 20 minutes for clean up and reflection. Each lesson was outlined in detail and included specific learning outcomes.

The classroom lessons were designed to cover a specific nutrition relevant topic for approximately 40 minutes paired with an activity associated with each lesson. Lessons focused on various topics such as: how to read a recipe, appropriate measurements and equipment use, USDA MyPlate, food safety, kitchen safety, and menu planning. Table 3 describes chronologically the lesson plans and recipes for each session. After each lesson, participants moved into the kitchen and began the cooking practicum.

Table 3: Lesson plans and objectives for Pink and Dude Chef Programs.

Lesson	Topic	Objectives
Lesson 1	Introduction	• Lesson introduces the "Pink and Dude Chefs" program and concept of nutrition through cooking skills. • Classroom and food safety rules are established.
Lesson 2	How to Read a Recipe	Lesson teaches participants how to: • Properly extinguish a kitchen fire • Properly read and follow a recipe from start to finish • Correctly identify the measurement tools needed for the recipe
Lesson 3	Cutting Edge	This lesson focuses on: • Knife safety and knife skills • Different cutting techniques: chopping, slicing, dicing, chiffonade, julienne, and mincing.
Lesson 4	MyPlate	This lesson teaches: • How to build their "MyPlate" for healthy eating, with an emphasis on balance among food groups and portion sizes
Lesson 5	"Get the Facts"	This lesson teaches: • How to read a Nutrition Facts Label • How to compare food products by using the Nutrition Facts Label • How to substitute ingredients for a "healthier" version of a recipe.
Lesson 6	Carbohydrates	This lesson: • Discusses the difference between simple and complex carbohydrates, refined and unrefined carbohydrates, and what makes a grain whole. • It talks about fiber and the importance of fiber in one's diet. • It also focuses on how to incorporate whole grains into the diet.
Lesson 7	Protein	• The lesson focuses on the importance of protein in the diet and how plant protein can be used as an alternative to animal protein.
Lesson 8	Fats	• This lesson teaches a student how dietary fat is important in a healthy diet and the different types of fat. • It also focuses on alternative cooking methods to use other than frying for a healthier option. •
Lesson 9	Breakfast	• This lesson teaches participants the physiological, cognitive, and nutrition benefits of eating breakfast. • Lesson also teaches ways to make quick breakfasts
Lesson	Calcium	• This lesson teaches participants about the nutrition

10		benefits of calcium for strong bones. • Participants will write a meal plan that meets the daily 1300 mg calcium requirement using dairy and non-dairy sources.
Lesson 11	Nutrition Trivia	• This lesson quizzes the participants on information presented throughout the last 10 lessons through an interactive nutrition trivia game.
Lesson 12	Family Fiesta	• This lesson works on team building and teaches participants how to cater an event for their families/friends. • This lesson also teaches participants how to work together to assemble a family meal using culinary skills, proper timing, and cumulative nutrition information taught throughout the course.

Cooking Lesson

The cooking section of the PDC program highlighted a theme of each lesson that was taught in the classroom practicum. A list of recipes paired with each lesson is shown in Table 4 and were provided to each student in their workbooks for them to use at home for additional practice with their families and friends (See Appendix A for an example of a lesson recipe). Participants took home leftovers to share with family members to highlight their newly acquired skills and introduce a new recipe into their household. Each of the recipes was formatted to be easy to use in addition to requiring simple and affordable ingredients.

The cooking portion of the program began with each participant washing their hands and putting on a hat and apron for food safety measures. Volunteers set up each station for student groups and a station/central table for recipe ingredients. The instructor demonstrated any new culinary skills or techniques for the lesson, explained and highlighted ingredients, and then went through the recipe. Participants were then allowed to start the recipe with their groups, take turns cutting the vegetables, use the stove or

oven with supervision, plate the finished food product, clean dishes, and clean group stations. Participants were supervised by the instructor and research assistants, who monitored food safety practices and to ensured proper measurement techniques and ingredients were used.

Table 4: Recipes for Pink and Dude Chefs programs.

Lesson	**Topic**	**Recipe**
Lesson 1	Introduction	Personality Pies
Lesson 2	How to Read a Recipe	Blueberry Muffins
Lesson 3	Cutting Edge	Rainbow Stir Fry
Lesson 4	MyPlate	MyPlate Pizza
Lesson 5	"Get the Facts"	White Bean Mac and Cheese
Lesson 6	Carbohydrates	Apple Crisp
Lesson 7	Protein	Tofu Scramble
Lesson 8	Fats	Sweet potato fries, Low-fat Brownies, Baked Chicken Strips
Lesson 9	Breakfast	Breakfast Sandwiches.
Lesson 10	Calcium	Quinoa and Black Bean Salad
Lesson 11	Nutrition Trivia	Prep for Family Fiesta
Lesson 12	Family Fiesta	Students Choice from previous lessons

Goal Sheets

In effort to engage and involve families in the program, each of the lessons contained one to three goals that were included as homework and signed by parents. The goal sheets described what was covered in the lesson and tasks to be completed by the next lesson with family member or friends. The philosophy behind this was to engage participants outside the classroom/kitchen by reinforcing lesson objectives with an action item to be completed with a family member. An example of a goal that participants were asked to do was to "teach a family member how to properly wash your hands (See

Appendix B).” Participants were asked to complete the goal sheets and turn them in the following session with the incentive of earning a raffle ticket to win a prize at Family Fiesta.

Family Fiesta

The last lesson of the program session, or lesson 12, was the end of program celebration called “Family Fiesta” where the participants displayed their newly acquired culinary skills to family and friends. This event showcased what participants had learned over the course of the program by planning, preparing, and cooking a three-course meal for their invited friends and family. This experience enabled the participants to make key decisions on the menu and preparation, organization and timing, and practice presentation skills. Each participant was supervised by the program instructor and assistants who helped adjust menu items for larger proportions and purchased ingredients. The menu that the participants came up with aimed to incorporate objectives of each lesson to create a balanced meal that contained at least one protein source, grain, fruit and vegetable (MyPlate Lesson 4). For example, the Arroyo Grande site participants chose to make the baked chicken strips (Lesson 8), baked sweet potato fries (Lesson 8), white bean mac and cheese (Lesson 5), a green salad (Lesson 4), and apple crisp for dessert (Lesson 6). After preparing the meal, participants served the meal to guests, decorated the dinner area, and helped clean up. In addition to cooking for the guests of Family Fiesta, the participants were involved in an awards ceremony where they received a Culinary Certificate of Completion and a raffle prize was given out as an award to acknowledge participants who returned the most goal sheets.

Program Evaluation

Data collection

Pre/Post Survey

A formative (pre) survey was applied prior to any instruction on the first day of class and a summative (post) survey on the last day of class prior to Family Fiesta. Each participant was instructed to fill out the dictated survey honestly and individually. At each site, the instructor led the participants through each survey question for quality control purposes. Participant identities were coded for confidentiality. The survey contained five sections including food frequency questionnaires for dietary preferences and intake, nutrition knowledge, dietary patterns and culinary confidence (See Appendix C). Sociodemographic information was included on Parent Consent forms (See Appendix G). Table 5 shows the research questions along with a sample question that coincides with the sections of the survey.

Table 5: Pink and Dude Chefs survey sections, research questions, and example of survey questions.

Section	Research Question	Sample Question
Fruit Preference	Does the participation in the Pink and Dude Chefs Program increase fruit preference?	How much do you like these fruits? Apple: □ Not at all □ A little bit □ Somewhat □ Pretty much □ I love it □ I don't know what this is
Vegetable Preference	Does the participation in the Pink and Dude Chefs Program increase vegetable preference?	How much do you like these vegetables? Zucchini: □ Not at all □ A little bit □ Somewhat □ Pretty much □ I love it □ I don't know what this is
Fruit Intake	Does the participation in the Pink and Dude Chefs Program increase fruit intake?	In the past 7 days, how many times did you eat these fruits? □ Not at all □ Once □ Twice □ 3 times □ 4+ times □ I don't know what this is
Vegetable Intake	Does the participation in the Pink and Dude Chefs Program increase vegetable intake?	In the past 7 days, how many times did you eat these vegetables? □ Not at all □ Once □ Twice □ 3 times □ 4+ times □ I don't know what this is
Nutrition Knowledge	Does the participation in the Pink and Dude Chefs Program increase nutrition knowledge?	99% of the calcium in your body is found in your____ □ Skin □ Hair □ Bones and teeth □ Tongue

Semi-structured Interviews

Semi-structured interviews were conducted to supplement the survey data with qualitative information from participants and their parents (See Appendix D and E). During the Family Fiesta event, students and parents in the California cohorts participated in post program semi-structured interviews with research assistants and the program instructor. The interviews were given in English or Spanish and took about ten minutes each. The interviews for the students consisted of several reflective questions about lessons and the overall program, recipes, culinary confidence, and exposures to new recipes and foods for program evaluation. The parent interviews consisted of questions related to children's participation in helping with family meals, whether they cooked any recipes from the program, and what their overall thoughts about the program were. Some of the questions asked in the survey were: "What do you think of the Pink and Dude Chefs program?", "Did you look forward to coming to each session?", and "Why do you think learning to cook or prepare food is important?"

Data Coding

The project coordinator and research assistants entered data from each pre and post survey for every participant. Double data entry was performed and compared for quality control purposes. All data was coded and entered into Microsoft Excel spreadsheets and transferred to STATA (College Station, USA) for statistical analysis.

Demographic Data

At each site location, individual demographic data was collected from each individual participant's parent or guardian that was asked through a series of questions on the parental consent forms. Parent/guardians selected their child's ethnicity/race and

values were assigned ("White" =1, "Hispanic or Latino"=2, "Black/African American" = 3, "Asian" =4, "American Indian/Alaskan Native" =5, "Mixed"=6, "Other"=7). Every participant's age, sex, and grade level were also collected and values were assigned. Values were also assigned for the number of people in each student's household and whom they lived with.

Fruit and Vegetable Preference

On each survey the fruit and vegetable preference scores were assigned according to each response. Table 6 shows an example of coding for questions on the survey for preferences. Positive responses, such as "pretty much" and "I love it," were assigned a higher number and negative responses, such as "not at all," "a little bit," and "I don't know what this is," were assigned a lower number. An increase in the numeric score for each item and overall suggest increased preferences.

Table 6: Example of coding of survey questions for food preference.

Question: How much do you like peas	**Code**
Not at all	1
A little bit	2
Somewhat	3
Pretty much	4
I love it	5
I don't know what this is	0

Fruit and Vegetable Intake

Fruit and vegetable intake were coded similar to the preference section of the survey. Scores were assigned according to each response and Table 7 shows an example of coding for questions on the survey for intake. Positive responses, such as "pretty much" were assigned a higher number and negative responses were assigned a lower number. An increase in the numeric score for each item and overall suggest increased intake.

Table 7: Example of coding of survey questions for food intake.

Question: In the past 7 days how many times did you eat squash?	**Code**
Not at all	1
Once	2
Twice	3
Three times	4
Four or more	5
I don't know what this is	0

Nutrition Knowledge

Nutrition knowledge was measured by seven survey questions related to objectives and outcomes of each lesson. A correct response gave a point and an incorrect response gave a score of 0. The scores were then examined individually for each question that tested nutrition knowledge and as a whole for total nutrition knowledge. The individual nutrition knowledge scores ranged from 0 to 1 and the total nutrition knowledge scores ranged from 0 to 7.

Statistical Analysis

Only pre- and post- surveys that were matched and had complete data were included in the analysis. Participants that had participated in the program in previous years were allowed to enroll in the program again, however, their data were not included in these analyses.

The main exposure (independent variable) of interest was participation in the program. The main outcome (dependent) variables of interest were: nutrition knowledge, fruit and vegetable intake, fruit and vegetable preferences. Other variables of interest (potential confounders) included site location (California vs. Tennessee), sex, and race/ethnicity. Some results were stratified to account for heterogeneity.

The mean, standard deviation, percent change in mean scores, and p-values were calculated for each participant and the group for fruit preference, vegetable preference, nutrition knowledge, fruit intake, and vegetable intake. P-values were calculated by using paired t-tests and one-way analysis of variance (one-way ANOVA). Due to the relatively small number of participants, adjusted analyses were not conducted, in favor of stratified analyses. Calculations were preformed using STATA (College Station, TX) and Excel 2010 (Redmond, WA).

IRB

The Institutional Review Board (IRB) at California Polytechnic State University approved all aspects of this study. All student participants signed written informed assent forms and parents provided written informed consent (See Appendix F and G). A copy of the consent forms were given to parents for their reference which contained contact information for the program leader in the event of questions or concerns and outlined the program in detail.

Program Support

Donations and Funding

In order to successfully implement the program, necessary cookware and utensils were needed for each location. Each site had different forms of donations and funding in order to pay for ingredients and supplies. In Shandon, CA the program was funded by an internal YMCA grant. In Arroyo Grande, funding for supplies (i.e. kitchen equipment, utensils, knives, bowls) were provided by Cal Poly Instructionally Related Activities (IRA) and from the Maxwell foundation (Chessen, 2009). In Nashville, funding was provided by the Boedecker Foundation.

CHAPTER 3

Results

Demographics and Individual Level Characteristics

From April 2014 to December 2014, 45 boys and girls aged 11-14 years and in 6^{th}-8^{th} grade participated in four cohorts of PDC in California and Tennessee. Accounting for attrition, a total of 32 pairs of pre- and post-intervention surveys were included into the statistical analysis (Table 8). Fifteen students participated in the California cohorts and 17 students participated in the Nashville cohorts. Cohorts had an equal distribution of boys and girls, with more girls being enrolled in the Tennessee cohorts and more boys being enrolled in the California cohorts. Overall, the majority of participants were Black (50%), all from Tennessee, with smaller proportions of White (23%) and Hispanic/Latino (17%).

The proportion of participants living in households with 2-5 members was 81% whereas 19% lived in households with six members or more. In both California and Tennessee, more than 50% of participants lived with both parents whereas no students reported living with grandparents, foster family, or parent plus step-parent but 18.2% lived in "other" or mixed households. Due to some missing or incomplete data, sample sizes were lower for questions regarding race/ethnicity, household number, and people in household and ranged from 21-32 (see Table 8 footnotes).

Table 8: Baseline socio-demographic characteristics of Pink and Dude Chef Participants in California and Tennessee (Spring and Fall 2014).

Variable	Overall (%)	California (%)	Tennessee (%)
	n= 32	n= 15	n= 17
Sex			
Boy	50	60	41.2
Girl	50	40	58.8
Race/ Ethnicity[1]			
Hispanic/Latino	16.7	38.5	0
White	23.3	46.2	6
Black	50	0	88.2
Other	10	15.3	5.8
Number of people living in household (including participant) [2]			
2-5	81	85	75
6 or more	19	15	25
Household composition [3]			
Both parents	54.5	50	62.5
One parent	27.3	21.4	37.5
Other	18.2	28.6	0

[1] n= 30 overall, 13 for California
[2] n= 21 overall, 13 for California, 8 for Tennessee
[3] n= 22 overall, 14 for California, 8 for Tennessee

Research Question #1: How does participation in the Pink and Dude Chefs program impact fruit and vegetable preferences among boy and girl participants aged 11-14 years in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

Fruit Preference

Table 9 shows the mean fruit preference scores from the pre- and post- surveys and the change in mean fruit and preference score for participants in California and Tennessee. The scores ranged for each question on scale from 0-5 and the overall fruit score ranged from 0-35. Due to missing data, the sample size ranged from 31-32 for individual fruits and 29 overall. There was an increase in mean preference for every individual fruit except for melons, which decreased by 0.1(SD 0.8). The greatest increase in preference was for bananas and cherries, with an observed increase in mean score of

both items of 0.3 (0.1). The overall increase in score for fruit preference was 4.2%, representing a mean score increase of 1.1 (SD 3.8), p=0.1 (Figure 5).

Change in individual raw scores ranged from -5 to 14, indicating some participants had lower preference at the end of the program. Seven participants (24%) showed no change in score whereas eight (28%) and 14 (48%) showed a decrease and increase in score, respectively. Figure 6 shows the range of individual change scores expressed as a percentage of total score for all categories tested. The first data point shows that fruit preference changed from -14% to 40%.

Table 9: Mean fruit preference scores from pre- and post-survey and change in mean fruit preference score for participants in California and Tennessee (Spring and Fall 2014).

Variable	Mean (SD) Pre Score	Mean (SD) Post Score	Change in Mean (SD)	p-value*
Apples	4.0 (1.1)	4.3 (1.0)	0.2 (0.8)	0.1
Bananas	4.0 (1.3)	4.3 (1.0)	0.3 (0.9)	0.1
Berries (blueberries, strawberries, raspberries)	4.1 (1.4)	4.3 (1.4)	0.2 (0.9)	0.2
Cherries	3.5 (1.7)	3.8 (1.7)	0.3 (0.9)	0.1
Grapefruit	2.3 (1.8)	2.5 (1.7)	0.2 (1.2)	0.5
Melons (honeydew, cantaloupe, watermelon)	4.1 (1.4)	4.0 (1.5)	-0.1 (0.8)	0.7
Oranges	3.8 (1.3)	4.0 (1.0)	0.2 (1.4)	0.4
Overall[1]:	26.3 (5.4)	27.4 (5.7)	1.1 (3.8)	0.1

Score range for individual fruits [0,5] and [0,35] for overall
[1]n=31-32 for individual fruits and 29 for overall
*p-value by paired t-test

Vegetable Preference

Table 10 shows the mean vegetable preference scores and the change in mean score for each vegetable and for overall vegetables. The scores for individual vegetables were on a scale of 0-5 and 0-70 for overall vegetable score. The sample size ranged from 30-32 for individual vegetables and 23 for overall due to missing data from participants. There was an overall increase in 11 out of 14 vegetables and overall mean vegetable preference increase from 39.6 (SD 11.3) to 43.4 (SD 12.3), p=0.1, and had a 9.8% change in mean score (Figure 5). The greatest increase in preference was for asparagus, with an observed increase in mean score of 0.5 (p=0.06). The greatest decrease for vegetable preference was -0.3 (p=0.3) for peas. The only scores that did not change were for greens, with a 0.00 (SD 1.2) change in mean score (p=1.0).

Change in individual raw scores ranged from -22 to 37, indicating some participants had lower preference at the end of the program. Ten (43%) of participants showed a decrease in score whereas the remainder showed an increase. Figure 6 shows the range of individual change scores expressed as a percentage of total score for all categories tested. The second data point shows that vegetable preference changed from -31% to 53%.

Table 10: Mean vegetable preference scores from pre- and post-survey and change in mean vegetable preference score for participants in California and Tennessee (Spring and Fall 2014).

Variable	Mean (SD) Pre Score	Mean (SD) Post Score	Change in Mean (SD)	p-value*
Asparagus	2.3 (1.9)	2.8 (1.8)	0.5 (1.5)	0.06
Avocado	2.1 (1.5)	2.4 (1.5)	0.3 (1.0)	0.1
Bell Pepper	2.5 (1.6)	2.9 (1.5)	0.4 (1.3)	0.1
Broccoli	3.8 (1.5)	3.9 (1.3)	0.1 (1.2)	0.7
Cabbage	3.3 (1.6)	3.3 (1.5)	-0.1 (1.5)	0.8
Carrots	3.3 (1.4)	3.4 (1.5)	0.2 (1.6)	0.6
Cauliflower	2.4 (1.8)	2.7 (1.6)	0.4 (1.4)	0.2
Corn	4.3 (1.3)	4.2 (1.3)	-0.03 (1.4)	0.9
Green Beans	3.7 (1.4)	3.8 (1.3)	0.2 (1.5)	0.6
Greens (kale, spinach, lettuce)	3.6 (1.4)	3.6 (1.5)	0.00 (1.2)	>0.9
Peas	2.6 (1.6)	2.3 (1.4)	-0.3 (1.3)	0.3
Sweet Potato	2.4 (1.8)	2.7 (1.7)	0.3 (2.0)	0.4
Tomatoes	2.6 (1.6)	2.7 (1.8)	0.1 (1.4)	0.7
Squash (acorn, butternut, zucchini, yellow squash)	2.3 (1.6)	2.4 (1.6)	0.1 (2.0)	0.9
Overall[1]:	39.6 (11.3)	43.4 (12.3)	3.9 (12.4)	0.1

Score range for individual vegetables [0,5] and [0,70] for overall

[1] n = 30-32 for individual vegetables and 23 for overall

*p-value by paired t-test

Research Question #2: How does participation in the Pink and Dude Chefs program impact nutrition knowledge among boy and girl participants aged 11-14 years in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

Table 11 shows the mean nutrition knowledge scores from the pre- and post-surveys and change in mean nutrition scores for participants. Scores ranged from 0-1 for individual knowledge questions and 0-7 for overall knowledge questions, stemming from dichotomous response variables scored 0 for incorrect and 1 for correct. The sample size ranged from 23-24 for individual knowledge questions and 23 overall. Scores for six of the seven questions increased from the pre- to post- survey. The questions that showed the most increase from pre- to post-survey related to calcium, types of fat and plant protein. The change in mean for the question about calcium was 0.2 (SD 0.4) and had a significant p-value of 0.02; the change in mean for the question about fats was 0.5 (SD 0.7) and had a significant p-value of 0.002; and the change in mean for the question about protein was 0.2 (SD 1.4) and had a significant p-value of 0.02. The only question that showed a decrease was the question on fiber, with a score of -0.1 (SD 0.7), p=0.1. The overall mean nutrition knowledge score increased from 3.8 (SD 0.9) to 5.1 (SD 1.1), with a significant p-value of 0.0002, representing a 34.2% change in mean score (Figure 5).

Change in individual raw scores ranged from -1 to 4. Seven (30%) of participants showed no change in score whereas two (9%) and 14 (61%) showed decreases and increases, respectively. Figure 6 shows the range of individual change scores expressed as a percentage of total score for all categories tested. The third data point shows that knowledge scored changed from -14% to 57%.

Table 11: Mean nutrition knowledge scores from pre- and post-survey and change in mean nutrition score for participants in California and Tennessee (Spring and Fall 2014).

Question	Mean (SD) Pre Score	Mean (SD) Post Score	Change in Mean (SD)	p-value*
Which has more fiber?	0.7 (0.5)	0.5 (0.5)	-0.1 (0.7)	0.4
99% of calcium in your body is found in your_____.	0.8 (0.4)	1.0 (0.0)	0.2 (0.4)	0.02
Based on the USDA MyPlate guidelines, how much of the plate should be made up of fruits and vegetables?	0.5 (0.5)	0.7 (0.5)	0.1 (0.6)	0.3
Which type of fat should you avoid?	0.3 (0.5)	0.8 (0.4)	0.5 (0.7)	0.002
Where can you find the most natural, healthy items in the grocery store?	0.5 (0.5)	0.6 (0.5)	0.1 (0.6)	0.5
The serving size of grapes is equivalent to the size of a _____?	0.4 (0.5)	0.6 (0.5)	0.3 (0.7)	0.08
Beans can be an excellent source of_____.	0.8 (0.4)	1.0 (0.0)	0.2 (0.4)	0.02
Overall [1]:	3.8 (0.9)	5.1 (1.1)	1.3 (1.4)	0.0002

Score range for individual knowledge [0,1] and [0,7] for overall
[1] n = 23-24 for individual knowledge questions and 23 overall
*p-value by paired t-test

Research Question #3: How does participation in the Pink and Dude Chefs program impact fruit and or vegetable intake among boy and girl participants aged 11-14 y in Arroyo Grande, California; Shandon, California; and Nashville, Tennessee?

Fruit Intake

The mean fruit intake scores from the pre- and post-surveys and change in mean fruit intake scores for participants are seen in Table 12. The score range for individual fruit was on a scale of 0-5 and 0-35 for total fruits. The sample size for this category was 30 for individual fruits and 30 for overall due to missing data from participants. There was an increase between all scores except for oranges which decreased from 2.6 (SD 1.7) to 2.5 (SD 1.6), p=0.9. The fruit intake that increased the highest was for berries

(blueberries, strawberries, raspberries), with a mean score increase of 0.5 (SD 1.7), p=0.1; grapefruit, with a mean score increase of 0.5 (SD 1.3) p=0.06; and neither an increase nor decrease (0.00, SD 1.5) in mean score for melons (honeydew, cantaloupe watermelon) p = 1.0. The overall percent change in mean score for fruit intake was 10.1% and seen in Figure 5.

Change in individual raw scores ranged from -7 to 17. Two (7%) of participants showed no change in score whereas 13 (43%) and 15 (50%) showed decreases and increases, respectively. Figure 6 shows the range of individual change scores expressed as a percentage of total score for all categories tested. The fourth data point shows that fruit intake changed from -20% to 48%.

Table 12: Mean fruit intake scores from pre- and post-survey and change in mean fruit intake score for participants in California and Tennessee (Spring and Fall 2014).

Variable	Mean (SD) Pre Score	Mean (SD) Post Score	Change in Mean (SD)	p-value*
Apples	2.8 (1.4)	2.9 (1.4)	0.1 (1.6)	0.8
Bananas	2.3 (1.3)	2.6 (1.5)	0.3 (1.4)	0.2
Berries (blueberries, strawberries, raspberries)	2.4 (1.4)	2.9 (1.7)	0.5 (1.7)	0.1
Cherries	1.5 (1.1)	1.7 (1.3)	0.2 (1.6)	0.6
Grapefruit	1.2 (0.5)	1.7 (1.3)	0.5 (1.3)	0.06
Melons (honeydew, cantaloupe, watermelon)	2.0 (1.5)	2.0 (1.4)	0.0 (1.8)	>0.9
Oranges	2.6 (1.7)	2.5 (1.6)	-0.03 (1.7)	0.9
Overall[1]:	14.8 (4.3)	16.3 (6.3)	1.5 (5.7)	0.2

Score range for individual fruits [0,5] and [0,35] for overall
[1]n=30 for individual fruits and 30 for overall
*p-value by paired t-test

Vegetable Intake

The mean vegetable intake scores from the pre- and post-surveys and the change in the mean vegetable intake score for participants are seen in Table 13. The score range for individual vegetables ranged from 0-5 and 0-70 for overall vegetables. The sample size for individual vegetables ranged from 30-32 for individual questions and 27 for overall vegetable intake questions due to missing data from participants. The vegetables that had the highest increase in mean values were carrots with an increase of 0.5 (SD 2.0), cabbage with an increase of 0.3 (SD 1.6), and squash with an increase of 0.3 (SD 1.4). The vegetables that showed the greatest decrease in mean score were greens and cauliflower. The greens showed a decrease of -0.7 (SD 1.7, p=0.003) and cauliflower showed a decrease of -0.1(SD 1.4, p=0.8). The overall vegetable intake mean scores showed a 0.7 (SD 13.2) increase in vegetable intake and p-value of 0.8. The overall percent change in mean score for vegetable intake was 2.8% and seen in Figure 5.

Change in individual raw scores ranged from -15 to 48. Three (11%) of participants showed no change in score whereas 15 (56%) and 9 (32%) showed decreases and increases, respectively. Figure 6 shows the range of individual change scores expressed as a percentage of total score for all categories tested. The first data point shows that vegetable intake changed from -21% to 69%.

Table 13: Mean vegetable intake scores from pre- and post-survey and change in mean vegetable intake score for participants in California and Tennessee (Spring and Fall 2014).

Variable	Mean (SD) Pre Score	Mean (SD) Post Score	Change in Mean (SD)	p-value
Asparagus	1.3 (0.7)	1.3 (1.0)	0.1 (1.0)	0.6
Avocado	1.4 (1.1)	1.5 (1.1)	0.1 (1.5)	0.8
Bell Pepper	1.9 (1.5)	2.1 (1.4)	0.2 (1.7)	0.5
Broccoli	2.0 (1.4)	2.3 (1.4)	0.2 (1.7)	0.5
Cabbage	1.5 (1.2)	1.8 (1.4)	0.3 (1.6)	0.3
Carrots	1.9 (1.5)	2.4 (1.6)	0.5 (2.0)	0.2
Cauliflower	1.6 (1.4)	1.6 (1.1)	-0.1 (1.4)	0.8
Corn	2.5 (1.4)	2.6 (1.5)	0.1 (2.2)	0.8
Green Beans	2.1 (1.5)	2.2 (1.4)	0.1 (1.4)	0.7
Greens (kale, spinach, lettuce)	2.7 (1.5)	2.0 (1.5)	-0.7 (1.7)	0.03
Peas	1.5 (1.1)	1.6 (1.4)	0.1 (1.6)	0.7
Sweet Potato	1.3 (1.0)	1.3 (0.9)	0 (0.9)	>0.9
Tomatoes	2.0 (1.3)	2.1 (1.5)	0.0 (1.5)	0.9
Squash (acorn, butternut, zucchini, yellow squash	1.4 (1.0)	1.7 (1.3)	0.3 (1.4)	0.3
Overall[1]:	24.7 (9.3)	25.4 (12.08)	0.7 (13.2)	0.8

Score range for individual vegetables [0,5] and [0,70] for overall

[1] n = 30-32 for individual vegetables and 27 for overall

*p-value by paired t-test

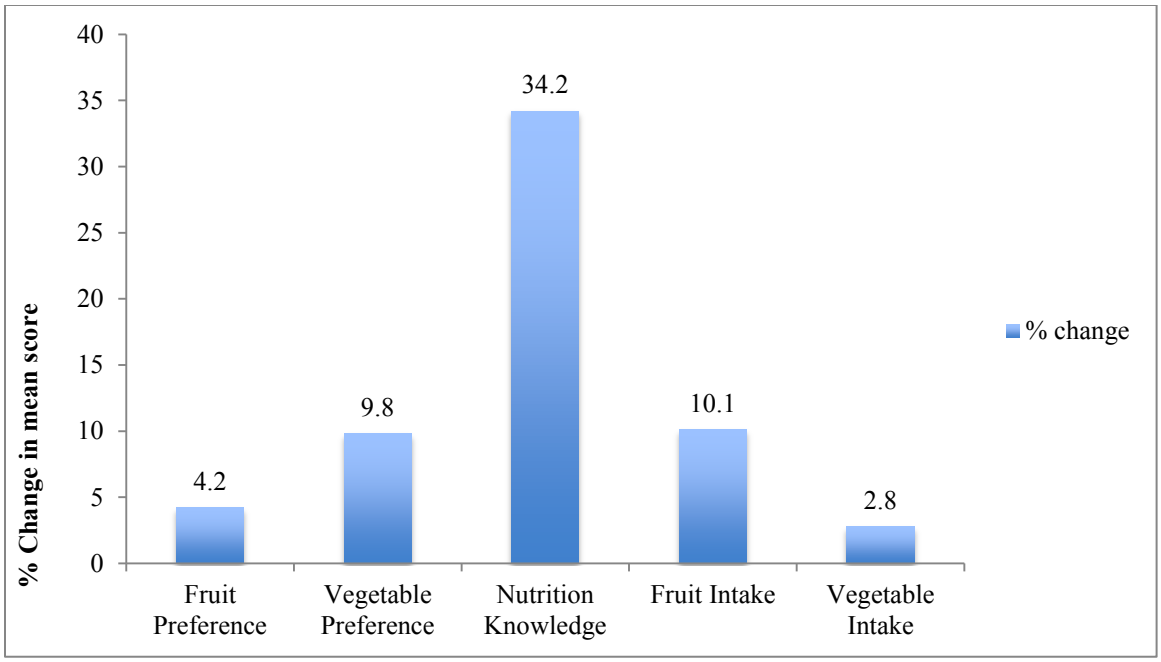

Figure 5: Percent change in mean scores for pre- and post survey questions on individual question scores for participants in California and Tennessee (Spring 2014 and Fall 2014).

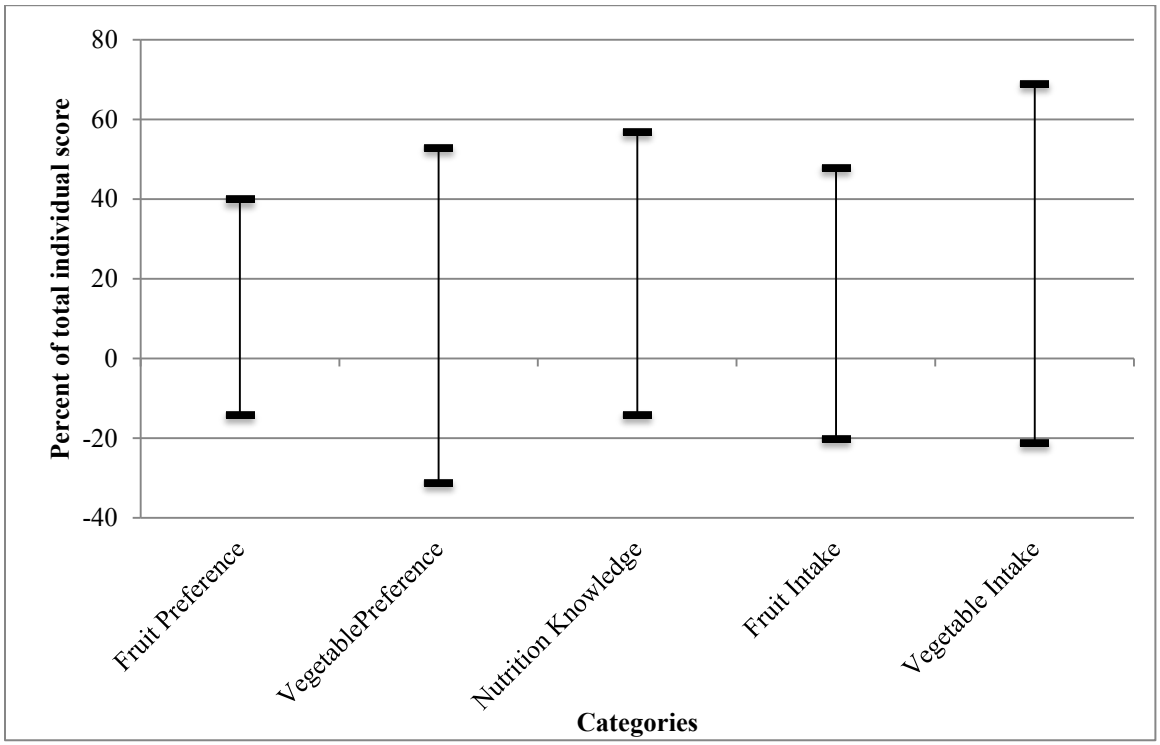

Figure 6: Range of individual change scores expressed as a percentage of total score for participants in California and Tennessee (Spring 2014 and Fall 2014).

Covariables

Gender

Figure 7 shows percent change in mean scores for each question stratified by sex. The sample size ranged from 9-14 for boys and 11-16 for girls due to missing data from participants. Among girls, the change in fruits preference score was 1.5 (SD 4.5), corresponding to a 6.1% change (p=0.2) and the change in vegetable preference score was 4.9 (SD 9.6), corresponding to a 12.6% change (p=0.08). Change in nutrition knowledge scores among girls was 1.1 (SD 1.4), corresponding to a 26.7% change (p=0.03). The change in fruit intake score was 1.0 (SD 6.1) corresponding to a 6.8% change (p=0.5), while the change in vegetable intake score was 0.6 (SD 11.1), corresponding to a 2.2% change (p=0.9).

Among boys, the change in fruit preference score was 0.7 (SD 2.8), corresponding to a 2.5% change (p=0.4), while the change in vegetable preference score was 2.3 (SD 16.4), corresponding to a 5.7% change (p=0.7). Change in nutrition knowledge score increased by 1.4 (SD 1.4), corresponding to a 39.7% change (p= 0.006). Change in fruit intake score was 2.0 (SD 5.3), corresponding to a 13.5% change (p=0.2), and the change in vegetable intake score was 0.8 (SD 15.5), corresponding to a 3.7% change (p=0.8).

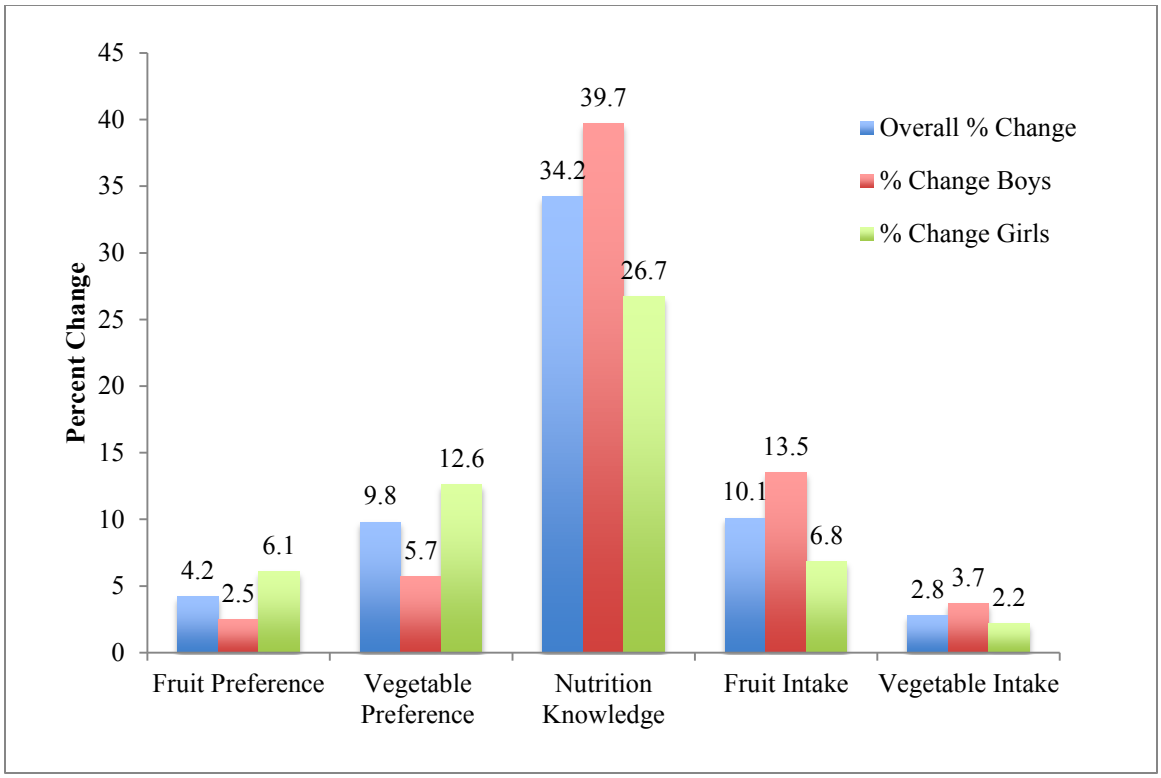

Figure 7: Percent change in mean scores for pre- and post survey questions on individual question scores for participants in California and Tennessee stratified by sex (Spring 2014 and Fall 2014).

Table 14 examines the differences between boys and girls in each category. Using one-way ANOVA, p-values for each category were >0.6, suggesting that there were no differences between boys and girls.

Table 14: Comparison between boy and girl participants in California and Tennessee for pre and post survey questions.

Gender[2]	**Boys**	**Girls**	**Between groups**
Pre vs. Post Measure Item	**Change in Mean (SD)**	**Change in Mean (SD)**	**p-value**[1]
Fruit Preference	0.7 (2.8)	1.5 (4.5)	0.6
Vegetable Preference	2.3 (16.4)	4.9 (9.6)	0.6
Nutrition Knowledge	1.4 (1.4)	1.1 (1.4)	0.6
Fruit Intake	2 (5.3)	1 (6.1)	0.6
Vegetable Intake	0.8 (15.5)	0.6 (11.1)	>0.9

[1]p-value by one-way ANOVA
[2]n=9-14 for boys, n=11-16 for girls

Site Location: California and Tennessee

Figure 8 shows the percent change in mean scores for each pre- and post-survey question stratified by state. Sample size ranged from 11-14 for California participants and 9-16 for Tennessee due to missing data from participants. The percent change in the mean for fruit preference scores was 4% for each location. The change in mean scores for vegetable preference increased 21.1% among California participants (p=0.08) and 0.2% among Tennessee participants (p>0.9). Nutrition knowledge increased the most significantly for Tennessee participants with a 46.8% change in mean score and p-value of 0.005. Among California participants, nutrition knowledge change in mean scores increased by 25.8% and had a p-value of 0.02. California had a change in mean score of 1.8 (SD 5.6) for fruit intake (p=0.3), while Tennessee had a 1.2 (SD 1.5) change in mean score and a p-value of 0.4. Among Tennessee participants there was a 7.9% change in mean for vegetable intake (p=0.7), whereas among California participants, there was a -1.4% change in mean for vegetable intake (p=0.9).

Table 15 examines the differences between California and Tennessee in each category. Using one-way ANOVA, p-values for fruit preference, fruit intake, vegetable intake were >0.6, suggesting that there were no differences between site location. P-values for vegetable preference (p=0.4) suggests that there was a 40% chance the difference between the two sites was due to random variation, whereas nutrition knowledge p-value (p=0.1) suggest that there is a 10% chance the difference between the two sites was due to random variation.

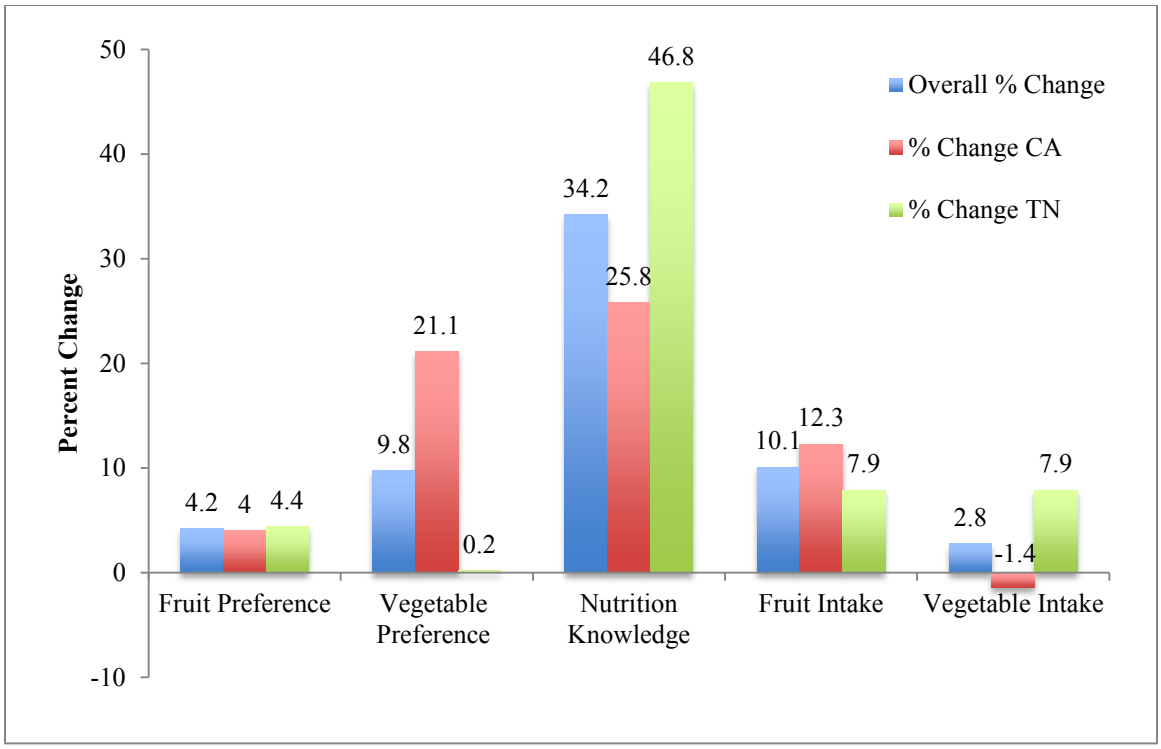

Figure 8: Percent change in mean scores for pre- and post survey questions on individual question scores for participants in California and Tennessee stratified by State. (Spring 2014 and Fall 2014).

Table 15: Comparison between California and Tennessee participants for pre and post survey questions.

Site[2]	**California**	**Tennessee**	**Between groups**
Pre vs Post Measure Item	**Change in Mean (SD)**	**Change in Mean (SD)**	**p-value**[1]
Fruit Preference	1.1 (3.0)	1.0 (4.5)	>0.9
Vegetable Preference	8 (13.4)	0.08 (10.5)	0.1
Nutrition Knowledge	1.1 (1.5)	1.6 (1.2)	0.4
Fruit Intake	1.8 (5.6)	1.2 (6.0)	0.8
Vegetable Intake	-0.4 (12.6)	1.7 (14.0)	0.7

[1]p-value by one-way ANOVA
[2]n=11-14 for California, 9-16 for Tennessee

Race/Ethnicity

In Appendix H, data was stratified by race/ethnicity to examine data among White, Hispanic/Latino, and Black groups. Sample sizes ranged from 6-7 for Whites, 3-5 for Latino/Hispanics, and 8-15 for Blacks due to missing data from participants. The "Mixed" group was omitted due to missing data from participants and having a small n

ranging from 1-3. When stratified by race/ethnicity, there was a 6.5% change in mean scores from pre- to post-surveys for fruit preference (p=0.02) among White participants, 4.2% change in mean scores (p=0.5) among Hispanic/Latino, and a 5.2% change in mean scores (p=0.4) among Black. Total vegetable preference score increased for all race/ethnic groups with the highest being a 42.5% change in mean scores (p = 0.2) among Hispanic/Latinos, a 13.6% change in mean scores among Whites (p=0.3), and a 0.9% change in mean scores among Blacks (p=0.9). The highest percent change in nutrition knowledge score was 55.4%, representing a mean score increase of 1.8 (SD 1.2) among Black participants (p=0.004), White participants had a 14.9% change in mean scores (p=0.2), and Hispanic/Latino participants showed a 10.5% change in mean scores (p=0.5). Fruit intake increased in all three categories with the highest percent change being 14.8% (p=0.5) among White participants, followed by Black participants with an 11.4% change in mean scores (p =0.3), and then followed by Hispanic/Latinos with an 11.1% change in mean scores (p=0.5). Vegetable intake was the only category that had a decrease change in mean scores with a -1.0% change for Hispanic/Latinos, whereas among White participants there was an increase change in mean scores of 13% (p = 0.6), and a 7.4% change in mean scores among Blacks (p = 0.7).

When examining the differences between racial/ethnic groups for fruit preferences, fruit intake, and vegetable intake, there was no difference (p>0.9) seen between White, Hispanic/Latino, and Black participants (Table 16). The greatest difference between groups was for nutrition knowledge (p=0.1) and vegetable preferences (p=0.2).

Table 16: Comparison between racial/ethnic group participants in California and Tennessee for pre and post survey questions.

Race/Ethnicity[2]	White	Hispanic/Latino	Black	Between groups
Pre vs Post Measure Item	**Change in Mean (SD)**	**Change in Mean (SD)**	**Change in Mean (SD)**	**p-value[1]**
Fruit Preference	1.9 (1.6)	1.2 (3.7)	1.2 (4.8)	0.9
Vegetable Preference	6.0 (11.4)	14.3 (16.4)	0.4 (11.0)	0.2
Nutrition Knowledge	0.7 (1.4)	0.4 (1.1)	1.8 (1.2)	0.1
Fruit Intake	2.3 (7.6)	1.8 (5.5)	1.6 (5.9)	> 0.9
Vegetable Intake	3.5 (16.9)	-0.3 (5.0)	1.6 (14.7)	0.9

[1]p-value by one-way ANOVA
[2]n=6-7 for Whites, 3-5 for Hispanic/Latinos, 8-15 for Blacks

Household Size

Household size was categorized in two different categories: 2-5 people and 6 or more people living full time in the household (See Appendix I). Sample sizes ranged from 7-11 for the smaller household size and 3-4 for the larger household size due to missing data from participants. When stratified by household size there was a 1.8 (SD 4.5) change in fruit preference mean score for the smaller household, corresponding to a 6.3% change (p=0.1), and a 2.7 (SD 3.8) change in mean score for the larger household size corresponding to a 10.4% change (p=0.3). Vegetable preference among the smaller household had a 6.5 (SD 13.2) change in mean score corresponding to a 17% change in mean (p=0.09), whereas the larger household has a -4.0 (SD 18) change in mean score, corresponding to a -9% change (p=0.7). Nutrition knowledge showed the highest change in mean scores among both groups with a 1.0 (SD 1.2) change in mean score for the smaller household, corresponding to a 22.7% change (p=0.03), and a 1.0 (SD 1.4) change in mean score for the larger household corresponding to a 25% change in mean (p=0.5). Fruit intake showed a 1.9 (SD 5.2) increase in mean score for the smaller household

corresponding to a 14% change (p=0.2) and a 3.5 (SD 3.0) increase in mean score for the larger household corresponding to a 27% change (p = 0.1). Vegetable intake score decreased by -2.2 (SD 12.5) among the smaller household with a corresponding -7.7% change in mean (p = 0.5), and showed an increase among the larger household size with a 14.0 (SD 22.6) change in mean score and corresponding 81% change (p = 0.3).

Table 17 examines the differences between household size for each category. Using one-way ANOVA, p-values for fruit preference, nutrition knowledge, and fruit intake category were >0.6, suggesting that there were no differences between household size. Vegetable preference was seen to have a 30% chance the difference between the two household sizes was due to random variation. Vegetable intake was seen to have a greatest difference in all categories with a 7% chance that the difference between the two household sizes was due to random variation.

Table17: Comparison between household size and participants in California and Tennessee for pre and post survey questions.

Household Size[2]	**2-5**	**6+**	**Between groups**
Pre vs Post Measure Item	**Change in Mean (SD)**	**Change in Mean (SD)**	**p-value[1]**
Fruit Preference	1.8 (4.5)	2.7 (3.8)	0.8
Vegetable Preference	6.5 (13.1)	-4.0 (18)	0.3
Nutrition Knowledge	1.0 (1.2)	1.0 (1.4)	>0.9
Fruit Intake	1.9 (5.2)	3.5 (3.0)	0.6
Vegetable Intake	-2.2 (12.5)	14 (22.8)	0.07

[1]p-value by one-way ANOVA
[2]n=10-15 for the household size 2-5, n= 2-4 for the household size 6+

Household Composition

Household composition of each participant was divided into three categories of whom the participant lived with based on their responses to the survey: both parents (n= 7-11), single parents (n= 2-6), and other (n= 3-4) (See Appendix J). Sample size varied due to missing data from the participant. There was a 1.1 (SD 3.5) increase in fruit

preference mean scores among participants living with both parents with a corresponding 4.1% change (p=0.3), a 3.2 (SD6.9) increase in fruit preference for single parents with a corresponding 13.1% change (p=0.4), and a 1.3 (SD 2.3) increase in fruit preference for "other", with a corresponding 4.6% change (p=0.4). Vegetable preference showed a 6.9 (SD 19.2) increase corresponding to a 19.4% change in mean scores among participants living with both parents (p=0.3), a 4.4 (SD 10.4) increase and corresponding 12.2 % change in mean scores among participants living with a single parent (p=0.4), and a 0.5 (SD 3.9) increase and corresponding 1% change in mean scores among participants living with "other" (p=0.8). Nutrition knowledge scores increased by 0.4 (SD 1.3) with a corresponding 9.7% increase among participants living with both parents (p=0.4), a 1.5 (SD 2.1) increase and corresponding 30% increase among participants living with a single parent (p=0.5), and a 1.3 (SD 1.0) increase and corresponding 30.6% increase among participants living in "other" (p=0.08). Fruit intake scores increased by 1.7 (SD 4.2) with a corresponding 12.2% increase among participants living with both parents (p=0.2), a 0.2 (SD 3.8) increase and corresponding 1.4% increase among participants living with a single parent (p=0.9), and a 4.3 (SD 1.0) increase and corresponding 30.4% increase among participants living in "other" (p=0.4). Vegetable intake scores increased by 4.1 (SD 14.9) with a corresponding 17.6% increase among participants living with both parents (p=0.4), a -9.2 (SD 6.9) decrease and corresponding -28.6% decrease among participants living with a single parent (p=0.6), and a 8.3 (SD 24.6) increase and corresponding 27.7% increase among participants living in "other" (p=0.6).

Table 18 examines the differences between household composition in each category. Using one-way ANOVA, p-values for fruit intake, fruit preference, vegetable

preference, and nutrition knowledge categories were >0.5, suggesting that there were no differences between household composition, whereas vegetable intake showed a slight difference between household composition (p=0.2)

Table 18: Comparison between household composition and participants in California and Tennessee for pre and post survey questions.

Lives with[2]	**Both parents**	**Single parent**	**Other**	**Between groups**
Pre vs Post Measure Item	**Change in Mean (SD)**	**Change in Mean (SD)**	**Change Mean (SD)**	**p-value[1]**
Fruit Preference	1.1 (3.5)	3.2 (6.9)	1.3 (2.3)	0.7
Vegetable Preference	6.9 (19.3)	4.4 (10.4)	0.5 (3.9)	0.8
Nutrition Knowledge	0.4 (1.3)	1.5 (2.1)	1.3 (1.0)	0.5
Fruit Intake	1.7 (4.2)	0.2 (3.8)	4.3 (8.6)	0.5
Vegetable Intake	4.1 (14.9)	-9.2 (6.9)	8.3 (24.6)	0.2

[1]p-value by one-way ANOVA
[2]n=7-11 for both parents, n= 2-6 for single parent, n=3-4 for other

CHAPTER 4

Discussion

This study assessed the impact of Pink and Dude Chefs, a 12-lesson nutrition education and culinary intervention program among middle school students in California and Tennessee. The key questions of interest were whether participation in the afterschool program impacted fruit and vegetable preference, nutrition knowledge, and fruit and vegetable intake. Results indicated that participant fruit and vegetable preferences, nutrition knowledge and fruit and vegetable intake all increased. However, statistical significance was only achieved with nutrition knowledge, likely due to small sample size. Stratified analysis was also conducted and seemed to show some patterning, but statistical power was similarly limited.

Fruit and Vegetable Preference

Overall fruit preference increased by 4.2% (p=0.1) with participation in the PDC program. Preference scores increased most for cherries and bananas whereas melons were the only fruit that showed a decrease in score. It is important to note that not all of the fruits and vegetables assessed were included as a part of the recipes or program curriculum. Most of the fruits were incorporated on the first lesson, Personality Pie, where students decorated healthy pies with various fruits. Melons were not incorporated into this lesson and neither were cherries. This suggests that the increase or decrease in preference for a specific fruit may not have been due to direct exposure from the program, but from indirect impacts of education, social/environmental influences, and behavioral factors (Story, Neumark-Sztainer, & French, 2002). Several of the students mentioned in their post-program interviews that they preferred eating mangos and

pineapples to apples, yet preferences for mangos and pineapples was not assessed on the surveys, suggesting that preferences for all types of fruits may be impacted indirectly as a result of this type of programming (Wang et al., 2010). It has been shown that repeated experience with food can enhance preferences through associative conditioning (Birch & Fisher, 1998), however, if adolescents do not have access and or availability of fruits and vegetables for consumption in their home, for example, the impact of associative conditioning could be less relevant. As such, exposure during programming may be critical for making gains in preferences. Therefore, programs such as PDC can provide the environmental conditions for adolescents to gain the exposure and repetition needed for long-term effects (Chessen, 2009).

Overall vegetable preference increased after participation in the PDC program by 9.8% change in mean score ($p=0.1$). Cabbage, corn, and peas were the only vegetables whose scores decreased, while greens did not have any change from pre to post survey. Similar to the fruits above, it is important to note that cabbage and peas were not included in the recipes and curriculum and therefore students were not introduced or exposed to these vegetables as they were to others that increased. Asparagus, cauliflower, and bell peppers were vegetables that increased the most among participants and were included in several recipes (stir fry, MyPlate pizza, white bean mac and cheese). This suggests that with participation in the program, preferences for these vegetables increased due to exposure from the variety of recipes. When examining differences between the site locations (21.1% change in mean score preference for California vs. 0.2% change in mean score preference for Tennessee), all three of these vegetables were grown in proximity to one of the California sites (Agegerter et al, 2014; Hartcz et al., 1996; UC

Vegetable Research Center, 2015). California sites had a higher increase in vegetable preferences compared to Tennessee, raising the question of whether California participants could have been preconditioned for preferences of those particular vegetables due to environmental exposures. These findings coincide with Chessen's conclusions about repeated exposure to vegetables in the PDC program, which could have helped participants overcome barriers with a particular vegetable and/or taught them learn how to use those ingredients in different way (Chessen, 2009).

When stratified, preferences for vegetables among the Hispanic/Latino group increased by 42.5%, compared to the overall California cohort of 21.1%. It is worth considering that Pink and Dude Chefs, which targets low-income minority populations, exposes participants to more vegetables than they would normally be exposed to in their home environment (Sheehan, 2013). Hispanic/Latino populations have higher food insecurity compared to White populations, which is a powerful barrier to consumption of health-promoting fruit and vegetables (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). If increasing exposure to vegetables leads to increased consumption among food-insecure populations, it follows that increasing preferences may help address issues related to consumption of fruits and vegetables among food-insecure populations, reducing obesity risk by addressing these disparities (Kumanyika, 2008).

Nutrition Knowledge

Participant's nutrition knowledge scores increased after participation in the program (34.2% change in means scores, $p<0.0002$). When stratified, results suggested there were few differences between groups, implying that participants experienced relatively homogenous increases in nutrition education (Tables 14-18). Survey questions

were derived from lesson materials and curriculum. The only question whose score decreased was "which has more fiber?" and asked participants to choose from the list: white bread, white potato, oatmeal, and olive oil. The correct answer was oatmeal, which was covered in the lesson but was perhaps not emphasized. The lesson was specifically on carbohydrates and increasing fiber in one's diet by incorporating whole grains. Oats were used in the recipe for apple crisp rather than for oatmeal, and potatoes were talked about having fiber in their skins, potentially confusing the participant with the correct answer. The question that had the strongest p-value (0.002) was "which type of fat should you avoid?" and was covered in depth during the "fats" lesson along with examples. Participants mentioned during their interviews that they "learned about trans fats/saturated fats" when asked what new things they learned after completing the program, highlighting participants' acquired knowledge through the program. Other studies have also shown that curriculum-based afterschool nutrition education programs are effective ways to increase knowledge among participants (Kelder et al., 2005; McFarland, 2014; Werner, Teufel, Holtgrave, & Brown, 2012). Previous research suggests that enhancing nutrition knowledge skills in adolescents may translate into an increase in healthier dietary choices (Grosso et al., 2013). More importantly, interventions that include knowledge and skill building increase the likelihood that positive behavior changes will occur (Lockhart, 2014).

Other influential factors, not examined in the current analysis, could have impacted nutrition knowledge scores as well. For example, participants' attendance in a health class or another outside program that incorporated nutrition education, if the participant attended every class, if they actively participated in class and kitchen

activities, and if their parents/guardians had involvement in the program or had a background in nutrition. Parental education has been identified as an influencing factor on adolescent obesity whereby parents with lower education were more likely to have obese children (National Center for Health Statistics, 2011). In addition, higher education is associated with higher SES and the financial means with which to provide a healthier diet and lifestyle (Fradkin et al, 2014). Parent/caregiver education has also been found to have an association with higher levels of vegetable and fruit consumption (Guerrero & Chung, 2015). Future programs should focus on increasing adolescent nutrition knowledge while incorporating parental/family involvement in an effort to impact multiple levels of factors affecting nutrition and diet (Grosso et al., 2013).

Fruit and Vegetable Intake

Few adolescents meet the recommendations for fruit and vegetable intake with fried potatoes and tomato products being the primarily eaten vegetables and for fruit alone (Kimmons et al., 2009). Overall change in fruit intake mean scores increased by 10.1% with participation in the PDC program with the strongest increase being from grapefruit ($p=0.06$). It is important to note that there were not any recipes or lessons that contained grapefruit and therefore students were not introduced or exposed to grapefruit during this program, as they were to others some other fruits that increased. On the other hand, orange consumption decreased from pre- to post- survey, which was used in the first lesson for personality pie recipe. It is difficult to extrapolate the reasons for the apparent disconnect between what was in the curriculum versus what students reported on surveys. However, other PDC studies have described this phenomenon, attributing an indirect effect to more global changes in students' preferences and consumption. Several

of the students interviewed mentioned that they "have changed their eating habits" while being in Pink and Dude Chefs and have "tried eating more fruits." This may indicate that the indirect effect may have contributed to overall attitudes and not necessarily single fruits or vegetables.

Overall vegetable intake scores increased overall after participation in the program (2.8% change in mean scores). The greatest increase was seen in carrots, cabbage, and squash. Cabbage was not used in any of the recipes but carrots and squash were used in the stir-fry recipe, quinoa and black bean bowl recipe, and MyPlate pizzas. Greens decreased significantly from pre-to post-survey, which was not expected since they were used throughout the program. Since the survey only stated, "during the past seven days have you eaten___" the participants could have eaten any vegetable listed eight days prior to the survey. The list of vegetables on the survey was also limited with the options of vegetable to account for increase/decrease intake. One participant mentioned that they ate more eggplant, and eggplant was not on the survey or included in any of the recipes. Other students mentioned that they tried eating more carrots (which increased), avocados, broccoli, squash, kale, bell peppers, and even went to the food bank to get vegetables with their family.

Stratified results showed some patterns, but as noted, were statistically underpowered. Participants in California showed greater increase in mean score for fruit (12%) compared to participants in Tennessee (8%). Tennessee participants showed the same increase for vegetables (8%) whereas California participants showed a decrease (-1.4%). Hispanic/Latino participants, who were all from California, had lower vegetable intake scores compared to White and Black participants. The intake for fruits and

vegetables could have been influenced by family access to fruits and vegetables, and the availability of produce in proximity to their home that could account for the lack or increase in intake (Ding et al., 2012). Even though California sites were located in an agricultural prevalent area, the nearest grocery store to one of the California locations was about 20 miles. In these areas, mini markets/convenient stores are often used for basics and have limited availability of fresh fruit and vegetables (Kaufman & Karpati, 2007). This point was mentioned in one of the interviews with a participant who said he had could not eat more vegetables because not many vegetables were available at home. Having adequate access to fruits and vegetables is a key factor to increasing consumption in low-income populations, which tend to have limited access to supermarkets and fresh produce (Kratt, Reynolds, & Shewchuk, 2000). In addition, increasing the availability of fruits and vegetables in the home environment will help encourage greater consumption of healthier dietary patterns in adolescents (Ding et al., 2012). Future iterations of PDC and similar programs should consider the home environment as a major contributor to fruit and vegetable intake, and design upstream elements to facilitate intake at multiple levels.

The types of vegetables that were served at school during the time the survey was taken could have influenced the intake of the participant, in addition to seasonality of the produce. Many children participate in the school lunch program, which has requirements to meet with the USDA Dietary guidelines that aim to increase the consumption of fruits, vegetables, whole grains, and fat-free and low-fat fluid milk in school lunches; reduce levels of sodium, saturated and trans fat in meals (USDA Federal Register, 2015). To

address this, future research could include questions on the survey related to participation in the school lunch program (Sheehan, 2013).

Strengths and Limitations

Strengths

The greatest strength of this study was that it was built upon previous research studies on Pink and Dude Chefs and based on behavioral change theories. Theory-driven research has been shown to be helpful in addressing different perspectives and incorporating diverse constructs that clarify or predict certain behaviors (Achterberg & Miller, 2004). Previous research suggests that adolescent food preparation frequency is positively associated with self-efficacy for cooking ($r=0.854$, $p<0.001$) (Woodruff & Kirby 2013) and increased consumption of fruit and vegetables (Larson, Story, Eisenberg, & Neumark-Sztainer, 2006). Pink and Dude Chefs elaborates this concept by pairing nutrition education with culinary skills training, and reinforces those learned skills in subsequent lessons. Successful programs have shown that by reinforcing lessons, students were able to learn responsible health behaviors and put those behaviors into practice (Werner, Teufel, Holtgrave, & Brown, 2012).

Very few programs have included all of the three major constructs that were tested in this study: preferences, nutrition knowledge, and consumption. Several studies mentioned previously have focus only on nutrition related material such as contents and benefits of food groups, reading food labels, and tips eating in restaurants/school cafeteria (Dake, Fahlman, Martin, McCaughtry, 2008). The nutrition education component of a few of the programs mentioned previously was to incorporate nutrition into a snack and introduced participants to tasty and healthful foods, emphasizing fruits and vegetables,

and/or designed to support healthful eating and skill building through recipes creation and nutrition choices (Kelder et al., 2005; Thonney & Bisogni, 2006). Pink and Dude Chefs goes beyond these methods by having a structured curriculum that delivers pedagogical approaches to advance culinary skills and increase nutrition knowledge.

Previous research with PDC found that participation in the program increased nutrition knowledge, fruit intake, cooking skills, and culinary confidence. Pink and Dude Chefs uses a multifactorial approach to intervention with special considerations for a wide range of socio-economic factors. For example, PDC uses inexpensive ingredients that are easy to find at most supermarkets and are widely available at most food banks. Moreover, recipes are intentionally simple, facilitating adolescent-aged participation at home. Programs that employ specific strategies, such as these, when dealing with a low socioeconomic population seem to be most effective in improving or preventing obesity-related risk factors because it demonstrates the feasibility of cooking, and improving behaviors, attitudes and beliefs about dietary habits (Gatto, et al., 2012).

Adolescence is a critical age during which eating habits are formed, underscoring the need for interventions for healthy changes (Story, Neumark-Sztainer, & French, 2002). The introduction, or the reintroduction, of fruits and vegetables occurred during every lesson, surprised some participants who found they liked some of the fruits/vegetables that they did not normally like. The majority of participants said that they "tried eating fruits and vegetables in lunch even though old habits die hard." (Personal Communication, November 12, 2014). This suggests that participants were able to overcome preconceived barriers and change dietary habits through educational initiatives (Hyland, Stacy, Adamson, & Moynihan, 2006). Participants were also able to

make connections between dietary habits and health outcomes for each lesson objective to make healthier choices (Lockhart, 2014). Programs out of school that are able to address barriers to becoming a healthier community, while aimed at educating youth about obesity prevention, are most beneficial (Ying-Ying Goh et al., 2009).

Encouraging family participation was another strength of this study. Participants had a copy of each recipe in their student workbooks and were sent home with leftovers of the recipes to share with family members. Parents mentioned in their interviews that they enjoyed tasting the recipes and also learned more about what topics were taught during each lesson through goal sheets. Parents also expressed how their child taught them how to make an alternative mac and cheese, kale chips, quinoa, and ate more salads. Previous research has shown when individuals spend a greater amount of time spent on food preparation, they have a higher quality of diet that include more vegetables, salads, fruits, and fruit juices (Monsivais, Aggarwal, & Drewnowski, 2014). Furthermore, adolescents consume a higher percentage of fruit, vegetables, fiber, folate, and vitamin A when they help prepare family meals (Larson, Story, Eisenberg, & Neumark-Sztainer , 2006). Although family involvement was not the primary focus of this study, future research should consider family involvement and the outcomes associated with adolescent health.

Another strength of this study was the preexisting relationship PDC and Bright Futures due to previous cohorts of PDC that graduate students from Cal Poly implemented. This relationship enabled the program to run smoothly since Bright Futures staff members were familiar with the program and knew what to expect. The instructors

from Nashville were able to see one of the PDC lessons in action, which helped them prepare for their lessons in addition to watching the training videos.

Limitations

One of the most notable limitations of this study was a small sample size (n = 32) that limited power to detect statistically significant associations and being able to stratify with more confidence. Participants were limited to a small group of students since there was a maximum number of 16 students per cohort, and a recommended ratio of four participants to one volunteer. There was also no control group used in this study. This limits interpretation of causality because results may have been due to environmental influences that were not included in the program. For example, a control group could have also helped identify if the differences in preferences and intake between the pre- and post- survey were due to program participation or changes in school lunch program. Furthermore, the participants were not randomized, potentially biasing our samples and had to be enrolled in either Bright Futures or YMCA afterschool programs. Participants enrolled could have also had a prior interest or experience with cooking and not a true representation of a general group of middle school students. Randomization of the participants into a treatment or control group would have eliminated this bias and helped contextualize findings with respect to a non-intervention group. More multi-site collaborations and multiple cohort sites that combine data could be implemented to address the relatively small sample sizes inherent to these types of programs.

Bright Futures and YMCA had several other afterschool programs going on simultaneously with PDC, which may have accounted for inconsistent attendance. For example, in the Bright Futures program, Drama was a very popular afterschool program

and some of the participants had to choose one over the other every other week. Several of the students missed the final survey for this reason and were not included in the final analyses, which also happened with a previous PDC study (Lockhart, 2014). Results could have been analyzed by attendance, but this was limited with such a small sample size. Future iterations with larger sample sizes could include attendance as an analytic variable to highlight the impact of intervention exposure.

The survey used to collect data from each participant could have been a source for potential error. The instructor verbally administered the survey before the first class and after the last class. Participants were instructed to follow along with the instructor as they read each question for clear instructions and to mitigate any confusion with questions asked on the survey. After looking through the data, several participants did not follow directions appropriately and either missed questions, did not answer them, or answered questions twice. For these reasons, we omitted some data, reducing the sample size. Also, it is possible that participants were not completely honest with how they answered each question and that they did not fully understand all of the questions or answer options (Sheehan, 2013). Future research should seek to standardize and validate surveys among young populations and those who may have differential reading and comprehension levels (Sheehan, 2013).

Potential inconsistent implementation of the intervention could have lead to bias. The instructor could have influenced the results of participants based on personal factors such as, teaching methods, enthusiasm, knowledge, and skill. Most of the instructors did not have a background in nutrition, which also could account for information being taught differently compared to Arroyo Grande, CA, where the instructor was a nutrition

graduate student. In Nashville, TN, it was assumed that the program was run the same during Spring 2014 and Fall 2014 and the data was combined. Due to this expanded timeline, there may have been some unacknowledged differences, which may have influenced the data. However, to address these potential biases, the online training was required for each site's instructor and supported enough information to carry out each lesson thoroughly without having to have a background in nutrition. The structured curriculum provided ample resources, education information, and helpful culinary techniques for the instructor to use. The program curriculum also provided the flexibility to accommodate each site's specific needs. In addition, student workbooks also provide examples of lesson materials and activities to reinforce learning objectives. Future research could incorporate support mechanisms, such as an online forum for instructors to ask questions or weekly meetings to shared any issues that arise from implementation.

Conclusion

Advances to reduce and prevent adolescent obesity have been made despite the complex interrelated causes of obesity. Afterschool-based healthy eating programs that provide hands-on experiences offer promising opportunities to enhance student learning, facilitate socio-behavioral skills, and promote health in an effort to decrease the burden of chronic disease (Horodynski, Hoerr, & Coleman, 2004; Veugelers & Fitzgerald, 2005). Nutrition and culinary interventions, including Pink and Dude Chefs, have been shown to be effective mediators of nutrition knowledge, food preferences, and healthy eating in adolescents. If these programs have causal associations with decreased risk for obesity, their public health impact could improve long-term health outcomes for adolescents and prove to be beneficial in terms of reducing obesity and obesity related diseases, mitigating the consequences of obesity.

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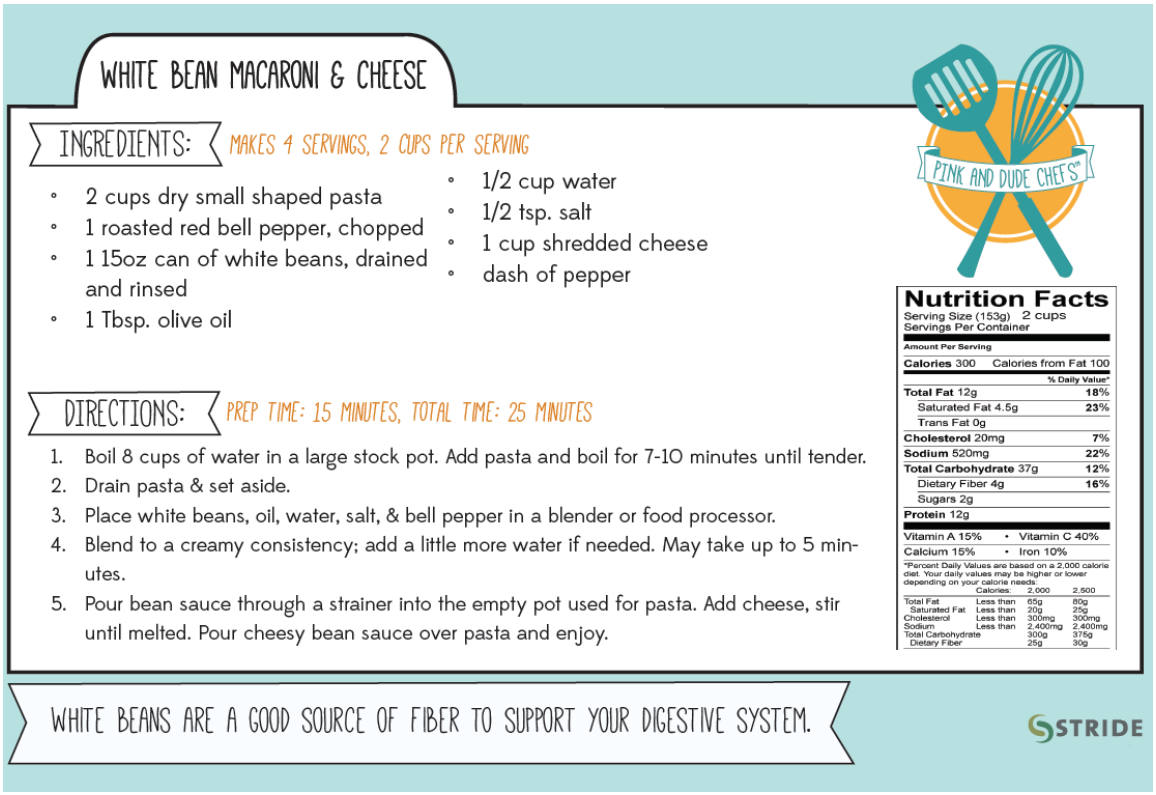
Appendix A: Example of a Lesson Recipe



WHITE BEAN MACARONI & CHEESE

INGREDIENTS: MAKES 4 SERVINGS, 2 CUPS PER SERVING

- 2 cups dry small shaped pasta
- 1 roasted red bell pepper, chopped
- 1 15oz can of white beans, drained and rinsed
- 1 Tbsp. olive oil
- 1/2 cup water
- 1/2 tsp. salt
- 1 cup shredded cheese
- dash of pepper

PINK AND DUDE CHEFS™

Nutrition Facts

Serving Size (153g) 2 cups
Servings Per Container

Amount Per Serving	
Calories 300	Calories from Fat 100
	% Daily Value*
Total Fat 12g	**18%**
Saturated Fat 4.5g	**23%**
Trans Fat 0g	
Cholesterol 20mg	**7%**
Sodium 520mg	**22%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 2g	
Protein 12g	

Vitamin A 15% • Vitamin C 40%
Calcium 15% • Iron 10%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

DIRECTIONS: PREP TIME: 15 MINUTES, TOTAL TIME: 25 MINUTES

1. Boil 8 cups of water in a large stock pot. Add pasta and boil for 7-10 minutes until tender.
2. Drain pasta & set aside.
3. Place white beans, oil, water, salt, & bell pepper in a blender or food processor.
4. Blend to a creamy consistency; add a little more water if needed. May take up to 5 minutes.
5. Pour bean sauce through a strainer into the empty pot used for pasta. Add cheese, stir until melted. Pour cheesy bean sauce over pasta and enjoy.

WHITE BEANS ARE A GOOD SOURCE OF FIBER TO SUPPORT YOUR DIGESTIVE SYSTEM.

STRIDE

Appendix B: An Example of a Goal Sheet

Appendix C: Youth Survey

Instructions
We would like you to complete this survey. You may skip questions you do not want to answer but we hope that you will answer all of them. Any information about who you are will be kept confidential. We will use a number on each survey instead of using your name.

I. Your Food Preferences

Now we want to know how much you like or don't like some foods.

How much do you like these fruits?		Not at all	A little bit	Somewhat	Pretty Much	I love it	I don't know what this is
1.	Apples	❑	❑	❑	❑	❑	❑
2.	Bananas	❑	❑	❑	❑	❑	❑
3.	Berries (blueberries, strawberries, raspberries)	❑	❑	❑	❑	❑	❑
4.	Cherries	❑	❑	❑	❑	❑	❑
5.	Grapefruits	❑	❑	❑	❑	❑	❑
6.	Melons (honeydew, cantaloupe, watermelon)	❑	❑	❑	❑	❑	❑
7.	Oranges	❑	❑	❑	❑	❑	❑
How much do you like these vegetables?		Not at all	A little bit	Somewhat	Pretty Much	I love it	I don't know what this is
8.	Asparagus	❑	❑	❑	❑	❑	❑
9.	Avocados	❑	❑	❑	❑	❑	❑
10.	Bell Peppers	❑	❑	❑	❑	❑	❑
11.	Broccoli	❑	❑	❑	❑	❑	❑
12.	Cabbage	❑	❑	❑	❑	❑	❑
13.	Carrots	❑	❑	❑	❑	❑	❑
14.	Cauliflower	❑	❑	❑	❑	❑	❑
15.	Corn	❑	❑	❑	❑	❑	❑
16.	Green Beans	❑	❑	❑	❑	❑	❑
17.	Greens (spinach, kale, lettuce)	❑	❑	❑	❑	❑	❑
18.	Peas	❑	❑	❑	❑	❑	❑
19.	Sweet Potatoes	❑	❑	❑	❑	❑	❑
20.	Tomatoes	❑	❑	❑	❑	❑	❑
21.	Squash (acorn, butternut, zucchini, yellow squash)	❑	❑	❑	❑	❑	❑

II: Nutrition Knowledge			
Check the one best answer you can think of for the following questions.			
22.	Which has more fiber?		
	❑ White bread	❑	Olive oil
	❑ White potato	❑	Oatmeal
23.	99% of the calcium in your body is found in your_____.		
	❑ Skin	❑	Bones and teeth
	❑ Hair	❑	Tongue
24.	Based on the USDA MyPlate guidelines, how much of the plate should be made up of fruits and vegetables?		
	❑ 1/4 of the plate	❑	1/2 of the plate
	❑ 1/3 of the plate	❑	The whole plate
25.	Which type of fat should you avoid?		
	❑ Unsaturated fat	❑	Trans fats
	❑ Omega 3 and omega 6	❑	Omega 1 and Omega 2
26.	Where can you find the most natural, healthy items in the grocery store?		
	❑ The perimeter	❑	The middle
	❑ The check-out line	❑	The frozen food aisle
27.	The serving size of grapes is equivalent to the size of a _____.		
	❑ Football	❑	Golf ball
	❑ Tennis ball	❑	Soccer ball
28.	Beans can be an excellent source of _____.		
	❑ Fat	❑	Candy
	❑ Plant protein	❑	Dairy

III: How Comfortable Are You in the Kitchen?

Please say how comfortable or confident you are doing the following things in the kitchen right now.

	How sure or confident are you that you can do these things right now? Right now, in the kitchen I can . . .	Not at All	A Little	Somewhat Sure	Pretty Much	I know I can
29.	Help one of my parents (or another adult) prepare a dish or a meal using fruits, vegetables or other fresh ingredients	❑	❑	❑	❑	❑
30.	Follow a simple recipe in a cookbook to make a dish	❑	❑	❑	❑	❑
31.	Put out an oil or grease fire on the stove	❑	❑	❑	❑	❑
32.	I can cook a dish or a meal using fresh fruits, vegetables, meats or other raw ingredients from scratch	❑	❑	❑	❑	❑
33.	Use a kitchen knife to safely slice or dice an ingredient	❑	❑	❑	❑	❑
34.	Accurately measure the right amount for a recipe (teaspoon, tablespoon, 1/3 cup, 16 ounces)	❑	❑	❑	❑	❑

IV: Your Typical Food and Beverage Choices

These questions are about things you have done in the PAST 7 days (week). Provide your best guess.

In the PAST 7 DAYS, how many times did you eat these fruits?		Not at all	Once	Twice	3 times	4+ times	I don't know what this is
35.	Apples	❑	❑	❑	❑	❑	❑
36.	Bananas	❑	❑	❑	❑	❑	❑
37.	Berries (blueberries, strawberries, raspberries)	❑	❑	❑	❑	❑	❑
38.	Cherries	❑	❑	❑	❑	❑	❑
39.	Grapefruits	❑	❑	❑	❑	❑	❑
40.	Melons (honeydew, cantaloupe, watermelon)	❑	❑	❑	❑	❑	❑
41.	Oranges	❑	❑	❑	❑	❑	❑
In the PAST 7 DAYS, how many times did you eat these vegetables?		Not at all	Once	Twice	3 times	4+ times	I don't know what this is
42.	Asparagus	❑	❑	❑	❑	❑	❑
43.	Avocados	❑	❑	❑	❑	❑	❑
44.	Bell Peppers	❑	❑	❑	❑	❑	❑
45.	Broccoli	❑	❑	❑	❑	❑	❑
46.	Cabbage	❑	❑	❑	❑	❑	❑
47.	Carrots	❑	❑	❑	❑	❑	❑
48.	Cauliflower	❑	❑	❑	❑	❑	❑
49.	Corn	❑	❑	❑	❑	❑	❑
50.	Green Beans	❑	❑	❑	❑	❑	❑
51.	Greens (spinach, kale, lettuce)	❑	❑	❑	❑	❑	❑
52.	Peas	❑	❑	❑	❑	❑	❑
53.	Sweet Potatoes (do NOT count fries)	❑	❑	❑	❑	❑	❑
54.	Tomatoes	❑	❑	❑	❑	❑	❑
55.	Squash (examples: acorn, butternut, zucchini, yellow squash)	❑	❑	❑	❑	❑	❑

In the PAST 7 DAYS, how many times did you drink these beverages?		Not at all	Once	Twice	3 times	4+ times	I don't know what this is
56.	Milk (include using for cereal)	❑	❑	❑	❑	❑	❑
57.	100% fruit juice (orange, apple, grape) (Do not count punch, Kool-Aid, sports drinks, or fruit-flavored drinks)	❑	❑	❑	❑	❑	❑
58.	Water with a meal (breakfast, lunch, dinner)	❑	❑	❑	❑	❑	❑
59.	**Regular** soda or soft drinks	❑	❑	❑	❑	❑	❑
60.	**Diet** soda or soft drinks	❑	❑	❑	❑	❑	❑

V: What Have You Done in the Past Week?

These questions are about things you have done in the PAST 7 days (week). Provide your best guess.

In the PAST 7 DAYS, how many times did you do these things?		Not at all	Once	Twice	3 times	4+ times	I don't know what this is
61.	Study the nutrition facts panel on a food package	❑	❑	❑	❑	❑	❑
62.	Help someone prepare a meal	❑	❑	❑	❑	❑	❑
63.	Make a meal by yourself	❑	❑	❑	❑	❑	❑
64.	Skip breakfast	❑	❑	❑	❑	❑	❑
65.	Buy a snack from a vending machine	❑	❑	❑	❑	❑	❑

Appendix D: Youth Interview Guide

Notes for interviewers:
The interview is designed to ask very broad questions that allow a wide range of responses from the participant. These questions should be asked as close to verbatim as possible.

- More specific probes help to illicit additional information and to clarify initial responses. These are more flexible and should align and flow with the conversation.

- Your language should be adjusted as appropriate.
  - Know who you are talking with before the interview. "Mother/father" should be replaced with the appropriate reference to the caregiver as appropriate depending on the relationship between caregiver and youth.
  - Interviews are intended to be conducted in the last week of the program but before the Family Fiesta. The verb sense should be adjusted if interviews are conducted after the end of the program.
- The questions are roughly grouped according to topics. Try to stay on the topic but don't be so rigid as to lose the opportunity to further explore or clarify a youth comment.

Introduction:

Hi_____[student's name]_____. Thank you for agreeing to talk with me (us).

We are helping Bright Futures and Cal Poly improve the Pink and Dude Chefs program.

I will be asking you several questions about the Pink and Dude Chefs program. ***There are no right or wrong answers****. We really just want to know what you think and feel about the program.*

Also, everything that you say is confidential. That means that I will not share what you say with the program staff so that they know who said what. We will give a summary of what all of the students say about the program.

Is it ok if I audio record our session? I do not want to miss anything you say. I will also take some notes to help me remember.

I would like to begin by asking you a few general questions about the Pink and Dude Chefs Program.

1. What do you think of the Pink and Dude Chefs program?
2. What made you decide to participate?
3. Was there anything about the program that surprised you?
4. Did you look forward to coming each session?

5. Was it "cool" to be in the program?
6. Why do you think learning to cook or prepare food is important?

I am curious if you have talked to others about the Pink and Dude Chefs program . . .

6. Did you talk to your parents about Pink and Dude Chefs or what you learned?
    a. *if YES:* What did you talk about?
    b. *If NO:* Why not?
7. Did you talk with your friends about Pink and Dude Chefs or what you learned?
    a. *If YES:* What did you talk about?
        i. Did your friends think that the program was cool?
        ii. Do they think it is cool to learn to cook?
    b. *If NO:* Why not?

Now I am going to ask you a few questions about what you might have learned or what you might do differently because of the Pink and Dude Chefs program.

8. What has been the best thing about being in the Pink and Dude Chefs program?
    a. Why?
    b. What else was great about being in the program?

9. Have you learned new things about healthy eating?

10. What new thing that you have learned has made you think the most? (For example, what has been the most interesting or surprising new thing you have learned?)

11. Because of this information, have you changed your eating habits?

    If YES: Can you give me an example of how?
12. Have you learned new cooking skills from the program?
    a. *If NO:* Why not?
    b. *If YES:*
        i. Can you give me a few examples of something new that you learned to do in the kitchen?
        ii. What is one thing that you feel really good or confident about doing?
        iii. Are there any other cooking skills that you are good at?

iv. Is there anything you'd like to practice more?

13. Since the program started, are you helping more at home to prepare meals and snacks?
    a. *If YES:*
        i. How often did you help in the kitchen before Pink and Dude Chefs?
        ii. Can you give me a few examples of how you have been helping in the kitchen more recently?
        iii. Why do you think you have been more involved in cooking at home?
    b. *If NO:*
        i. Why do you think you have not been helping more at home to prepare means and snacks?
        ii. How often do you help in the kitchen?
14. Since the program started, have your eating habits changed? That is, have you tried to change the foods that you eat?
    a. If YES:
        i. Can you give me a few examples?
15. Have you tried to eat more fruits since the program started?
16. Have you tried to eat more vegetables since the program started?
17. Have you tried to eat or drink less of certain food or beverages?
    a. If YES: Can you give me a few examples?
18. Is it sometimes harder to choose healthier foods or beverages?
    a. If YES:
        i. When do you think it is sometimes harder?
        ii. Why do you think it is sometimes harder?

I have just a few more questions for you.

19. What can the PDC staff do to make the program better?
20. Are you interested in participating again, if there was another class offered at Bright Futures?
21. Is there anything else you'd like to say about the program?

Thank you for your time and for talking with me (us) about the Pink and Dude Chefs Program!

Appendix E: Parent Interview

Notes for Interviewers:

- Ensure written informed consent is obtained before the interview.
- The interview is designed to ask very broad questions that allow a wide range of responses from the participant. These questions should be asked as close to verbatim as possible.
    - More specific probes help to illicit additional information and to clarify initial responses. These are more flexible and should align and flow with the conversation.
- Your language should be adjusted as appropriate.
    - Know who you are talking with before the interview. "Son/daughter" should be replaced with the appropriate term (e.g., grandson) as appropriate depending on the relationship between caregiver and youth.
    - Interviews are intended to be conducted in the last week of the program but before the Family Fiesta. The verb sense should be adjusted if interviews are conducted after the end of the program.
- The questions are roughly grouped according to topics. Try to stay on the topic but don't be so rigid as to lose the opportunity to further explore or clarify a parent comment.

I. Introduction

Hi, is it ok that I (we) ask you some questions about the Pink and Dude Chefs program before we get started on the awards ceremony?

My name is _____. I am from Cal Poly. We are helping Cal Poly and Bright Futures improve the Pink and Dude Chefs program. Our conversation will take about 5-10 minutes.

- *I will be asking you several questions about the Pink and Dude Chefs program.*
- *Everything that you say is confidential. That means that I will not share what you personally say with the program staff. We will give a summary of what parents and caregivers say about the program.*
- *Also, do you mind if I record our conversation? I don't want to miss anything you say. I will also take some notes to help me remember.*

I would like to begin by asking you what you think about the Pink and Dude Chefs Program.

1. What do you think of the program?
2. Was there anything about the program that surprised you?
3. Has your son/daughter talked with you about the program?
    a.) How often?
    b.) What kind of things has he/she said?
4. Did you encourage your son/daughter to participate?
    a.) *If YES:* Why?
    b.) *If NO:* Why not?
5. Has your son/daughter benefited from being in the PDC program?

    If YES:

    a. How do you feel s/he has benefited from the PDC program?
    b. In what ways? *[Ask for examples if appropriate]*
    c. Why is that *[a specific outcome]* important?
6. Do you think your son/daughter has learned new things about healthy eating?
    a. What do you think s/he has learned?
7. Has your son/daughter been more involved in food preparation or cooking at home?
    a. *If YES:*
        i. In what ways? Can you give me a few examples? ***[listen for involvement AND specific skills and clarify as needed]***
        ii. Are there ways in which he/she wants to be involved that make cooking or preparing a meal more difficult (e.g. time-consuming)?
    b. If NO,
        i. Why not?
8. Have you noticed any differences in your son's/daughter's eating habits since beginning the program?
    a. *If YES:*
        i. In what ways?
        ii. Can you give me a few examples?
9. Do you wish that your son/daughter would eat healthier foods?
    a. In what ways? Can you give me some examples of how you son/daughter could eat better?

b. What tends to get in the way of him/her eating better?

10. Did you learn anything new about food or cooking from your son/daughter after a PDC session?
    a. *If YES:* Can you give me an example?

Wrap-Up

I have just a few more questions for you.

11. What suggestions do you have for making the Pink and Dude Chefs program better?
12. Is there anything else you'd like to share about your son's/daughter's participation in the program?

Thank you for your time and for talking with me (us) about the

Pink and Dude Chefs Program.

Appendix F: Informed Assent for Participant

Informed Assent Form for Cal Poly Research

INFORMED ASSENT TO PARTICIPATE IN:
Pink and Dude Chefs, *a program of Cal Poly*
For the Participant

Pink and Dude Chefs is a research project that was created by professors and students at Cal Poly, San Luis Obispo. The people who are currently running the project are Dr. Aydin Nazmi in the Food Science and Nutrition Department, and Jessie Bierlich, a graduate student in the Food Science and Nutrition Department at Cal Poly, San Luis Obispo, California. The goal of Pink and Dude Chefs is to use cooking classes to make you more confident in your ability to cook meals at home. We hope to do this by teaching you the skills to prepare food, showing you how to buy food, and allowing you to create a menu.

Pink and Dude Chefs has a total of 12 educational cooking classes: one class per week on Tuesdays. These classes will include a short talk regarding the daily topic; group activities and games; and cooking the recipe of the day. The classes are held at ***Shandon Elementary, Shandon, California***. Cal Poly STRIDE will not be able to provide you with rides to or from Shandon Elementary School.

As part of Pink and Dude Chefs, we will be asking you to take a survey at the beginning and end of the 12-week program. The questions in the survey will ask you about what you usually eat, how you feel about cooking, how you rate your cooking skills, and basic nutrition questions.

There will also be a post evaluation interview with each student following the end of the 12-week program. During this interview group, Jessie Bierlich, the STRIDE Health Ambassador Coordinator, will lead the interview and ask you questions about your attitudes towards cooking, diet, and food preferences.

You are not required to take the survey or go to the interview and you can stop coming to the Pink and Dude Chefs classes at any time. You can also skip any questions you prefer not to answer.

There will always be adults present to prevent injuries during cooking and activities. You'll be required to wear closed-toed shoes with traction (slip-resistant shoes) for your protection. You will be taught safety rules for extinguishing a fire (a fire extinguisher is located in the kitchen), proper knife use and storage, consistent use of potholders to reduce the risk of burns, food safety and the proper handling of food to prevent food-borne illnesses.

There is a chance you may be injured as a result of participating in this program. The possible risks may include: burns from stovetop, oven, scalding water, cuts from knives, falls from spillage, choking from food consumption, or psychological stress from completing survey questions. If you get hurt while participating in Pink and Dude Chefs activities, notify an adult in the room immediately. Your parents have been told how to get medical attention if you require it. If you're uncomfortable with any of the questions or activities, please contact Jessie Bierlich, Program Coordinator for Pink and Dude Chefs at (949) 633-0409 for assistance.

The surveys that you take are all confidential. This means that we will write a code number on your survey instead of your name. Any information about you will be kept in a filing cabinet in a locked room. We will use a code number on any data sheets or other paperwork instead of your name. Only project coordinators will have access to any information about you. Your answers will remain private and only presented as anonymous or group results.

There are benefits that you might gain from participating in this program. These include: increased knowledge of nutrition and web-based cooking resources, building skills for healthful cooking, communication, time management and goal setting, and increased confidence for cooking family meals. You will be able to bring food home weekly. Other incentives you might receive include cooking tools and supplies, which are given for attendance and participation in activities and games.

We would like to take photographs and video of you as you participate in the program and use these images in presentations and publicity. Please indicate below if you don't want us to take photographs or video of you. You will not be identified by name.

☐ **No,** *I do not give permission for my photo and video to be taken for presentations and media use.*

If you want to participate in this research project as described, please indicate this by signing below. Please keep one copy of this form for your parent/guardian.

Thank you for your participation in this study!

(PRINT) Name of Child Volunteer	**(SIGNATURE)**	Date

(PRINT) Name of Researcher	**(SIGNATURE)**	Date

Appendix G: Informed Parent Consent

Informed Consent Form for Cal Poly Research
Parental/Guardian Permission Form
INFORMED PERMISSION TO PARTICIPATE IN:
Pink and Dude Chefs, *a program of Cal Poly*

A research project using cooking classes to increase confidence for cooking meals prepared at home is being conducted by Dr. Aydin Nazmi in the Food Science and Nutrition Department and Jessie Bierlich, a graduate student in the Food Science and Nutrition Department at Cal Poly, San Luis Obispo, California. The purpose of this study is to improve your child's confidence for cooking and to teach your child menu planning, food buying and food preparation skills.

Your child is being asked to take part in this study by attending a total of 12 educational cooking classes: two 2-hour classes per week held on Mondays and Fridays. These classes will include a short talk regarding the daily topic; group activities and games; and cooking the recipe of the day. The program will take place at ***Mesa Middle School, 2555 Halcyon Road, Arroyo Grande, California***. No transportation to or from Mesa Middle School will be provided by our program.

Your child will be asked to complete a survey before and a survey after the 6-week program. These questions ask about your child's current diet, attitudes towards cooking, cooking skills, and general nutrition knowledge.

There will also be a post evaluation interview with students following the end of the 6-week program. During this interview group, Jessie Bierlich, the STRIDE Health Ambassador Coordinator, will lead the interview about their attitudes towards cooking, diet, and food preferences. In addition, there will be a parent component where the program coordinator will interview you about your perspective on the class and thoughts about how it influenced your child's food choices. You may choose to not attend this interview.

Please be aware that your child is not required to participate in this research and your child may discontinue his/her participation at any time. Your child may also omit any questions he/she prefers not to answer.

During food preparation, your child will be directly supervised to reduce the risk of injury. Your child will be required to wear closed-toed shoes with traction (slip-resistant shoes) for their protection. Your child will be taught safety rules for extinguishing a fire (a fire extinguisher is located in the kitchen), proper knife use and storage, consistent use of potholders to reduce the risk of burns, food safety and the proper handling of food to prevent food-borne illnesses.

The possible risks associated with participation in this study are minor but may include burns from stovetop, oven, scalding water, cuts from knives, falls from spillage, choking from food consumption, or psychological stress from completing survey questions. If your child should experience any injuries due to possible cuts or burns, please be aware that you may contact your own physician/clinic or the Arroyo Grande Fire Department at 2391 Willow Rd., Arroyo Grande (805) 473-7171. Insurance coverage is not offered for this program, should your child experience any injuries due to participation in the classes. If you should experience any discomfort with any part of the study, please be aware that you may contact Jessie Bierlich, Program Coordinator for Pink and Dude Chefs (949) 633-0409 for assistance.

To protect your child's privacy all identifying information will be kept in a filing cabinet in a locked room. Participants will only be identified by code number on data sheets or other paperwork. Only project coordinators will have access to the information. Your child's responses will remain private and only presented as anonymous or group data.

Potential benefits associated with this program include: increased knowledge of nutrition and web-based cooking resources, building skills for healthful cooking, communication, time management and goal setting, and increased confidence for cooking family meals. All participants will bring food home weekly. Other incentives your child may receive include cooking tools and supplies, which are given for attendance and participation in activities and games.

We would like to take photographs and video of the children as they participate in the program and use these images in presentations and publicity. Please indicate below if you do not authorize this. Your child will not be identified by name.

☐ **No,** *I do not give permission for my child's photo and video to be taken for presentations and media use.*

If you have questions regarding this study or would like to be informed of the results when the study is completed, please feel free to contact Dr. Aydin Nazmi (805) 756-6447 and/or the STRIDE office (805) 756-0673, STRIDE@calpoly.edu. If you have concerns regarding the manner in which the study is conducted, you may contact Dr. Steve Davis, Chair of the Cal Poly Human Subjects Committee, at (805) 756-2754, sdavis@calpoly.edu or Dr. Dean Wendt, Interim Dean of Research at (805) 756-2988 or dwendt@calpoly.edu.

If you agree that your child may participate in this research project as described, please indicate your agreement by **signing below. We ask that you answer four short demographic questions. You do not have to answer the four survey questions below in order for your child to participate**. Please keep one copy of this form for your reference, and thank you for your participation in this study.

(PRINT) Name of Child Volunteer		Date
(PRINT) Name of Parent or Guardian	**(SIGNATURE)**	Date
(PRINT) Email of Parent or Guardian		Phone #
(PRINT) Name of Emergency Contact Person (if different than Parent/Guardian)		Phone #
(PRINT) Relationship of Emergency Contact Person		
(PRINT) Name of Researcher	**(SIGNATURE)**	Date

Please respond to all of the following questions related to your child and household. Please be sure to answer all four questions, not skipping any questions.

1. Is your child male or female? □ Male □ Female

2. Is your child Hispanic or Latino? □ NO □ YES

3. What race is your child? (You may select more than one.)

- ☐ White
- ☐ Black or African American
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Asian
- ☐ Mixed
- ☐ Other

4. How many people live in your household?

☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more

5. Who does your child live with? (check all that apply)

- ☐ Both parents
- ☐ One parent only
- ☐ Parent and step-parent
- ☐ Grandparent/s
- ☐ Foster family
- ☐ Other, specify: _____

Appendix H: Comparison Among Racial/ethnic Group Participants in California and Tennessee for Pre and Post Survey Questions

	White				Latino/Hispanic				Black			
Pre vs Post Measure Item	**n**	**Change in Mean (SD)**	**% Change**	**p-value[1]**	**n**	**Change in Mean (SD)**	**% Change**	**p-value[1]**	**n**	**Change in Mean (SD)**	**% Change**	**p-value[1]**
Preference Fruit	7	1.9 (1.6)	6.5%	0.02	5	1.2 (3.7)	4.2%	0.5	13	1.2 (4.8)	5.2%	0.4
Preference Vegetable	6	6.0 (11.4)	13.6%	0.3	4	14.3 (16.4)	42.5%	0.2	11	0.4 (11.0)	0.9%	0.9
Nutrition Knowledge	7	0.7 (0.5)	14.9%	0.2	5	0.4 (1.1)	10.5%	0.5	8	1.8 (1.2)	55.4%	0.004
Intake Fruit	6	2.3 (7.6)	14.8%	0.5	5	1.8 (5.5)	11.1%	0.5	15	1.6 (5.9)	11.4%	0.3
Intake Vegetable	6	3.5 (16.9)	13.0%	0.6	3	-0.3 (5.0)	-1.0%	0.9	13	1.6 (14.7)	7.4%	0.7

[1]p-value by paired t-test.

Appendix I: Comparison Among Household Size for Participants for Pre and Post Survey Questions

Household	2-5 people				6+ people			
Pre vs Post Measure Item	**n**	**Change in Mean (SD)**	**% Change**	**p-value[1]**	**n**	**Change in Mean (SD)**	**% Change**	**p-value[1]**
Preference Fruit	15	1.8 (4.5)	6.3%	0.1	3	2.7 (3.8)	10.4%	0.3
Preference Vegetable	14	6.5 (13.2)	17.0%	0.09	3	*-4 (18)	-9.5%	0.7
Nutrition Knowledge	10	1 (1.2)	22.7%	0.03	2	1 (1.4)	25.0%	0.5
Intake Fruit	15	1.9 (5.2)	13.6%	0.2	4	3.5 (3)	27.5%	0.1
Intake Vegetable	14	-2,2 (12.5)	-7.7%	0.5	4	14 (22.6)	81.2%	0.3

[1]p-value by paired t-test.

Appendix J: Comparison Among Household Composition for Participants for Pre and Post Survey Questions

Live With	Both Parents				Single Parent				Other			
Pre vs Post Measure Item	**n**	**Change in Mean (SD)**	**% Change**	**p-value***	**n**	**Change in Mean (SD)**	**% Change**	**p-value***	**n**	**Change in Mean (SD)**	**% Change**	**p-value***
Preference Fruit	11	1.1 (3.5)	4.1%	0.3	5	3.2 (6.9)	13.1%	0.4	3	1.3 (2.3)	4.6%	0.4
Preference Vegetable	8	6.9 (19.2)	19.4%	0.3	5	4.4 (10.4)	12.2%	0.4	4	0.5 (3.9)	1.0%	0.8
Nutrition Knowledge	7	0.4 (1.3)	9.7%	0.4	2	1.5 (2.1)	30.0%	0.5	4	1.3 (1.0)	30.6%	0.08
Intake Fruit	10	1.7 (4.2)	12.2%	0.2	6	0.2 (3.8)	1.4%	0.9	4	4.3 (8.6)	30.4%	0.4
Intake Vegetable	11	4.1 (14.9)	17.6%	0.4	5	*-9.2 (6.9)	-28.6%	0.04	3	8.3 (24.6)	27.7%	0.6

[1]p-value by paired t-test