

YOUNG ADULTS' FRUIT AND VEGETABLE LIKING AND INTAKE IS DEPENDENT
ON AGE, GENDER, BMI, YEAR IN SCHOOL, AND CHILDHOOD FEEDING
PRACTICES

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AUTHORIZATION TO SUBMIT THESIS

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ABSTRACT

Fruit and vegetable intake in college students is below recommendations. Additional study is needed on the factors associated with fruit and vegetable liking and intake in college students. The purpose of this study was to identify the factors of dependency related to fruit and vegetable liking and intake in college students and examine the relationship between liking and intake of fruits and vegetables from childhood to adulthood. A retrospective survey was administered to a randomly selected sample of young adults between the ages of 18 to 25 years from two Northwestern universities (n=676). Pearson's Chi-Square Tests with standardized residuals examined dependency between fruit and vegetable liking and intake and factors of interest, including age, gender, year in school, university attended, raised in an urban or rural setting, current BMI, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. Females reported greater fruit and vegetable liking and fruit intake compared to males ($p < .05$). Upperclassmen and the 21 to 25 age group reported a greater frequency of vegetable liking and intake compared to underclassmen and the 18 to 20 age group ($p < .05$). Diminished vegetable liking and low fruit intake was weakly associated with being overweight or obese ($p < .05$). Individuals forced by caregivers to eat vegetables as a child reported a lower than expected frequency for vegetable liking than those not forced ($p < .001$). McNemar's Tests compared childhood and young adulthood fruit and vegetable liking and intake. Fruit and vegetable liking had significantly greater frequencies in young adulthood compared to childhood ($p < .001$). However, fruit and vegetable intake had significantly greater frequencies in childhood than young adulthood ($p < .001$). These factors associated with fruit and vegetable liking and intake and the shift in childhood liking and intake indicates areas for additional research.

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Chapter One

Introduction

In the United States, low fruit and vegetable intake is evident at all ages (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Meeting dietary recommendations for fruits and vegetables is an important preventative measure to reduce the risk of developing chronic diseases (USDA, 2010). Low dietary intake of fruits and vegetables is associated with chronic diseases such as cardiovascular disease, hypertension, diabetes, cancer, and osteoporosis (USDA, 2010), as well as gastrointestinal cancer deaths, ischemic heart disease deaths, and stroke deaths worldwide (World Health Organization [WHO], 2009). An estimated 2.7 million lives could be saved each year with adequate fruit and vegetable consumption (World Health Organization, 2002). Specifically, diets high in fruits and vegetables have been associated with reduced risk for coronary heart disease, hypertension, stroke, cancer and preventing weight gain (Boeing et al., 2012).

Fruit and vegetable recommendations are established to maximize health and prevent chronic diseases (USDA, 2010), however only 40% of the U.S. population met the recommendation of five or more half-cup servings of fruits and vegetables per day according to the 1999-2000 National Health and Nutrition Examination Survey (Guenther et al., 2006). Current recommendations from the U.S. Department of Agriculture's (USDA) 2010 Dietary Guidelines for Americans recommends 2 cups of fruit and/or fruit juices and 2.5 cups of vegetables for a 2,000-calorie diet (USDA, 2010). Target goals from Healthy People 2020 recommend increasing fruit consumption to 0.9 cup/1,000 calories and vegetable consumption to 1.1 cup/1,000 calories in populations 2 years and older (U.S. Department of Health and Human Services, 2013). Since lifelong fruit and vegetable consumption patterns

develop during childhood (Mannino, Lee, Mitchell, Smiciklas-Wright, & Birch, 2004), identifying barriers to childhood fruit and vegetable consumption is imperative to supporting recommended fruit and vegetable consumption from childhood to adulthood

Low fruit and vegetable consumption in adulthood may be related to low consumption in childhood, since food patterns from childhood persist into adulthood (Mannino et al., 2004; Skinner, Carruth, Bounds, & Ziegler, Reidy, 2002a). Childhood eating experiences and food patterns are predictive of adult eating patterns; therefore, childhood is an opportune time to promote fruit and vegetable consumption (Mannino et al., 2004). Past eating experiences and factors influencing childhood consumption of fruits and vegetable shapes children's future eating (Birch & Fisher, 1998) and eating behaviors in young adulthood (Fletcher & Branen, 1999). Since childhood is a central time for the development of food preferences and consumption patterns, promoting fruit and vegetable consumption at an early age can promote lifetime consumption patterns and prevent chronic diseases (Mannino et al., 2004; Cooke, 2007).

Many factors influence children's consumption and liking of fruit and vegetables including taste preferences, food neophobia, early exposure, repeated introductions, and parent feeding practices (Birch & Fisher, 1998; Branen & Fletcher, 1999; Dovey, Staples, Gibson, & Halford, 2008; Geller & Dzewaltowski, 2009; Skinner et al., 2002a; Wardle & Cooke, 2008). Taste preferences, or likes and dislikes, are identified as the most influential factors for fruit and vegetable consumption (Geller & Dzewaltowski, 2009). A universal rejection of bitter and sour flavors and preference for sweet and salty flavors in children and many adults result in a decreased preference for vegetables (Wardle & Cooke, 2008).

Children experience the greatest amount of unwillingness to try new foods, or food neophobia, between the ages of two to six (Dovey et al., 2008), which limits taste exposure to a variety of new foods and reduces diet quality. To improve diet variety and quality, repeated taste introductions to new foods at an early age can increase preferences for fruits and vegetables (Birch & Fisher, 1998; Pliner & Stallberg-White, 2000; Cooke, 2007; Skinner, Carruth, Bounds, Zeigler, & Reidy, 2002a). Feeding practices used by adult caregivers influence children's fruit and vegetable intake (Cooke, 2007; Fox, Condon, Briefel, Reidy, & Deming, 2010). For example, coercive feeding techniques used to increase fruit and vegetable consumption, such as rewarding or forcing, have unintended consequences and lead to reduced intrinsic liking of fruits and vegetables later in life (Branen & Fletcher, 1999; Fisher & Birch, 1999a). Coercive feeding strategies used in childhood do not promote food liking or intake in college students, especially related to vegetables (Bastell, Brown, Ansfield, & Paschall, 2002).

Young adults in college are making their own food choices independent of parental influence, which makes this period critical to the development of lifelong health (Keim, Voichick, & Stewart, 1997). Individuals in the transition period between adolescence and young adulthood, which includes the college student population, have a high incidence of and maintenance of obesity (Gordon-Larsen, Popkin, Nelson, & Adair, 2004). As the most important factor, college students identify perceptions about taste as most influential to fruit and vegetable intake (Hartman et al., 2013). Factors identified as influential to fruit and vegetable intake in college students include sensory aspects, social influences, barriers to accessibility, and childhood dietary habits (Hartman et al., 2013; Keim, Voichick, & Stewart, 1997). While common factors have been identified as promoting intake, certain barriers are

identified as influencing intake and include: cost, eating environment, and accessibility (Hartman et al., 2013; Lacaille, Dauner, Krambeer, & Pedersen, 2011).

Additional research is needed on the factors influential to fruit and vegetable intake in college students, which is a critical time for establishing greater dietary control and self-efficacy for health (Hartman, Wadsworth, Penny, Van Assema, & Page, 2013). Research is needed on the factors influencing college students' fruit and vegetable intake as well as the food preferences and motivations for fruit and vegetable intake from childhood to adulthood. This research can provide valuable insight to inform strategies for improving lifelong diet quality.

Problem Statement

Since childhood feeding practices influence adult eating habits, a greater understanding of the factors influential to fruit and vegetable liking and intake in college students requires additional study. Fruit and vegetable preferences, intake, and eating patterns in childhood and adulthood have been studied; however, additional research is needed to examine the relationship between childhood and young adult fruit and vegetable liking and intake.

Statement of Purpose

The purpose of this retrospective study was to examine factors associated with fruit and vegetable liking and intake in college students. The factors included age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. This study also aimed to examine the relationship between past and present fruit

liking, fruit intake, vegetable liking, and vegetable intake, specifically between childhood and young adulthood.

Research Question

Does liking and intake of fruits and vegetables depend on the following factors, including age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers? Does a relationship exist between childhood and college student fruit and vegetable liking and intake?

Significance of Study

Previous research on college students identified eating behaviors in early adulthood as dependent on recalled childhood eating behaviors (Branen & Fletcher, 1999). Although previous studies have examined college students' recollections of fruit and vegetable intake in childhood (Kattelman, & Phillips, 2012; Murashima, Hoerr, Hughes; Ünüsan, 2006); additional research is needed to determine if current liking and intake of fruits and vegetables is dependent on specific factors. As a result, a greater understanding of the factors dependent on college students' intake and liking of fruits and vegetables was obtained. Additionally, since childhood food behaviors persist into adulthood (Branen & Fletcher, 1999), additional research is needed to examine the persistence of fruit and vegetable preferences and intake from childhood to adulthood.

Definition of Terms

Authoritarian feeding style:

Parents exert greater control over children's eating behavior by determining what, when, and how much the child can eat (Branen & Fletcher, 1999).

Authoritative feeding style:

Also known as cooperative parenting style, in which the parent promotes self-regulation of energy intake by being responsive to the child's needs (Johnson & Birch, 1994). In this type of parenting style, the division of responsibility is shared between the child and the adult and clear feeding roles are established. The parent is responsible for providing food options, while the child determines how much to eat and even whether to eat (Satter, 1986).

Early exposure:

Introductions to new flavors and foods at an early age, including *in-utero*, infancy, and childhood which can enhance liking and acceptance of flavors (Mennella & Ventura, 2010).

Feeding Style:

A set of parental feeding behaviors in which parents encourage eating using differing levels of responsiveness and demandingness (Hughes, Power, Orlet Fisher, Mueller, & Nicklas, 2005).

Food neophobia:

An unwillingness to try new foods (Dovey, Staple, Gibson, & Halford, 2008).

Parenting style:

A set of attitudes and expressed beliefs towards the child that creates an emotional environment (Darling & Steinberg, 1993).

Permissive feeding style:

The child controls the eating environment including what, when, and how much he or she will consume (Fletcher & Branen, 1999).

Picky eating:

Consuming an inadequate variety of foods through rejection of large amount of foods that are both familiar and unfamiliar (Dovey et al., 2008).

Taste preference:

Predisposition for certain flavors, which influences types of foods consumed (Geller & Dzewaltowski, 2009).

Repeated introductions:

Exposure to a flavor or to a variety of flavors within a particular food group (e.g., fruits or vegetables) following 8-10 days of continuous food introductions (Mennella & Ventura, 2010).

Whole fruit:

Includes fresh, canned, frozen, and dried fruit, but excludes any processed form such as fruit juice (USDA, 2010).

Limitations

The retrospective cross-sectional survey design of the study inherently presents a limitation, as the participants' responses are their recollection of childhood fruit and vegetable liking and intake; however, previous research in adults' recollections of childhood eating and feeding experiences has been reported (Branen & Fletcher, 1999; Murashima et al., 2012; Ünüsan, 2006). A random selection of young adults from two universities located in different states was included in the study. However, both universities are located in the Northwest, one geographic area, which may limit the inference of the findings to other geographical locations. Participants were primarily Caucasian, which also may limit the generalizability of the results to other ethnic groups, although there were 16 percent non-

Caucasian students who participated in the study. Additionally, this distribution of ethnicity is representative of the two Universities located in the Northwest. A further limitation is the survey did not distinguish between student living groups; therefore, comparisons between off-campus and on-campus living groups cannot be established. While students were randomly selected to participate in the study, a response bias may exist if the survey was more likely to be completed by participants who like fruits and vegetables; however, an incentive was offered to control for this potential bias and the survey test for reliability showed consistency in responses.

Summary

A lack of research exists for the factors surrounding fruit and vegetable intake in college students, which is a critical time for establishing greater dietary control and self-efficacy for health (Hartman, Wadsworth, Penny, Van Assema, & Page, 2013). Since childhood eating experiences and food patterns are predictive of adult eating patterns, childhood is an opportune time to promote fruit and vegetable intake (Mannino et al., 2004). While many contributing factors for fruit and fruit and vegetable intake and liking have been studied, the liking and intake of fruit and vegetables from childhood to adulthood requires additional research. The purpose of this study was to identify the factors associated with fruit and vegetable liking and intake in college students and examine the difference between liking and intake of fruits and vegetables from childhood to adulthood. The first chapter provided an introduction, problem statement, purpose statement, research question, significance of study, definition of terms, and limitations of the study. The second chapter will review the available literature on current intake of fruits and vegetables, food preferences and liking, and factors influential to child and adult fruit and vegetable liking and intake. The third

chapter is written in journal-style format and includes an introduction, the methodology, the results, the discussion, and implications from this research.

Chapter Two

Review of Literature

Adequate fruit and vegetable consumption is related to many health benefits, including reduced risk for chronic diseases and obesity (Boeing et al., 2012; USDA, 2010; WHO, 2002; WHO, 2009). Even with these known benefits, few individuals meet the recommended intakes for fruit and vegetables (Fox et al., 2010; Guenther et al., 2006; USDA, 2010). Early childhood eating experiences are influential to future eating habits and food choices as adults (Cooke, 2007); therefore, understanding the factors influencing fruit and vegetable preferences from childhood to adulthood is necessary.

The purpose of this retrospective cross-sectional study was to examine the relationship between young adults' fruit and vegetable liking and intake and recollections of childhood liking and intake. A number of factors were examined, including, age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. This literature review begins with an overview of the importance of fruits and vegetable intake in adults and children, followed by information on children's and adults' current fruit and vegetable intake. After this discussion, information regarding food patterns from childhood to adulthood will be presented. Specifically, the formation of likes and dislikes will be described and how those likes and dislikes apply to child and adult intake of fruits and vegetables. Factors related to children's fruit and vegetable intake will then be discussed, such as parent feeding styles, coercive and rewarding parental feeding practices, and parental attitudes and beliefs influencing fruit and vegetable consumption. Lastly, the factors influential to college students' fruit and vegetable liking and intake will be presented.

Fruit and Vegetable Intake in the U.S.

Fruit and vegetable intake during childhood and adolescence is below recommendations, and intake levels continue to decrease with age (Enns, Goldman, & Mickle, 2002; Fox et al., 2010; Guenther et al., 2006). Children ages 2 to 3 years had the highest consumption of whole fruits, fruit, orange vegetables, and legumes per age category; however, Americans ages 4 and older do not meet recommended intakes later in life (Krebs-Smith, Guenther, Subar, Kirkpatrick, & Dodd, 2010). Fewer than 10% of children ages 4 through 8 consume the number of servings of fruit and vegetables recommend by the Dietary Guidelines for Americans (Guenther et al., 2006). Young children may be close to meeting the recommended servings for fruits and vegetables; however consumption in late childhood and adolescence does not increase to meet age-recommended intakes (Guenther et al., 2006; Lorson, Melgar-Quinonez, & Taylor, 2009; Mannino, Lee, Mitchell, Smiciklas-Wright & Birch, 2004).

Even with the national public awareness campaigns aimed at increasing fruit and vegetable consumption like the 5-A-Day Program for Better Health, there were no improvements in Americans' fruit consumption and a small decrease in vegetable intake during this campaign (Casagrande, Wang, Anderson, & Gary, 2007). According to NHANES III 1988-1994 and NHANES 1999-2002, approximately 89% of Americans failed to meet USDA dietary guidelines for fruits and vegetables, with half of the participants surveyed failing to consume any fruit, and a quarter of the participants consuming no vegetables daily (Casagrande et al., 2007). Similarly, the Center for Disease Control and Prevention (CDC) State Indicator Report on Fruits and Vegetables in 2013 indicates 37.7% of Americans consumed less than one serving of fruits and 22.6% consumed less than one

serving of vegetables per day. Few individuals meet the recommended intakes for fruit and vegetables, even with government campaigns and research supporting the benefits of fruit and vegetables (Fox et al., 2010; Guenther et al., 2006; USDA, 2010).

Types of Fruit and Vegetables Consumed in the U.S.

Children consume different types of fruit and vegetables; however, there are some fruit and vegetables that are commonly consumed. Over 31% of young children consume white potatoes, including fried products (Fox et al., 2010). According to the 2003-2004 NHANES, fried potatoes increased adolescents' daily vegetable intake from 0.72 cups to 1.21 cups per day. (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). In a study of dietary patterns of children ages 6 to 11 years, researchers analyzed three national surveys covering a span of 25 years (Enns, Goldman, & Mickle, 2002). Intake of fried white potatoes increased in consumption, while intake of leafy green vegetables, beans, corn, peas, and lima beans decreased. Few American adolescents and adults meet the recommendations for dark green and orange vegetables and legumes (Kimmons et al., 2009).

Children ages 2 through 18 consume more than half of their fruit intake as juice (USDA, 2010). While 100% fruit juice provides important nutrients, it is high in calories and low in dietary fiber (USDA). In a 2003-2004 NHANES study, fruit juice was the primary contributor for fruit intake in adolescents, while adults primarily consumed whole fruits (Kimmons et al., 2009). Similarly, 100% fruit juice contributes to 30% of total fruit intake among 6 to 11 year olds and more than 38% of total fruit intake in 2 to 5 year olds and 12 to 18 year olds (Lorson, Melgar-Quinonez, & Taylor, 2009). The most commonly consumed whole fruits include fresh apples, bananas, and grapes (Fox et al., 2010). The USDA (2010)

recommends the majority of fruit be consumed in the whole form, including fresh, canned, frozen, and dried fruit, with limited 100% fruit juice.

Government Recommendations Emphasize Fruit and Vegetable Intake

Fruit and vegetable recommendations are established to maximize health benefits and prevent chronic diseases (USDA, 2010). Current recommendations from the U.S. Department of Agriculture's (USDA) 2010 Dietary Guidelines for Americans recommends 2 cups of fruit, including fruit juices, and 2.5 cups of vegetables per 2,000 calories. The USDA provides specific recommendations for fruits and vegetables dependent on age, gender, and activity level (UDSDA, 2010). For children up to age ten, the recommendation for fruit and vegetables is between 2 to 3.5 cups per day, which are established to prevent chronic diseases (USDA, 2010). With the goal of health promotion and reduction of chronic diseases through a consumption of a healthful diet and healthy body weight, Healthy People 2020 provides recommendations for fruit and vegetable intake (U.S. Department of Health and Human Services, 2013). These target goals recommend increasing fruit consumption to 0.9 cup per 1,000 calories and vegetable consumption to 1.1 cup per 1,000 calories in populations 2 years and older (U.S. Department of Health and Human Services, 2013). Globally, the World Health Organization & Food and Agriculture Organization recommend a minimum intake of 400 grams of fruit and vegetables per day, excluding potatoes and starchy tubers (2005).

Fruit and Vegetables Decrease Risk for Chronic Diseases

The USDA recommendations are established to promote lifelong healthy habits and to prevent chronic disease (USDA, 2010). For example, in a meta-analysis of cohort studies, He, Nowson, Lucas & MacGregor (2007) identified that a daily intake of three to five servings of fruits and vegetables corresponded with a reduction in coronary heart disease.

Poor dietary intake of fruits and vegetables is associated with chronic diseases such as cardiovascular disease, hypertension, diabetes, cancer, and osteoporosis; therefore, meeting these recommendations may prevent these chronic diseases (USDA, 2010). The World Health Organization (2009) estimates that low fruit and vegetable intake is associated with 14% of the diagnosed gastrointestinal cancer deaths, 11% of the diagnosed ischemic heart disease deaths, and 9% of the stroke deaths worldwide, indicating that adequate fruit and vegetable consumption could reduce disease risk (Boeing et al, 2012).

With the link between inadequate consumption of fruits and vegetables to an increased risk for developing chronic diseases in adulthood, ensuring adequate lifelong fruit and vegetable consumption from childhood to adulthood is important. An estimated 2.7 million lives could be saved each year with adequate fruit and vegetable consumption (World Health Organization, 2002). Emphasizing nutrient-dense fruits and vegetables could lead to a lower overall energy intake and be protective against weight gain and obesity (Enns, Goldman, & Mickle, 2002). Diets high in fiber and complex carbohydrates, which contain the recommended servings of fruits and vegetables, may lead to a diet lower in fat and simple carbohydrates (Enns, Goldman, & Mickle, 2002).

Children Benefit from Fruit and Vegetable Intake. While the majority of research surrounding chronic disease prevention focuses on adults, children benefit from increased fruit and vegetable consumption related to blood pressure (Miller, Moore, Kral, 2011). Higher intakes of fruits and vegetables throughout early to middle childhood resulted in reduced systolic blood pressure in adolescence (Moore et al., 2005). Researchers examined children ($n=95$) ages 3 to 6 years old annually over the span of 8 years to assess systolic and diastolic blood pressure in relation to fruit and vegetable intake. Higher intakes of fruits and

vegetables was associated with lower-adjusted intake of fat, saturated fat, calcium, sodium, and vitamin D, and higher intake of carbohydrates and potassium (Moore et al., 2005).

Researchers suggested the lower blood pressure in children could be explained by reduced adiposity through a diet rich in fruits, vegetables, and dairy (Moore et al., 2005).

Low fruit and vegetable consumption corresponds with a higher BMI in children (Miller, Moore, & Kral, 2011), which is a risk for obesity-related chronic diseases.

Researchers identified a higher consumption of nutrient-dense fruits and vegetables as protective against obesity due to the displacement of energy-dense foods (Miller, Moore, & Kral, 2011). Additionally, research indicates that childhood diets rich in fruits and vegetables are protective of chronic diseases in adulthood (Kaikkonen, Mikkilä, Magnussen, Juonala, Viikari, & Raitakari, 2013).

Food Patterns from Childhood to Adulthood

Establishing a well-balanced eating pattern early in life could promote a healthy eating pattern throughout middle childhood and emerging adulthood (Larson, Laska, Story, & Neumark-Sztainer, 2012; Mannino et al., 2004). In a study by Mannino and colleagues (2004), dietary intake remained consistent from early to middle childhood, providing evidence for the stability of food patterns and dietary intake at an early age. While dietary patterns remained consistent in girls between the ages 5 through 9, diet quality declined, with a larger proportion of girls at age 9 failing to meet dietary recommendation when compared to younger ages. Specifically, while nutrient needs increased between ages 5 through 9, intake of fruits and vegetables did not increase to meet the nutrient recommendations by age. This study also contains limitations, including all subjects being non-Hispanic Caucasian girls from 2-parent households, limiting generalization to other racial, ethnic, or

socioeconomic groups. As the research on childhood intake patterns identify, early introductions of foods influence dietary patterns throughout middle childhood (Mannino, et al., 2004).

Since childhood is recognized as a period of development for food preferences, these experiences influence eating behaviors later in life (Birch & Fisher, 1998). Early childhood eating patterns and food preferences are influential to future eating behaviors (Cooke, 2007). Longitudinal and prospective studies of childhood and adolescent eating patterns support early childhood exposure and acceptance of foods to be predictive of food preferences later in life (Skinner, Carruth, Bounds & Ziegler, 2002b). In a longitudinal study of mother-child pairs, children's dietary variety at ages 2 to 24 months, 6 years, 7 years, and 8 years was assessed (Skinner et al., 2002b). Changes in food preferences over time was minimal at all three ages studied, while the category for foods never tasted gradually decreased over time. For example, vegetables ranked the lowest among children's food preferences, with only a 2% increase in liking from ages 2 to 3 to age 8 years. The researchers proposed that children's food preferences may be shaped at an early age and influence future fruit and vegetable consumption patterns (Skinner et al., 2002b); however this study did not assess children's intake in later adolescents and young adulthood which could propose that preferences may take longer to develop.

Formation of Likes and Dislikes: Food Preferences

Three common factors are involved with shaping the formation of fruit and vegetable preferences: taste preferences, early introductions, and repeated exposures to a variety of foods (Geller & Dziewaltowski, 2009; Osborne & Forestell, 2012; Skinner et al.,

2002b). Since food likes and dislikes shape food preferences and guide dietary patterns, an understanding of the formation of food preferences is necessary.

Taste Preferences. Rejection of bitter and sour flavors contributes to a universal dislike of vegetables in children and many adults (Wardle & Cooke, 2008). While this response may have been protective during prehistoric times (Rozin, 1984), rejection of new foods limits exposure to a varied diet and reduces diet quality (Cooke, 2007). Taste preferences are the driving force to food consumption (Osborne & Forestell, 2012). The flavor of vegetables, particularly bitter vegetables, may be less palatable to children in the presence of fruit options, which may lead to lower vegetable consumption in children. Therefore, early exposure of fruits and vegetables to young children is needed to modify innate taste preferences for salty and sugary foods and increase preferences towards fruits and vegetables (Geller & Dzewaltowski, 2009). For these reasons, future research should look at fruit consumption separately from vegetable consumption, with specific dependent variables, such as types of fruits and vegetables. Fruit and vegetable preferences is a primary influencer of consumption in children and adolescents (Geller & Dzewaltowski, 2009).

Maternal Taste Preferences Influence Children's Taste Preferences. While taste preferences can be innate, maternal taste preferences influence children's taste preferences (Galloway, Lee, & Birch, 2003).- Children's taste preferences may be related to maternal food preferences (Galloway, Lee, & Birch, 2003). A positive correlation between children's most liked and disliked foods and mothers' most liked and disliked foods was identified (Skinner et al., 2002b). However, certain foods liked by mothers were disliked by their children, including raw onion, coleslaw and raw tomatoes; indicating that tastes for these foods may develop in later childhood or adolescence. Examining children's food

preferences, of the 24 foods most disliked by children at 8 years old, 17 of those foods were vegetables, including raw onions, mushrooms, summer squash, and raw tomatoes. Since maternal and children's food preferences were related, maternal food dislikes typically were not offered to children, limiting children's diet variety. In another study, maternal eating habits and taste preferences influenced daughter's food choices and taste preferences (Galloway, Lee, & Birch, 2003). When the impact of pickiness and food neophobia on vegetable consumption was examined, maternal food neophobia was positively associated with food neophobia in their daughters (Galloway, Lee, & Birch, 2003).

Introduction to New Food Influences Taste Preferences. Taste preferences influence diet quality; therefore, early exposures or introductions to new foods is crucial to enhancing fruit and vegetable palatability from an early age (Skinner et al., 2002b). In a retrospective cross-sectional study of African American women, an increased intake of vegetables in childhood was associated with greater enjoyment of new foods and a greater variety of fruits and vegetables (Haire-Joshu, Kreuter, Holt, & Steger-May, 2004). This provides support for repeated exposures of new foods at an early age to support a diverse and well-balanced diet from childhood to adulthood. Children are more likely to dislike foods that are introduced later in childhood versus earlier, making early introductions of fruits and vegetables important for diet variety (Skinner et al., 2002b). Therefore, exposure to a variety of foods should begin at early ages to establish taste preferences for less preferred flavors, such as bitter and sour flavors, and improve liking for fruits and vegetables (Geller & Dziewaltowski, 2009).

In a separate study by Skinner et al. (2002a), fruit consumption was enhanced by early feeding exposures with a variety of foods during infancy. The frequency and variety of

fruit exposures were significant factors to enhancing a variety of fruit consumption in later childhood. These results did not extend to vegetable variety and early feeding exposures. While consumption patterns differed between fruits and vegetables, the factors related to fruit and vegetable liking were similar. These factors included duration of breastfeeding, feeding exposure, and produce variety (Skinner et al., 2002a).

Since children are more likely to accept foods introduced early in life, research on childhood food introductions and *in utero* taste exposures are imperative to understanding taste preferences (Skinner et al., 2002b; Mennella & Ventura, 2010). First experiences with taste exposures are facilitated by mothers *in utero*, through breastfeeding, and in infancy and childhood through food introductions (Mennella & Ventura, 2010). Prior to any direct experiences with feeding, fetuses are exposed to flavors transferred in the amniotic fluid during the prenatal period, at approximately 12 weeks of age (Mennella & Ventura, 2010). This flavor learning begins *in utero* and continues throughout infancy as neonates are exposed to a variety of flavors transferred through breast milk, such as anise, garlic, ethanol, carrot, mint, vanilla, and blue cheese. Exposure to flavors *in utero* and in breast milk enhances acceptability of foods later in life, which could include fruits and vegetables. These early flavor introductions, both *in utero* and throughout infancy and childhood, promote diet variety and could influence taste preferences for less preferred flavors, including fruits and vegetables (Mennella & Ventura, 2010; Geller & Dzewaltowski, 2009).

Repeated Exposure. Repeated exposures to particular foods or food information can enhance children's consumption and liking for the food (Osborne & Forestell, 2012; Savage, Fisher, & Birch, 2007). Repeated taste exposure to a neutrally-liked vegetable revealed a greater increase in liking of this target vegetable in children than merely providing parents

with child-feeding information (Wardle, Cooke, Gibson, Sapochnik, Sheiham, & Lawson, 2003). The use of repeated exposures to increase children's liking of fruits and vegetables is contrary to conventional wisdom, in which parents interpret initial rejection as genuine dislike and discontinue offering previously rejected foods to children (Cooke, 2007). In a study by Birch and Marlin (1982), repeated exposures to initially unfamiliar cheese and fruits led to improved liking for new flavors as familiarity with these foods increased. In this study of 2 year olds, 10 to 15 exposures to the new foods resulted in improved taste acceptance. However, in a study of preschool children, repeated exposures of disliked vegetables improved liking for the target vegetable by the sixth exposure (Anzman-Frasca, Savage, Marini, Fisher, & Birch, 2012). Additionally, the increases in liking for vegetables was sustained throughout the experiment and small tastes of the initially disliked vegetables were shown to be as impactful on long-term vegetable liking as large tastes.

Parent Feeding Styles

Parenting styles exert influence on parental feeding practices, which can encourage or discourage specific foods, such as fruits and vegetables (Galloway, Fiorito, Lee, & Birch, 2005; Papaioannou et al., 2013). Parenting style is defined as a set of attitudes and expressed beliefs towards the child that creates an emotional environment (Darling & Steinberg, 1993). Parenting style is conceptualized as the context that influences specific parenting practices; therefore, an understanding the different parenting styles is imperative as the basis for specific child feeding parenting practices (O'Connor et al., 2010).

Baumrind (1971) has described three parenting styles, each focusing on differing levels of control: authoritarian, authoritative, and permissive. Authoritarian parenting is a demanding form of parenting in which the parent attempts to control a child's behavior to

confirm to specific rules; often, the threat of punishment or forcing is involved (Baumrind, 1971). Authoritative parenting is a responsive style in which parents establish rules and boundaries but also promote a child's individuality and independence. Permissive or indulgent parenting favors few rules and allows the child to be the authority on his or her impulses and decisions with little punishment.

Parent Feeding Styles Influence Child Feeding Practices

Distinctive from parenting style, parent feeding style is a set of feeding behaviors used by parents to encourage dietary intake using differing levels of responsiveness and demandingness (Hughes, Power, Orlet Fisher, Mueller, & Nicklas, 2005). Parent feeding style related to child feeding is influential to energy intake and self-regulation in children (Johnson & Birch, 1994) and young adults (Branen & Fletcher, 1999).

Recognized as the optimal feeding style, authoritative or cooperative feeding style allows children to self-regulate their energy intake and develop lifelong healthy eating habits (Johnson & Birch, 1994). The division of responsibility is shared between the child and the adult and clear feeding roles are established (Satter, 1986). The parent is responsible for providing nutritious food options, while the child determines how much to eat and even whether to eat.

Authoritarian feeding style may be used by parents to encourage acceptable eating behaviors and promote a healthy body weight; however, this style of feeding may have the unintended consequences of promoting weight gain, disinhibited eating, and fruit and vegetable dislike (Batsell et al., 2002; Fisher & Birch, 1999b). Greater parental control of eating behavior in childhood, such as identified in authoritarian parenting, resulted in reduced self-control in later adolescence (Branen & Fletcher, 1999). Additionally, this feeding style

resulted in maternal-controlled feeding in which children were less capable of self-regulating energy intake (Johnson & Birch, 1994). An explanation for the increased intake is the focus on external feeding cues, which could disinhibit children's internal cues for hunger and satiety. As identified, parent feeding styles influence food choices and intake throughout childhood and adolescence, influencing lifelong food habits and diet quality (Branen & Fletcher, 1999; Johnson & Birch, 1994).

Coercive Feeding Practices Influence Food Preferences. Related to fruit and vegetable intake, parental feeding practices, including pressuring children to eat fruits or vegetables by using coercive feeding strategies, can have unintended consequences of creating food aversions and decreasing intake (Batsell, et al., 2002; Galloway et al., 2005). The majority of parents indicated that forcing children to eat a particular food (i.e. vegetables) led to a reduction in the child's preference for the target food (Osborne & Forestell, 2012; Russell & Worsley, 2013). As a feeding strategy, coercive feeding techniques resulted in children consuming fewer fruits and vegetables, providing additional evidence against the use of pressure or coercion as a feeding strategy to promote fruit and vegetable intake (Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002). In a study of 9 year-old girls, researchers identified lower fruit and vegetable intake as dependent upon pressure to eat from parents (Galloway, Fiorito, & Birch, 2005). Researchers suggested coercive feeding strategies, including maternal pressure, promoted picky eating and lower fruit and vegetable consumption in girls.

Conversely, rewarding a child for completing a specific task, such as dessert as a reward for eating vegetables, can increase the intrinsic value of the reward (Birch, Zimmerman, & Hind, 1980). In a study of parental beliefs, parents identified labeling a food

as a reward intrinsically increased their children's liking for the reward food (Birch et al., 1980; Russell & Worsley, 2013). Therefore, coercive and rewarding feeding practices can lead to the unintended consequence of promoting highly-palatable foods and can compete with a child developing preferences for less palatable fruits and vegetables.

As identified, parents utilize a variety of specific parent feeding techniques to promote food intake. While many of these researched techniques focus on negative practices, including pressure and rewarding, O'Connor and colleagues (2010) examined positive parenting strategies. In a study of positive parenting behaviors, a non-directive approach utilizing enhanced fruit and vegetable availability and teachable moments was associated with greater fruit and vegetable intake (O'Connor et al., 2010).

Parental Attitudes and Beliefs Influence Children's Food Preferences. Parental attitudes and beliefs can influence children's food preferences and promote or discourage intake of certain foods, such as fruits and vegetable (Fisher, et al., 2002; Russell & Worsley, 2013). In a study of parents of 2 to 5 year old children, semi-structured interviews explored parental beliefs about children's food preferences and the role of parents (Russell & Worsley, 2013). The researchers cited two types of beliefs held by parents in relation to child food preferences: parental attributions and self-efficacy level. Their research indicated a bidirectional relationship between children's food preferences and parent feeding behaviors. Related to self-efficacy, parents of food neophobic children were more likely to interpret food preferences in children as innate and unchangeable, which could influence the introduction of new or disliked foods. Conversely, parents of food neophilic children were more likely to perceive greater influence, or self-efficacy, over their children's food preferences.

Fruit and Vegetable Liking and Memory Recall

Eating experiences are established in early childhood, indicating that memory interventions regarding food likes and dislikes could increase food liking in children (Pollard, Cade, Kirk, & Greenwood, 2001; Rode, Durlach & Rozin, 2007). Enjoyment for a food can be enhanced by increasing the positive memories of the most recent eating experience with this food (Pollard et al., 2001). In a study of UK college undergraduate university students, the relationship between recall of vegetable liking, prediction for future vegetable liking, and actual vegetable intake was examined (Pollard et al., 2001). A significant relationship between positive memory recall of vegetable intake and self-reported vegetable intake was identified, indicating that memories of previous vegetable intake could promote future intake (Pollard et al., 2001). These findings are important to future research on fruits and vegetables since individuals rely on memories of previous eating experiences rather than the actual experience (Rode, Durlach,& Rozin, 2007). Recalling previous food preferences is an important factor for future food liking and intake and is the focus of this research.

Recalling a negative eating experience impacts future food preferences and eating patterns (Batsell, Brown, Ansfield, & Paschall, 2002). In their study, 69% of college students surveyed recalled pressure to eat a novel, disliked, or aversive food as a child. Each of these episodes involved interpersonal conflict, a negative outcome, and a feeling of powerlessness or lack of control. The majority of these aversive eating experiences included an authority figure, such as a teacher or parent. As a result, the majority of respondents were unwilling to consume the target food, with the majority of target foods being a vegetable. Coercive feeding strategies do not promote food liking or intake, especially related to vegetables (Bastell et al., 2002).

Factors Influencing College Students' Fruit and Vegetable Intake

A lack of research exists for the factors surrounding fruit and vegetable intake in college students, which is a critical time for establishing greater dietary control and self-efficacy for health (Hartman et al., 2013). Young adults in college are making their own food choices independent of parental influence, which makes this period critical to the development of lifelong health (Keim, Voichick, & Stewart, 1997). The transition between adolescence and young adulthood has a significantly high rate of incidence and maintenance of obesity (Gordon-Larsen, Popkin, Nelson, & Adair, 2004). In a study of college students during freshman and sophomore year, 70% of students demonstrated a potentially significant weight gain of approximately 9 pounds during the first 2 years of school (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). This study highlighted physical inactivity and unhealthy dietary behaviors as two predominant characteristics of college underclassmen. For example, more than half of the students sampled consumed fewer than five servings of fruits and vegetables daily.

Common factors influential to fruit and vegetable intake in college students have emerged in research and include sensory aspects, social influences, barriers to accessibility, and childhood dietary habits (Hartman et al., 2013; Keim, Voichick, & Stewart, 1997). While health benefits have been studied as a factor related to fruit and vegetable intake, college students are less impacted by this factor (Keim, Voichick, & Stewart, 1997). This may be due to the perception of health and vitality as a young adult, with most students citing the intention to eat more fruits and vegetables when they are older and finished with college (Hartman et al., 2013). Additionally, respondents identified greater ability to eat fruits and vegetables post-college due to greater ability to afford fruits and vegetables, more control

over purchasing decisions, and a greater concern over future health. Self-efficacy, or the measure of perceived ability, is influential to fruit and vegetable intake (Hartman et al., 2013; Larson et al, 2012). In adolescence and emerging adulthood, predictors of higher vegetable intake included perceived benefits of healthy eating and self-efficacy for healthy eating (Larson et al., 2012).

College students identified perceptions about taste as the most important factor to promote fruit and vegetable intake (Hartman et al., 2013). Across ages 15, 20, and 26, the liking of fruits and vegetables was the only intake factor positively associated with intake over the span of the study, further highlighting the importance of fruit and vegetable liking to promoting intake. Related to social influences, college students' fruit and vegetable intake is influenced by peer support and roommates.

Certain barriers were identified as influential to fruit and vegetable intake, including: cost, eating environment, and accessibility (Hartman et al., 2013; Lacaille et al., 2011). College students identified the cost of fruits and vegetables as a central barrier, which limited intake and variety (Hartman et al., 2013). The lack of healthy options, including limited access to fruit and vegetables, were barriers to healthy eating on campus (Lacaille et al., 2011). Environmental barriers to eating healthy on campus included perceived lack of time, competing time demands and desire for convenient and inexpensive foods, which often equated to high-fat, energy-dense convenience foods. Additionally, specific gender differences influence food choices on campus, with males identifying all-you-can-eat buffets and a desire to gain weight as barriers to healthy eating, while females identified campus dining food preparation methods, social support, and a lack of cooking facilities as barriers. As identified, there is a need to establish favorable taste preferences for fruits and vegetables,

improve the convenience of healthy eating, and enhance the campus food environment in order to promote the intake of fruits and vegetables in college students (Lacaille et al., 2011; Larson et al., 2012; Hartman et al., 2013).

Summary

Adequate fruit and vegetable intake is positively associated with numerous health benefits, including reduced risk for chronic diseases and obesity (USDA, 2010), however few Americans meet the recommended intake levels for fruits and vegetables (Guenther et al., 2006). Fruit and vegetable intake in childhood is influential to intake patterns in adulthood (Larson et al., 2012; Mannino et al., 2004). Since childhood is recognized as an influential period of development for food preferences and eating behaviors (Birch & Fisher, 1998), the development of fruit and vegetable preferences from childhood to emerging adulthood requires additional study. While previous studies have examined college student's recollections of food intake and feeding practices (Brannen & Fletcher, 1999; Murashima et al., 2012); additional research on the factors specific to fruit and vegetable intake and liking is warranted. Research surrounding memory recall of previous eating experiences provides the basis for retrospective studies examining the transition of fruit and vegetable intake and preferences from childhood to adulthood (Batsell et al., 2002). Due to the poor diet quality of college students, including low fruit and vegetable intake (Racette et al., 2005), research examining strategies to improve fruit and vegetable liking and intake from childhood to adulthood is necessary. Therefore, the purpose of this study was to identify the influence of the factors related to college student's liking and intake of fruits and vegetables and the persistence of food preference and eating patterns from childhood to young adulthood.

Chapter Three

Young Adults' Fruit and Vegetable Liking and Intake is Dependent on Age, Gender, BMI, Year in School, and Childhood Feeding Practices

Introduction

Consuming the recommended intake of fruit and vegetables is associated with a decreased incidence of chronic diseases, including cardiovascular disease, hypertension, diabetes, cancer, and osteoporosis, (USDA, 2010), which has prompted interest in understanding factors influencing fruit and vegetable intake. Although fruits and vegetables are universally recognized as an important component of preventing chronic diseases (USDA, 2010), approximately 60% of the U.S. population failed to meet the recommended five or more half-cup servings of fruits and vegetable per day (Guenther et al., 2006). Low consumption of fruits and vegetables extends to the college student population as well (Racette et al., 2005).

The most influential factor for children's and adult's fruit and vegetable consumption and intake patterns is food preferences (Geller & Dzewaltowski, 2009; Hartman et al., 2013). Early childhood is a formative period for the development of food preferences (Fox, Condon, Briefel, Reidy, & Deming, 2010); therefore, the food patterns established in childhood influence future eating habits and food choices as adults (Cooke, 2007). The college years have been identified as a critical time for establishing greater dietary control and self-efficacy for health (Hartman et al., 2013). While the majority of studies investigated the factors surrounding fruit and vegetable intake in childhood and adulthood separately, research is needed on the factors that influence college students' fruit and vegetable liking and intake from childhood to adulthood (Batsell et al., 2002; Rode, Durlach & Rozin, 2007). With the

limited research regarding the factors influencing fruit and vegetable liking and intake in college students, and the recognition of eating habits formed in childhood as influential to fruit and vegetable intake in adulthood (Hartman et al., 2013), further research of the specific factors influencing fruit and vegetable liking and intake is necessary. Therefore, the purpose of this study was to examine the relationship between current liking and intake of fruits and vegetables in college students to recollections of past liking and intake. Additionally, factors dependent on college students' fruit and vegetable liking and intake were examined: age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers.

Methods

A retrospective survey design was used to examine the factors associated with fruit and vegetable liking and frequency of intake and to compare liking and intake from childhood to young adulthood. The University of Idaho and Washington State University Institutional Review Boards approved the study.

Participant Sample. From 40,135 students attending two Universities in the Inland Northwest, 2,000 students were randomly selected from each University. Of the 904 respondents, 676 responses met the inclusion criteria of survey completion and an age between 18 to 25 years, the age range for young adulthood (Arnett, 2000). Participants were given an incentive to be entered into a drawing for one of four \$50 gift cards for completion of the survey.

Fruit and Vegetable Liking and Intake Questionnaire. The Fruit and Vegetable Liking survey (see Appendix A) contained 31 questions, with 10 questions about students'

current fruit and vegetable liking and intake and 12 questions pertaining to childhood fruit and vegetable liking and frequency of being offered. The survey consisted of five distinctive sections: (1) current fruit intake in college, (2) fruit offering in childhood around the age of 6 years, (3) current vegetable intake in college, (4) vegetable offering in childhood around the age of 6 years, and (5) demographic questions. Participants were asked to recall their fruit and vegetable liking and frequency of offering from childhood, as well as their current fruit and vegetable liking and frequency of intake as a college student. The survey instrument was developed by a nutrition expert and integrated a cognitive design as indicated by Salant and Dillman (1994) to prevent survey respondents from answering retrospective questions quickly and without consideration. After responding to current liking and intake of fruit and vegetables, participants were asked to recall when they were a young child of approximately six years of age, prior to answering the subsequent questions. Questions about childhood fruit and vegetable liking and offering specified that participants' recall when they were six years of age, which previous research has supported for childhood memory recall (Branen & Fletcher, 1999). Eight of the questions were Likert scale questions, pertaining to liking and frequency of intake or offering of fruits and vegetables. Two multiple choice questions pertained to participants' motivations surrounding fruit and vegetable liking and asked: "do you eat fruit/vegetables because you feel that you have to or do you truly like fruit/vegetables." Potential answers included: I like eating some fruit or vegetables but mainly for health benefits and I eat fruit or vegetables because I enjoy it, not for the health benefits. The survey contained 10 open-ended questions specifically asking respondents to list fruit and vegetables that participants currently like eating, currently dislike eating, liked eating as a child, disliked eating as a child, and fruits and vegetables they were forced to eat

as a child. The final section of the survey contained 9 demographic questions. This section also included a question about childhood weight and breastfeeding. The complete survey is provided in Appendix A. The survey was initially reviewed by a campus statistical research unit and piloted with three college students for question clarity and formatting. The survey was tested for test-retest reliability at one of the universities using a sample of 45 college students in an introductory nutrition class who completed the survey pre and post class. Pearson's correlation was conducted with reliability score of $r=0.71$ or greater for all questions, except the why eat fruit ($r=.53$) and child liking of vegetables ($r=.65$). Four questions with dichotomous responses were analyzed by joint probability analysis to test reliability at 0.84 or above. Joint probability analysis identified the following paired responses to have a high reliability score: forced as a child to eat fruit ($r=.94$), forced as a child to eat vegetables ($r=.84$), breastfed as an infant ($r=.98$) and overweight as a child ($r=.93$). A reliability of 0.60 is considered minimally acceptable (Multon, 2010).

Procedure for administering the survey. The survey was entered into Survey Monkey™, an online survey program. Surveys were e-mailed to participants using the Total Design Method (Salant & Dillman, 1994). Using the list of e-mails randomly selected by the universities' registrar offices, 2,000 students from each university were sent an initial e-mail with a link to the Survey Monkey™ questionnaire. The e-mail explained the purpose of the survey, described the importance of the students' participation, assured complete anonymity of responses, and informed participants that they would be entered into a drawing to receive one of four \$50 gift cards to Amazon™ upon completion of the survey (see Appendix B and C). At one, three, and six weeks, reminder e-mails were sent to participants who had not completed the survey. A total of seven weeks were allowed for survey completion.

Data analysis. Descriptive statistics were conducted on demographic data, including age, weight, and Body Mass Index (BMI) to identify mean, standard deviation, and degree of skewness. Body mass index was calculated for each participant using self-reported weight and height. In this calculation, BMI was calculated as kilograms of body weight divided by height in squared meters. Inferential tests of frequencies were conducted using Pearson's Chi-Square Tests to identify dependency between fruit and vegetable liking and intake and factors of interest, including age, year in school, gender, raised in an urban or rural setting, current BMI, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. The McNemar Tests examined differences in proportion for paired past and present data, specifically childhood and young adult paired questions for fruit and vegetable liking and intake. To ensure cell counts would meet criteria for minimum expected count, categorical data was compressed into dichotomous categories. Contingency table analyses on dichotomous 2x2 tables were computed for a binomial distribution. Statistical significance was set at $p < 0.05$ for all tests and SPSS Statistics (IBM Corp. Released 2011. IBM SPSS Statistics for Windows. Version 20. Armonk, NY: IBM Corp) was used to complete the analysis. The standardized residuals, or the differences between the observed frequencies and expected frequencies, were converted into z-scores and compared to a critical value equivalent to an alpha of < 0.05 (± 1.96) to identify directionality of significant chi-square tests.

Results

Demographics. Of the 904 total survey responses, 3.5% ($n=33$) of participants stopped the survey after the fourteenth question, or at the halfway mark, and were removed from the sample. Of the remaining 871 responses, 6% ($n=54$) of participants did not provide

an age and were removed. Of the remaining 816 responses, 17% (n=140) of the respondents were older than 18 to 25 years of age. The 140 responses outside of the young adult age range were excluded from the study. The remaining responses (n=676) included participants between 18 to 25 years of age. The mean age of respondents was 20.8 years. The majority of participants were Caucasian (n=554, 84%), which is representative of the demographics of both universities. A greater percentage of respondents were female (63%, n=554), and grew up in an urban setting compared to a rural setting. See Table 1 for the complete demographics.

Table 1

Demographic Characteristics of Respondents Ages 18-25 Years

Age (y), mean (range)	20.6 (18-25)
Race, n (%)	
Caucasian	554 (84)
Asian	38 (6)
Hispanic or Latino	39 (6)
American Indian or Alaskan Native	12 (2)
Black or African American	8 (1)
Native Hawaiian or Other Pacific Islander	7 (1)
Education, n (%)	
Freshman	139 (21)
Sophomore	131 (20)
Junior	166 (24)
Senior	200 (29)
Graduate Student	36 (5)
Non-matriculated	1 (<1)
Gender, n (%)	
Female	426 (63)
University of Attendance, n (%)	
University of Idaho	376 (56)
Washington State University	292 (44)

Table 1 (Continued)

Demographic Characteristics of Respondents Ages 18-25 Years

Childhood setting, n (%)	
Urban	376 (56)
Rural	299 (44)
BMI (n=667), mean (range)	24.2 (16-45)
Underweight <18.5, n (%)	18 (3)
Normal Weight 18.49-24.9, n (%)	436 (65)
Overweight 25-29.9, n (%)	141 (21)
Obese >29.9, n (%)	72 (11)
Weight (y), mean (range)	157.9 (95-340)
Overweight as a Young Child, n (%)	
Yes	110 (16)
No	560 (84)
Breastfed as an Infant (%)	
Not breastfed	66 (10)
Do not know if breastfed	81 (12)
Breastfed but not sure of duration	350 (52)
Breastfed <6 months	60 (9)
Breastfed 6-12 months	97 (14)
Breastfed >12 months	19 (3)

Descriptive Data from Demographics. The majority of respondents reported a genuine liking for fruit, while 17.2% ate fruit mainly for health benefits. A greater percentage of respondents indicated greater liking for some or most fruit as a college student (87%, n=587) compared to as a child (70%, n=471). Additionally, fruit was more frequently offered daily and multiple times a day as a child compared to current fruit intake frequency. The majority of respondents indicated that they were not forced to eat fruit as a young child (n=530, 78%). Regarding vegetable liking, 65% of respondents (n=441) reported eating most or all vegetables. A greater percentage of respondents ate vegetables primarily for the health benefits (n=191, 28%), while 57% (n=387) indicated a genuine liking for vegetables. Vegetable intake frequency was reportedly greater in childhood, with the majority of respondents indicating frequency of intake daily or multiple times a day in childhood (n=422, 62%) versus young adulthood (n=305, 45%). The majority of respondents indicated a caregiver forced them to eat vegetables as a child (54%, n=364). Only 10% (n=66) indicated they were not breastfed, while 12% (n=81) did not know if they were breastfed. Of those who knew they whether or not they were breastfed, 78% (n=526) indicated being breastfed for some length of time. Of the participants that were breastfed, the majority of respondent (14.3%, n=97) reported being breastfed for 6-12 months. The majority of respondents indicated being overweight as a child (83%, n=560). University distribution was slightly greater from one University compare to another.

Factors Dependent on College Students' Fruit Liking and Intake

Pearson's Chi Square Tests were conducted to determine the relationship between college student fruit liking and intake and the following factors: age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index,

overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. Table 2 illustrates the chi-square results, including degrees of freedom, p-value, and chi-square value. As indicated by a p-value of $<.05$, current fruit liking and intake was dependent on gender. Standardized residuals of the chi-squares indicates females reported a higher intake and liking of fruit more frequently than males ($p<.05$). Fruit frequency of intake was dependent on BMI, $X^2(1, N=666) = 5.82, p=.016$, with less frequent consumption weakly associated with being overweight or obese as identified by a z-score of 1.7.

Fruit Liking				Fruit Intake Frequency		
Factors of Dependency	<i>Df</i>	p-value	X^2	<i>Df</i>	p-value	X^2
Age	1	.305	1.05	1	.096	2.78
Gender	1	.03*	4.71	1	.028*	4.8
Rural or Urban	1	.302	1.07	1	.928	.008
Year in School	1	.489	.48	1	.178	1.82
University	1	.412	.67	1	.315	.575
Overweight as a child	1	.498	.46	1	.71	.14
BMI (by category)	1	.063	3.45	1	.016*	5.82
Breastfed as an Infant	1	.08	3.07	1	.283	1.153
Forced by Caregivers	1	0.74	3.2	1	.096	2.78

*indicates significant relationship $p < .05$ ** indicates significant relationship $p < .001$

Factors Dependent on College Students' Vegetable Liking and Intake

Pearson's Chi Square Tests were conducted to determine the relationship between college student vegetable liking and intake and the following factors: age, year in school, university attended, gender, raised in an urban or rural setting, current body mass index, overweight as a child, breastfed as an infant, and forced to eat fruits or vegetables by caregivers. Table 3 illustrates the chi-square results, including degrees of freedom, p-value, and chi-square value.

Vegetable liking and intake were dependent on a greater number of factors than fruit liking and intake. Vegetable liking was associated with age, gender, year in school, BMI, and forced to eat vegetable by a caregiver. The examination of z-scores showed an overrepresentation of older adults (ages 21-25) and upperclassmen (juniors, seniors, and upper division degrees) reporting greater liking and intake of vegetables ($p < .05$). Additionally, females reported liking vegetables more frequently than males ($p < .001$). Vegetable liking was dependent on BMI, $X^2(1, N=667) = 7.38, p = .007$, with dislike for vegetables associated with being overweight or obese, as identified by a z-score of 1.8. Vegetable liking was also dependent on being forced to eat vegetables by a caregiver, $X^2(1, N=672) = 19.0, p = .000$, with a significantly lower than expected frequency for vegetable liking in those forced to eat vegetables by caregivers, identified by a z-score of 2.6.

Table 3: Current College Student Vegetable Liking and Intake: Factors of Influence						
Vegetable Liking				Vegetable Intake Frequency		
Factors of Dependency	<i>Df</i>	p-value	X^2	<i>Df</i>	p-value	X^2
Age	1	.001**	10.89	1	.016*	5.8
Gender	1	.001**	11.43	1	.65	.21
Rural or Urban	1	.28	1.17	1	.12	2.39
Year in School	1	.02*	5.44	1	.014*	6.01
University	1	.95	.005	1	.84	.04
Overweight as a child	1	.70	.15	1	.56	.33
BMI (by category)	1	.007*	7.38	1	.22	1.53
Breastfed as an Infant	1	.79	.15	1	.21	1.58
Forced by Caregivers	1	.000**	19.0	1	.15	2.06

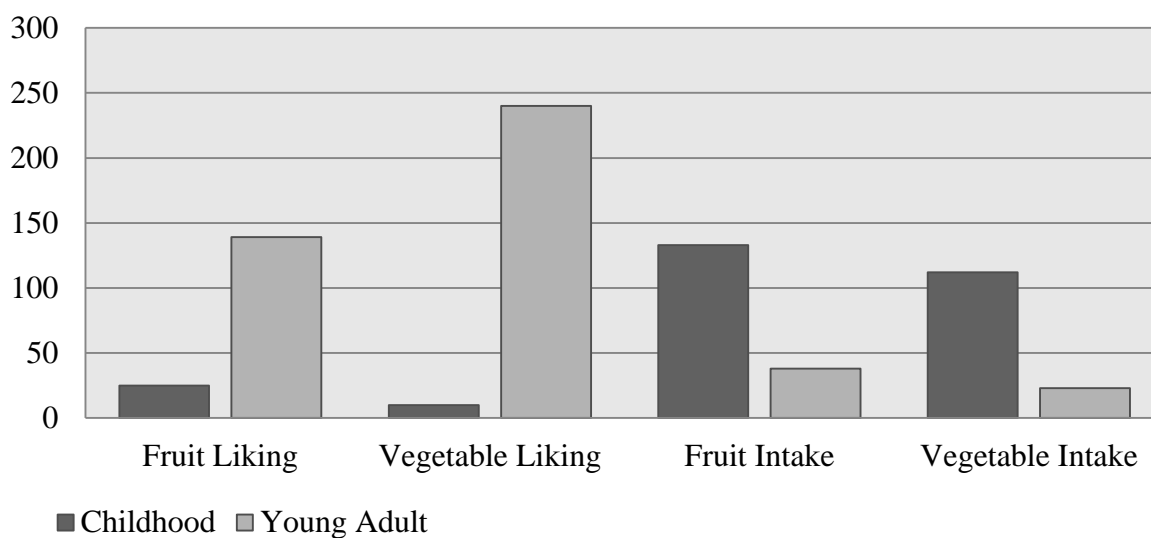
*indicates significant relationship $p < .05$ ** indicates significant relationship $p < .001$

Comparisons of Childhood Recollections to Young Adult Fruit and Vegetable Liking and Intake

McNemar Tests comparing the past and present matched pairs for fruit liking, fruit intake, vegetable liking, and vegetable intake identified a statistically significant difference ($p < .001$). Within the sample, fruit liking and vegetable liking had significantly greater frequencies in young adulthood compared to childhood. However, fruit and vegetable intake

had significantly greater frequencies in childhood than young adulthood. Indicating that while young adults' reported liking for fruits and vegetables was greater in young adulthood, reported frequency of intake was significantly less than childhood frequency of being offered. Figure 1 illustrates the differences between childhood and young adult fruit and vegetable liking and intake.

Figure 1: Past and Present Fruit and Vegetable Liking and Intake



Discussion

This study aimed to examine the relationship between liking and intake of fruits and vegetables from childhood to adulthood. Previous research has indicated specific factors influencing fruit and vegetable intake in college students, including accessibility, perceived benefits and self-efficacy for eating healthy (Larson et al., 2012). In the present study, fruit and vegetable liking increased from childhood to young adulthood, however frequency of intake decreased. These results indicate that while reported liking for fruits and vegetables is improved, intake of fruits and vegetables was negatively impacted from childhood to adulthood. Liking of fruits and vegetables has been identified as the most important intake factor for adolescents and young adults (Larson et al., 2012). In consideration of the increase

in liking, but decline in fruit and vegetable intake as college students, as compared to childhood, additional research on the barriers and factors associated with college students' produce intake is warranted. Since childhood fruit and vegetable liking improved or remained consistent with age, this suggests that future research focus on barriers to fruit and vegetable intake of college students, rather than strategies to improve or influencing liking. Previous research indicates predictors of higher vegetable intake include perceived benefits and self-efficacy for eating healthy in adolescence and emerging adulthood; therefore, these motivations and barriers require additional study (Larson et al., 2012).

Factors associated with fruit and vegetable liking and intake included being forced to eat vegetables by caregivers, gender, age, year in school, and BMI ($p < .05$). The significant association between being forced to eat vegetables by a caregiver and decreased vegetable liking in young adulthood is supported by previous research that identifies coercive feeding strategies have unintended consequences of creating food aversions and decreased intake of forced foods (Batsell, Brown, Ansfield & Paschall, 2002; Galloway et al., 2005). Notably, vegetable liking was also dependent on whether or not a child was forced to eat vegetables by a caregiver. Most significant, participants forced by caregivers to eat vegetables as a child reported a lower than expected frequency for vegetable liking than those not forced. Within this study, half of respondents were forced to eat a vegetable as a child, compared to less than a quarter of respondents being forced to eat a fruit. This is likely due to the increased palatability of fruits compared to vegetables (Wardle & Cooke, 2008). As such, adults are more likely to use coercive or forcing feeding strategies to encourage children to eat vegetables, as compared to fruits (Osborne & Forestell, 2012; Russell & Worsley, 2013). Previous research has identified coercive feeding strategies in childhood, such as forcing a

child to eat a fruit or vegetable, do not promote food liking or intake in college students, especially related to vegetables (Batsell et al., 2002). This study identified decreased vegetable liking strongly associated with being forced by caregivers to eat vegetables in childhood, which indicates that coercive feeding practices can create food aversions that persist into young adulthood. This finding is supported by previous research on college students, which identified eating behaviors in early adulthood are dependent on recalled childhood eating behaviors (Branen & Fletcher, 1999).

Gender was a dependent factor for college students' fruit liking, fruit intake, and vegetable liking, with females having a greater liking and intake as compared to males. Previous research supports a difference between genders and fruit and vegetable intake (Mikkilä et al., 2004; Unüsan, 2006). Men consume fewer fruits and vegetables compared to females in relation to total energy intake (Mikkilä et al., 2004), and in a study of college students, female college students were identified as more likely than males to consume fruits and vegetables and cited a higher preference for eating vegetables at lunch and dinner (Unüsan, 2004).

Vegetable liking and intake was also dependent on age and year in school, with older adults (ages 21-25) and upperclassmen (juniors, seniors, and upper division degrees) reporting greater liking and intake of vegetables. Previous research indicates adults in college are making their own food choices independent of parental influence, which makes this period critical to the development of lifelong health (Keim, Voichick, & Stewart, 1997).

Fruit intake and vegetable liking were dependent on BMI. Less fruit intake was weakly associated with being overweight or obese. Additionally, liking for no or some vegetables was weakly associated with being overweight or obese. Previous research has

emphasized consuming nutrient-dense fruits and vegetables could lead to a lower overall energy intake and be protective against weight gain and obesity (Enns, Goldman, & Mickle, 2002).

While this study provides preliminary findings regarding factors influencing fruit and vegetable intake, certain limitations exist. The retrospective survey design of the study inherently presents a limitation, as the participants' responses are their recollection of childhood fruit and vegetable liking and intake; however, previous research in adults' recollections of childhood eating and feeding experiences have been reported (Branen & Fletcher, 1999; Murashima et al., 2012; Ünüsan, 2006). A random selection of young adults from two universities located in different states was included in the study. However, both universities are located in the Northwest, one geographic area, which may limit the inference of the findings to other geographical locations. Participants were primarily Caucasian, which also may limit the generalizability of the results to other ethnic groups, although there were 16 percent non-Caucasian students who participated in the study. Additionally, this distribution of ethnicity is representative of the two Universities located in the Northwest. A further limitation is the survey did not distinguish between student living groups; therefore, comparisons between off-campus and on-campus living groups cannot be established. While students were randomly selected to participate in the study, a response bias may exist if the survey was more likely to be completed by participants who like fruits and vegetables; however an incentive was offered to control for this potential bias and the survey test for reliability showed consistency in responses.

Implications for Future Studies

This study identifies influential factors related to fruit and vegetable intake in college students. While previous research on college students identified healthy food preferences and eating behaviors in childhood as influential to food patterns in adulthood (Branen & Fletcher, 1999), this study has identified specific factors that are associated with college student liking and intake of fruits and vegetables. These influential factors, including gender, age, year in school, BMI and coercive feeding strategies, can enhance or diminish fruit and vegetable liking and intake in young adults. This research highlights the importance of understanding the barriers to college students fruit and vegetable consumption, especially since this population is at a unique transitional time of developing independent dietary habits, making this period critical to the development of lifelong health (Keim, Voichick, & Stewart, 1997).

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Appendix A

Fruit and Vegetable Liking and Intake Survey

Thank you for taking the time to complete this survey. We want to learn about college students' liking and dislike of fruit and vegetables.

FRUIT QUESTIONS

Q-1. In general, do you currently like eating fruit?

1. No fruit
2. Some fruit
3. Most fruit
4. All fruit

Q-2. Do you eat fruit because you feel that have or do you truly like fruit?

1. I don't eat fruit
2. I don't like eating fruit, but I do it for the health benefits
3. I like some fruit, but I eat it mostly for the health benefits
4. I like eating fruit both because it's enjoyable and for the health benefits
5. I eat fruit because I enjoy it, not for the health benefits

Q-3. How frequently do you eat fruit?

1. Never
2. Monthly
3. Weekly
4. Multiple times a week
5. Daily
6. Multiple times daily

Q-4. If any, what types of fruit do you currently like eating? Please list (up to 10):

Q-5. If any, what types of fruit do you currently NOT like eating? Please list (up to 10):

TRANSITION- Think back to when you were around 6 years of age. We will now ask you questions about your fruit intake when you were a young child.

Q-6. Thinking to when you were a young child, around 6 years of age, did you like eating fruit?

1. No fruit
2. Some fruit
3. Most fruit
4. All fruit

Q-7. How frequently were you offered fruit as a young child? (select one)

1. Never
2. Monthly
3. Weekly
4. Multiple times a week
5. Daily
6. Multiple times a day

Q-8. What types of fruit did you like eating as a child? Please list (up to 10)

Q-9. If any, what types of fruit did you NOT like eating as a child? Please list (up to 10)

Q-10. Thinking to when you were a young child, were you forced to eat certain fruit? As in, were you required to eat certain fruit by your caregiver(s)?

1. Yes
2. No

If so, please list the types of fruit you were forced to eat:

Now we will ask about your current experiences with vegetables.

Q-11. Do you currently like eating most vegetables?

1. No vegetables
2. Some vegetables
3. Most vegetables
4. All vegetables

Q-12. Do you eat vegetables because you feel that you have to or do you truly like vegetables?

1. I do not eat vegetables
2. I don't like eating vegetables, but I do it for the health benefits
3. I like some vegetables, but I eat them mostly for the health benefits
4. I like eating vegetables both because it's and for the health benefits
5. I eat vegetables because I enjoy it, not for the health benefits

Q-13. How frequently do you eat vegetables? (select one)

1. Never
2. Monthly
3. Weekly
4. Multiple times a week
5. Daily
6. Multiple times a day

Q-14. If any, what types of vegetables do currently like eating? Please list (up to 10)

Q-15. If any, what types of vegetables do you currently NOT like eating? Please list (up to 10)

TRANSITION- Think back to when you were around 6 years of age. We will now ask you questions about your vegetable intake when you were a young child.

Q-16. When you were a young child, around 6 years of age, did you like eating vegetables?

1. No vegetables
2. Some vegetables
3. Most vegetables
4. All vegetables

Q-17. How frequently were you offered vegetables as a young child? (select one)

1. Never
2. Monthly
3. Weekly
4. Multiple times a week
5. Daily
6. Multiple times a day

Q-18. If any, what types of vegetables did you like eating as a child? Please list (up to 10)

Q-19. If any, what types of vegetables did you NOT like eating as a child? Please list (up to 10)

Q-20. Thinking to when you were a young child, were you forced to eat certain vegetables? As in, were you required to eat certain vegetables by your caregiver(s)?

1. Yes
2. No

If yes, please list the vegetables you were forced to eat:

Demographic Information

Q-21. What is your age in years?

_____ YEARS

Q-22. What is your year in school? (select one)

1. Freshman
2. Sophomore
3. Junior
4. Senior
5. Graduate Student
6. Non-matriculated

Q-23. Please indicate your gender. (select one)

1. Female
2. Male

Q-24. What is your height?

_____ FEET _____ INCHES

Q-25. What is your current weight?

_____ POUNDS

Q-26. With which of the following ethnic groups do you consider yourself a member?
(Indicate all that apply)

1. American Indian or Alaska Native
2. Asian
3. Black or African American
4. Caucasian
5. Native Hawaiian or other Pacific Islander
6. Hispanic or Latino
7. International
8. Other (please specify) _____

Q-27. Did you grow up in an urban or rural setting? (select one)

1. Urban
2. Rural

Q-28. If you were breastfed as a child, how long were you breastfed?

1. I was not breastfed
2. I do not know if I was breastfed
3. I know I was breastfed but I do not know how long
4. I was breastfed less than 6 months
5. I was breastfed for between 6-12 months
6. I was breastfed for longer than 12 months

Q-29. Were you overweight as a child?

1. Yes
2. No

Thank you for completing the survey! To be eligible for the drawing for 1 of the 4 Amazon gift cards, please email Dr. Ramsay at sramsay@uidaho.edu stating the survey had been completed. The survey is anonymous and the email is the notification of your completion.

Appendix B
Sample Cover Letter

Dear NAME,

We are asking you to complete an online questionnaire on your like and dislike of fruit and vegetables. This Project has been approved by the University of Idaho Institutional Review Board.

In order for the results to be an accurate representation, it is important that each question is completed. We realize how busy you are and want to assure you that it should take less than 10 minutes to complete. Please click on the link below to complete the survey no later than 1/9/13.

[LINK HERE](#)

If you return a completed survey, you will be entered in a drawing for one of four \$50 Amazon gift cards!

The purpose of this questionnaire is to identify fruit and vegetable like and dislike as a college student and as a child. These results will help us to improve our knowledge on fruit and vegetable intake among college students and how the home atmosphere may be influential.

You may be assured of complete anonymity. The online questionnaire does not ask for your name. In addition, if you feel any discomfort during the survey or do not want to answer a particular question, you may skip it. During the course of this study, you may stop at any time with no penalty. If you do decide to stop, you will still be entered in the drawing.

We would be happy to answer any questions you have. Please call the School of Family and Consumer Sciences in Moscow at (208) 885-6026 and ask for Dr. Ramsay.

Sincerely,

Samantha Ramsay PhD, LD, RD
Assistant Professor, Foods and Nutrition
University of Idaho

Appendix C

Follow-Up E-mail to Participants

Dear NAME,

You were recently sent an email regarding a survey about your fruit and vegetable intake. This Project has been approved by the University of Idaho Institutional Review Board. Please consider taking the survey. In order for the results to be an accurate representation, it is important that each question is completed. We realize how busy you are and want to assure you that it should take less than 10 minutes to complete. Please click on the link below to complete the survey no later than 1/14/13.

[LINK HERE](#)

If you return a completed survey, you will be entered in a drawing for one of four \$50 Amazon gift cards!

The purpose of this questionnaire is to identify fruit and vegetable like and dislike as a college student and as a child. These results will help us to improve our knowledge on fruit and vegetable intake among college students and how the home atmosphere may be influential.

You may be assured of complete anonymity. The online questionnaire does not ask for your name. In addition, if you feel any discomfort during the survey or do not want to answer a particular question, you may skip it. During the course of this study, you may stop at any time with no penalty. If you do decide to stop, you will still be entered in the drawing.

We would be happy to answer any questions you have. Please call the School of Family and Consumer Sciences in Moscow at (208) 885-6026 and ask for Dr. Ramsay.

Sincerely,

Samantha Ramsay PhD, LD, RD
Assistant Professor, Foods and Nutrition
University of Idaho