An Examination of the Associations Between Eating Competence, Physical Activity, Mealtime Activities and School Behavior in Adolescents

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AN EXAMINATION OF THE ASSOCIATIONS BETWEEN EATING COMPETENCE, PHYSICAL ACTIVITY, MEALTIME ACTIVITIES AND SCHOOL BEHAVIOR IN ADOLESCENTS

A THESIS IN
Health and Well-Being Management

Presented to the Faculty of the Rochester Institute of Technology in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE IN HEALTH AND WELL-BEING MANAGEMENT

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Rochester, New York
June 6, 2023

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ACKNOWLEDGEMENTS

First, I would like to thank my thesis committee advisor, Dr. Barbara Lohse for her continuous support and guidance through the entire process of completing my thesis. Her expertise in eating competence and research allowed her to provide important feedback that guided all the steps of this process and aided me in feeling confident in the work I produced. I would also like to thank my committee members, Dr. Elizabeth Ruder and Dr. Jessamy Comer. Dr. Ruder provided guidance and advice and shared her expertise in nutrition and research to help me complete my thesis and was willing to help at any time throughout the process. Dr. Comer provided a different perspective using her background in psychology and provided invaluable feedback throughout the process to guide me in the right direction. I would like to thank Leslie Cunningham-Sabo, PhD, RD for providing access to the data. Additionally, I would like to acknowledge the funding provided by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2012-68001-19603.

I would also like to thank my husband for his unwavering support throughout the entire process and encouraging me every step of the way. My parents and friends also provided much needed support and relief in times of stress. I am so grateful for the opportunity to continue my education through the Wegmans School of Health and Nutrition and am excited to embark on a new career path.
ABSTRACT

Background: An association between eating competence (EC) and physical activity, diet quality, less stress, greater weight satisfaction and many other outcomes has been identified in adult populations. However, limited research has been conducted into EC and associations in the adolescent population. Specifically, the associations between eating competence and physical activity, mealtime activities, and school behavior in adolescents has not been examined.

Purpose: To examine the congruence between eating competence and physical activity, mealtime activities, and school behavior in adolescents (ages 11-16) who had participated in the Fuel for Fun study as 4th graders.

Methods: Secondary data analysis of collected data from self-report validated surveys: Satter Eating Competence Inventory (ecSI 2.0™), Godin and Shepard physical activity questionnaire, cooking experience questions, fruit and vegetable preference questions, cooking self-efficacy questions, cooking attitudes questions, mealtime practices questions and student academic and social difficulties questions adapted from National Longitudinal Study of Adolescent Health. Independent t-tests, Pearson correlations, Chi-Square, one-way ANOVA’s and univariate general linear models were utilized to examine for association and to test mean differences between groups.

Results: The sample of participants was predominately white, with an equal representation of males and females and a mean age of 13.4 (1.1). Out of the 132 participants, 93, or 70% were considered EC. Eating competent students reported higher physical activity than non-EC students in both Metmin/week (3357.5 ±1694.6 vs. 1897.2 ±1581.1, \( P=\leq0.001 \)) and MVPA/week (400.4 ±213.9 vs. 211.0 ±190.8, \( P=\leq0.001 \)). This relationship remained significant when controlling for gender. Participants that made food with family had higher total ecSI 2.0™
(37.1 ±7.0 vs. 33.5 ±8.3, P=0.02), food acceptance (6.3 ±2.3 vs. 4.5 ±2.4, P=<0.001) and contextual skills scores (11.1 ±2.9 vs. 9.7 ±2.9, P=0.02). Participants that made food with friends reported higher ecSI 2.0TM (11.1 ±2.9 vs. 9.7 ±2.9, P=0.02) and contextual skills scores (11.4 ±2.9 vs. 10.2 ±2.8, P=0.02). Students that cooked had higher food acceptance (6.2 ±2.3 vs. 4.8 ±2.4, P=0.003) and tended to have higher contextual skills (10.9 ±2.9 vs 9.9 ±2.9, P=0.08) than students that did not cook. These scores continued to be significant when controlling for gender. Eating competent students had higher total mealtime scores than those that were not eating competent (19.7 ±9.3 vs. 14.2 ±6.1, P=<0.001). The relationship was still significant when controlling for gender. Total mealtime activity scores were related with ecSI 2.0TM (r=0.40, P=<0.001), eating attitudes and behavior (r=0.18, P=0.04), food acceptance (r=0.44, P=<0.001), and contextual skills (r=0.41, P=<0.001). Initial findings showed that EC students had less trouble paying attention in school and less trouble getting homework done. Mealtime activities were also correlated with the summed score of academic troubles (p=0.033). Eating competence and school behaviors were no longer significantly correlated when controlling for mealtime activity score. Findings did not support a relationship between EC in adolescence and study treatment, cooking self-efficacy, fruit and vegetable preference or cooking attitudes. Students who had more trouble getting along with teachers reported higher Metmin/week (r=.218, P=.012) and MVPA/week (r=.238, P=.006).

**Conclusion:** This study showed that eating competent persons are more physically active and participated in more mealtime activities than non-eating competent persons. Eating competence is associated with many benefits in adults and findings from this study highlight similar associations in adolescents. Given the multifaceted nature of eating competence, more in depth research is needed to fully understand the benefits of eating competence in adolescents.
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CHAPTER ONE

Introduction

1.1 Background Information on Eating Competence

Eating Competence (EC) is a comprehensive model addressing an approach to food and eating that focuses on enjoying food and eating, paying attention to variety in diet, attending to signals of hunger and satiety, and preparing meals and snacks regularly with some attention to nourishing food and the environment in which it is consumed, rather than on nutrients, portion size, or food groups. According to the Satter Eating Competence model (ecSatter), competent eaters are positive, comfortable, and flexible with eating and are matter-of-fact and reliable about getting enough to eat of enjoyable and nourishing food. Eating competence includes four components: 1) Attitudes about eating and food-related behavior, 2) food acceptance skills, 3) internal regulation skills and 4) skills and resources for managing the food context and orchestrating family meals, or contextual skills. In the context of EC, eating attitudes include a positive and relaxed attitude towards food with a harmony among food desires, food choices and amounts eaten. Food acceptance includes having a positive interest in food, being comfortable in the presence of unfamiliar food and being inclined to experiment with novel food. Internal regulation skills include being able to regulate food intake and listen to internal cues of hunger and fullness. Contextual skills revolve around the ability to effectively plan meals and establish a consistent routine of regular eating, ensuring frequent and reliable opportunities to eat.

Eating competence is measured using the Satter Eating Competence Inventory (ecSI 2.0™). ecSI 2.0™ is a validated instrument for assessing adult eating competence as defined by the Satter Eating Competence Model. The instrument, which requires permission from the Ellyn Satter Institute to use, has been validated in the United States with English-speaking adult
women and men across income groups as well as in the United States with low-income English-speaking adult women. The instrument has been translated into Arabic, Finnish, German, Japanese, Spanish and Brazilian Portuguese. The ecSI 2.0™ is a 16-item questionnaire that assess overall eating competence. Each item has 5 response options ranging from 3 (Always) to 0 (Rarely or Never) with a total possible score range of 0-48. A score of 32 or higher signifies a person as being eating competent.

1.2 Eating Competence in Adults

The Satter Eating Competence Inventory was initially validated in 2007 with a large sample of adults in the United States who were mostly female, white, educated, overweight, physically active and food secure. In 2009, Krall and Lohse examined the validity of the Satter Eating Competence Inventory with low-income women and found that four items were misinterpreted for various reasons, such as problems with clarity and wording. This led to the development of the ecSatter Inventory for Low-Income (ecSI/LI). In 2011, Krall and Lohse evaluated the construct validity for ecSI/LI and found it to be a valid measure of EC for low-income females. Lohse found, in 2015, that the low income version of ecSatter Inventory could be used for non-low income people as well and it was renamed ecSI 2.0. Godleski et al. utilized a confirmatory factor analysis in 2019 and revised two of the subscales to create the version currently available to users. Several studies have used the validated ecSI 2.0 to assess EC in adults and the relationship of EC to other related outcomes. Competent eaters reported more physical activity, better sleep quality, greater parent modeling of healthful eating behaviors, higher dietary quality, less disordered eating, less emotional and uncontrolled eating, more positive affective behaviors toward food and eating, higher levels of social and emotional
functioning, less stress, as well as lower blood pressure, greater weight satisfaction, and less overweight/obesity.¹

1.3 Eating Competence in Adolescence

Early studies of EC focused on adult samples; only two studies have examined EC in adolescents. Tanja et al. examined EC in Finnish adolescents (n=976) and affirmed that relationships with meal frequency, food selection, meal patterns, perceived body size and self-esteem found in adults also held in 10 – 17 year olds.⁸ Girls were also found to be more eating competent than boys. Lin et al. examined the relationship between eating competence, body appreciation and personal and social responsibility in girls (n= 21) attending a Southern California middle school.⁹ No differences in the quantitative findings were noted, but focus groups indicated that participants experienced differences in confidence, respect for body, consciousness about health, interest in sports, and behavior. Changes in confidence included both internal, such as self-esteem, and external, such as self-expression, changes. Respect for body was tied to changes in listening to cues in the body for things such as hunger and fullness and soreness after physical activity. Participants became more conscious about health by eating mindfully and in moderation and participants felt more interest in sports. Behavioral changes included practicing mindfulness, eating foods that provide energy and participating in physical activity because of the health benefits and not because of appearance.

1.4 Adolescent Health Status

Adolescence is an important developmental period, and studies have shown that eating habits in childhood and adolescence predict eating habits later in life.⁸ Therefore, it is important
to design interventions that would enhance the EC in adolescents so they may continue to experience the benefits of being a competent eater through various life stages.

According to the World Health Organization (WHO), adolescence starts in the second decade of life. Adolescents are generally healthy, but mental health, substance abuse, obesity and risky sexual behavior are common problems adolescents face. Many high school students in the United States do not get the recommended 60 minutes of physical activity on five or more days. One study reported that only 57% of males and only 37% of females achieved the recommended activity levels. Overall, only 47% of the high school students were physically active.

In 2011-2012, one in five adolescents aged 12-19 (21%) were categorized as being obese, which can be a problem as being overweight can increase the risk of cardiovascular disease, Type 2 diabetes, high cholesterol and asthma. Adolescents also deal with mental health issues such as depression, with a high number of students reporting depressive symptoms and female high school students (39%) being twice as likely to report depressive symptoms, and attention deficit hyperactivity disorder, with one in nine adolescents (11%) aged 12-17 experiencing the disorder. Other issues can plague adolescents such as tobacco use, alcohol use, dating violence and bullying. Education can play an important role in adolescent health as well, as youth who perform better in school and complete more education are healthier over the course of their adult lives.

1.5 Addressing Adolescent Health

Adolescence is a critical period for the adaption of health behavior because it establishes activity and diet related lifestyle habits and attitudes that may track into adulthood. Learning to make appropriate decisions regarding nutrition and eating practices in adolescence can help
support long-term health. Additionally, maintaining healthy physical activity is important for preventing obesity and the health risks associated with obesity. These issues can persist into adulthood but can be mitigated with proper education, supportive relationships, successful interventions and policies and environments that support healthy growth. School based interventions to address these issues have shown promise, especially if the student is involved in cooking and food preparation and physical activity is increased during the school day.

Cunningham-Sabo et al. examined EC in youth in Colorado through an assessment of a cooking intervention called Fuel for Fun (FFF). The study was longitudinal with students beginning the intervention in fourth grade (n=1,428). Outcomes were measured over the course of six years with students growing into adolescences. This intervention combined theory-based cooking and tasting lessons, active recess, lesson-driven cafeteria promotions and family nights and home activities. The focus of FFF was to examine the relationship between multiple characteristics including cooking experience, cooking attitudes, cooking self-efficacy, fruit and vegetable preference, and physical activity. Findings showed that from baseline to post intervention (7 months later), cooking self-efficacy, cooking attitudes and fruit and vegetable preference significantly increased. Metmin (summed value for metabolic equivalents) and moderate to vigorous physical activity (MVPA) both significantly increased. At baseline and post-intervention, girls reported higher levels of self-efficacy and attitudes towards cooking and boys were more active than girls.

The focus of the present study is to explore EC in adolescents, from the FFF intervention, by examining its relationship with established principles of EC in adults, including attitudes and practices related to food and health. The study’s primary aim is investigating the connection between EC and physical activity, mealtime activities and school behavior.
CHAPTER TWO

Literature Review

2.1 Theoretical Framework

The theory of salutogenesis, which is described as health as a continuum ranging from “total ill health” to “total health,” was introduced by Antonovsky who also developed Sense of Coherence (SOC). Sense of Coherence is a theoretical model that explains successful coping with stressors and has a salutogenic orientation, which means searching for factors contributing to health, that strives to explain what makes a person move towards the healthy end of the continuum. The model consists of three components: comprehensibility, manageability, and meaningfulness. Comprehensibility looks at the extent to which a person sees the world as ordered and is able to mobilize the resources needed to cope. Manageability deals with understanding the problem and having the necessary resources to cope successfully and meaningfulness refers to the belief that coping makes sense and that one wishes to cope. The three components work together to determine how a person handles stress. People with stronger SOC are able to identify and use the resources available to them and are less likely to perceive stressful situations as threatening and anxiety provoking. Sense of Coherence is a flexible and adaptive dispositional orientation that enables successful coping with adverse experience and maintenance of good health.

A strong SOC is associated with higher levels of physical activity, lower rates of alcohol consumption, lower rates of cigarette smoking and with healthier food choices in adults. Wainwright et al, did a study examining SOC in adults and its’ association with cigarette smoking, alcohol consumption, physical inactivity, and dietary intake of fruit, vegetables, fiber, saturated fat, salt and sugar. Findings showed that those with a strong SOC were less likely to be
current smokers, less likely to be physically inactive, and reported eating more fruits, vegetables and fiber. Tanja et al., found that eating competence was associated with strong SOC in adolescents.\(^8\)

Eating competence can contribute to a person’s SOC by promoting a sense of comprehensibility, manageability, and meaningfulness in relation to food and eating. Eating competence can enhance comprehensibility by encouraging individuals to understand and recognize their internal cues of hunger and fullness, allowing them to respond appropriately to their body’s needs. It emphasizes the importance of listening to one’s body and comprehending the impact of food choices on overall well-being. Eating competence can contribute to manageability by enhancing individuals’ confidence and ability to manage their eating habits effectively through the development of practical skills related to food selection, preparation and eating in various situations. Eating competence promotes meaningfulness through the idea that food is not just about nourishment but also pleasure, enjoyment, and social connection. It encourages individuals to find meaning in their food choices and foster a sense of meaning and satisfaction in their relationship with food. Enhancing eating competence and developing a positive and balanced approach to food may strengthen a person’s sense of coherence.

Another theory that relates to eating competence is Self-Determination Theory. Self-Determination Theory (SDT) places emphasis on people’s inherent motivational propensities for learning and growing and identifies three basic needs: autonomy, competence, and relatedness.\(^{20}\) In SDT, autonomy is a sense of initiative and ownership in one’s actions. Competence is the feeling of mastery, a sense that one can succeed and grow, and relatedness is a sense of belonging and connection. Relatedness is a sense of belonging and connection.\(^{20}\) SDT suggests that when the three basic needs are met, individuals will act in a
more intrinsically motivated way. Intrinsic motivation is positively related to sustained health-promoting behaviors.\textsuperscript{21}

Eating competence and SDT are both frameworks that focus on individuals’ relationship with food and eating behaviors, but from different perspectives. As previously mentioned, EC emphasizes developing positive attitudes towards food and eating and cultivating the ability to listen to internal hunger and fullness cues and appropriately responding to them. Additionally, EC promotes contextual skills related to food selection, preparation and eating in various situations and focuses on empowering individuals to have a healthy and flexible relationship with food, free from strict rules or rigid dieting. Self-Determination Theory examines the way in which one is motivated and behaves in the context of eating. An eating competent person has autonomy with respect to food choices and eating behaviors. By developing skills and confidence necessary to make informed and healthy food choices, competence is supported and the act of partaking in mealtimes supports relatedness. By addressing the three basic needs, SDT provides a framework for understanding how individuals may engage in positive and comfortable eating behaviors.

In summary, the sense of coherence model focuses on an individuals’ approach to life, and EC examines how individuals incorporate eating into their lives. Self-Determination Theory explores the motivation that drives individuals to engage in activities, including eating.

\textbf{2.2 Eating Competence}

\textit{2.2.1 Additional Eating Competence Background}

As previously described, EC is a model addressing an approach to food and eating and is considered an intra-individual approach to food-related attitudes and behaviors.\textsuperscript{22} “Competent
Eating competence is broken down into four basic components: attitudes about eating and about food, food acceptance skills, internal regulation skills, and skills and resources for managing the food context and orchestrating family meals. Each component of eating competence, which is measured as a subscale in the ecSI2.0,™ is described below.

Eating Attitudes

Eating competent persons are “positive, confident, relaxed, comfortable, and flexible attitude about eating.” Eating attitudes aligned with eating competence are supported by genuine capability with respect to food acceptance, food regulation, and management of the food context. Within the context of eating competence, eating attitudes include:

- A positive interest in food
- Responsive attunement to inner and outer food experience
- Relaxed self-trust about managing food and eating
- Harmony among food desires, food choices, and amounts eaten

When these attitudes are present, one can be attuned to outer and inner experiences related to eating. “Outer experiences include food availability, social interactions with eating companions, and supports or pressures on eating attitudes and behaviors inherent in those interactions. Inner experiences include the sensations of hunger and appetite, anticipatory excitement and arousal, sensory responses to the organoleptic qualities of food and comfort or conflict with those responses.”

Food Acceptance
Food acceptance attitudes and behaviors comprise taking a positive interest in food, being at ease when encountering unfamiliar food and demonstrating a willingness to experiment with novel food and learning to like it.\textsuperscript{2} Within the context of eating competence, food acceptance attitudes and behaviors include:

- Being calm in the presence of food, including unfamiliar and disliked food items
- Being comfortable with eating preferred food, including food that is high in sugar, salt and fat
- Being able to pick and choose from available food, being polite and matter of fact in accepting or turning down food offerings
- Being able to settle for less preferred food when necessary to satisfy caloric or other nutritional needs
- Being curious about novel food
- Being inclined to experiment with novel food by examining it, watching others eat it and repeatedly tasting it
- Eventually becoming familiar enough with the taste and texture of novel food to enjoy it and include it as part of a personal food repertoire

The motivation to eat a variety of foods comes from learned preference and is internal and the competence to food acceptance depends on early learning and current context.\textsuperscript{2} Food Acceptance skills increase dietary quality and are positively associated with food preference.\textsuperscript{6,23}

Internal Regulation

The EC model approaches the regulation of food intake, energy balance and body weight from an experiential standpoint. It highlights that internally regulated eating prioritizes the
physiological homeostatic mechanisms that facilitate the maintenance of a biologically preferred body weight. It involves attuning to the sensations of hunger and fullness to ensure energy balanced is maintained.”

In the context of eating competence, food regulation attitudes and behaviors include:

- Ability to tolerate hunger sufficiently to conform to the social structure of meals and snacks
- Confidence that there will be enough rewarding food at structured eating times to satisfy hunger and appetite
- Ability to eat in an intentional fashion, paying attention and responding to the internal regulators or hunger, appetite and fullness
- Ability to stop when satisfied
- Comfort with the amounts eating and the experience of satiety
- Acceptance of the body weight that evolves from such internally regulated eating

Individuals who have stronger internal regulation are inclined to consume more regular meals, as they have a natural awareness of hunger and can sustain a predictable pattern of meals. Physical activity is instrumental in supporting homeostatic energy regulation processes and therefore stable body weight. Effective internal regulation supports each person’s relatively stable body weight and correlates with optimum health.

Eating Context

With respect to maintaining nutritional quality of the diet, the primary nutrition goal is structure, and the primary intervention is planning. Eating competent attitudes and behaviors with respect to context include the following.
EATING COMPETENCE IN ADOLESCENTS

• Having the skills and resources to procure and/or provide adequate amounts of rewarding food at predictable intervals

• Being able to pay attention to food and self during the process of eating

• Being able to postpone eating and tolerate moderate hunger in order to conform to the structure of meals and snacks

• Being confident that there will be enough food to satisfy hunger

• Being able to make meals intrinsically rewarding by choosing preferred food

• Being able to use sugar, salt and fat in order to make food taste good and satisfy energy needs

• Being able to manage time and self in order to suspend other activities and make time for eating

• Having an intrinsically rewarding system for choosing food to satisfy nutritional needs

Meals provide reliable access to food, offer a wider variety of food than that commonly chosen for snacks or grazing, and give a framework for repeated, neutral exposures to unfamiliar foods. The maintenance of regular meals depends on competencies in other areas, including having a relaxed and positive attitude toward eating and being positively attuned to and trusting internal regulators of hunger, appetite and satiety. Structure and meal planning aid in intention of meals by deliberately feeding oneself, schedule eating times and setting aside time to eat.

As mentioned, studies have examined EC and outcome measures in mostly adult populations. This is an emerging field and gaps exist in the literature relating EC to physical activity, mealtime activities and school behavior. Literature that examines EC and SOC and SDT is limited. This study examines many areas of research that have yet to be explored.

2.2.2 Eating Competence and Outcome Measures
Eating competence has been examined in relation to other health outcomes in adult populations. Lohse et al., found that individuals who were considered EC had a distinct profile. Some of the characteristics of the EC participants were included: reported lower BMI and incidence of overweight, were less dissatisfied with weight, more physically active, practiced better food resource management and noted fewer food dislikes and greater food acceptance. Elderly Spanish women reported higher EC and an association with ingesting more fruit and fish, consuming fewer dairy products and consistently adhering to the Mediterranean diet. Lohse et al., found that food acceptance, fruit and vegetable intake, food management, and self-reported physical activity were positively related to ecSI/LI (Satter Eating Competent Inventory for Low Income) scores in low income females. Additionally, EC low income women reported better diet quality and higher physical activity with the perception of being physically active higher in EC women. Other studies have found a positive correlation between eating competence and improved dietary patterns, including increased fruit and vegetable consumption and increased awareness and self-efficacy related to nutrition behaviors. As previously mentioned, there are a lack of studies examining these same outcomes measures within the adolescent population.

Research has demonstrated varying percentages of eating competent participants across studies with different populations. Examining the eating competence of college students enrolled in an introductory nutrition course (n=557), a total of 47\% were classified as eating competent, with mean scores being higher for males than females. When evaluating an online program for low income women, a sample of 288 participants had only 39\% of the sample as EC. Within a sample of elderly Spanish women, 46\% reported being EC. Tanja et al., found that within Finnish adolescents, 58\% of the participants were classified as eating competent.
2.3 Diet and Academic Behavior

Few studies have explored the relationship between eating competence and school performance measures, but several studies have examined the connection between academic performance and eating habits. Healthy eating habits, or diet quality has been linked to eating competence within adult populations and may potentially be linked in adolescents. The relationship found between academic performance and eating habits may suggest a connection between eating competence and academic performance, but more research is needed in this area to better understand these relationships.

During adolescence, good eating has been shown to be associated with better cognitive control and academic performance. A Chilean study found that adolescents with unhealthy diets were less likely to perform well in school than adolescents with a healthy diet. Dubuc et al, found in high school students that changes in eating habits and in studying time correlated with changes in academic performance in male students only, and changes in eating habits, screen time and social media use seemed to predict the change in cognitive control measures in females. Examining the relationship between diet and academic achievement, it was found that eating a daily breakfast and consuming salads weekly were associated with a better academic performance. Lopez-Gil examined the association between eating habits and perceived school performance in a cross sectional study of 46,455 adolescents from 42 countries. The main findings of this study were all the healthy habits analyzed were associated with high perceived school performance in both males and females. More frequent consumption of fruits and vegetables was related to a higher perceived school performance and higher frequency of breakfast consumption was related to higher perceived school performance. Further research is
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needed to examine the possible associations of diet and academics with eating competence to determine how they may be related.

2.4 Mealtime Practices in Adolescents

The examination of eating competence and mealtime activities in adolescents has yet to be researched, but research has looked at mealtime practices and involvement of adolescents. Engaging in certain practices and behaviors during meals can promote a positive and healthy relationship with food, which in turn may promote eating competence. More research needs to be done examining the impact mealtime activities have on eating competence.

Studies have shown a strong relationship between the frequency of family meals and a range of positive adolescent outcomes including healthy body weight, better psychological well-being, higher academic achievement and risk behavior avoidance. Family meals may provide a routine time for parents to connect with children and ask about achievements or problems, transmit values and establish family identity. Not only do higher frequency of mealtimes promote higher quality family relationships, but they are also associated with a healthier dietary pattern. Project EAT (Eating Among Teens) suggests a higher frequency of dinner with family is predictive of meeting dietary guidelines for fruits and vegetables not only from early to middle adolescence, but also from late adolescence to early adulthood. Children who eat ≤ 1 meal with their families per week are approximately 25% more likely to experience nutritional health problems compared to those whose families consume at least five meals together.

Not only is family mealtime important, but involvement in food preparation is positively associated with dietary patterns in adolescents. Chu et al. found that Canadian children in 5th grade (n=151) had a higher self-efficacy for their ability to select and eat healthy foods when
they helped to prepare and cook food more frequently. Additionally, preference for fruits and vegetables was associated with frequency of meal preparation. Larson et al., studied United States adolescents (n=4,746) and found greater involvement in dinner preparation is associated with higher fruit and vegetable consumption among girls, lower intakes of soft drinks among girls and lower intakes of fried food among boys. Females reported helping more frequently with both prepping and shopping for food and in general girls helped with meal preparation significantly more than boys. Leech et al., found that Australian adolescents (n=2,793) reported that the weekly frequency of helping to prepare dinner was significantly higher for girls than boys, and overall, family food involvement was higher for girls than boys. Woodruff et al., found that Canadian students in grades 4-8 (n=145) prepared food more often with family than friends and food preparation was positively associated with self-efficacy for cooking. These findings did not differ by gender. The frequency and occurrence of family meals may act as a protective factor for adolescents for many nutritional health related problems. Mealtime participation has many positive benefits for adolescents and the tenets of eating competence support mealtime participation. Research is needed to examine mealtime activities in adolescents and the relationship to eating competence.

2.5 Physical Activity

Eating competence has been shown to be related to physical activity in adult populations but there is a lack of research showing the link between eating competence and physical activity in adolescents. As mentioned previously, adolescents struggle to meet the recommended daily physical activity goals and cope with obesity. Physical activity is important in the adolescent population to improve overall well-being.
Many adolescents have the opportunity to get physical activity through sports participation and sports participation in youth may contribute to sustaining healthy physical activity behaviors in adulthood. Of note, females are less active than males and remain so throughout childhood and into adulthood. One study found that there was a significant difference in organized sport participation between boys and girls over time and another study reported 51% of girls participated in organized sports and 58% of males participated. Studies have shown that participation in organized sports can improve mental health, reduce risk taking behavior, improve cardiovascular fitness and reduce the risk of metabolic syndrome in adulthood. Torstveit et al., found that participation in organized sports within Norwegian adolescents (n=13,269) is associated with decreased odds of unhealthy lifestyle habits including: substance use, irregular meal patterns, high intake of unhealthy food and beverage, low physical activity, high screen time and having a short sleep duration. Croll et al., found that American adolescents (n=4,746) involved in sports had healthier eating habits and nutrient intakes than their peers not involved in sports. Positive associations between physical activity and outcomes related to overall well-being have been shown in adolescents. In addition, eating competence and physical activity are both associated with numerous health benefits; however, further investigation is required to explore the potential link between these two components.

2.5.1 Physical Activity and Academic Performance

A systematic review looked at the literature examining the association between school-based physical activity and academic performance. Interventions showed promising results with eight out of the ten studies showing one or more positive associations between physical activity and academic performance. One study found no difference in academic achievement across various levels of daily physical activity within fifth graders and another study found that
extending physical activity was positively associated with math, reading and writing test scores.
Nonintervention studies were examined using standardized test data to assess academic
performance and the four studies found either a neutral or positive relationship between physical
activity and academic indicators. Studies of children in kindergarten through fourth grade that
examined the relationship between recess and cognitive skills and academic behavior resulted in
three studies with no association and three studies with positive associations. One study found
that students were less fidgety, less listless, more focused and more on task when they had recess
compared to no recess and another study found that students’ attention was lower after longer
periods of classroom work without a break than after shorter periods. Additionally, it was found
that students that had recess everyday had better overall classroom behavior. There were nine
studies that examined the relationship between interscholastic school sports and academic
performance. One study of eighth grade students found that participation in sports was
correlated with higher math grades and overall GPA yet another study of twelfth graders found
no relationship between varsity sports and GPA. These studies had mixed results as they all
examined various outcomes, but generally there was either a neutral or positive
association. Children within the United States aged 6-11 (n=31,117) who did not participate in
any sports or clubs were less likely to show respect for teachers and neighbors and less likely to
try and get along with other children.\textsuperscript{42} Hoffmann et al. found within a large study of adolescents
across the United States aged 9-13 years (n=11,235) that participants in team sports reported
17\% lower social problem scores, 17\% lower thought problem scores and 12\% lower attention
problem scores.\textsuperscript{43}
2.6 Purpose of the Study

The primary aim of this study was to examine the associations between eating competence and physical activity, school behavior, mealtime activities, as well as the cooking self-efficacy, fruit and vegetable preference, and cooking attitudes of adolescents. Additionally, the association between participation in the FFF intervention and the effect on EC and mealtime practices was researched. Lastly, the association between physical activity and school behavior was examined. Several hypotheses alternate to the null are suggested and are summarized below.

H₁. Eating competent persons are more physically activity than persons who are not eating competent with higher Metmin/wk and MVPA/wk. In addition, ecSI 2.0TM scores will be positive associated with Metmin/wk and MVPA/wk.

H₂. Eating competent persons will have more positive school behavior characterized by lower school behavior scores than persons who are not eating competent. Additionally, ecSI 2.0TM scores will be inversely related to school behavior scores.

H₃. Eating competent persons will participate in more mealtime activities with higher mealtime activity scores than persons who aren’t EC. Additionally, ecSI 2.0TM scores will be positively related to mealtime behavior scores.

H₄. Eating competent persons will have more positive FFF outcomes with higher scores than non-eating competent persons on cooking self-efficacy, fruit and vegetable preference and cooking attitudes. Additionally, ecSI2.0TM scores will be positively related to cooking self-efficacy, fruit and vegetable preference and cooking attitude scores.

H₅. Compared to the control groups, participants in the Fuel for Fun intervention will have higher ecSI2.0TM scores.
H₆. Compared to the control groups, participants in the Fuel for Fun intervention will have higher mealtime activity scores.

H₇. Participant Metmin/wk and MVPA/wk values will be inversely related to school behavior scores.
3.1 Study Design

Data were utilized from the last data collection cycle of the Fuel for Fun study\textsuperscript{16} in a secondary data analysis design. Participants were from all 4 previous study cohorts. Cohort 1 began in the 2012-2013 school year, and a new cohort was added each year until the 2015-2016 school year, resulting in a total of four cohorts. The final follow-up was conducted in 2018 when students were in grades 6 (cohort 4) to 9 (cohort 1). Figure 1 illustrates the timeline of student participation and data collection. Although the last follow-up survey included questions asked at the baseline (start of 4\textsuperscript{th} grade), follow-up 1 (end of 4\textsuperscript{th} grade) and follow-up 2 (start of 5\textsuperscript{th} grade) several questions were unique to the last follow-up survey. The follow-up will be referred to as longitudinal follow-up for the remainder of the study.

**Figure 1** Fuel For Fun Participation and Data Collection Timeline\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort 1</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
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<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
<td>8</td>
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<tr>
<td>Cohort 3</td>
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<tr>
<td>Cohort 4</td>
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<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Notes: Column headings are the school year; rows are the cohorts
\textsuperscript{a}Table entries are grade levels
\textsuperscript{b}2017-2018 is the Follow Up Data Collection

3.2 Recruitment of Participants

Participants were recruited to the longitudinal follow-up session through an email to all parents of students’ parents who had previously participated in FFF. Eligibility criteria included parental consent, student assent, student completion of baseline and first follow-up surveys and
continued enrollment in either of the two district schools. A $15 Amazon gift card was provided to participants.

The recruitment email included a flyer outlining the study’s purpose and a link to a Qualtrics consent form. Parents provided contact information for themselves and their child and completed the informed consent. If a response was not received within 1-2 weeks, a reminder email was sent to parents. Of note is that the students assented to the study when appearing for the study through an online form. Figure 2 below shows the recruitment process for the follow-up.

Figure 2: Flowchart of Follow-Up Recruitment

3.3 Data Collection

3.3.1 Procedure

Data were collected in a specific location on the Colorado State University Campus. Data collection had IRB approval. Research staff verified the parent consent and student assent. Upon check-in, students received a digital tablet to complete the assent form and the follow-up survey. Of the 99 survey questions, specific ones are the focus of this study and are described
below. Height and weight were measured by trained research staff using standard anthropometric protocols.

3.3.2 Instruments

Demographics

Child demographic information, (e.g., ethnicity, race, age) was obtained from class rosters provided by schools and school information, (e.g., free and reduced lunch participation) was provided by school personnel.

Height

Height was measured to the nearest tenth of a centimeter using a portable stadiometer (model 213 Seca). Students were instructed to remove shoes prior to measurement. They were to keep their arms to their side and their heads looking straight ahead. Hats and any hair appliances that could impact accurate measures were removed.

Weight

Weight was measured using a standard digital scale (model 394KLX Health-o-meter). Weight was measured to the nearest tenth of a kilogram. Students were instructed to remove shoes and any heavy clothing items prior to measurements.

Satter Eating Competence Inventory

Eating competence was measured using the Satter Eating Competence Inventory (ecSI 2.0™). The ecSI 2.0 has 16 items with 5 response options (Always, Often, Sometimes, Rarely, Never, scored as 3,2,1,0,0 respectively. The scale is composed of four subscales, Eating Attitudes and Behavior (possible score 0 -18), Internal Regulation (possible score 0 – 6), Food Acceptance (possible score 0-9) and Contextual Skills (possible score 0 -15). Possible total
score is 0-48, with 32 or higher considered as being eating competent. The internal consistency of ecSI 2.0™ was demonstrated with a Cronbach alpha of 0.86.

Physical Activity

Physical activity time and intensity were measured using the Godin and Shephard questionnaire, which is 6 items with 8 response options for days/week and 7 options for mins/day for vigorous, moderate and mild PA during free time.\textsuperscript{44,45}

Cooking Experience

Items included affirmative or negative responses to “Do you cook with family? Do you cook with friends? And “Do you cook?”\textsuperscript{46}

Fruit and Vegetable Preference

The survey included questions pertaining to the preference for different fruits and vegetables.\textsuperscript{46} A total of 18 items were assessed, 7 seasonably available fruits and 11 vegetables. Response options were: I really like it, I like it, I don’t like it, I really don’t like it and I don’t know if I like it. Scores can range from 1-5 with a possible total score of 18-90. Preference for the following foods were self-reported: Grapes, romaine lettuce, cantaloupe, celery, red onions, sunflower sprouts, black beans, tomato, plum, squash, spinach, mango, cucumber, broccoli, tangerines, peas, strawberries, and grapefruit. Higher scores indicated greater preference.

Cooking Self-Efficacy

Self-efficacy for skills related to cooking were assessed with eight items.\textsuperscript{46} Each item had 5 response options scored from 1 (NO!) to 5 (YES!) with a possible total score of 8-40. Higher scores indicate greater self-efficacy. Items included: I can make a snack with fruit, I can make a snack with vegetables, I can help my family make a meal and I can cut up food.
Cooking Attitudes

The survey included questions to assess students’ attitudes towards cooking and making food.\textsuperscript{46} The 6 questions had 5 responses scored from 1 (I’m not sure) to 5 (I really like) with a possible total score of 6-30. Higher scores indicate more positive responses. Items included: How do you feel about cooking? How do you feel about foods you have helped cook? How do you feel about making food with friends?

Mealtime practices

A set of questions about students’ mealtime activities from Leech et al., such as involvement in meal preparation, planning and clean-up were uniquely examined in this follow-up event.\textsuperscript{32} The 6 questions had 6 response options scored 0 (never or rarely) to 7 (every day). Each question was individually scored. Higher scores indicate more involvement in mealtime activities. The internal consistency was demonstrated with a Cronbach alpha of 0.69.

Student Academic and Social Difficulties

The survey included questions to assess students’ adjustment in school taken from the National Longitudinal Study of Adolescent Health.\textsuperscript{47} The four questions had five response options from 0 (Never) to 4 (Every day). Higher scores indicated more trouble in school. The internal consistency was demonstrated with a Cronbach alpha of 0.90.

### 3.4 Data Analysis

Surveys were scored and summed according to individual tool directions. Statistical analyses were completed with SPSS statistical analysis software version 26.\textsuperscript{48} Total ecSI 2.0 and subscales scores, BMI, FV preference, cooking attitudes, cooking self-efficacy, Metmin/week, MVPA/week, and total mealtime scores were examined for normal distribution using histograms,
Q-Q plots, skewness and kurtosis. Variables with skewness and kurtosis values between -1 and +1 were considered normally distributed.

For this analysis, multiple characteristics were grouped into different categories. Participation in sports was categorized as being organized or not with organized sport involvement being further grouped into 1 sport or 2+ sports. Organized sports were denoted if they were formally organized, such as school teams, or activities that generally have regular practice schedules and require student time commitment. Mealtime practices were examined individually and as a summed score of all the items. The summed score had a possible range of 0 to 42. Responses for the student academic and social difficulties were grouped to indicate the academic troubles, social troubles and overall total school behavior score. Responses to having trouble paying attention in school and having trouble getting homework done were summed to examine academic troubles. The summed score had a possible range of 0 to 8. Responses to having trouble getting along with teachers and having trouble getting along with other students were summed to examine social troubles. The summed score had a possible range of 0 to 8. Scores were summed for all four questions to determine a total school behavior score and the possible range was 0 to 16.

For all of the analyses, a p value of <0.05 was considered significant and homogeneity of variance was examined using the Levene’s test. Independent t-tests, Pearson correlations, Chi-square, one-way ANOVA’s and general linear models (GLM) univariate analysis were utilized to examine for association and to test mean differences between groups. Results from GLM univariate analyses are reported as means (standard error). Cooking self-efficacy, fruit and vegetable preference and cooking attitudes were made to be fitted variables to the classroom and schools as the student outcome is considered to have a relationship with a school. When
analyzing these variables, the fitted data is used, but reporting of means and standard deviations, the non-fitted values are used.

Means analyzed included: total ecSI 2.0™ score and subscale scores, mealtime practices, Metmin/week, MVPA/week, academic and social difficulties, cooking self-efficacy, FV preference and cooking attitudes. Means were compared controlling for gender or mealtime activities using a general liner model univariate analysis. Pearson correlations were used to examine the relationships of total ecSI 2.0™ and subscale scores, with Metmin/week, MVPA/week, academic and social difficulties, mealtime activities, cooking self-efficacy, FV preference and cooking attitudes. Using a partial correlation, the relationship between eating competence and subscales and school behavior was controlled for mealtime activities. The associations of treatment group, EC status, cooking experience, and organized sport participation were assessed with Chi-square. Total ecSI 2.0™ and subscale scores and academic and social difficulties were compared by levels of organized sport with a one way ANOVA.
CHAPTER FOUR

Results

4.1 Description of Participants

The longitudinal follow-up study consisted of an equal number of participants in the intervention and control groups. The sample was predominately white, with an equal representation of male and female participants. Those in the longitudinal follow-up study were representative of the baseline sample that chose not to participate in the longitudinal follow-up. The baseline sample was evenly divided between male and female, mostly white and represented both intervention and control groups. Participants in both cohorts (longitudinal follow-up and baseline) were similar in age, fruit and vegetable preference, cooking self-efficacy and cooking attitudes scores at baseline. At the time of the longitudinal follow up, the participants had an average age of 13.37 (1.12). Participants came from the same two school districts and the same 8 school buildings in both the longitudinal follow-up and the baseline. A total of 32 classrooms were represented in the longitudinal follow-up sample and 38 classrooms from the sample that did not participate in the longitudinal follow-up. Within the school districts, on average 38% of kindergarten to fifth-grade students qualified for free or reduced-price meals. The percentage of students qualifying for free or reduced-price meals in each of the eight schools ranged from 25% to 66%. Poudre School District had an average free or reduced lunch of 39.5% and Thompson School District had an average free or reduced lunch of 52.2%. Thompson School District had a lower social economic status than Poudre School District. Participant information at baseline may be found in Table 1.

Participants were generally eating competent with a mean score higher than 32, which is the threshold for being considered a competent eater. Subscale scores are reported in Table 2.
Out of the 132 participants, 93 participants, or 70%, were EC (ecSI 2.0™ score of 32 or higher), and 39 were not EC.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Follow-Up (n=132)</th>
<th>Non-Follow-Up Participants (n=1296)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>66</td>
<td>673</td>
</tr>
<tr>
<td>FFF</td>
<td>66</td>
<td>623</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
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<tr>
<td>Male</td>
<td>72</td>
<td>639</td>
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<td>Female</td>
<td>60</td>
<td>657</td>
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<td><strong>Ethnicity</strong></td>
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<td>218</td>
</tr>
<tr>
<td>American Indian</td>
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<td>11</td>
</tr>
<tr>
<td>Asian</td>
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<td>21</td>
</tr>
<tr>
<td>White</td>
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<td>960</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Hawaiian/Pacific Islander</td>
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<td>2</td>
</tr>
<tr>
<td>Two or More Races</td>
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<td>2</td>
</tr>
<tr>
<td><strong>Participation in Organized Sports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Participants</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Participants</td>
<td>99</td>
<td>N/A a</td>
</tr>
<tr>
<td>Age b</td>
<td>9.1 (0.4)</td>
<td>9.2 (0.4)</td>
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<tr>
<td>BMI Percentile</td>
<td>49.7 (30.9)</td>
<td>57.1 (30.1)</td>
</tr>
<tr>
<td>Fruit and Vegetable Preference c</td>
<td>67.9 (9.4)</td>
<td>64.3 (12.1)</td>
</tr>
<tr>
<td>Cooking Self-Efficacy d</td>
<td>36.6 (3.6)</td>
<td>33.9 (5.5)</td>
</tr>
<tr>
<td>Cooking Attitudes e</td>
<td>25.9 (3.1)</td>
<td>25.9 (3.6)</td>
</tr>
</tbody>
</table>

Note. Non-follow-up participants does not include the 132 participants from the follow-up.

a Participation in organized sports was only examined for follow up participants

b Following values represent mean (standard deviation)

c Fruit and Vegetable Preference total scores may range from 18-90

d Cooking Self-Efficacy total scores may range from 8-40

e Cooking Attitudes total scores may range from 6-30
Table 2 Eating Competent and Subscale Measures for Longitudinal Follow-Up Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>Total ecSI 2.0™ Score</td>
<td>36.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Eating Attitude and Behavior</td>
<td>14.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>4.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>5.9</td>
<td>2.4</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>10.7</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Abbreviation: ecSI 2.0™ is the Satter Eating Competence Inventory 2.0
a Measured with ecSI 2.0™ total scores may range from 0-48; Eating Attitude and Behavior may range from 0-18; Food Acceptance may range from 0-9; Internal Regulation may range from 0-6; Contextual Skills may range from 0-15

All of the results reported forthwith do not include any data from baseline and only pertain to longitudinal follow-up participants. Participants were from both school districts, which had different social economic statuses (SES), but no significant differences were found between school districts for any outcome measures. Most importantly, eating competent scores did not differ between school districts with 70% of students being eating competent in the Poudre School District and 70% of students being eating competent in the Thompson School District.

4.2 Study Treatment

Control and FFF students did not differ on any EC scores. No relationship was found between treatment and control groups in terms of EC, with 72% of the treatment group and 68% of the control group being EC (Table 3). There was no need to control for treatment group when analyzing other variables. At the longitudinal follow-up, control and FFF participants did not differ on cooking preferences, cooking self-efficacy, fruit and vegetable preference, cooking attitudes, or mealtime activities (Table 4 and 5).
Table 3 Eating Competent and Subscale Scores for Longitudinal Follow-Up Control and FFF Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Control (n=66)</th>
<th>FFF (n=66)</th>
<th>P&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ecSI 2.0&lt;sup&gt;™&lt;/sup&gt; Score&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36.3 (7.3)</td>
<td>36.2 (7.7)</td>
<td>0.95</td>
</tr>
<tr>
<td>Eating Attitudes and Behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>14.8 (3.2)</td>
<td>15.1 (3.1)</td>
<td>0.64</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>4.7 (1.4)</td>
<td>4.8 (1.3)</td>
<td>0.80</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>6.1 (2.4)</td>
<td>5.7 (2.4)</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>10.7 (3.1)</td>
<td>10.7 (2.7)</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Abbreviations: FFF is Fuel for Fun, ecSI 2.0<sup>™</sup> is the Satter Eating Competence Inventory 2.0

<sup>a</sup> Table values are mean (standard deviation)

<sup>b</sup> Measured with ecSI 2.0<sup>™</sup> total scores may range from 0-48; Eating Attitude and Behavior may range from 0-18; Food Acceptance may range from 0-9; Internal Regulation may range from 0-6; Contextual Skills may range from 0-15

<sup>c</sup> P value from independent t-test

Table 4 Cooking Preferences for Longitudinal Follow-Up Control and FFF Groups

<table>
<thead>
<tr>
<th>Question</th>
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<th>FFF (n=66)</th>
<th>P&lt;sup&gt;b&lt;/sup&gt;</th>
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<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you make food with your family?</td>
<td>52</td>
<td>14</td>
<td>49</td>
</tr>
<tr>
<td>Do you make food with your friends?</td>
<td>31</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Do you cook?</td>
<td>53</td>
<td>13</td>
<td>46</td>
</tr>
</tbody>
</table>

Abbreviation: FFF is Fuel for Fun

<sup>a</sup> Table values are number of participants that answered yes/no to each question

<sup>b</sup> P value from Pearson Chi-Square test

4.3 Gender Differences Among Characteristics

Male and female participants did not differ significantly on ecSI 2.0<sup>™</sup> scores (36.9 ±7.2 vs. 35.5 ±7.7, P=0.29), eating attitude and behavior scores (15.3 ±3.1 vs. 14.5 ±3.1, P=0.15), internal regulation scores (4.8 ±1.4, P=0.33), food acceptance scores (6.0 ±2.3 vs. 5.7 ±2.5, P=0.35) and contextual skill scores (10.7 ±2.7 vs. 10.7 ±3.2, P=0.98). The proportion of males that were considered EC was 76%, or 55 males, and the proportion of females considered EC
was 63%, or 38 females. Differences between genders were significant for cooking self-efficacy, fruit and vegetable preference, cooking attitudes, and physical activity measures (Table 6). As anticipated, a greater proportion of females, compared to males, cooked with family (85% vs 69%, \( P=0.04 \)), friends (65% vs 24%, \( P=0.001 \)), and identified as a cooker (83% vs 68%, \( P=0.04 \)). Additionally, students differed in individual academic and social difficulties based on gender (Table 7). Male students appear to have more trouble in school overall (7.8 ±5.1 vs. 5.1 ±4.7, \( P=0.002 \)) as well as academically (4.1 ±2.6 vs. 3.1 ±2.5, \( P=0.02 \)) and socially (3.6 ±2.9 vs. 2.0 ±2.4, \( P=<0.001 \)) than females.

**4.4 Eating Competence and Outcome Measures**

**4.4.1 Eating Competence and Physical Activity**

EC students differed significantly from non-EC students in Metmin/week (3357.5 ±1694.6 vs. 1897.2 ±1581.1, \( P=<0.001 \)) and MVPA/week (400.4 ±213.9 vs. 211.0 ±190.8, \( P=<0.001 \)). Additionally, Metmin/week and MVPA/week were directly associated with ecSI 2.0 scores and all but Internal Regulation subscale scores (Table 8). Students who were EC had higher physical activity measures than non-EC students even when controlling for gender.

**4.4.2 Eating Competence and School Behavior**

EcSI 2.0™ score and contextual skills were inversely related to ability to pay attention in school (\( r=-0.19, P=0.03 \) for both). Trouble getting homework done was inversely related to ecSI 2.0 scores (\( r=-0.23, P=0.009 \)), contextual skills (\( r=-0.22, P=0.012 \)) and eating attitudes and behavior (\( r=-0.19, P=0.03 \)). Table 9 shows the differences for EC students and non-EC students’ scores on the individual academic and social difficulties questions. Total school behavior scores did not differ between EC and non-EC students (6.2 ±5.3 vs. 7.4 ±4.4, \( P=0.22 \)), however when gender was controlled there was a trend (\( P=0.08 \)) for those who were not EC to have more
difficulties in school than those who were EC (7.7 ±0.8 vs. 5.9 ±0.5). Academic difficulties were not significantly different between students that were EC and those that were not EC (3.4 ±2.6 vs. 4.3 ±2.3, \( P=0.07 \)), however when controlling for gender, those who were EC had fewer academic difficulties that those that were not EC (3.3 ±0.3 vs. 4.4 ±0.4, \( P=0.03 \)). Social difficulties were not significantly different between students that were EC and non-EC students even when controlling for gender (2.8 ±2.9 vs. 3.1 ±2.4, \( P=0.57 \)).

As previously mentioned, scores were summed for the school behavior questions as well as academic and social troubles. Overall school behavior showed a negative association with total ecSI 2.0™ score and academic trouble showed a negative association with total ecSI 2.0™ score and contextual skills. (Table 10)

4.4.3 Eating Competence and Mealtime Activities

Participants that made food with family reported higher total ecSI 2.0™ (37.1 ±7.0 vs. 33.5 ±8.3, \( P=0.02 \)), food acceptance (6.3 ±2.3 vs. 4.5 ±2.4, \( P=<0.001 \)) and contextual skills scores (11.1 ±2.9 vs. 9.7 ±2.9, \( P=0.02 \)). Participants that made food with friends reported higher ecSI 2.0™ (11.1 ±2.9 vs. 9.7 ±2.9, \( P=0.02 \)) and contextual skills scores (11.4 ±2.9 vs. 10.2 ±2.8, \( P=0.02 \)). Students that cooked had higher food acceptance (6.2 ±2.3 vs. 4.8 ±2.4, \( P=0.003 \)) and tended to have higher contextual skills (10.9 ±2.9 vs 9.9 ±2.9, \( P=0.08 \)) than students that did not cook. All of these relationships continued to be significant when controlling for gender using a partial correlation and GLM univariate analysis.

Total mealtime activity scores were related with ecSI 2.0™ (\( r=0.40, P=<0.001 \)), eating attitudes and behavior (\( r=0.18, P=0.04 \)), food acceptance (\( r=0.44, P=<0.001 \)), and contextual skills (\( r=0.41, P=<0.001 \)).
Table 11 shows the significant relationships found between how often students participate in mealtime activities and total ecSI 2.0™ score and subscale scores. Table 12 shows the difference between EC and non-EC participants and mealtime activities participation as well as total mealtime activity score. Eating competent students did not differ in cooking with family, cooking with friends or being cookers compared to non-EC students.

Findings show that ecSI 2.0 is related to both school behaviors and mealtime activities. Mealtime activities are also correlated with the summed score of academic troubles (p=0.033). Using a partial correlation to control for mealtime activities, ecSI 2.0 and total school behavior are no longer correlated, and ecSI 2.0 and contextual skills are no longer correlated with the summed score of academic troubles.

4.4.4 Eating Competence and Cooking Self-Efficacy, Fruit and Vegetable Preference and Cooking Attitudes

Eating competent students did not differ from non-eating competent students in cooking self-efficacy, fruit and vegetable preference or cooking attitudes (Table 13). ecSI 2.0™ scores and subscale scores were not significantly related or associated with cooking self-efficacy, fruit and vegetable preference and cooking attitudes (Table 14). A lack of differences between EC and non-EC students in these areas persisted even when controlling for gender using a GLM univariate analysis.
Table 5 Cooking Self-Efficacy, Fruit and Vegetable Preference, Cooking Attitudes and Mealtime Activities Scores for Longitudinal Follow-Up Control and FFF Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Control (n=66)</th>
<th>FFF (n=66)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Self-Efficacy(^c)</td>
<td>36.7 (2.1)</td>
<td>36.5 (2.6)</td>
<td>0.54</td>
</tr>
<tr>
<td>Fruit and Vegetable Preference(^d)</td>
<td>68.1 (2.8)</td>
<td>67.7 (3.7)</td>
<td>0.48</td>
</tr>
<tr>
<td>Cooking Attitudes(^e)</td>
<td>25.9 (1.8)</td>
<td>25.7 (2.0)</td>
<td>0.40</td>
</tr>
<tr>
<td>How often do you make or help to make breakfast(^f)</td>
<td>3.5 (2.6)</td>
<td>3.4 (2.7)</td>
<td>0.87</td>
</tr>
<tr>
<td>How often do you make or help to make lunch</td>
<td>2.7 (2.5)</td>
<td>3.3 (2.8)</td>
<td>0.23</td>
</tr>
<tr>
<td>How often do you make or help to make dinner</td>
<td>2.1 (2.1)</td>
<td>1.9 (1.9)</td>
<td>0.59</td>
</tr>
<tr>
<td>How often do you shop or help to shop for food and other groceries</td>
<td>1.8 (1.8)</td>
<td>1.9 (2.0)</td>
<td>0.74</td>
</tr>
<tr>
<td>How often do you clean up or help to clean up after a meal</td>
<td>3.8 (2.6)</td>
<td>4.6 (2.4)</td>
<td>0.09</td>
</tr>
<tr>
<td>How often do you decide or help to decide what your family would eat for a meal</td>
<td>3.4 (2.3)</td>
<td>3.8 (2.3)</td>
<td>0.36</td>
</tr>
<tr>
<td>Mealtime Activities Total Score(^g)</td>
<td>17.3 (8.9)</td>
<td>18.9 (8.8)</td>
<td>0.32</td>
</tr>
</tbody>
</table>

\(^a\) Table values are mean (standard deviation)  
\(^b\) \( P \) value from Independent T test  
\(^c\) Cooking Self-Efficacy score may range from 8-40  
\(^d\) Fruit and Vegetable Preference score may range from 18-90  
\(^e\) Cooking Attitudes score may range from 6-30  
\(^f\) “How often” questions scores may range from 0-7  
\(^g\) Mealtime Activities total score may range from 0-42
**Table 6** Male versus Female Participant Scores for Cooking Self-Efficacy, Fruit and Vegetable Preference, Cooking Attitudes and Physical Activity Measures

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Male (n=72)</th>
<th>Female (n=60)</th>
<th>P b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Self Efficacy^b</td>
<td>35.3 (2.2)</td>
<td>38.1 (1.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fruit and Vegetable Preference^c</td>
<td>67.3 (3.5)</td>
<td>68.5 (2.9)</td>
<td>0.04</td>
</tr>
<tr>
<td>Cooking Attitudes^d</td>
<td>24.6 (1.5)</td>
<td>27.3 (1.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Metmin</td>
<td>3269.9 (1949.8)</td>
<td>2513.5 (1479.6)</td>
<td>0.01</td>
</tr>
<tr>
<td>MVPA</td>
<td>382.1 (243.3)</td>
<td>299.3 (190.9)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Abbreviations: MVPA = Moderate to Vigorous Physical Activity

METmin = Metabolic Equivalents

^a Table values are mean (standard deviation)

^b P value from independent t-test

^b Cooking Self-Efficacy score may range from 8-40

^c Fruit and Vegetable Preference score may range from 18-90

^d Cooking Attitudes score may range from 6-30

**Significant values are bolded**

**Table 7** Male versus Female Participant Scores for Academic and Social Difficulties Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Male (n=72)</th>
<th>Female (n=60)</th>
<th>P b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since school started this year, how often have you had trouble:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting along with your teachers?</td>
<td>1.8 (1.5)</td>
<td>0.9 (1.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paying attention in school?</td>
<td>2.1 (1.3)</td>
<td>1.5 (1.3)</td>
<td>0.009</td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting your homework done?</td>
<td>2.0 (1.4)</td>
<td>1.6 (1.3)</td>
<td>0.07</td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting along with other students?</td>
<td>1.9 (1.7)</td>
<td>1.1 (1.4)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

^a Table values are mean (standard deviation), answers may range from 0 (never) to 4 (every day)

^b P value from independent t-test

**Significant values are bolded**
**Table 8** Relationship between Eating Competent Scores and Physical Activity Measures

<table>
<thead>
<tr>
<th>Eating Competence and Subscales</th>
<th>Physical Activity Measures</th>
<th>r&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating Attitudes and Behavior</td>
<td>METmin</td>
<td>0.28**</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>METmin</td>
<td>0.35***</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>METmin</td>
<td>0.38***</td>
</tr>
<tr>
<td>Total EC Score</td>
<td>METmin</td>
<td>0.41***</td>
</tr>
<tr>
<td>Eating Attitudes and Behavior</td>
<td>MVPA</td>
<td>0.30***</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>MVPA</td>
<td>0.34***</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>MVPA</td>
<td>0.40***</td>
</tr>
<tr>
<td>Total EC Score</td>
<td>MVPA</td>
<td>0.42***</td>
</tr>
</tbody>
</table>

Abbreviations: METmin = Metabolic Equivalents

MVPA = Moderate to Vigorous Physical Activity

<sup>a</sup> Pearson correlation coefficient

**P<0.01, ***P<0.001

**Table 9** Academic and Social Difficulties Scores for Eating Competent versus Non-Eating Competent Participants<sup>a</sup>

<table>
<thead>
<tr>
<th>Academic and Social Difficulties Questions</th>
<th>EC (n=93)</th>
<th>Not EC (n=39)</th>
<th>P&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since school started this year, how often have you had trouble: Getting along</td>
<td>1.35 (1.53)</td>
<td>1.41 (1.31)</td>
<td>0.84</td>
</tr>
<tr>
<td>with your teachers?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble: Paying</td>
<td>1.72 (1.35)</td>
<td>2.21 (1.24)</td>
<td>0.057&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>attention in school?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble: Getting your</td>
<td>1.69 (1.40)</td>
<td>2.08 (1.35)</td>
<td>0.14</td>
</tr>
<tr>
<td>homework done?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since school started this year, how often have you had trouble: Getting along</td>
<td>1.44 (1.61)</td>
<td>1.69 (1.44)</td>
<td>0.40</td>
</tr>
<tr>
<td>with other students?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: EC = Eating Competence

<sup>a</sup> Table values are mean (standard deviation), answers may range from 0 (never) to 4 (every day)

<sup>b</sup> P value from independent t-test

<sup>c</sup> 0.057 although not significant, shows a trend between EC and Not EC participants
### Table 10 Pearson’s Correlation Coefficients Between Total School Behaviors, Eating Competence, and Subscale Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total ecSI 2.0™ Score</th>
<th>Eating Attitudes and Behavior</th>
<th>Internal Regulation</th>
<th>Food Acceptance</th>
<th>Contextual Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total School Behavior Score</td>
<td>-0.18*</td>
<td>-0.13</td>
<td>-0.03</td>
<td>-0.16</td>
<td>-0.17</td>
</tr>
<tr>
<td>Total Academic Trouble Score</td>
<td>-0.22*</td>
<td>-0.17</td>
<td>-0.07</td>
<td>-0.16</td>
<td>-0.22*</td>
</tr>
<tr>
<td>Total Social Trouble Score</td>
<td>-0.12</td>
<td>-0.08</td>
<td>0.01</td>
<td>-0.14</td>
<td>-0.11</td>
</tr>
</tbody>
</table>

Abbreviation: ecSI 2.0™ is the Satter Eating Competence Inventory 2.0

*Table values are Pearson correlation coefficients

*P<0.05

### Table 11 Pearson’s Correlation Coefficients Between Mealtime Activities, ecSI 2.0™, and Subscale Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total ecSI 2.0™ Score</th>
<th>Eating Attitudes and Behavior</th>
<th>Internal Regulation</th>
<th>Food Acceptance</th>
<th>Contextual Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often do you make or help to make breakfast</td>
<td>0.32**</td>
<td>0.19*</td>
<td>0.09</td>
<td>0.31**</td>
<td>0.31**</td>
</tr>
<tr>
<td>2. How often do you make or help to make lunch</td>
<td>0.29**</td>
<td>0.11</td>
<td>0.08</td>
<td>0.29**</td>
<td>0.34**</td>
</tr>
<tr>
<td>3. How often do you make or help to make dinner</td>
<td>0.35**</td>
<td>0.15</td>
<td>0.24**</td>
<td>0.40**</td>
<td>0.29**</td>
</tr>
<tr>
<td>4. How often do you shop or help to shop for food and other groceries</td>
<td>0.23**</td>
<td>0.06</td>
<td>0.19*</td>
<td>0.26**</td>
<td>0.23**</td>
</tr>
<tr>
<td>5. How often do you clean up or help clean up after a meal</td>
<td>0.14</td>
<td>0.01</td>
<td>-0.05</td>
<td>0.19*</td>
<td>0.22*</td>
</tr>
<tr>
<td>6. How often do you decide or help to decide what your family would eat for a meal</td>
<td>0.20*</td>
<td>0.15</td>
<td>0.07</td>
<td>0.22*</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Abbreviation: ecSI 2.0™ is the Satter Eating Competence Inventory 2.0

*P<0.05, **P<0.01
## Table 12 Differences in Mealtime Activities between Eating Competent and Non-Eating Competent Adolescents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>EC (n=93)</th>
<th>Not EC (n=39)</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you make or help to make breakfast</td>
<td>3.9 (2.6)</td>
<td>2.3 (2.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>How often do you make or help to make lunch</td>
<td>3.4 (2.7)</td>
<td>1.9 (2.3)</td>
<td>0.004</td>
</tr>
<tr>
<td>How often do you make or help to make dinner</td>
<td>2.3 (2.1)</td>
<td>1.3 (1.6)</td>
<td>0.003</td>
</tr>
<tr>
<td>How often do you shop or help to shop for food and other groceries</td>
<td>2.1 (2.0)</td>
<td>1.4 (1.5)</td>
<td>0.04</td>
</tr>
<tr>
<td>How often do you clean up or help to clean up after a meal</td>
<td>4.1 (2.6)</td>
<td>4.3 (2.5)</td>
<td>0.66</td>
</tr>
<tr>
<td>How often do you decide or help to decide what your family would eat for a meal</td>
<td>3.9 (2.3)</td>
<td>2.8 (2.0)</td>
<td>0.008</td>
</tr>
<tr>
<td>Mealtime activities total score</td>
<td>19.7 (9.3)</td>
<td>14.2 (6.1)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Abbreviation: EC = Eating Competence

a Table values are mean (standard deviation)

b P value from Independent T test

c Each “how often” question score may range from 0-7

d Mealtime activities score may range from 0-42

e Significant values are bolded

## Table 13 Cooking Self-Efficacy, Fruit and Vegetable Preference and Cooking Attitudes Scores for Eating Competent Participants versus Non-Eating Competent Participant

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>EC (n=93)</th>
<th>Not EC (n=39)</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Self-Efficacy</td>
<td>36.6 (2.3)</td>
<td>36.6 (2.6)</td>
<td>0.88</td>
</tr>
<tr>
<td>Fruit and Vegetable Preference</td>
<td>68.0 (3.4)</td>
<td>67.5 (3.0)</td>
<td>0.40</td>
</tr>
<tr>
<td>Cooking Attitudes</td>
<td>25.8 (1.9)</td>
<td>26.0 (1.9)</td>
<td>0.53</td>
</tr>
</tbody>
</table>

a Table values are mean (standard deviation)

b P value from independent t-test

c Cooking Self-Efficacy score may range from 8-40

d Fruit and Vegetable Preference score may range from 18-90

e Cooking attitudes score may range from 6-30
Table 14 Relationship between Eating Competent Scores, Subscale Scores and Cooking Self-Efficacy, Fruit and Vegetable Preference and Cooking Attitudes

<table>
<thead>
<tr>
<th></th>
<th>( r^2 )</th>
<th>( p^b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ecSI 2.0</td>
<td>0.07</td>
<td>0.39</td>
</tr>
<tr>
<td>Eating Attitude and Behavior</td>
<td>0.01</td>
<td>0.95</td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>-0.06</td>
<td>0.53</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>0.14</td>
<td>0.12</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>0.09</td>
<td>0.26</td>
</tr>
</tbody>
</table>

**Cooking Self Efficacy**

<table>
<thead>
<tr>
<th></th>
<th>( r )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ecSI 2.0</td>
<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>Eating Attitude and Behavior</td>
<td>0.12</td>
<td>0.17</td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>0.01</td>
<td>0.95</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>0.16</td>
<td>0.07</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>0.14</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Fruit and Vegetable Preference**

<table>
<thead>
<tr>
<th></th>
<th>( r )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ecSI 2.0</td>
<td>-0.001</td>
<td>0.99</td>
</tr>
<tr>
<td>Eating Attitude and Behavior</td>
<td>-0.06</td>
<td>0.47</td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>-0.12</td>
<td>0.19</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>0.08</td>
<td>0.35</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>0.05</td>
<td>0.57</td>
</tr>
</tbody>
</table>

**Cooking Attitudes**

<table>
<thead>
<tr>
<th></th>
<th>( r )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ecSI 2.0</td>
<td>-0.001</td>
<td>0.99</td>
</tr>
<tr>
<td>Eating Attitude and Behavior</td>
<td>-0.06</td>
<td>0.47</td>
</tr>
<tr>
<td>Internal Regulation</td>
<td>-0.12</td>
<td>0.19</td>
</tr>
<tr>
<td>Food Acceptance</td>
<td>0.08</td>
<td>0.35</td>
</tr>
<tr>
<td>Contextual Skills</td>
<td>0.05</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Abbreviation: ecSI 2.0™ is the Satter Eating Competence Inventory 2.0

- \( r^2 \) Pearson correlation coefficient
- \( p \) value from Pearson correlation
- Cooking Self-Efficacy score may range from 8-40
- Fruit and Vegetable Preference score may range from 18-90
- Cooking attitudes score may range from 6-30

### 4.6 Organized Sports

Students who participated in organized sports (n=99) participated in a wide variety of sports including football, track and field, basketball, baseball, cross country, swimming, wrestling, martial arts, lacrosse, tennis, soccer, gymnastics, hockey, color guard, skiing, volleyball, dance, golf, rugby, softball, and cheerleading. Students either participated in no organized sport (n=33), one organized sport (n=42), or 2 or more organized sports (n=57).
Students who participated in organized sports had greater food acceptance compared to those not participating in organized sports (6.1 ±2.3 vs. 5.1 ±2.4, \( P=0.032 \)). Differences were not significant on ecSI 2.0™ scores and other subscales. Participation in organized sport does not differ between EC or non-EC students, nor by gender.

Students who participated in organized sport did not differ from those students who did not participate in organized sports in school academic and social difficulties, mealtime activities, Metmin and cooking food with friends. Table 15 shows significant differences in cooking self-efficacy, fruit and vegetable preference and cooking attitudes and students who participate in organized sports. A higher proportion of students who participated in organized sports cooked with family (83% vs. 58%, \( p=0.003 \)) and were cooks (81% vs. 58%, \( p=0.008 \)). Students who participated in organized sport showed no difference in school behavior than students who did not participate.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Organized Sport Participants (n=99)</th>
<th>Organized Sport Non-Participants (n=33)</th>
<th>( p^b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Self-Efficacy(^c)</td>
<td>36.9 (2.1)</td>
<td>35.5 (2.9)</td>
<td>0.01</td>
</tr>
<tr>
<td>Fruit and Vegetable Preference(^d)</td>
<td>68.2 (3.1)</td>
<td>66.8 (3.5)</td>
<td>0.03</td>
</tr>
<tr>
<td>Cooking Attitudes(^e)</td>
<td>26.1 (1.8)</td>
<td>25.2 (2.2)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

\(^a\)Table values are mean (standard deviation)

\(^b\)\( P \) value from independent t-test

\(^c\)Cooking Self-Efficacy score may range from 8-40

\(^d\)Fruit and Vegetable Preference score may range from 18-90

\(^e\)Cooking attitudes score may range from 6-30
Students who participated in either no organized sports, 1 organized sport, or 2+ organized sports was associated with differences in cooking self-efficacy, fruit and vegetable preference, and cooking attitudes ($P=0.01$, $P=0.03$, $P=0.04$, respectively). Making food with family and cooking were more associated with amount of organized sport participation ($P=0.01$, $P=0.03$ respectively). No significant differences were found in physical activity or mealtime activities based on the amount of organized sport participation. The amount of organized sport participation did not have an association with school behavior.

4.7 School Behavior and Physical Activity

Students who had more trouble getting along with teachers reported higher Metmin/week ($r=.218$, $P=.012$) and MVPA/week ($r=.238$, $P=.006$). No other school behaviors were associated with physical activity measures. As previously reported, compared to female students, male students reported more trouble getting along with teachers and were more physically active. However, Metmin/week was not significantly different by gender when controlling for getting along with teachers.

Participants who had trouble getting along with other students also had trouble paying attention in school ($r=0.65$, $P=<0.001$), getting homework done ($r=0.78$, $P=<0.001$) and getting along with teachers ($r=0.72$, $P=<0.001$). In addition, those who had trouble getting along with teachers had trouble paying attention in school ($r=0.72$, $P=<0.001$).

4.8 Summary

The findings related to the hypotheses of the study are summarized below:

H$_1$. Not refuted, not refuted

H$_2$. Not refuted when controlling for gender, correlational hypothesis was
not refuted  

H₃. Not refuted, not refuted.

H₄. All rejected

H₅. Rejected

H₆. Rejected

H₇. Rejected

This study showed that eating competent persons are more physically active than those not eating competent persons with more Metmin/wk and MVPA/wk and ecSI 2.0™ scores were higher as Metmin/wk and MVPA/wk increased; thus, the alternate hypothesis was not refuted.

When looking at each school behavior question separately, eating competent persons did not have more positive school behavior (defined by lower school behavior scores), rejecting the hypothesis that was alternative to the null. When controlling for gender, there was a relationship found between school behavior scores and academic behavior scores and eating competent status. Therefore, the hypothesis that eating competent persons have better school behavior is not refuted when controlling for gender. The hypothesis that ecSI 2.0 scores were inversely related to school behavior scores is not refuted because higher ecSI 2.0™ were related to lower school behavior scores.

The hypothesis about mealtime activities and eating competence was not refuted because eating competent persons participated in more mealtime activities than non-eating competent persons and ecSI 2.0™ scores were positively related to mealtime activity scores.

Eating competent persons did not differ in FFF outcome scores (cooking self-efficacy, fruit and vegetable preference and cooking attitudes) than non-eating competent persons, and
ecSI 2.0™ scores were not positively related to the FFF outcomes, thus rejecting the proposed hypothesis. Additionally, those in the FFF intervention did not have higher ecSI 2.0™ scores or mealtime behavior scores than the control group rejecting the hypothesis about better performance of the FFF group. Metmin/wk and MVPA/wk were not inversely related to school behavior scores, (i.e., more physically active students did not have better school behavior) rejecting that hypothesis. In fact, the findings were the opposite of the hypothesis because students who had more trouble getting along with teachers reported higher Metmin/week and MVPA/week.
CHAPTER FIVE

Discussion

5.1 Summary

This study of 132 adolescents in 6th-9th grade is one of the few to examine eating competence and its relationship to physical activity, mealtime activities, cooking and diet preferences and school behavior within the adolescent population. Students that were EC or had high ecSI 2.0™ and subscale scores were more physically active and participated in more mealtime activities. Both of these findings were still significant even when controlling for gender. This finding is novel because there is a lack of research specifically focused on eating competence and mealtime activities like cooking, food preparation and food related decision making. Furthermore, eating competent students showed no difference in cooking self-efficacy, fruit and vegetable preference or cooking attitudes than non-eating competent students. Students with higher ecSI 2.0 scores had less trouble paying attention in school and less trouble getting homework done. Although, when controlled for mealtime activities (i.e., making meals, grocery shopping, cleaning up after meals) these associations were no longer significant. When controlling for gender, non-EC students had more difficulties in school than EC students. Participation in the FFF intervention had no association with eating competence or mealtime activities compared to the control group. Lastly, students that were more physically active had more school behavior issues, but students that participated in organized sports showed no difference in school behavior.
5.2 Eating Competence and Associations with Physical Activity, Mealtime Activities and Academic Behavior

In this sample, 70% of students demonstrated eating competence in the survey responses. In contrast, lower levels of eating competence were reported in samples consisting of college students (47%)\textsuperscript{27}, low-income women (39%)\textsuperscript{25} and elderly women (46%).\textsuperscript{23} A higher level of 58% was reported eating competent in Finnish adolescents\textsuperscript{8}, which is lower than this sample of adolescents. The higher percentage of this sample could potentially be due to the responsibilities of adolescents pertaining to food compared with adults. As an adolescent many things related to eating are done as part of a family and the responsibilities of meals do not fall solely on adolescents. An adolescent may report behaviors aligned with EC because their food choices and preparations are decided for them. A student may be relaxed about eating, enjoy eating, and eat until they are satisfied because their families and institutions, such as schools, are making sure regular meals and feeding is occurring. Additionally, the students that participated in the longitudinal follow-up had already completed the survey at an earlier follow-up. Furthermore, only those students whose parents had participated in the earlier portion of the study were invited to participate, although the participants in the longitudinal follow-up were representative of the participants that did not participate in the longitudinal follow-up at baseline. Internal validity may have been affected due to the repeated process of survey completion with students becoming more familiar with the survey.

Low-income women (age 30.7 ±7.5 years, n=512) who were considered eating competent reported higher physical activity (PA) than those that were not eating competent.\textsuperscript{25} This aligns with this study’s report that EC students reported higher Metmin/week and MVPA/week. Physical activity was associated with higher ecSI 2.0 and all the subscale scores with the
exception of the internal regulation subscale. Internal regulation pertains to the ability to tolerate hunger and be confident there will be enough food at mealtimes. Those participating in high amounts of PA may feel they are not confident in knowing there is enough food to satisfy their hunger levels as their energy expenditure creates more hunger and therefore, they may feel less internal regulation.

Both SOC and SDT may provide insights into the underlying factors of the relationship between physical activity and eating competence. A higher SOC is associated with increased PA in adults and eating competence has been linked to SOC in adolescents. A person with a higher SOC may perceive PA as meaningful and comprehensible, understanding the benefits of PA for well-being. They may also view PA as manageable and feel confident in their ability to overcome barriers and develop strategies to exercise. A person with a high SOC may also feel a sense of control and coherence in relation to one’s eating. Additionally, the satisfaction of the three basic needs of SDT, autonomy, competence and relatedness can influence both EC and PA. A person who picks physical activity that aligns with values and interests is practicing autonomy and demonstrating competence through skill mastery and progress withing PA. Physical activity can also foster social connections and a sense of belonging. Those that are EC feel autonomous in their food choices and competent to feed themselves in a comfortable manner. Mealtimes also provide a chance for relatedness. The findings showing the relationship between EC and PA support the idea that a strong SOC or high levels of autonomous motivation, as posited by SDT, may contribute to the positive relationship between eating competence and physical activity.

Participants in organized sports have higher food acceptance, cooking self-efficacy, fruit and vegetable preference and cooking attitudes than those that did not participate in organized sports. Adolescent participation in organized sport was associated with decreased odds of
unhealthy lifestyle habits including irregular meal patterns, high intake of unhealthy food and beverages, and low intake of healthy foods in Norwegian adolescents in junior high and high school (n=13,269) based on self-report surveys.\textsuperscript{40} Data from Project EAT (Eating Among Teens), a survey that “explores socio environmental, personal and behavioral factors of relevance to adolescent food choices, weight status and overall health” reported that middle and high school students in the US (n=4,746) that participated in sports reported healthier eating habits and nutrient intakes than their peers not involved in sports.\textsuperscript{49} Food acceptance is associated with being able to pick and choose foods that are available, being comfortable with eating preferred foods, being able to settle for less preferred foods when necessary and being open to experiencing new foods.\textsuperscript{2} Those participating in sports may be aware that they need an adequate intake of food for their level of physical activity and are comfortable with getting enough food. Through the participation in sports, one may feel able to effectively cope with challenges, set goals, and develop a sense of competence which may enhance perceived control and coherence in life and promote a higher SOC. Furthermore, participation may promote autonomy with individuals feeling like they have a choice and control over their sport participation. Sports can also promote competence through skill development and mastery and relatedness through the social interactions inherent in sports.\textsuperscript{50} Sport participation can support both SOC and SDT within an individual.

The tenets of EC support a relationship with more involvement in mealtime activities and participating in cooking and food related decisions because the skills needed to be eating competent relate to producing mealtimes. Adolescent participants in mealtime practices have shown associations with healthier food selection and dietary patterns.\textsuperscript{36,51} Overall dietary quality was higher among Canadian fifth graders (n=3,398) who helped prepare home meals at least
once a week compared with those who never helped with meal preparation.\textsuperscript{34} Helping with meal preparation at home was positively associated with eating more fruits and vegetables among youth.\textsuperscript{34} The novel findings of this study show that EC is related to cooking and mealtime activities. An eating competent person generally has a positive and relaxed attitude towards food, can eat a variety of foods and feel calm and comfortable in the presence of all food, is able to listen to hunger and fullness cues and has the skills and resources to eat at regular intervals.\textsuperscript{2} Conversely one study of Australian children aged 10-12 (n=155) reported via a parent reported questionnaire that greater family food involvement and frequency of family dinner meals were not consistently associated with dietary patterns.\textsuperscript{32} This could be owing to a difference in culture of Australian and American children. Parenting styles may be different in each culture and may contribute to the findings, as well as differences in social norms that may be present in each country. The association of eating competence and mealtime participation is supported from both the SOC and SDT standpoint. A higher level of EC may contribute to a greater sense of coherence during mealtimes as individuals may feel competent in their eating behaviors and therefore may experience a greater sense of control and manage stress related to food.

Individuals may also be able to cope better during mealtimes with both EC and a strong SOC as they perceive themselves as more equipped to manage stressors associated with eating. Furthermore, individuals with higher EC may feel more autonomous in their food choices and meal behaviors and may engage in mealtime activities out of intrinsic motivation rather than external pressures and rules. Engaging in mindful eating practices, exploring new recipes, or sharing meals with others can contribute to autonomy, competence and relatedness satisfaction.

Studies of families have shown a positive relationship between families having meals together and academic performance.\textsuperscript{30} Academic performance is usually reported by grades \textsuperscript{28,30}
rather than academic behaviors, e.g., getting homework completed or paying attention in school, 
although not getting homework completed and not paying attention would certainly affect grades. The study found no significant relationship between eating competence and school behaviors, but when controlling for gender, non-EC students had more difficulty in school than EC students both overall and academically. This suggests that gender is a confounder and influences the relationship between academics and eating competence. Yet, no significant differences were found between gender and eating competence measures within the study. Other mediating variables may explain the relationship such as individuals who are not eating competent may experience difficulties with concentration and energy levels from their food consumption and this could affect their academic performance. The interplay between gender, eating competence and academic behaviors may be multifaceted and it would be important to explore potential underlying mechanisms that could explain the gender specific relationship in future research.

This study also examined the relationship between academic behavior and eating competence and found that students with higher ecSI 2.0™ scores had less trouble paying attention in school or getting homework done. After controlling for mealtime activities, the relationship between ecSI 2.0™ and trouble paying attention was no longer statistically significant. Therefore, this suggests that mealtime activities is a mediating variable that explains the relationship. Previous studies support positive mealtime habits and strong academic performance suggesting that having healthier mealtime habits is associated with lower trouble with schoolwork.\textsuperscript{28–30} A strong rationale exists for having mealtime behaviors be associated with eating competence. For example, contextual skills include anticipated and skilled actions such as procuring and preparing food, and planning menus, which parallel the planning and time
management actions needed to successfully get homework completed. These findings align with SDT as participating in mealtime activities requires attention, planning and executive function. These skills aid in developing autonomy and competence as similar skills are needed in completing schoolwork. In addition, these findings align with SOC, as participation in mealtime activities supports the tenets of manageability and comprehensibility providing the skills to successfully cope with stress by practicing time management and planning. These are just simply associations though and there are many factors that were not measured in the study that are associated with both mealtime activities and academic performance such as parental support, family structure and nutrition provided at mealtimes. Other factors may be contributing to this association.

Studies examining adult population samples have shown that those who are EC have better food resource management, increased fruit and vegetable consumption and increased awareness and self-efficacy related to nutrition behaviors than non-EC adults. Tanja et al, examined eating competence in a sample of Finnish adolescents, (n=582) aged 10 to 17 using a questionnaire with the following included items: eating competence, eating patterns, perception of body image, weight loss efforts, self-esteem and sense of coherence. Those who were EC reported higher meal frequency, had better diet quality, had greater influence on food selection and preparation at home. The present study did not measure the exact items ascertained in Tanja et al, but did assess parallel constructs, e.g., cooking self-efficacy, fruit and vegetable preference and cooking attitudes. However, the current study did not find a relationship between EC and these behaviors. This difference is striking as the adolescent sample in Tanja et al., was similar in demographics to our sample in terms of ethnicity and gender, although they were older than the present study’s sample. All of the instruments Tanja et al. used were validated and suggest that
the results were meaningful and reliable. As research of adolescents and eating competence is an emerging field, this discrepancy warrants additional research.

5.3 Physical Activity and Academics

Physical activity has been shown to improve academic performance. Physical activity has been shown to improve academic performance. As research of adolescents and eating competence is an emerging field, this discrepancy warrants additional research.

5.3 Physical Activity and Academics

Physical activity has been shown to improve academic performance. Students who are active have either positive or neutral relationships with academic indicators, but the indicators generally used in studies look at academic performance via test scores or GPAs. United States adolescents aged 9-13 years (n=11,235) reported participation in team sports led to lower social problem scores and lower attention problem scores than non-sport participants. Additionally, adolescents in the United States aged 6-11 (n=31,117) who did not participate in sports or clubs were less likely to show respect for teachers and to try and get along with other children. Rather than examining test scores of GPAs, the present study examined academic behaviors such as getting homework done and getting along with teachers. Findings indicated students that are more active have more trouble getting along with teachers, which contradicts previous research. It could be that physical activity affects behavior differently than grades in students.

5.4 Strengths and Limitations

This study had several strengths. The study used validated instruments and the sample size aligns with other studies done on eating competence. Also, students participated in the study for at least one year and answered surveys so they may be comfortable with the process and familiar with the researchers. Students also completed the surveys in real time and did not have to recall information from past years. However, the study is not without limitations. Although the FFF intervention was a longitudinal intervention, the longitudinal follow-up data was cross-sectional data and therefore causality between the outcomes and eating competence
status could not be determined. Since the study relied on secondary data, research was limited to the questions asked and the data collected. Participants were recruited solely through parents who had previously participated in FFF so students that had previously participated without their parents were not included in recruitment. The data were collected from self-report surveys, which always have an inherent risk of information recall bias. The sample population was mostly white and lacked diversity so the results may not be able to be generalized to adolescents as a whole. Although students were from two different school districts, with one having lower SES than the other, no differences were found between districts. This suggests that SES did not impact results and strengthens the generalizability. Also, the students were from Colorado. Finally, only those students whose parents had participated in the earlier portion of the study were invited to participate, meaning the sample could be biased toward more healthful lifestyles and behaviors.

5.5 Conclusion

The present study revealed associations between eating competence, physical activity, and mealtime activities in adolescents. Theoretically, developing eating competence as an adolescent can be important for developing a good relationship with food. Additionally, adolescents today are less active than previous generations and those habits can carry through life. Improper nutrition and lack of adequate physical activity can lead to a myriad of problems that can follow adolescents into adulthood. Findings demonstrate the usefulness of developing eating competent adolescents, as they may participate in mealtime activities more often and be more physically active. Both outcomes contribute to overall health positively and more work on interventions to develop eating competent adolescent to ensure better dietary habits and physical activity levels is important.
Appendix A: Recruitment Emails
Email subject line: Fuel for Fun Follow-Up from your child’s 4th grade.

Dear Parent/Guardian,

When your middle school child was a 4th grader, s/he participated in our project called Fuel for Fun. In fact, you may have participated too. Your child completed surveys, participated in cooking and physical activity lessons during school, and may have participated in some family activities.

We learned a lot about nutrition and physical activity education for youth from your child's (and possibly your) participation. Now we are interested in learning about how you and your child's eating patterns and health have changed since you were in the Fuel for Fun study in the 4th grade. We are also interested in learning how genes can affect health and eating. Knowing this information will help us understand how programs like Fuel for Fun can help students and families be healthier. You and your child can both be in this research and we will pay you and your child for your time.

If you give permission for your child to be in the study, s/he will be asked to attend a data collection event at a site close to you. At this event they will complete an online version of the survey they completed as a 4th/5th grader with some additional questions relevant to adolescents; have their height and weight measured; have the option to also do an online diet recall and an option to swab the inside of your cheek to provide a genetic sample. If they choose to do a diet recall, we will also ask that they later do two more diet recalls online. Your child will be paid for what they do and can get up to $60.

If you do the study you will be asked to fill out an online survey; given the option to do 3 separate online diet recalls; and the option to swab the inside of your cheek to provide a sample for testing. You will be paid for what you do and can get up to $80.

Are you or your child interested in learning more about this study? If so, please follow the link [Insert link.]

Questions? Please feel free to contact the Research Coordinator at healthandnutrition@colostate.edu or call 970-491-2493. A flyer attached to this email includes the information in this email.

Research Coordinator
healthandnutrition@colostate.edu
970-491-2493
Appendix B: Informed Consent
Parental Consent

Consent to Participate in a Research Study
Colorado State University

Thank you for your interest in this study!

This consent form will explain in detail what your child will do and what you will do if you choose to participate. At the end of this form, you can tell us if you agree for your child to do the study and if you also will do the study.

Your child must be in the study for you to also do the study.

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**TITLE OF STUDY:** *Fuel for Fun* Follow-up

**Principal Investigator:** Leslie Cunningham-Sabo, Degree: PhD, Food Science and Human Nutrition, Colorado State University. Email: Leslie.Cunningham-Sabo@colostate.edu, Phone: 970-491-6791.

**Co-Principal Investigator:** Barbara Lohse, Degree: PhD, Wegmans School of Health and Nutrition, Rochester Institute of Technology (RIT). Email: balihst@rit.edu, Phone: 814-880-9977.

**WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH?:**
Your child was in a research project in 4th grade called *Fuel for Fun*. This project took place from 2013 to 2016 and included completing surveys about health and foods and (for some groups) may have also included in-school cooking and tasting lessons and other activities such as playground games. You may also have done some surveys and activities for this project. We would like to learn more about how *Fuel for Fun* may have impacted your health over the last few years. You may have had more than one child participate during this time frame. Any child who took part in *Fuel for Fun* is able to take part in this research.

**WHO IS DOING THE STUDY?**
Leslie Cunningham-Sabo, PhD, of the Food Science and Human Nutrition Department at Colorado State University (CSU) and Barbara Lohse, PhD from Rochester Institute of Technology are doing this study. Xanna Burg, CSU Department of Food Science and Nutrition, is the Research Coordinator. In addition, other faculty and trained graduate and undergraduate students from both institutions will assist with the project.

**WHAT IS THE PURPOSE OF THIS STUDY?**
The purpose of this study is to know how you and your child's eating patterns and health may have changed since you were in the Fuel for Fun study in the 4th grade. We are also interested in learning more about how genes can affect body metabolism, eating behavior, and learning. Researchers have identified eight genes that might be related to health and eating. This study will help us learn more about how genes might play a role in nutrition education. Knowing this information will help us understand how programs
like Fuel for Fun can help students and families be healthier after 4th grade.

**WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?**

This study will take place either at your child’s middle school or another approved-by-you, local location (e.g., CSU). The study will either take place before or after school, during school hours if a good time is known by the principal, on a weekday evening, or on a weekend. If your child is in the study, it will take them about 1 hour to attend the in-person data collection and 40 minutes to complete two more diet recalls online within a week or so. If you do the study, it will take about 1 hour to do the survey, first online diet recall, and cheek swab, and 40 minutes to complete two more diet recalls online within a week or so.

**WHAT WILL I OR MY CHILD BE ASKED TO DO?:**

At the data collection event, your child will be asked to fill out an online survey asking about cooking, fruit and vegetable likes, and physical activity, like the one they filled out in the 4th grade with some additional questions for adolescents. If you gave permission for them to do so, they will measure their height and weight, do 1 online diet recall, and swab the inside of their cheek to provide a sample. The cheek swab will be used to collect DNA to see which variation your child has of the eight genes we think are related to health and eating. The laboratory analyzing their cheek swab will destroy the sample according to their policy, which is to keep for 3 years. Within 1 to 2 weeks, your child will be asked to do 2 more online diet recalls.

If you participate, you will do the following at a location (such as home) and time best for you: fill out an online survey about your eating and physical activity, like the one you may have filled out before; do 3 online diet recalls, and swab the inside of your cheek to provide a sample that you will mail to us at no cost to you. As before, you will do the survey after completing these consent form questions. The survey will take approximately 17 - 20 minutes to complete; you will be paid via PayPal. We will email you directions for completing the diet assessments. Your child will bring home the cheek swab kit with instructions after participating in the data collection event. The cheek swab will be used to collect DNA to see which variation your child has of the eight genes we think are related to health and eating. The laboratory analyzing their cheek swab will destroy the sample according to their policy, which is to keep for 3 years.

**ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY?**

No reasons are known for why you or your child should not be in this study.

**WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?**

We will make every effort to protect you and your child’s privacy by choosing private locations for data collection and using password protected software. Data stored will not include any names. If your child attends a data collection event at a school, school staff will be informed before data collection begins and will be contacted immediately if a student is unhappy about the process.

There is a risk that the cheek swab could be lost in the mail when sending it back to CSU or when CSU mails samples to a lab for processing. The cheek swab kit will only be labeled with unique ID numbers and will not have your name or any other identifying information on it. When you mail your cheek swab back to CSU it will not have your address or name on the package. So even if it is lost in the mail, you will not be identified. To minimize loss of samples in the mail, cheek swabs will be mailed using tracking so research staff can follow delivery of the samples.
All data collection personnel will complete training on protection of participants and about precautions to handle data so that it is kept private. It is not possible to identify all potential risks in these research procedures, but the researchers have taken reasonable safeguards to lessen any known and potential, but unknown, risks.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY?
There may be no direct benefit to you or your child, but the knowledge we gain from you or your child’s participation in this study will be used to learn effective ways of involving nutrition and physical activity in school and to encourage children to eat healthfully and be physically active. If interested, some of the results can be shared with you at the end of the study.

DO I OR MY CHILD HAVE TO TAKE PART IN THE STUDY?
You or your child do not have to take part in this study; being in the study is voluntary. If your child or you decide to be in the study, you may stop being in the study at any time without any penalty.

WHAT WILL IT COST US TO PARTICIPATE?
There is no cost to you and/or your child to be in the study.

WHO WILL SEE THE INFORMATION THAT I GIVE?
We will keep private all research records that identify you, to the extent allowed by law. For this study, we will assign a code to your data so that the only place your name will appear in our records is on the consent and in our data spreadsheet which links you to your code. Only the research team will have access to the link between you, your code, and your data. The only exceptions to this are if we are asked to share the research files for audit purposes with the CSU Institutional Review Board (CSU IRB) ethics committee, if necessary.

In addition, for funded studies like the Fuel for Fun project, the CSU financial management team may also request an audit of research expenditures. For this purpose, only the fact that you participated would be shared, not any research data. When we write about the study to share with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials. We may publish the results of this study; however, we will keep your name and other identifying information private. Your identity/record of receiving payment (NOT your data) may be made available to CSU officials for financial audits.

WILL I RECEIVE ANY PAYMENT FOR TAKING PART IN THIS STUDY?
To show our thanks to your child for taking part in this study, they will receive an online payment of $15 for submitting the survey and height and weight, $10 for each dietary recall completed, and another $15 for providing a cheek swab. If your child completes all activities, they will be paid a total of $60. Online payment will be sent to the email address indicated in this consent form.

To show our thanks to you for taking part in this study, you will receive an online payment of $20 for submitting the survey, $15 for each dietary recall, and another $15 for providing a usable cheek swab. If you complete all activities, you will be paid a total of $80. Online payment will be sent to the email address indicated in this consent form.
WHAT HAPPENS IF I AM INJURED BECAUSE OF THE RESEARCH?
This is unlikely; however the Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

WHAT IF I HAVE QUESTIONS?
Before you decide to take part in the follow up study, you may have questions about the study. If so, you can contact the Research Coordinator at 970-491-2493, or at healthandnutrition@colostate.edu. If you have any questions about you or your child’s rights as a volunteer in this research, contact the CSU IRB at: RICRO_IRB@mail.colostate.edu; 970-491-1553.

Select one of the choices below for your child's participation:

- YES, I consent for my child to be in this study.  (1)
- NO, I do NOT consent for my child to be in this study.  (3)

You've said you do not consent for your child. If you accidentally chose the wrong option and would like to change your consent decision, please click the back button at the bottom of the page.

Children Consent

Hi!
I work for Colorado State University. I study healthy eating and physical activity. My research is about a follow-up to the Fuel for Fun program you were a part of in 4th grade. I am asking you if it is OK that I collect more information.
If you say it is OK, I'll ask you to do a survey, a diet recall asking about what food you ate, measure your height and weight and have you provide a cheek swab sample. It will take about 1 hour today to complete
most of these activities. We will ask that you do 2 more diet recalls at home, which will take about 20 minutes each. We will send you directions for those diet recalls to your email. You will be paid for each of the activities you complete and can get up to $60 if you do them all.

Agreeing to be in this project will not hurt you and you do not have to participate. If you say "yes" now but later change your mind, you can stop being in the research any time by just telling me.

I asked your parents and they said it is OK that you do this. If you want to be in this research and do the survey, measure your height and weight, and do a diet recall, fill in your name below.

 FirstName First name:  

________________________________________________________

 LastName Last name:  

________________________________________________________
Appendix C: Student Survey
Fuel for Fun Follow-up: Cooking with Kids Student Survey

First name: ______ [Required]
Last name: ______ [Required]
Today’s Date: ______

Please click on the box to mark your answer.

1. Do you make food with your family?
   - Yes
   - No

2. Do you make food with your friends?
   - Yes
   - No

3. Do you cook?
   - Yes
   - No

Please click on the box to mark your answer.

<table>
<thead>
<tr>
<th></th>
<th>I really like it.</th>
<th>I like it.</th>
<th>I don’t like it.</th>
<th>I really don’t like it.</th>
<th>I don’t know if I like it.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapes</td>
<td>[Smiley face]</td>
<td>[Smiley face]</td>
<td>[Sad face]</td>
<td>[Sad face]</td>
<td></td>
</tr>
<tr>
<td>Romaine Lettuce</td>
<td>[Smiley face]</td>
<td>[Smiley face]</td>
<td>[Sad face]</td>
<td>[Sad face]</td>
<td></td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>[Smiley face]</td>
<td>[Smiley face]</td>
<td>[Sad face]</td>
<td>[Sad face]</td>
<td></td>
</tr>
</tbody>
</table>
Please click on the box to mark your answer.
<table>
<thead>
<tr>
<th>Item</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>Score 4</th>
<th>Score 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Cucumber</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Broccoli</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Tangerines</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Peas</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Strawberries</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
<td>😐😊😊😊</td>
</tr>
</tbody>
</table>

*Please click on the box to mark your answer.*

1. I can make a snack with fruit.
2. I can make a snack with vegetables.

3. With help, I can use a recipe.

4. I can help my family make a meal.

5. I can make a salad.

6. I can cut up food.

7. I can measure ingredients.

8. I can follow recipe directions.

Please click on the box to mark your answer.
1. How do you feel about cooking?
   - I really like to cook.
   - I kind of like to cook.
   - I don’t like to cook.
   - I really don’t like to cook.
   - I’m not sure if I like to cook.

2. How do you feel about foods that you have helped cook?
   - I really like foods that I have helped cook.
   - I kind of like foods that I have helped cook.
   - I don’t like foods that I have helped cook.
   - I really don’t like foods that I have helped cook.
   - I’m not sure if I like foods that I have helped cook.

3. How do you feel about measuring ingredients?
   - I really like to measure ingredients.
   - I kind of like to measure ingredients.
   - I don’t like to measure ingredients.
   - I really don’t like to measure ingredients.
   - I’m not sure if I like to measure ingredients.

4. How do you feel about making snacks?
   - I really like to make snacks.
   - I kind of like to make snacks.
   - I don’t like to make snacks.
   - I really don’t like to make snacks.
   - I’m not sure if I like to make snacks.

5. How do you feel about making food with your friends?
   - I really like to make food with my friends.
   - I kind of like to make food with my friends.
   - I don’t like to make food with my friends.
   - I really don’t like to make food with my friends.
   - I’m not sure if I like to make food with my friends.

6. How do you feel about making food with your family?
   - I really like to make food with my family.
   - I kind of like to make food with my family.
   - I don’t like to make food with my family.
   - I really don’t like to make food with my family.
   - I’m not sure if I like to make food with my family.
I feel pretty confident about my food preparation skills.

<table>
<thead>
<tr>
<th>How often did you…</th>
<th>Never or rarely</th>
<th>Less than once per week</th>
<th>Once per week</th>
<th>2-3 times per week</th>
<th>4-6 times per week</th>
<th>Every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make or help to make breakfast.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2. Make or help to make lunch.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>3. Make or help to make dinner.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>4. Shop or help to shop for food and other groceries.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>5. Clean up or help clean up after a meal.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>6. Decide or help to decide what your family would eat for a meal.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Below are statements about your eating. Think about each one, then click the box that is the best response for you.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Always</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am relaxed about eating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am comfortable about eating enough.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have regular meals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel it is okay to eat food that I like.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I experiment with new food and learn to like it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the situation demands, I can “make do” by eating food I don’t much care for.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I eat a wide variety of foods.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am comfortable with my enjoyment of food and eating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I trust myself to eat enough for me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I eat as much as I am hungry for.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I tune in to food and pay attention to eating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I make time to eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy food and eating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I consider what is good for me when I eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I plan for feeding myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Intentions

Using a four-point Likert-type scale (1 = Not at all true of me; 4 = Very true of me), five items assessed intentions to adopt healthy eating behaviors. The common stem “In the next three months do you ...” provided a time referent to direct respondents to regard their intentions for the short-term future (e.g. ...do you intend to eat healthier portion sizes during meals - for example, not eating till you feel full).

**Intentions scale**

Please click on the box that is the best answer for you.

In the last THREE MONTHS do you...

<table>
<thead>
<tr>
<th></th>
<th>Not at all true of me</th>
<th>Not very true of me</th>
<th>Somewhat true of me</th>
<th>Very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>...INTEND to eat at least 3 servings of fruit each day?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>2.</td>
<td>...INTEND to eat at least 4 servings of vegetables/salad each day?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>3.</td>
<td>...INTEND to choose low-fat foods and drinks whenever you have a choice?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>4.</td>
<td>...INTEND to choose drinks and foods that are low in added sugar whenever you have a choice?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>5.</td>
<td>...INTEND to eat healthier portion sizes during meals (e.g. not eating till you feel full)?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

**Situation scale**

Click on the box for ONE option to indicate how much you agree or disagree with each statement:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Agree Slightly</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>At home there are healthy snacks available to eat.</td>
<td>SD</td>
<td>D</td>
<td>DS</td>
<td>AS</td>
<td>A</td>
</tr>
<tr>
<td>2.</td>
<td>At home there are healthy drinks available (e.g. cold water in the fridge, sugar-free drinks, reduced-fat milk).</td>
<td>SD</td>
<td>D</td>
<td>DS</td>
<td>AS</td>
<td>A</td>
</tr>
<tr>
<td>3.</td>
<td>At home fruit is always available to eat (including fresh, canned or dried fruit).</td>
<td>SD</td>
<td>D</td>
<td>DS</td>
<td>AS</td>
<td>A</td>
</tr>
<tr>
<td>4.</td>
<td>At home vegetables are always available to eat (including fresh, frozen or canned vegetables).</td>
<td>SD</td>
<td>D</td>
<td>DS</td>
<td>AS</td>
<td>A</td>
</tr>
</tbody>
</table>
**EATING COMPETENCE IN ADOLESCENTS**

**Behavioral strategies**

**Behavioral strategies scale**
Click on the box for ONE option for each question. In the past THREE MONTHS...

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...did you choose reduced-fat options when they were available (e.g. “lite” milk, reduced-fat cheese and yogurt)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...rather than choose sugary drinks such as fruit juice or soft drink, did you choose water or sugar-free drinks such as diet soft drink?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...did you leave food on your plate once you felt full during a meal?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...did you prepare healthy snacks and meals for yourself that were that were low in fat and low in added sugar?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...did you try preparing new recipes for meals and snacks that were low in fat and low in added sugar?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>N</td>
<td>R</td>
<td>S</td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>...did you do things to make eating fruits and vegetables more enjoyable (e.g. try a new recipe or blend fruit to make a fruit smoothie)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Outcome expectations and expectancies scale**
Please click on the box for ONE option to indicate how much you agree or disagree with each benefit and how important each benefit is to you:

1a. Healthy eating can reduce my risk for some illnesses and diseases (e.g. heart disease, diabetes, some cancers, etc).
   - Strongly Disagree
   - Disagree
   - Partly Disagree
   - Partly Agree
   - Agree
   - Strongly Agree

1b. How important is reducing your risk for illness and disease to you?
   - Not at all important
   - Only slightly important
   - Important
   - Extremely important

2a. Healthy eating can help me to feel better physically.
   - Strongly Disagree
   - Disagree
   - Partly Disagree
   - Partly Agree
   - Agree
   - Strongly Agree
2b. How important is feeling better physically to you?
   - Not at all important
   - Only slightly important
   - Important
   - Extremely important

3a. Healthy eating can help me to control my weight.
   - Strongly Disagree
   - Disagree
   - Partly Disagree
   - Partly Agree
   - Agree
   - Strongly Agree

3b. How important is controlling your weight to you?
   - Not at all important
   - Only slightly important
   - Important
   - Extremely important

4a. Healthy eating (e.g. not skipping meals) can help to improve my concentration at school.
   - Strongly Disagree
   - Disagree
   - Partly Disagree
   - Partly Agree
   - Agree
   - Strongly Agree

4b. How important is improving your concentration at school to you?
   - Not at all important
   - Only slightly important
   - Important
   - Extremely important

5a. Healthy eating can help me to feel more energetic throughout the day.
   - Strongly Disagree
   - Disagree
   - Partly Disagree
   - Partly Agree
   - Agree
   - Strongly Agree

5b. How important is feeling more energetic to you?
   - Not at all important
   - Only slightly important
   - Important
   - Extremely important
Eating disorder questions

1. How much do you worry about the size and/or shape of your body?
   - Not at all
   - A little
   - Somewhat
   - Quite a bit
   - Very much

Stress scale

1. Using a scale of 1 to 10 where 1 means “no stress” and 10 means “an extreme amount of stress” how much stress would you say you have experienced in the last year?
   [Insert scale 1-10]

This section is about physical activity. Please click on the box for the number of days in a week and how many minutes each day that best describes how much activity you do when you’re NOT in school.

**Hard activity** (It makes my heart beat quickly, and makes me sweat.)

Examples are: running, jogging, fast bicycling, rollerblading, paddling, fast swimming, soccer, basketball, football, martial arts

1. **How many days** a week do you do this?
   *Remember, only count hard activity done out of school.*

   0 1 2 3 4 5 6 7

2. **How many minutes** each day?
   *Remember, only count hard activity done out of school.*

   0 10 20 30 40 50 60+

**Medium activity** (It doesn’t make me tired, and makes me sweat just a little.)

Examples are: fast walking, slow bicycling, easy swimming, weight lifting, baseball, softball, tennis, volleyball

3. **How many days** a week do you do this?
EATING COMPETENCE IN ADOLESCENTS

Remember, only count medium activity done out of school.

0 1 2 3 4 5 6 7

4. How many minutes each day?
Remember, only count medium activity done out of school.

0 10 20 30 40 50 60+ 60+

Easy activity (It makes me use little effort, and doesn’t make me sweat.)

Examples are: slow walking, bowling, fishing, golf, yoga.

5. How many days a week do you do this?
Remember, only count easy activity done out of school.

0 1 2 3 4 5 6 7

6. How many minutes each day?
Remember, only count easy activity done out of school.

0 10 20 30 40 50 60+ 60+

7. How many hours a day do you spend watching television, playing video games and using a computer, tablet, or phone (not for homework)?

0 1 2 3 4 5 6 7 8 9 10+

Question 8 is about regular physical activity. Regular physical activity is:

- Activity that happens for 30 minutes at a time (or more) in a day.
- It must be 5 days (or more) in a week.
- It should be enough to make your heart beat faster and/or make you breathe harder…like walking fast, biking, swimming, paddling, and ice-skating.

8. Do you do regular physical activity, as it is described above? Please click on the box to mark your answer.

• No, and I do not plan to in the next 6 months.
• No, but I plan to in the next 6 months.
• No, but I plan to in the next 30 days.
• Yes, I have been, but for less than 6 months.
• Yes, I have been for more than 6 months.
9. Do you participate in any organized sports or physical activities during the year, (e.g. at school or a community group)?
   • Yes: Please describe when and which sports/activities __________
   • No

Selected Questions from the National Longitudinal Study of Adolescent Health related to adjustment in school.

Since school started this year, how often have you had trouble:

1. Getting along with your teachers?
   1. Never
   2. Just a few times
   3. About once a week
   4. Almost every day
   5. Every day

2. Paying attention in school?
   1. Never
   2. Just a few times
   3. About once a week
   4. Almost every day
   5. Every day

3. Getting your homework done?
   1. Never
   2. Just a few times
   3. About once a week
   4. Almost every day
   5. Every day

4. Getting along with other students?
   1. Never
   2. Just a few times
   3. About once a week
   4. Almost every day
   5. Every day

10. [Open-ended] Please tell us if there is anything else that may be influencing what you eat, your health, or your activity level.

Thank you so much for completing this survey!
References


22. Lohse B, Cunningham-Sabo L. Eating competence of hispanic parents is associated with attitudes and behaviors that may mediate fruit and vegetable-related behaviors of 4th grade youth. *Journal of Nutrition*. 2012;142(10):1903-1909. doi:10.3945/jn.112.164269


25. Lohse B, Arnold K, Wamboldt P. Evaluation of About Being Active, an online lesson about physical activity shows that perception of being physically active is higher in eating


49. Croll JK, Neumark-Sztainer D, Story M, Wall M, Perry C, Harnack L. Adolescents Involved in Weight-Related and Power Team Sports Have Better Eating Patterns and Nutrient Intakes
