Considering Mindfulness Training for Obesity-Related Eating Behaviors in Children and Adolescents: A Conceptual Review

Gillian A O’Reilly* and David S Black
Department of Preventive Medicine, Keck School of Medicine, University of Southern California, USA

*Corresponding author: Gillian A O’Reilly, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Tel: 949-463-4007; E-mail: goreilly@usc.edu

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Abstract

Obesity in children and adolescents is a major public health problem in the United States. Obesity-related eating behaviors are an important contributing factor to this issue. Youth in the United Stated tend to have unhealthful dietary intake and poor eating habits, such as consumption of large portion sizes, fruit, vegetable, and dietary fiber intake below dietary recommendations, and sugar intake above dietary recommendations. Emotional eating, external eating, and binge eating, behaviors that are linked with excess weight gain, have also been found to occur in youth. Eating behaviors established during the early years of life tend to persist into adulthood, so forming healthful eating habits and relationships with food early in life are important for the current and future health of children and adolescents. However, numerous factors including parenting practices, the food environment at home and outside of the home, and food advertising impart compelling influences on eating behaviors in youth. It is essential to arm children and adolescents with skills that help them make healthful dietary choices and develop healthful eating styles in the face of influences that may impede healthful behaviors. Mindfulness training may be a promising approach. A recent systematic literature review by our research group found that mindfulness training programs can improve obesity-related eating behaviors in adults. Research has also shown that mindfulness training can be successfully implemented in child and adolescent populations with promise for improving stress-related and neurocognitive outcomes. The aim of this brief conceptual review is to provide an overview of obesity-related eating behaviors in children and adolescents and suggest how mindfulness training might hold promise as an intervention approach and a way of being to support healthful eating behaviors in the early years of human development.

Keywords: Mindfulness; Attention training; Obesity; Children; Adolescents; Review

Introduction

Obesity-related eating behaviors are a significant public health concern for youth in the United States and worldwide. There are a variety of problematic eating behaviors that lead to excess weight gain in children and adolescents. One of the most important of these is poor dietary intake. Overall, daily total energy intake by children and adolescents has increased in the past 30 years by as much as 150 to 300 calories per day [1]. This can be attributed at least partly to an increase in portion sizes [2] and a shift in dietary patterns away from consumption of low-calorie, nutrient-rich foods toward energy-dense, nutrient-poor foods [3]. Youth aged 2 years and older should consume balanced diets that consist predominantly of low-calorie, nutrient-dense foods such as fruits, vegetables, and high-fiber whole grains [3]. However, most youth do not meet dietary recommendations [4]. Studies have shown that children and adolescents consume an excess of energy-dense, nutrient-poor foods that are high in added sugar and precipitate excess weight gain. According to the 2010 Dietary Guidelines for Americans, intake of discretionary calories, such as those from added sugars, should be limited to 5-15% of daily caloric intake [4]. However, recent estimates have found that calories from added sugars represent as much as 16% of the total daily energy intake for children and adolescents [13]. Sugar-sweetened beverage (SSB) consumption is a major contributor to daily added sugar intake in youth, especially among adolescents [3,14]. One study of SSB intake in youth that examined the 2009-2010 National Health and Nutrition Examination Survey (NHANES) data found that SSBs contributed approximately 8% of daily energy intake among children and adolescents [15]. This is a particularly alarming problem because excess consumption of SSBs has been associated with displacement of nutrient-rich foods [14]. Unhealthful dietary patterns may be explained by the increase in availability of processed, nutrient-poor foods that has occurred over the past several decades, as well as increased availability of convenience foods [3]. Poor dietary intake may also be partially driven or exacerbated by maladaptive eating behaviors.

Dietary guidelines also recommend that youth limit consumption of energy-dense, nutrient-poor foods such as those high in added sugars [3]. However, sugar consumption among children and adolescents is a major problem. Studies have shown that children and adolescents may also be partially driven or exacerbated by maladaptive eating behaviors.

Several studies have found that some children and adolescents engage in maladaptive eating styles that precipitate weight gain including emotional eating [16-20] external eating [16,20] binge eating...
Health and Well-being

Consequences of Obesity-related Eating Behaviors to Health and Well-being

Weight gain is caused by an accumulation of positive energy balance over time [34]. Positive energy balance occurs when energy intake exceeds energy expenditure [34,35]. Growing evidence supports that poor dietary patterns and maladaptive eating styles are linked with weight gain due to their contributions to excess energy intake and thus [36] positive energy balance. A recent meta-analysis and systematic review that examined results from sixty randomized controlled trials and prospective cohort studies concluded that in both adults and youth, increased intake of dietary sugars was associated with increased body weight, while reduced dietary sugar intake was associated with decreased body weight [37]. Contrary to dietary sugar intake, consumption of dietary fiber, fruits, and vegetables has been found to be protective against overweight and obesity. Findings from epidemiologic studies indicate that dietary fiber, fruit, and vegetable intake are associated with lower body mass, and findings from intervention studies show that dietary fiber intake leads to weight loss [38-40]. This evidence suggests that poor dietary patterns and problem eating behaviors can increase risk for overweight and obesity.

Indeed, overweight and obesity are major health issues among children and adolescents in the U.S. Although there has been recent evidence of a plateau in the growth of overweight and obesity among youth [41-46] the prevalence is nonetheless alarmingly high. According to the latest available National Health and Nutrition Examination Survey (NHANES) data, 31.8% of youth aged 2-19 years in this country are overweight or obese [47] of those, 16.9% meet body mass index (BMI) criteria for obesity [47]. Despite public health efforts on multiple fronts, overweight and obesity prevalence in the general population is proving to be difficult to reduce.

The need to address obesity-related eating behaviors in children and adolescents is highlighted by evidence that poor dietary behaviors, overweight, and obesity during youth are associated with detrimental consequences for health during youth and into adulthood. Poor dietary intake, overweight, and obesity increase risk for chronic diseases including metabolic syndrome, type 2 diabetes [48,49] hypertension [50,51] nonalcoholic fatty liver disease [52,53] and cardiovascular disease [54-56]. Such diseases, which were known only to occur in adults in the past, have now become common among children and adolescents because of the rise of overweight and obesity in youth [57,58]. Studies have also shown that obesity increases risk for certain types of cancer, including pancreatic cancer, colon cancer, and breast cancer [59,60]. Further, excess adiposity is associated with a substantial increase in risk for mortality; relative risk for death increases across the body mass index (BMI) range of overweight and is even higher for obese individuals [61]. This indicates that overweight and obesity represent a serious health issue across the lifespan and highlights the need for effective interventions to combat overweight and obesity, especially early in life.

Overweight and obesity are also critical health issues during youth because of consequences that can impede development and well-being. Low health-related quality of life has been found to be associated with overweight and obesity across age groups [62-64]. Risk for mood disorders such as major depression, bipolar disorder, anxiety, and substance use disorders is higher for obese compared to normal weight youth and adults [56,65-68]. Poor self-esteem and adverse impacts on academic performance are more prevalent among overweight and obese adolescents compared to normal weight adolescents [63]. Such consequences hinder educational attainment and lifetime earnings [69,70] underscoring life-long, adverse impact of overweight and obesity on overall well-being. Growing evidence indicates that being overweight or obese during youth increases the risk for psychological and physical health issues in adulthood. For example, the longitudinal Northern Finland 1966 Birth Cohort Study, which followed participants from ages 14 to 31, found that individuals who were obese at 14 years old were more likely to have physician-diagnosed depression at 31 years old [71]. Participants in the Bogalusa Heart Study who were overweight or obese as adolescents had greater cardiovascular risk factors as young adults, including adverse levels of systolic and diastolic blood pressure, cholesterol, insulin, and glucose, compared to participants who were normal weight as adolescents [72]. One study that examined the association between childhood obesity and cardiovascular morbidity in a 57-year follow-up cohort study using the Carnegie Survey of Family Diet and Health found greater risk for heart disease and cardiovascular mortality for those who were overweight or obese as youth compared to those who were normal weight as youth [73]. Clearly, it is necessary to determine how to prevent and reduce excess adiposity during the critical developmental periods of childhood and adolescence.

The Challenge of establishing healthful eating behaviors in children and adolescents

Childhood and adolescence are critical periods for establishing lifelong weight-related behaviors [74,75] as dietary habits, overweight, and obesity in children and adolescents tend to track into adulthood [6,76,77]. However, establishing healthful eating behaviors during youth can be challenging because of the many competing sources of influence that can negatively impact dietary intake and eating habits. The food environments that children and adolescents are exposed to have a strong influence on their eating behaviors. The school food environment is particularly influential. Youth spend a large proportion of their time in school, so they consume a significant amount of their daily food intake at school [1]. Thus, the types of foods available at school influence what children and adolescents consume. Foods available through vending machines, snack bars, and school stores, which are often energy-dense, nutrient-poor snacks and beverages, can lead to excess caloric intake [1]. Access to these food options is also detrimental because they can replace consumption of more healthful food choices [1]. A recent study found that availability of energy-dense, nutrient-poor foods at vending machines or other sources in schools was associated with higher BMI z-scores of schoolchildren [1,78]. Evidence such as this demonstrates that the food available to

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[21-24] and eating in response to cravings [25]. Emotional eating, defined as eating in response to emotional arousal [26] and binge eating, defined as a loss of control over eating, have been postulated by escape theory [27] and affect regulation models [28,29] to be maladaptive coping mechanisms for emotional distress and negative self-assessments [30]. Emotional eating and binge eating can also be explained by the psychosomatic theory, which hypothesizes that eating in response to emotional arousal may be due to an inability to differentiate between physical hunger cues and emotional cues [30,31]. External eating, defined as eating in response to food-related cues, such as the sight, smell, and taste of food [32] has been postulated by externality theory to be due to a heightened sensitivity to such external food cues [30,33]. Clearly, the problem of obesity-related eating behaviors in youth is a large, multi-faceted problem.
children in the school environment can affect their food intake choices and have implications for excess weight gain.

Advertising represents another crucial influential factor for dietary intake and eating behaviors in children and adolescents. The food industry places a substantial focus on marketing to youth [3]. According to estimates from a recent Federal Trade Commission report, the food industry spends about $1.8 billion annually on marketing foods and beverages to children and adolescents [79]. This marketing is mostly for energy-dense, nutrient-poor foods such as candy, fast food, SSBs, and high-sugar breakfast cereals [3]. This is important because evidence indicates that food advertising directly influences the foods that youth request and consume [3,80]. Further, a recent study found that exposure to fast food marketing may contribute to youth overweight and obesity in the U.S. [81]. Food advertising clearly has the potential to have a strong impact on eating behaviors and risk for excess weight gain in children and adolescents.

Household sociocultural factors also have a particularly poignant impact on dietary intake and eating habits in youth, especially during early childhood. Parenting practices, for example, can negatively impact eating behaviors despite good intentions. Feeding strategies aimed at controlling dietary intake such as restricting certain foods or pressuring children to eat certain foods can incite problem eating behaviors such as overeating and compulsion to eat “forbidden” foods [3]. Food intake by parents and siblings have also been shown to influence dietary intake by youth, particularly for fruits, vegetables, fat, and total energy [82].

Children and adolescents certainly do not have absolute control over the foods they consume, since factors that parents usually control such as home food availability [83] and parent feeding practices [84] are significant influences on youth's dietary intake. However, what they choose to consume at school, how they adjust to parent feeding practices and other home environment factors, and how they react to media influences are factors over which youth can potentially have agency. Given that overweight, obesity, and obesity-related eating behaviors continue to be significant health issues among children and adolescents, youth need to develop skills that will enable them to make healthful dietary choices and practice healthful eating behaviors in the face of many influences.

Mindfulness Training: A possible Intervention Approach for Obesity-related Eating Behaviors

A large body of intervention research has been conducted pertaining to improving eating behaviors in children and adolescents. Most of this research has focused on family-based interventions aimed at improving eating behaviors and dietary intake in the home environment and school-based interventions aimed at improving nutrition knowledge and access to healthful foods in the school environment. Findings have shown that while these types of interventions can be successful at modifying eating behaviors in youth, novel approaches may be necessary to improve intervention efforts. For example, family-based interventions have been shown to be effective at improving child eating habits and dietary intake [85,86]. However, evidence indicates that family-based interventions are not always effective for all youth or their families, and post-intervention relapse is common [87].

School-based interventions aimed at improving dietary intake among children and adolescents have had mixed results. A recent meta-analysis and systematic review of school-based interventions for increasing fruit and vegetable intake in youth concluded that school-based interventions can have moderate positive impacts on fruit intake but have little impact on vegetable intake [6]. Another systematic review found that school-based interventions aimed at generally improving healthful dietary intake can lead to moderate improvements [88]. However, a different recent review of school-based lifestyle interventions to prevent obesity in children found results from dietary interventions to be short-term and inconsistent [89]. According to an overview of past research and future directions in school-based obesity intervention research, the modest effects from school-based interventions demonstrates that future interventions may need to incorporate alternative intervention approaches [90]. Although interventions aimed at improving eating behaviors in children and adolescents can be effective, integration of novel intervention components may be useful for improving short-term and long-term intervention effects.

Mindfulness training may be a promising complimentary or integrative approach for improving eating behavior outcomes in children and adolescents in various settings. Mindfulness is most commonly defined as a quality of consciousness characterized by continually attending to one's moment-by-moment experiences, thoughts, and emotions in an open, non-judgmental manner [91]. It can be cultivated through systematic training by practicing mindfulness meditations and exercises [92]. Mindfulness-based interventions (MBIs) have gained popularity for treating obesity-related eating behaviors. A recent systematic literature review by our research group examined the effectiveness of MBIs for obesity-related eating behaviors including binge eating, emotional eating, external eating, and dietary intake in adults [30]. The review found that MBIs appear to be effective for improving binge eating, emotional eating, and external eating behaviors [30]. The review also found that additional research is needed to determine if MBIs can improve dietary intake [30]. However, there is potential for MBIs to be effective intervention approaches for dietary intake. Only three studies examined the impact of a MBI on dietary intake, but two of the three studies reported improvements in dietary intake factors including total daily energy intake [93,94] and glycemic index and glycemic load of diet [93]. While the literature on MBIs lacks studies utilizing mindfulness training aimed at improving eating behaviors in youth, the growing field of mindfulness research in children and adolescents as well as the evidence from obesity-related eating behavior studies in adults indicates that this may be a potentially promising intervention approach for children and adolescents.

In recent years, there has been a surge in mindfulness training programs offered to youth by organizations in the U.S. and around the world as well as an increase in evidence from studies investigating the efficacy of mindfulness training for various health conditions that this intervention approach can be successfully implemented in children and adolescents [95,96]. The growth of MBIs for children and adolescents demonstrates that mindfulness programs are a viable intervention method for helping youth cultivate the ability to make healthful decisions about the foods they eat and establish healthful approaches to the way they eat. Regular engagement in mindfulness practice can modulate the neural systems involved decision-making and habitual reactions [97]. Findings from MBI studies in youth have shown that mindfulness training can improve executive functioning in children and adolescents [95]. Improved executive function has positive implications for planning, decision-making, self-regulation, and goal-directed behaviors [95,96].
These improved mental qualities could prime children to make healthful food choices in the midst of the obesogenic food environment. Regular engagement in mindfulness practice also strengthens attentional control, emotional flexibility, and cognitive flexibility, [99] which in turn reduces engagement in maladaptive, habitual behaviors that are often automatically carried out under stress [100]. A recent review of MBIs for children and adolescents found that mindfulness training leads to improved emotion regulation skills for youth spanning an age range of 6 to 18 years [95]. These skills could help children and adolescents develop adaptive responses to psychological distress and prevent them from forming maladaptive responses such engaging in emotional eating and binge eating. Mindfulness training can also cultivate skills that help one to acknowledge impulses, such as the impulse to eat in reaction to food cues, but not to act on those impulses [30]. This could mitigate external eating and eating in response to cravings in children and adolescents. Figure 1 provides a conceptual overview of possible ways in which mindfulness training may impact eating behaviors in children and adolescents.

**Figure 1:** Conceptual model showing potential effects of mindfulness training on obesity-related eating behaviors in children and adolescents.

### Future Directions and Conclusions

Previous research has shown that MBIs have been successful for treating obesity-related eating behaviors in adults [30]. To our knowledge, no published trials to date have examined the impact of mindfulness training on obesity-related eating behaviors in children or adolescents. Consequently, our conceptual review serves as a call for formative research to understand how MBIs can be implemented for optimal effectiveness in young populations. One area that will require extensive research is the impact of mindfulness training on dietary intake. Few studies have been conducted to understand how MBIs can influence food choice and consumption. However, there is some evidence that mindfulness training may shift dietary intake to more healthful dietary patterns in adults. Given that poor dietary intake is such a prominent issue among children and adolescents, future studies should aim to determine if MBIs can be effective standalone interventions or supplementary components to family-based and school-based interventions aimed at improving dietary intake in youth. Other obesity-related eating behaviors such as binge eating, emotional eating, and external eating are not typically targeted in family-based or school-based nutrition interventions. Future studies should also focus on determining if the positive impacts of mindfulness training on these obesity-related eating behaviors that have been observed in adults can be replicated in children and adolescents. Given findings from MBI eating behavior studies in adults and evidence that mindfulness training can be successfully implemented in children and adolescents, mindfulness training represents a potentially promising approach to help children and adolescents develop positive relationships with food and healthful eating behaviors in a manner that might reduce the costly impact of obesity in the United States.

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