

Assessing The Effectiveness of a Self-Efficacy and Dissonance-Based Intervention on the Nutrition Knowledge and Acceptance of Nutrition Misconceptions of 8th Grade Students

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Abstract

Background: Disordered eating attitudes and behaviors, nutrition-related knowledge deficits, and high acceptance rates of nutrition related misinformation concerning harmful weight control behaviors and attitudes are extremely prevalent among adolescents.

Objective: To assess the effectiveness of a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating in improving nutrition related knowledge and skills, and in reducing the acceptance of nutrition misinformation related to harmful disordered eating and weight control attitudes.

Methods: A quasi-experimental design study and pre/post-intervention assessments were used to measure the effectiveness of a 3-session self-efficacy and dissonance-based intervention program in improving the nutrition related knowledge and skills, and in reducing the acceptance of nutrition misconceptions related to harmful weight control behaviors and attitudes of 8th grade physical education (PE) students (n=4) voluntarily participating in the fitness unit. Wilcoxon signed rank tests were used to assess for significant changes in nutrition-related knowledge/skills and the acceptance of nutrition related misconceptions.

Results: The intervention did not yield statistically significant improvements in nutrition-related knowledge/skills or significant reductions in the acceptance of nutrition misconceptions related to harmful disordered eating and weight control attitudes.

Conclusion: The discrepancies between the findings of the current study and prior studies regarding of the effectiveness of the intervention's theoretical framework in eliciting improvements in nutrition knowledge, skills, and attitudes related to disordered eating, may suggest that the current study's exposure times were insufficient, and the sample size was too small to determine statistical significance.

Introduction

Adolescence is characterized by significant and rapid biological, cognitive, and sociocultural changes.¹ As a result, adolescents are increasingly vulnerable to health-related behaviors and require adequate nutrition to support healthy development and growth.^{1,2,3,4} These factors have the potential to negatively impact adolescent's attitudes and behaviors related to eating, which is problematic as adolescents are already known to have undesirable health related behaviors, poor levels of nutrition-related knowledge, and are increasingly susceptible to

nutrition misinformation. Many of the undesirable health related behaviors practiced by adolescents, coupled with their poor levels of nutrition related knowledge, are contributing to the increasing prevalence of adolescents that are obese and overweight, which has ultimately resulted in a national epidemic.⁵

In addition to the severe physical health-related consequences associated with adolescent obesity, there are also many significant psychosocial implications linked to adolescent obesity.¹ The psychosocial implications related to obesity are magnified during adolescence, as this is a time where appearance and fitting in are of utmost importance.¹ This results in adolescents having negative perceptions of their body image, engaging in harmful weight control behaviors, and experiencing extreme pressures to be thin.¹ To explain the link between obesity and disordered eating behaviors among the adolescent population, research has demonstrated that as body fat increases, self-esteem decreases, and this places adolescents at an increased risk for developing eating disorders.¹

A needs assessment was conducted on 8th grade students who were enrolled in physical education (PE) class at Mount Anthony Union Middle School (MAUMS) to assess the nutrition-related knowledge, acceptance of nutrition-related myths concerning harmful weight control behaviors and attitudes, and the prevalence of disordered eating behaviors and attitudes among the participants.⁷ The findings of the study indicated that disordered eating attitudes and behaviors are extremely prevalent among adolescents; there are significant knowledge deficits among adolescents regarding the components of a balanced diet and the function and sources of specific nutrients; and the adolescent population is increasingly susceptible to accepting nutrition related misinformation to be true, especially information concerning weight loss, dieting, and achieving thinness.⁷

Addressing the undesirable and harmful health related behaviors of adolescents is crucial due to both the serious consequences related to these behaviors, such as the development of chronic diseases or full-blown eating disorders, and the reality that the majority of the nutrition- and health-related behaviors adopted and reinforced during adolescents are carried into adulthood.^{1,2,4} Previous interventions have successfully addressed the nutrition knowledge deficits and undesirable health and nutrition related behaviors of adolescent females, by applying the social learning theory in an effort to elicit self-efficacy, as knowledge alone has proven to not be sufficient in influencing behavior changes.⁸ Self-efficacy can be described as one's own belief in their ability to utilize the knowledge and skills they have to behave a certain way or carry out a certain task.

The cognitive dissonance theory has served as the framework for past interventions aimed towards preventing and addressing disordered eating behaviors and attitudes.⁹ This behavior change theory is based on the principles that when individuals experience disagreeing perceptions, behaviors, and attitudes, this elicits dissonance, resulting in feelings of discomfort, and further resulting in the motivation to change to promote cognitive consistency.¹⁰ An existing study demonstrated how a dissonance-based intervention successfully elicited changes in attitudes related to disordered eating behaviors, eating disorders, intuitive eating, and body weight in young adult females (ages 18-24).⁹ Other studies have also successfully demonstrated the use of intuitive eating principles to address disordered eating behaviors and attitudes in young adults and adolescents.¹¹ This non-diet approach to eating focuses on the reliance of hunger and satiety cues to guide eating behaviors, rather than emotional cues, in hand replacing feelings of guilt associated with eating with feelings of pleasure.¹¹ An existing study has demonstrated the ability of an intervention based on the principles of intuitive eating to improve

the psychosocial health of and reduce disordered eating attitudes and behaviors among adolescents.¹¹

While past interventions have demonstrated the application of the cognitive dissonance theory, social learning theory, and intuitive eating principles independently in improving nutrition-related knowledge and reducing harmful weight control behaviors and attitudes among adolescents and young adults, there are no existing studies that have assessed the effectiveness of the combination of the cognitive dissonance theory, social cognitive theory, and intuitive eating principles in improving nutrition related knowledge and reducing the acceptance of nutrition related myths related to disordered eating behaviors and attitudes among 8th grade students. Adolescents in 8th grade (approximately 12-14 years old) represent an increasingly vulnerable population as they near the transition into high school, where they will experience increased freedoms regarding their food choices and other health-related ventures.⁷

To address this gap in existing literature and the needs of this vulnerable population, the purpose of the current quasi-experimental design study was to assess the effectiveness of a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating in improving nutrition related knowledge and skills and in reducing the acceptance of nutrition-related misinformation concerning harmful disordered eating and weight control attitudes in 8th grade PE students.

Methods

Study Design

A quasi-experimental design study and pre/post-intervention assessments were used to measure the effectiveness of a 3-session self-efficacy and cognitive dissonance-based intervention program, which incorporated the principles of intuitive eating, in improving the nutrition related knowledge and skills, and in reducing the acceptance of nutrition misconceptions related to harmful weight control behaviors and attitudes of 8th grade physical education (PE) students voluntarily participating in the fitness unit. The study received approval from the SUNY Oneonta IRB and the administrative staff from the participating school. All study participants provided both written parent consent and assent.

Intervention

The intervention consisted of three separate sessions lasting 30-minutes each, which were held during regular PE class times, and took place at Mount Anthony Union Middle School (MAUMS) in Bennington, VT over the course of two consecutive weeks. The first week consisted of one 30-minute session and then the following week consisted of two separate 30-minute sessions, with one day in between each session during the second week. All students who voluntarily selected to participate in the fitness unit during PE class participated in the sessions, however data was only collected on students who provided both written parent consent and assent.

The intervention was built upon the theoretical frameworks of both the social cognitive learning theory and the cognitive dissonance theory, in addition to the principles of intuitive eating. The social cognitive theory was applied to elicit self-efficacy amongst participants, specifically in terms of their ability to build a balanced meal using the knowledge and skills

learned and built upon during the intervention sessions. The cognitive dissonance theory was applied using the principles of intuitive eating to elicit changes in attitudes, specifically the harmful attitudes related to disordered eating and weight control behaviors. Intuitive eating principles were applied to introduce a non-dieting approach to eating, which focused on relying on internal hunger and satiety cues to guide eating behaviors, and these principles directly refuted the common nutrition related misconceptions believed to be true by adolescents.

Each intervention session included at least one or a combination of the following elements: PowerPoint presentations, hands-on food demonstrations, food tastings, interactive physical activity demonstrations, an interactive technology-based game, group discussions, and supplementary educational handouts. The first session focused on providing the knowledge and developing the skills necessary to build a healthy and balanced diet, specific to the adolescent life stage, and included a brief education lesson using a PowerPoint Presentation, a hands-on food demonstration, the opportunity to taste different food, and a group discussion. The second session focused on the physical activity guidelines for the adolescent population, the benefits of physical activity, and introductions to different ways to be physically active within their community. The components included in this second session were a brief education lesson using a PowerPoint presentation, physical activity demonstrations with opportunities to participate, and a group discussion. The third session was focused on rejecting the commonly believed nutrition misconceptions regarding disordered eating attitudes and the principles of intuitive eating. The components of the third session included a peer interactive technology-based game and an accompanying group discussion.

Participants

Of the 150, 8th grade students participating in the fitness unit in PE class at MAUMS, 6 students returned consent forms to the principle investigator and the PE teacher (4% participation rate). The response rate for the study was 83.33%, in which 5 out of the 6 students that returned consent forms provided assent and completed the pre-intervention assessments. One student did not complete the pre-assessment because they were absent on the day the pre-assessment surveys were administered. One student was absent on the day the final intervention session was conducted and the post intervention assessment surveys were administered, resulting in 4 participants completing the study and being included in the data analysis (66.67% completion rate).

The participants in the study were 8th grade physical education (PE) students in the 9:15 AM PE class at Mount Anthony Union Middle School in Bennington, VT. Participants were recruited from the students that voluntarily selected to participate in the fitness unit during PE class. Approximately 5 weeks prior to the initiation of the intervention, the principle investigator presented a brief overview of the intervention and distributed consent forms to all students who selected to participate in the fitness unit to be delivered to their parent or guardian to obtain written consent. Once consent forms were returned to the principle investigator, subsequent assent forms were distributed to the students by the principle investigator to obtain written assent. The MAUMS PE teacher was present when written assent was obtained.

Measures

To measure the effectiveness of the intervention, the participants were asked to fill out the following assessments prior to the intervention and immediately after the intervention: *Building a Balanced Meal Survey* and *Nutrition Concepts: Myth of Fact Survey*. The *Building a Balanced Meal Survey* (See **Appendix A**) was adapted from a preexisting nutrition knowledge quiz developed for students in grades 4-12 and assessed the nutrition related knowledge and skills of the participants related to the United States Department of Agriculture (USDA) MyPlate food groups. This assessment included 6 questions, 4 of which were multiple choice questions (questions #3-6), and 2 questions required the student to write in their own answer, and these two questions contained multiple parts (question #1-2). The *Nutrition Concepts: Myth or Fact Survey* (See **Appendix B**) was developed based on information provided in the article “Busting the Myths Around Teen Nutrition” published by Seeds of Hope, an eating disorder treatment initiative, and assessed the acceptance of common nutrition misconceptions related to dangerous attitudes regarding eating and exercise. This assessment included 9 false statements and each student was asked to indicate whether each statement was true or false. Acceptance, which was measured by indicating the statement was true, of any of the statements, indicated that the participant may have a dangerous or disordered attitude toward eating and exercise, and may be at risk for an eating disorder. It took participants approximately 20 minutes for both assessments to be completed.

Data Analysis

To assess if there was a significant change in the nutrition related knowledge and skills or in the acceptance of nutrition related misconceptions among the participants following the intervention, the quantitative data from the pre/post-intervention assessment was analyzed using SPSS version 27. Due to the study’s small sample size, the Wilcoxon signed rank test, a non-parametric statistical analysis test, was used to determine if there was a significant improvement in pre/post-assessment mean group scores for nutrition knowledge and skills or a significant reduction in the acceptance of nutrition related misconceptions. To determine statistical significance, the level for significance was set at $P < 0.05$. Mean group scores and standard deviations were used to summarize data from both pre/post-intervention assessments.

Results

Nutrition Knowledge and Skills

(See **Appendix A** for *Building a Balanced Meal Survey* and survey items)

The pre- and post-intervention results from the *Building a Balanced Meal Survey* are summarized in **Table 1**. A Wilcoxon signed rank test was conducted to compare mean nutrition knowledge and skills scores related on pre- and post-intervention assessments, which assessed their knowledge regarding and their ability to build balanced meals. There was no significant difference in pre-intervention ($M= 63.15, S=40.08$) and post-intervention ($M= 92.1, S= 9.12$) mean assessment scores (see **Figure 1**) [$p<0.05$]; $z= -1.826, p=0.068$]. The mean difference in test scores was 28.95 with a 95% confidence interval that ranged from -93.27 to 35.37, indicating

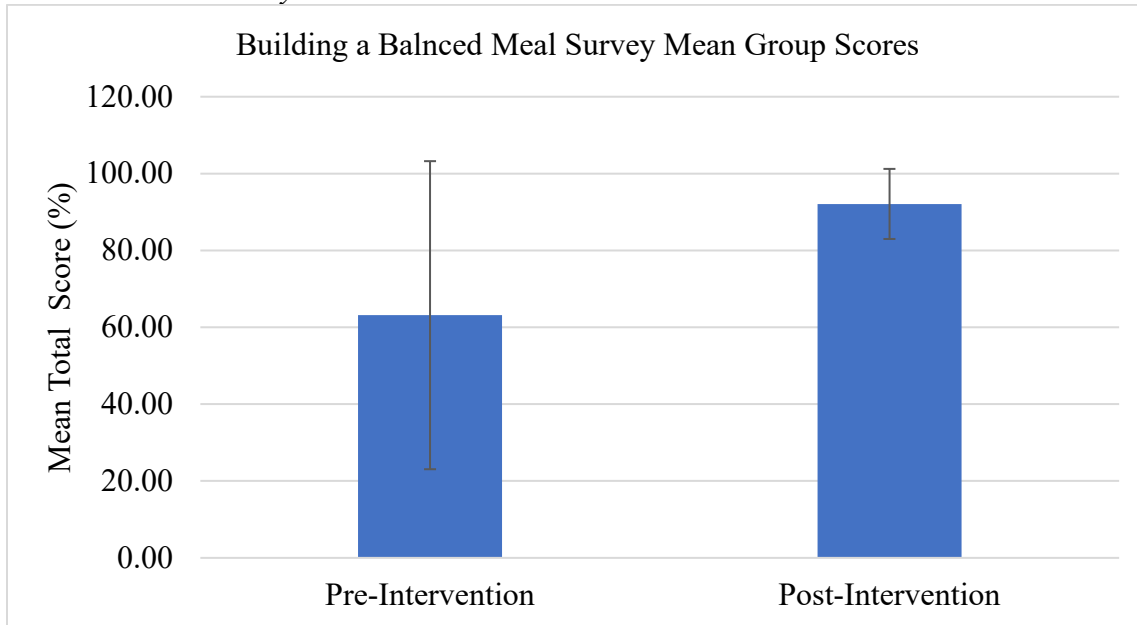
there was not a statistically significant difference in pre- and post-intervention nutrition knowledge and skill scores.

Table 1. Pre- and Post-Intervention mean group scores from the *Building a Balanced Meal Survey*

	Sample Size (n)	Mean (M) Group Percentage Score (%) ^a (n=4)	Sample Standard Deviation (S)	95% Confidence Interval (CI)
Pre- Intervention	4	63.15	40.08	23.87-102.43
Post- Intervention	4	92.1	9.12	83.16-101.04

^aThe mean group score is based on average points earned out of 19 possible points for each participant. Each correct response or selected answer earns 1 point; survey items #3-6 were worth 1 point; survey item #1 contained 5 components and was worth 5 points (each correct response was worth 1 point); survey item #2 contained 10 components and was worth 10 points (each correct response was worth 1 point).

Figure 1. Changes in the mean group scores from the pre-and post-intervention *Building a Balanced Meal Survey*



The figure displays mean and standard deviation. Mean group percentage scores are based on the average points earned by participants (n=4) out of the total possible points (19). The changes in mean group scores from the pre- and post-intervention assessment were not statistically significant ($p = 0.068$).

Acceptance of Nutrition-Related Misconceptions

(See **Appendix B** *Nutrition Concepts: Myth or Fact Survey* and survey items)

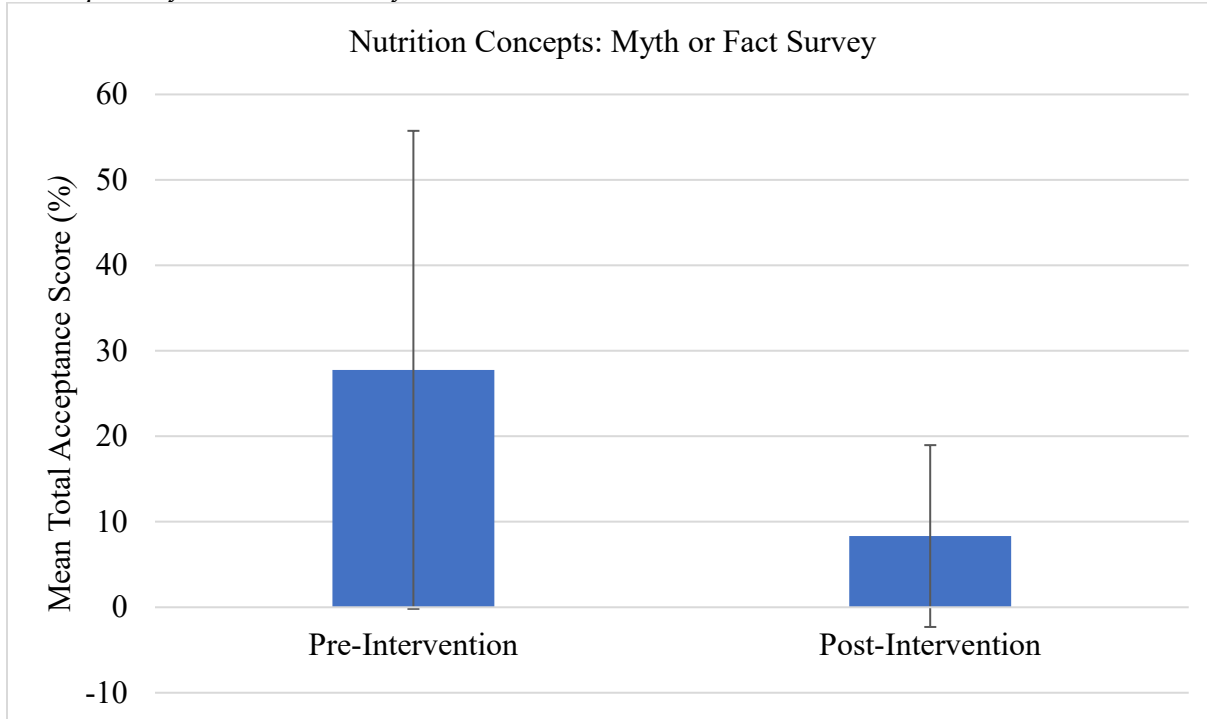
The pre- and post-intervention results from the *Nutrition Concepts: Myth or Fact Survey* are summarized in **Table 2**. A Wilcoxon signed rank test was performed to compare mean acceptance scores of nutrition-related misconceptions associated with harmful disordered eating and weight control behaviors and attitudes on pre- and post-intervention assessments. There was no significant difference in pre-intervention (M= 27.78, S=27.96) and post-intervention (M= 8.33, S= 10.64) mean acceptance scores (see **Figure 2**) [($p < 0.05$); $Z = -1.342$, $p = 0.180$]. The mean difference in percent acceptance scores on the *Nutrition Concepts: Myth or Fact Survey* was 19.45 with a 95% confidence interval that ranged from -31 to 70.23, indicating there was not a statistically significant difference in pre- and post-intervention misconception acceptance scores.

Table 2. Pre- and Post-Intervention mean group scores from the *Nutrition Concepts: Myth or Fact Survey*

	Sample Size (n)	Mean (M) Group Percentage Score (%) ^a (n=4)	Sample Standard Deviation (S)	95% Confidence Interval (CI)
Pre- Intervention	4	27.78	27.96	0.38-55.18
Post- Intervention	4	8.33	10.64	-2.09-18.75

^aPercentages are based on the number of misconception statements that participants (n=4) indicated to be true out of a total of 9 false statements included on the survey.

Figure 2. Changes in the mean group scores from the pre-and post-intervention *Nutrition Concepts: Myth or Fact Survey*



The figure displays mean and standard deviation. Mean group percentage scores are based on the average number of misconceptions accepted to be true by participants (n=4) out of 9 total false statements on the survey. The changes in mean group percent acceptance scores from the pre- and post-intervention assessment were not statistically significant ($p = 0.180$).

Discussion

The current study showed that a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating did not yield statistically significant improvements in nutrition related knowledge and skills, or significant reductions in the acceptance of nutrition misconceptions related to harmful disordered eating and weight control attitudes in 8th grade students.

The lack of the statistical significance in the study's findings could be attributed to the studies small sample size (n=4). Inadequate sample sizes can make it extremely difficult to detect meaningful effects, resulting in potentially inaccurate study conclusions, due to type I and II errors.¹² Future research should assess the effectiveness of a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating in improving nutrition related knowledge and skills, and in reducing the acceptance of nutrition misinformation related to harmful disordered eating and weight control attitudes using a larger sample size of 8th grade students. Due to a lack of similar existing studies that assess the effectiveness of an intervention based on the social learning theory, the cognitive-dissonance theory, and the principles of intuitive eating, studying a larger sample size would help to determine if the validity of the findings of the current study were compromised by the small sample size.

In contrast to the current study, prior research assessing the effectiveness of a social learning theory, specifically self-efficacy, and school-based intervention, found that such interventions are effective in increasing both food and nutrition-related knowledge and skills of middle schoolers.^{13,14} Similar to the current study, these studies identified that knowledge alone is not effective in improving food literacy, which includes the knowledge and skills needed to make informed decisions related to food and nutrition behaviors, such as selecting, preparing, and consuming balanced meals.¹³ One study in particular demonstrated the effectiveness of an 18 session intervention based on the social learning theory in improving the nutrition-related knowledge and skills of middle schoolers with a study population of 566 students.¹³ A different study found that a 20-hour school-based intervention built upon the framework of the social learning theory, which emphasized self-efficacy, significantly improved the participants nutrition related knowledge scores from 70% to 86%, a 22.86% increase.¹⁴ The study had a sample size of 181 students and the intervention incorporated elements similar to those included in the current study, such as nutrition education lectures, group discussions, games, and hands-on experiential learning activities.¹⁴ In comparison, the current study demonstrated a 45.84% increase in group mean nutrition knowledge and skill scores following the intervention, however based on the current study's protocol, this change in nutrition knowledge and skills was found to be not significant. The intervention protocol for the current study is similar to existing studies in that it was conducted in a school-based setting, however, the sample size and the duration of the intervention were significantly reduced in the current study. The 3-session duration of the current study, which amounts to only 90 total minutes of exposure, may not be sufficient enough to effectively improve nutrition-related knowledge and skills. The small sample size of the current study could potentially explain the non-significant differences in pre- and post-intervention nutrition knowledge and skills concerning the components of a balanced meal and ability to build a balanced meal. This finding supports the need for future research using a larger sample size.

The current study found that the intervention, which incorporated the social learning theory, cognitive-dissonance theory and principles of intuitive eating, resulted in a 70.01% (not significant) reduction in the acceptance of nutrition-related misconceptions associated with harmful discorded eating and weight control behaviors and attitudes. Existing research has found intuitive eating principles to be successful interventions for adolescents at risk for or those that have eating disorders, in decreasing disordered eating behaviors and attitudes.^{15,16,17,18} A previous study found that the adoption of intuitive eating principles was associated with significant decreases in disordered eating behaviors in adolescents.¹⁶ This study had a much larger sample size (n=1,419) than the current study (n=4).¹⁶ It is hypothesized that intuitive eating is successful in treating and preventing disordered eating behaviors and eating disorders through directly countering diet culture to promote behavior change, consequently eliciting dissonance.¹⁵ This mechanism of behavior change can be explained by the cognitive-dissonance theory, which was a component in the theoretical framework for the intervention assessed in the current study. An existing cognitive-dissonance based disordered eating prevention intervention program, known as *The Body Project*, has shown to be effective in significantly improving the following in various existing studies: eating disorders, disordered eating behaviors and attitudes, thin-idealization, dieting, body dissatisfaction, pressures to be thin, and dietary restraints.¹⁹ In comparison to the current study, these studies had larger sample sizes (n \geq 20), and many of the studies had longer exposure and follow-up times. In the current study, a single 30-minute session was dedicated to incorporating the intuitive eating principles and the cognitive-dissonance theory to address the high acceptance of nutrition misconceptions related to harmful disordered eating

and weight control behaviors and attitudes. The short exposure time in the current study could potentially explain the discrepancies between the findings of the current study and existing studies in the effectiveness of intuitive eating principles and the cognitive dissonance theory in reducing disordered eating behaviors and attitudes. Future research with larger sample sizes and longer exposure times is needed to evaluate the effectiveness of the intervention in the current study in reducing the acceptance of such nutrition misconceptions among adolescents.

Strengths & Limitations:

A strength of the current study includes the theoretical framework that the intervention is built upon, which incorporates a combination of theories that have successfully shown to elicit desirable changes in nutrition related knowledge and skills, in addition to attitudes and behaviors related to harmful disordered eating and weight control behaviors and attitudes. The limitations of the study include the low participation rate (4%), which resulted in a small sample size (n=4). Small sample sizes can compromise the reliability and the power of the study's findings, due to larger margins of error and standards of deviation. The small sample size can introduce the potential for a type II error, in which the results of the intervention are falsely determined to be not statistically significant. Additionally, not all participants that enrolled in the study attended all intervention sessions, and as a result were not included in the data analysis. This was due to student absences. The use of self-selected sampling is another limitation in the findings of the study, resulting in the potential for a biased and unrepresentative sample. The intervention was conducted during the students PE class time during school hours, and this limited the duration of the sessions to 30 minutes. The short sessions resulted in short exposure times, and longer exposure times may be more effective in eliciting changes in nutrition knowledge/skills and acceptance of nutrition related misconceptions concerning disordered eating and harmful weight control attitudes and behaviors.

Conclusion & Recommendations for Further Research

The current study shows that a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating was not effective in yielding significant improvements in nutrition related knowledge and skills and significant reductions in the acceptance of nutrition misinformation related to harmful disordered eating and weight control attitudes in 8th grade students. The discrepancies in the findings of the current study and prior studies in terms of the effectiveness of the intervention's theoretical framework in eliciting improvements in nutrition knowledge, skills, and attitudes related to disordered eating, may suggest that the current studies sample size was too small to determine statistical significance. Additional research is needed to study the effectiveness of a self-efficacy and dissonance-based intervention that incorporates the principles of intuitive eating in improving the nutrition knowledge and skills, and in reducing the acceptance of harmful nutrition misconceptions in a larger study sample of 8th grade students to reduce the risk of type I and type II errors occurring. The effect of longer exposure times should also be evaluated in future studies.

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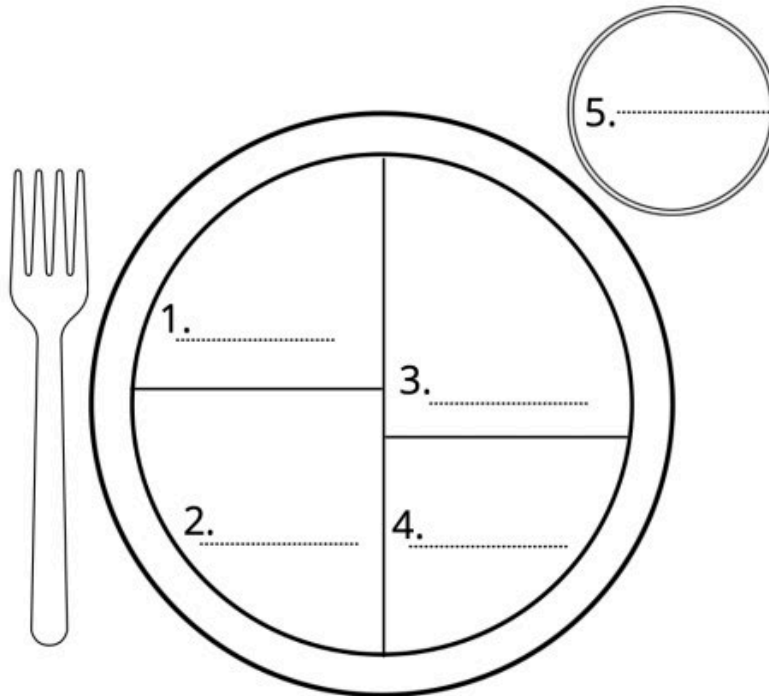
Appendix A

Participant Identification # _____

Building a Balanced Meal Survey

This assessment contains questions about the United States Department of Agriculture (USDA) MyPlate food groups. We would like to assess your knowledge of the MyPlate food groups, sources of food that belong in each food group, and the nutrients and the functions of the nutrients found in these foods. This is not a test, and you will not be graded on your answers. You are not required to answer every question on this survey and are free to skip any questions that you do not feel comfortable answering. Circle the letter next to the best response for each question or write in your response on the blank lines next to each questions.

1. Label the plate with the different MyPlate food groups.



2. Make a meal with all five food groups and list which food groups the food belongs to.

- a. Food: _____ Food Group: _____
- b. Food: _____ Food Group: _____
- c. Food: _____ Food Group: _____
- d. Food: _____ Food Group: _____
- e. Food: _____ Food Group: _____

3. Which food is not a whole grain?

- a. White rice
- b. Oatmeal
- c. Millet
- d. Popcorn

4. How does fiber help our body?

- a. Helps build strong bones
- b. Helps with our eyesight
- c. Helps have normal bowel movements

5. Which food is not in the dairy group?

- a. Soy milk
- b. Eggs
- c. Milk
- d. Cottage cheese

6. What nutrient is in whole fruits and vegetables but not normally in juice?

- a. Vitamin C
- b. Calcium
- c. Protein
- d. Fiber

Assessment adapted from:

Jacqueline. MyPlate Nutrition Quiz for Grades 4-9. Health Beet. <https://healthbeet.org/myplate-nutrition-quiz-for-grades-4-9/>. Published November 12, 2021. Accessed September 11, 2022.

Appendix B

Participant Identification # _____

Nutrition Concepts: Myth or Fact Survey

Below are nine nutrition related statements that we would like you to read, and then indicate whether you think that statement is true or false. This is not a test, and you will not be graded on your answers. To indicate whether you believe the statement is true or false, please write “true” or “false” in the empty box next to each statement. You are not required to answer every question on this survey and are free to skip any questions.

Statement	True or False
1. I should always choose to eat low-calorie foods	
2. Skipping meals will help me lose weight	
3. Certain food groups are bad for me, and I should avoid eating them	
4. Diet soda and other sugar-free foods are better for me	
5. I can't eat any desserts or treats if I want to be healthy	
6. Fad diets are popular, so they must work	
7. Going vegetarian or vegan is the best way to lose weight	
8. I need to exercise for hours every day to lose weight	
9. I need to be skinny or have huge muscles to be attractive	

Adapted from:

Busting the Myths Around Teen Nutrition. Seeds of Hope.

<https://seedsofhope.pyramidhealthcarepa.com/teen-diet-and-nutrition-myths/>. Published January 22, 2020. Accessed September 11, 2022.