

SPECIFIC AIMS- The overarching goal of this study is to better understand what effect school-based interventions have on eating disorder behavior in adolescents.

School-based interventions (SBIs) are one method that aims to reduce obesity rates among adolescents. Schools are arguably the most effective way to reach children and SBIs remain the most advocated anti-obesity methods in the United States, despite questioned efficacy due to less than statistically significant results¹. In theory, programs, often led by community leaders, address healthy nutrition and an increase in physical activity, but can vary in specific content. Adolescents with overweight or obesity are at a higher risk of engaging in eating disorder behaviors such as self-induced vomiting and laxative use, than their peers with thin body types². Adolescents with overweight and obesity are also at increased risk of Bulimia Nervosa and Binge Eating Disorder². Due to their weight status, and the focus on *anti-obesity* interventions, adolescents with obesity or overweight that exhibit signs of disordered eating behaviors, often go unnoticed. Further, food avoidance due to labeling as “bad” or forbidden” has been associated with restraint related behaviors of individuals with disordered eating patterns. Binge eating behavior specifically places forbidden foods, based on their food content, in a binge-only category³. Restraint theory suggests that dieting or restricted behavior often leads to disinhibited overeating, especially in the presence of forbidden foods⁴. Shared risk factors between individuals with overweight, and disordered eating prompt us to question whether SBIs have unintentional consequences in anti-obesity interventions.

AIM 1: In school-based interventions, assess whether assigning moral values to foods changes adolescents dietary restraint behaviors.

Hypothesis 1: We expect that school-based interventions that assign moral values to food will show changes in adolescents dietary restraint behavior and elicit emotional responses, such as anxiety, in the presence of these foods.

AIM 2: In school-based interventions, assess whether restricting adolescent’s access to certain foods changes normal eating behaviors around these foods.

Hypothesis 2: We expect that school-based interventions that restrict adolescent’s food to certain foods will predict high rates of disinhibited eating in the presence of these foods.

AIM 3: In school based interventions, the use of anti-obesity focused curriculum will further exacerbate internalized weight stigma for those overweight or obese. Further, thinner peers will see their overweight classmates differently, following intervention.

Hypothesis 3: We expect that school-based interventions that address weight status will change the way adolescents perceive themselves and others in terms of weight bias.

A. SIGNIFICANCE

A1. Why is it critical to understand the effect school-based intervention has on adolescents?

Planet Health, arguably one of the most effective school-based interventions, focused on increased vegetable and fruit consumption and physical activity, while focusing on decreasing TV viewing². Unlike other interventions, lessons were integrated into existing math, social sciences, etc. and taught by teachers². Unintentionally, Planet Health provided protective measures in disordered eating behavior². The correlation between effective school-based interventions and decreased rates of eating disorders further illustrates the importance of understanding implications of curriculum in SBIs.

A2. Emergence of Dietary Restraint

Dietary restraint was believed to accompany normative weight gain in puberty in adolescents⁵. More recently, dietary restraint has been associated with weight status in overweight girls as early as five years old. Higher levels of dietary restraint has been shown to contribute to weight gain through disinhibited eating behaviors following restraint⁵. Increased levels of restraint is correlated to increased weight gain during middle childhood⁵. Further, self-initiated diet attempts by adolescents can lead to increased weight gain rather than normalized eating behaviors, or weight loss⁵.

A3. Cacomorphobia/ Pocreoscophobia

Individuals that are overweight or obese are often depicted with no head, demeaning the individual, or are portrayed purely in stereotypical behaviors such as sitting, watching tv or eating⁶. In a study of lean school children, aged 4-11 years, professionally drawn pictures of overweight children attracted more than 50% negative attributions, described as ugly, lazy, stupid and selfish⁶. With rates of obesity and overweight in adolescents near 30% without properly addressing the effect weight stigma has on our perception, negative effects will continue to cause rejection of overweight and obese individuals while encouraging extreme dieting behaviors^{7,8}. SBIs aim to promote nutritious diets and increased exercise, but focus on *anti-obesity* rather than health promotion or overall education further exacerbating the perceived notion that weight status is directly related to health status.

A5. Progress

The obesity epidemic is a multifaceted public health issue which makes intervention difficult. The global cost of the obesity epidemic is average at 1.2 trillion dollars⁹. Furthermore, since the 1970s rates of obesity have skyrocketed with 60% of adults with either overweight or obesity¹⁰. School-based interventions are considered to be one of the most successful, and supported, anti-obesity movements in the United States¹. Due to this, similar programs have been implemented in Mexico City, as well as two cities in Brazil.

Children, as young as five, and adolescents, with internalized weight stigma and dietary restraint are at risk for developing an eating disorder⁵. Without better understanding what implications these programs might have for promoting disordered eating behaviors in adolescents with overweight or obesity, it's unclear whether any progress will be made, as links to increased weight gain through disinhibited eating as a result of restricted diets⁵. Further some dietary restriction from low-self esteem and poor body image can result in Anorexia Nervosa⁵, though those cases are much harder to track because weight loss is always seen as a positive event, especially in the anti-obesity movement. Thus, understanding the implications of anti-obesity school based interventions through assigning moral values to food, restricting intake of specific foods is not only vital but necessary to reducing the burden of disease.

B. INNOVATION

B1. Assessing School-Based Interventions promotion of disordered eating behavior

Our proposal aims to better understand the efficacy and impacts of school-based interventions. SBIs have an influential and widely supported role in the anti-obesity movement but lack statistical significance showing effectiveness in the ability to reduce obesity rates¹. Schools are the most practical and accessible venue for intervention with regular school attendance roughly 180 days a year for six hours or more per day¹⁰. Furthermore, schools receive national funding for programs, taxes and further financial assistance that is inaccessible to different programs¹¹.

Obesity is a complex public health issue that is not fully understood. Cause of obesity is normally associated with an increase in energy intake without energy expenditure¹⁰. However, this explanation is oversimplified, and fails to recognize various factors that can play a role in increased weight gain. The United States spends billions on healthcare, with little decrease in chronic health issues, due to lack of prevention approach. If SBIs should be effective and aren't, the role of healthcare leaders and providers is to better understand why. Overlap between obesity and disordered eating behaviors are evident¹², but are glossed over when anti-obesity becomes the focus. If rates of obesity and overweight are to decrease, it is time to better understand what effect pre-existing solutions might be exacerbating, not solving the solution.

The success of school-based interventions have been called into question, but to our knowledge, no study has assessed why school-based interventions are not working, in regards to shared risk factors among overweight, obese and disordered eating individuals.

B2. Dietary restraint as a result of moralization of food items

Our proposal aims to assess the use of morality to food. Dietary restraint is associated with a selective process in which foods are assigned as both forbidden and non-forbidden¹³. Research suggests that attempts to avoid certain desired substances results in increased preoccupation with that substance¹³. Higher levels of dietary restraint do not effectively promote sustainable weight loss, but rather contribute to weight gain through disinhibited eating behaviors following restraint⁵. Disinhibited overeating is a loss of cognitive control, as a result of prior dietary restraint⁵. Girls that are overweight and have mothers that report restricting a daughter's' intake of snack food, are most susceptible to overeating in the absence of hunger¹³. Thus, ensuring that dietary restraint is not occurring as a result of school-based interventions is necessary to a well-balanced diet, as well as hunger cues.

B3. School-Based Interventions as a viable, existing resource that can be modified

Our proposal aims to understand the efficacy of school-based interventions as a modifiable program that could potentially be used to promote healthy diets and physical education while providing a protective factor against dietary restraint behaviors. A successful program that addresses healthy lifestyle, without focusing on weight might aid in promotion of health behavior. Understanding the overlap between overweight, obesity and eating disorders in school-based interventions is a novel approach to the large public health problem the world faces.

C. APPROACH

C1. Overview

The overarching goal of this research is to better understand the overlap between anti-obesity programs for school-age children and disordered eating behavior. This will provide an opportunity to better utilize funding and opportunities to effectively educate on healthy nutrition and increased exercise without weight focus, but rather decreased screen time. We will conduct a series of nutrition and physical education classes and then interview adolescents with a diverse sample of at least 500 adolescents to explore the emotions of anxiety, dietary restriction and weight bias.

C2. Sample

We will conduct a series of nutrition and physical education classes with a diverse sample of participants ranging in ages 6-12 years of age. Participant recruitment will focus on obtaining a diverse sample with respect to key factors that relate to adolescents' risk of obesity, as well as risk for disordered eating behavior: 1) sex (male, female) 2) race/ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic, Asian) 3) socioeconomic status and 4) weight status.

In order to understand risk of behaviors at different ages, we aim to gather roughly equal amounts of adolescents between ages 6-9 years and 9-12 years and will conduct recruitment from schools in Southeastern Michigan. Adolescents that meet criteria for anorexia nervosa, bulimia nervosa and binge eating disorder will be excluded from the study, as will children of parents with a history of severe eating disorders. Adolescents that are already being taught dietary restraint at home, due to imposed diets from parental figures will also be excluded from the sample. Following the series of nutrition education and physical education classes, we will conduct cognitive interviews with the same 500 adolescents, with diversity of sex, race/ethnicity, weight status and age. The interview will assess behaviors of dietary restraint, anxiety, stigma, and internalized body issues. Interviews will be used to better understand how moral food labels, such as good or bad or use of phrases like "empty calories" affects an adolescent's behavior towards them. During the interview we will also assess how putting specific sugar rich foods under forbidden/ off- limit categories can create preoccupied thoughts, and disinhibited eating behaviors. Lastly, interviews will be used to better understand how moralization of foods and forbidden foods can affect one's internalized weight status and stigma towards those around them.

C4. Overall Study Protocol

The goal of this study is to assess why school-based interventions are not effective by understanding the importance of shared risk factors between overweight and obese individuals and individuals with eating disorders might further exacerbate the rates of disordered eating patterns in adolescents. In order to do so, randomized control study techniques will be used. Ten middle schools will be randomly assigned to intervention or control. Participants for the nutrition and physical education classes, and following interviews will be recruited from schools in Southeastern Michigan. Schools that will be considered must understand that through randomized control study design, their participation may mean they will serve as a control group. As set forth above, schools chosen should include a diverse group of adolescents in regards to sex, race, as well as socioeconomic and weight status. Furthermore, schools must currently implement both a general nutrition lesson and physical education lesson as part of their regular curriculum.

The control groups will be schools that are already implement either nutrition or health classes and physical education classes as part of their curriculum. The non-control groups will be schools where

school-based interventions will be implemented. The school-based interventions will adapt curriculum developed at the University of Michigan anti-obesity program: “Project Healthy Schools.”

Project Healthy Schools is a school-based intervention anti-obesity program that is used to achieve five main goals: Eat more fruits and vegetables, choose less sugary food and beverages, eat less fast and fatty foods, be active every day, spend less time in front of a screen. Project Healthy Schools consists of ten lessons and is geared towards students in the sixth grade, thus curriculum will be expanded to cover fifteen weeks of the academic year and be geared towards ages ranging in 6-12 years of age.

Following the school-based intervention, interviews will be conducted. The University of Michigan Research Assistants will conduct interviews after being trained on interview techniques by Dr. Sonnevile. Interviews will be conducted in Dr. Sonnevile’s lab or on the property of the schools involved. Parental consent will be necessary from all participants before interviews can be conducted. As part of the interview process, basic information in regards to the participant such as age, race, school grade, school attending as well as parental education and employment will be assessed. Interviews will be roughly 30 minutes in length and participants will be awarded gift-cards for their time.

C5. Measures

All participants in the educational classes will participate in a brief interview which will assess the following:

C5a. Attentional Biases to Food Pictures:

A dot-probe paradigm will be used to assess attention biases to “forbidden” or “bad” foods. The dot-probe paradigm uses two different dots: a neutral dot and a threatening dot. The dot-probe paradigm asks participants to identify the location of the dot relative to the two simultaneously exposed stimuli¹⁶. Location is indicated via specific computer keys. Reaction time indicates attentional biases. For this interview, the neutral dot will be different types of rocks while the threatening dot will be forbidden food pictures¹⁶. This tool has been used to assess selective attention and anxiety in regards to stimuli.

C5b. General Anxiety Disorder 7-Item Score:

The GAD-7 is a 7 question anxiety screening tool. The GAD-7 has been used to assess anxiety in anorexia nervosa¹⁷. The GAD-7 is accessible and easy for adolescents to understand and would be an ideal tool for this interview assessment.

C5c. Three-Factor Eating Questionnaire:

The Three-Factor Eating Questionnaire tool is an 18 question, self-report questionnaire used to assess eating behaviors such as dietary restraint and disinhibited eating: both uncontrolled and emotional¹⁸. This questionnaire has shown validity in differentiating between nutritive eating and different eating patterns and has shown positive associations with BMI z-scores in obese and non-obese adolescents¹⁸.

C5d. BMI z-score:

BMI z-score will be conducted using height and weight measurements. The BMI z-score will be derived using growth charts, specific to age and sex. The BMI z-score will be used to assess weight status¹⁹.

C5e. ecScatter Inventory

The ecScatter Inventory is a tool used to assess eating competence. Eating competence is one's perspective towards food and their food behaviors. The ecScatter Inventory includes four subscales: eating attitudes, food acceptance, internal regulation and contextual skills. This tool has been shown to have validity in recognizing both behavioral and cognitive responses to food²⁰.

C5f. Weight Bias Internalization Scale

The weight bias internalization scale is used to better understand what negative stereotype or stigmas one associates with themselves²¹. The weight bias internalization scale will be used to understand to what effect adolescents' perceptions of themselves change with the SBI curriculum⁶.

C5g. Body Size Perception Scale

The body size perception scale is a self-report tool that is used to understand body size perception²². The body size perception scale will be used to determine internalized weight perception as well as perception of weight of the RA, after consuming forbidden or bad foods during the initial interview process.

C6. Analyses

C6a. AIM 1, Hypothesis 1: *We expect that school-based interventions, that use moral food assignments will show disordered eating behaviors through increased anxiety surrounding “bad” foods.*

To test Hypothesis 1, we will compare scores between the control and experimental group to understand how placing moral values on food could increase anxiety.

C6b. AIM 2, Hypothesis 2: *We expect that school-based interventions that restrict certain food items will increase behaviors of disinhibited eating surrounding these foods.*

To test Hypothesis 2, we will compare scores between the control and experimental group to understand how restricting certain items could increase disinhibited eating behaviors surrounding these foods.

C6c. AIM 3, Hypothesis 3: *We expect that school based interventions, that reference weight status in any way, will change perceptions of fellow classmates with overweight or obesity.*

To test Hypothesis 3, we will compare internalized weight bias scores between the control and experimental group to understand how school based intervention curriculum might further weight bias internally or to others.

D. Conclusions

The findings from this research will help improve school-based intervention programs in best addressing the risks of overweight and obesity and help to understand the impact of school-based interventions on disordered eating behaviors

Resources

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