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Lauren Sophie Marx

Date

Mealtime Appetite Monitoring at a Camp for Overweight and Obese Youth

By

Lauren S. Marx
Master of Arts

Clinical Psychology

Linda W. Craighead, Ph.D.
Advisor

Patricia A. Brennan, Ph.D.
Committee Member

Stella F. Lourenco, Ph.D.
Committee Member

Accepted:

Lisa A. Tedesco, Ph.D.
Dean of the James T. Laney School of Graduate Studies

Date

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By

Lauren Sophie Marx
B.S., Duke University, 2009

Advisor: Linda W. Craighead, Ph.D.

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Abstract

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Appetite monitoring (AM), a self-regulatory strategy that trains individuals to eat in response to appetite cues, has been reported to be highly acceptable by adults with eating pathology. Although food monitoring is practiced at several camps for overweight youth, this is the first study to implement and evaluate AM in a residential camp setting. Participants were 88 overweight and obese campers (ages 9-14) and their parents, and they received brief AM training at a pre-camp family weekend. Campers then engaged in mealtime AM practice throughout the 5-day residential camp. Campers and their parents completed questionnaires assessing attitudes towards and use of AM at camp and at home. The Appetite Awareness Scale for Children (AAS-C), a self-report measure of sensitivity to appetite cues, was used to assess improvements in appetite awareness with the AM practice. Implementing meal-based AM at a weight management camp was feasible, and the practice was rated by campers and their parents as acceptable, utilized, helpful, and remembered at follow-up. Internal consistency and test-retest reliability of the AAS-C were found to be acceptable. Significant improvement in AAS-C scores was demonstrated by the end of camp and maintained at follow-up. Overall, mealtime AM was shown to be a feasible and acceptable addition to a weight management camp for youth. The AAS-C was found to be a reliable measure and was responsive to appetite training. Although preliminary, these results suggest that mealtime AM is a feasible and acceptable self-regulatory strategy for overweight and obese youth and warrants further investigation.

Keywords: childhood obesity, obesity interventions, weight management camps, appetite monitoring

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Introduction

Food monitoring (FM), a self-regulatory strategy in which individuals record food or calories consumed, has emerged as one of the most effective techniques of cognitive-behavioral therapy (CBT) for eating disorders and weight loss. Yet, the time and effort required to keep a detailed, running account of intake results in variability in FM practice among participants. Within interventions for overweight children and adolescents that include FM, greater weight loss appears to be associated with greater consistency and quality of monitoring (Kirschenbaum, Craigh, Kelly, & Germann, 2007; Mockus et al., 2011; Sandilands, Brennan, Walkley, Fraser, & Greenway, 2011). The effort required to monitor food also makes it difficult to maintain FM after treatment. Unfortunately, with adults, poor weight loss maintenance following treatment has been linked to discontinuing FM (Wilson & Brownell, 2002), with regain beginning soon after monitoring stops (Elfhag & Rössner, 2005; Wing & Hill, 2001). In addition, concerns have been raised that the focus on food in FM has the potential to increase food preoccupation (Hill, Craighead, & Smith, 2006), an effect which might be particularly problematic for younger individuals.

Appetite Awareness Training (AAT; Craighead, 2006) is a modification of CBT for eating and weight problems that replaces FM with appetite monitoring (AM). Whereas FM focuses attention on external food cues, AAT trains individuals to become more sensitive to their internal hunger and fullness sensations. The goal is to use these sensations, rather than food guidelines, to inform eating decisions and, thus, to reduce overeating by helping individuals become more in control of their eating to reduce overeating. AM maintains the self-regulatory benefits of FM, but because it is less effortful and may not promote as much obsession about food, may be particularly desirable for overweight youth.

AAT has been found to be as effective as CBT in reducing overeating, binge eating, and urges to eat in adults with binge eating disorder (Allen & Craighead, 1999; Craighead & Allen, 1995) and bulimia nervosa (Dicker & Craighead, 2004). Further, qualitative reports from participants suggest that AM is highly acceptable, with many participants preferring AM to prior FM experiences (Allen & Craighead, 1999; Craighead & Allen, 1995; Dicker & Craighead, 2004; Hill, Craighead, & Safer, 2011). Because it emphasizes getting back in touch with innate biological cues, many participants describe AAT as feeling more “natural” and less like a “diet” than FM, and report reduced preoccupation with food (Allen & Craighead, 1999; Hill, et al., 2011). Finally, participants typically report spontaneously starting to “see” the monitoring form in their mind as treatment progresses, which allows them to monitor “mentally” throughout the day (Allen & Craighead, 1999). Given the difficulty of sustaining written monitoring of any kind, the natural transition to mental monitoring with AM may be a significant long-term advantage.

The success and positive participant accounts of AM evident from trials with adults indicate that it could be a feasible and acceptable strategy for child and adolescent weight management. Also, the potential utility of AM for this age group is suggested by findings of reduced sensitivity to internal appetite cues and heightened sensitivity to external food cues in overweight compared to normal weight children based on parent reports (Carnell & Wardle, 2008; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009) and evidence from experimental (Barkeling, Ekman, & Rossner, 1992; Jansen et al., 2003; Mehra, Tsalikian, Chenard, Zimmerman, & Sivitz, 2011), genetic (Carnell & Wardle, 2009), biological (e.g., levels of satiety hormone peptide YY) (Roth et al., 2005), and neurological studies (Bruce et al., 2010).

Several intervention studies have targeted children’s impaired sensitivity to appetite

sensations. S.L. Johnson (2000) found improvements in preschool children's self-regulation of eating after training them to focus on their internal hunger and fullness sensations. Boutelle et al. (2011) compared children's AAT (CAAT) to cue exposure treatment (which focuses on recognizing and learning to cope with food cravings) for overweight and obese 8-12 year olds. After 8-weekly separate child and parent group sessions, children in both the CAAT and cue exposure conditions showed reductions in binge eating, but not caloric intake, and children in the cue exposure treatment showed reductions in eating in the absence of hunger. Bloom, Sharpe, Mullan, and Zucker (2013) randomized overweight and obese 6-12 year olds to a wait-list condition or to 6-weekly separate parent and child group CAAT sessions. They found a significant decrease in BMI of CAAT children, but not controls, from pre- to post-treatment.

Another recent study took a family approach, but included joint family sessions in addition to separate parent and child groups. In this pilot study, overweight 7-13 year olds and their families were assigned to AAT combined with family-based behavioral therapy (FBBT-AAT) or FBBT alone (Gunnarsdottir, Njardvik, Olafsdottir, Craighead, & Bjarnason, in preparation). No group differences in weight loss were seen post-treatment or at one-year follow-up. However, only children in the FBBT-AAT condition continued to lose weight, such that by two-year follow-up this group had lost significantly more than the FBBT group. This finding suggests that adding AAT to FBBT, the gold standard pediatric obesity treatment, may lead to greater and more sustained weight loss than FBBT alone. Also noteworthy was that FBBT-AAT children who reported remembering the "Hunger Scale," the AM form, at one-year follow-up had lost slightly more weight at both the one- and two-year follow-ups than children who did not.

Several intensive weight management camps for overweight youth include FM as a

central treatment strategy, and a recent review of these camps found an association between FM and weight loss success (Kelly & Kirschenbaum, 2010). To our knowledge, mealtime AM has not been implemented in a camp setting. Yet, because monitoring appetite appears to be less effortful, time-consuming, and easier to monitor mentally than FM, we predict AM to be more feasible to implement in hectic camp dining halls. We also hypothesize AM to be a highly acceptable, helpful, and maintainable self-monitoring practice for children and adolescents to learn and practice at a residential camp.

Also potentially favoring AM is evidence of an association between child weight loss and parent and family variables, including parent involvement in treatment, positive family support, and parents self-monitoring and making other lifestyle changes themselves (Hinkle, Kirschenbaum, Pecora, & Germann, 2011; Kirschenbaum, Germann, & Rich, 2012; McLean, Griffin, Toney, & Hardeman, 2003). Collaborative family AM could easily be instated; families could remind one another to “check-in” with the Hunger Scale throughout the day, or develop mealtime Hunger Scale rituals, like going around the table and sharing what number they are on the Hunger Scale. Moreover, camps are hypothesized to provide an ideal setting for learning to monitor (food or appetite) because campers eat all meals and snacks together over consecutive days, which provides the repetition and reinforcement necessary to make the practice routine. Finally, campers who lose versus gain weight appear to monitor food, activity, and weight more consistently (Gierut, Pecora, & Kirschenbaum, 2012), so AM may be a promising alternative for campers who find it difficult to practice FM consistently.

To assess the hypothesized feasibility and acceptability of AM in a camp setting, the current pilot study incorporated mealtime AM, or “Hunger Scale practice,” at a camp for overweight and obese youth ages 9-14. There was no control group; thus, the effectiveness of the

intervention (i.e., impact on weight) was not examined in this pilot study. The first aim was to assess the feasibility, acceptability, utility, predicted and actual use, and memory of the practice at follow-up in this sample. Also examined were differences in reactions to the practice by camper characteristics (e.g., age, gender, and eating pathology).

The study's second aim was to establish norms and report reliability for a child version of a self-report appetite awareness measure, and to use this measure to assess improvements in appetite awareness with the intervention. Previous studies have assessed children's appetite awareness with parent reports (e.g., the Child Eating Behavior Questionnaire or CEBQ; Carnell & Wardle, 2007; S. L. Johnson, 2000) or, indirectly, with self-report measures of related but distinct constructs (e.g., the Eating in the Absence of Hunger questionnaire or EAH-C; Boutelle, et al., 2011; Tanofsky-Kraff et al., 2008). Expensive and time-intensive techniques to assess appetite sensitivity, like lab-based eating tasks (S. L. Johnson, 2000) or neuroimaging (Bruce, et al., 2010), have also been used, but are not practical for evaluating interventions. Thus, a brief self-report measure of children's appetite awareness would be cost-effective and useful for monitoring progress during treatment.

Methods

Setting

This pilot study was conducted between March and October 2012 with participants of a low-cost, 5-day overnight camp sponsored by a large, not-for-profit children's hospital in the southeastern United States. The camp's mission is to provide overweight and obese youth (ages 9-14) and their families with an intensive introduction to family-based weight management strategies. The camp is promoted through a variety of sources, including the camp's website and flyers distributed by local medical

professionals. Interested families apply on the website. Criteria for camp attendance include child's BMI percentile in the overweight or obese range (85th percentile and above; Center for Disease Control and Prevention, 2011) and the child and household family members committing to attend one of four "welcome" weekends in the spring and one of four "reunion" weekends in the fall.

Procedure

The Emory University Institutional Review Board (IRB) approved all research conducted at this camp and notified the hospital's IRB of the research. At the welcome weekends, parents/guardians signed consent for themselves and their child to participate in the research conducted at camp, and children signed assent. All campers and their families participated in the intervention. See Figure 1 for a timeline of camp activities and intervention and data collection procedures.

Intervention

The Hunger Scale intervention was added to the curriculum of healthy lifestyle education already being implemented at camp. Primary goals of the intervention were: (1) To repeat and reinforce Hunger Scale use by providing campers with many opportunities throughout their approximately six month camp involvement to hear about and practice using the Hunger Scale; and (2) To encourage family communication about and use of the Hunger Scale at home. The Hunger Scale used was an 11-point scale (0 = *weak* and 10 = *bursting*). The core component of the intervention was mealtime Hunger Scale practice by campers throughout camper week. To further reinforce the practice and encourage collaborative family use, the Hunger Scale was also discussed informally and integrated into activities during camper week and at family weekends.

Campers, siblings, and parents (in separate child and parent sessions) were first briefly

taught to use the Hunger Scale as part of a mindful eating module at the welcome weekends. Participants were instructed to “check-in with their bellies” when making eating decisions (i.e., whether to eat or not eat, continue or stop eating) by choosing which number on the Hunger Scale best describes their hunger level. Particular emphasis was on “checking-in” before, during, and after meals and snacks. Participants then practiced using the Hunger Scale when eating a small snack, and each family was provided a Hunger Scale magnet for their refrigerator at home.

Before the first breakfast of camper week, campers were briefly reminded of how to use the Hunger Scale. Then, before and after each meal, campers were prompted over the loudspeaker to mentally “check-in” using the Hunger Scale (Hunger Scale placards were available on campers’ tables for them to look to when monitoring). Campers practiced using a written Hunger Scale at breakfast on Monday and Wednesday.

Measures

Demographic information (age, gender, race/ethnicity, and household income) was obtained from a questionnaire completed by parents at baseline.

Anthropometric measures. Campers’ weight and height were measured at baseline. Campers’ weight, height, age, and gender were entered into an online calculator (The Children's Hospital of Philadelphia Research Institute, 2013) to calculate BMI (in kg/m^2) and BMI percentile.

Hunger Scale Questionnaires (HSQs). To address this study’s first aim, three 5-item questionnaires were developed to assess the acceptability, utility, and predicted use of the Hunger Scale for campers, as well as the actual use and memory of the Hunger Scale by campers and their families. At the end of camper week, campers completed the Post HSQ-C, and at follow-up, campers and parents completed the FUP HSQ-C and FUP

HSQ-P, respectively (see Table 2 for questionnaire content). Responses were indicated on a 5-point Likert scale (0 = *not at all* and 5 = *very much, definitely yes, very often, almost every time I eat, or every time I eat*). Higher item and total scores denoted greater reported acceptability, utility, predicted and actual use, and memory of the Hunger Scale.

Parent version of the Questionnaire on Eating and Weight Patterns (QEWP-P; W. G. Johnson & Grieve, 1999). The QEWP-P is a 12-item questionnaire completed by parents about their child's eating behaviors over the past 6 months. The QEWP-P is a modification of the QEWP (Spitzer et al., 1992), a well-established, reliable, and valid self-report measure that provides a provisional diagnosis of binge eating disorder for adults. An episode of binge eating is defined by *both* objective overeating and loss of control over eating (APA, 1994). Parents in the current study completed the QEWP-P at baseline. Based on parent responses to the first item of the QEWP-P, campers were classified into two groups: those engaging in normal eating or disordered eating (objective overeating and/or binge eating). This item assesses *objective overeating* with two questions ("During the past 6 months, did your child ever eat what most people, like his/her friends, would think was a *really* big amount of food?" and "Did your child ever eat a *really big* amount of food within a short time [2 hours or less]?"). Campers were classified as normal-eating if their parent responded "no" to either question and as disordered-eating if their parents responded "yes" to both questions.

Appetite Awareness Scale for Children (AAS-C). The AAS-C (included in Appendix A), a child-adaptation of the AAS used with adults, is a 6-item measure of children's perceived sensitivity to their internal hunger and fullness cues over the past month. Responses are indicated on a 6-point Likert scale (1 = *never* and 6 = *always*), with

higher scores indicating poorer self-reported appetite awareness. The adult version has shown good internal consistency (α s = 0.86-0.91), convergent validity, and discriminant validity in samples of overweight men ($N = 45$), overweight women ($N = 95$), overweight women with BED ($N = 46$), and college women at risk for eating disorders ($N = 50$) (Brown & Craighead, unpublished manuscript). Campers completed the AAS-C at baseline, pre-camp, post-camp, and follow-up.

Results

Before running analyses, all variables were assessed for outliers and normality.

Sample Characteristics

Baseline sample characteristics (displayed in Table 1) were collected for 88 campers (56 female, 62.8%) ages 9-14. According to international conventions that classify child weight status by BMI percentile (Center for Disease Control and Prevention, 2011), most campers (91.8%) were classified as obese, and the rest were overweight. Post-camp measures were completed by 74 campers, and follow-up measures by 59 campers and 50 parents. Missing data was not imputed; thus, the number of participants included in each analysis differs slightly depending on the number of participants for whom data was available for that variable.

Ratings of Hunger Scale Practice

Mean HSQ item responses (displayed in Table 2) ranged from 2.38 to 4.77 on a 5-point scale, demonstrating overall moderate to high levels of reported acceptability, utility, actual and predicted use, and memory of the Hunger Scale. Immediately following the intervention, campers reported a moderate level of liking learning about the Hunger Scale, and they rated it as helpful in reminding them to stop eating before getting

“stuffed.” Campers endorsed thinking about the Hunger Scale more than half the times they ate, and they predicted they would think about it about that often after camp.

Campers also thought the Hunger Scale would help other kids their age.

At follow-up, campers and parents both endorsed a high level of remembering learning about the Hunger Scale. Approximately 56% of campers reported that their family talks about and helps them remember to check-in with their stomach somewhat to very often, and about 70% of parents reported that their family and child talk about and use the Hunger Scale somewhat to very often. Since camper week, campers reported thinking about the Hunger Scale moderately often, and they endorsed that many times thinking about the Hunger Scale helps them stop eating before getting stuffed. Parents rated the Hunger Scale as both helping their child to not get too hungry before eating and helping their child remember to stop eating before getting stuffed.

Internal consistency of each HSQ version was strong (Cronbach's α = 0.76-0.82), with Cronbach's $\alpha \geq 0.70$ considered acceptable (Nunnally & Bernstein, 1994). Mann-Whitney U Tests demonstrated significantly higher Post and FUP HSQ-C total scores for campers classified at baseline, on the basis of parent reports, as engaging in disordered eating compared to those classified as normal-eating (see Table 3). Thus, campers perceived by their parents as sometimes eating objectively large amounts and/or experiencing loss of control when eating responded more positively to and were more engaged in the intervention. Moreover, Kruskal Wallis Tests (see Table 4) revealed significant differences by age group for parents' FUP HSQ-P total score and for items 2 and 3, specifically, which assessed family use and communication about the Hunger Scale. Follow-up paired comparisons using Mann-Whitney U Tests demonstrated that

parents of 11-12 year olds gave more positive ratings than parents of 13-14 year olds, with ratings of parents of 9-10 year olds intermediate and not significantly differently from the other two age groups.

Using Spearman's rank-order correlation coefficients (r_s), campers' Post and FUP HSQ-C total scores were significantly correlated, $r_s(46) = .42, p < .01$, indicating reasonable consistency over time in campers' overall ratings of the intervention.

Changes in Appetite Awareness

The AAS-C was first evaluated for internal consistency, and Item 4 was dropped for subsequent analyses because it was found to not correlate as well with the other items. For the 5-item AAS-C, internal consistency coefficients were strong for each administration ($\alpha_s = 0.76-0.83$). In addition, BL and Pre AAS-C total scores were highly correlated, $r_s(36) = .76, p < .001$, providing preliminary evidence of test-retest reliability. The time between these administrations ranged from approximately 2 weeks to 2 months because families attended different welcome weekends.

Using Kruskal Wallis and Mann-Whitney U Tests, no differences in AAS-C total or change scores were found by any baseline sample characteristic, except for eating behavior classification (see below). Planned comparisons with Wilcoxon Signed Ranks Tests demonstrated a decline ($M_{\text{change}} = 0.92, SD_{\text{change}} = 2.88$) in AAS-C total scores from Pre ($M = 12.67, SD = 4.30$) to Post ($M = 11.75, SD = 3.91$), $Z = -2.19, n = 63, p < .05$, and no change from Post ($M = 11.88, SD = 3.98$) to FUP ($M = 11.51, SD = 4.33$), $Z = -0.63, n = 51, p = .53$. This finding indicates significant improvement in self-reported appetite awareness by the end of camp that was maintained at follow-up. Greater improvements in appetite awareness were reported by campers classified at baseline as

disordered-eating compared to normal-eating (shown in Table 3). Specifically, using Mann-Whitney U Tests, normal-eating campers reported no change in appetite awareness ($M_{Pre} = 11.75$, $SD_{Pre} = 3.89$; $M_{Post} = 11.64$, $SD_{Post} = 3.87$), $Z = -0.01$, $n = 28$, $p = .99$, whereas disordered-eating campers initially reported more significant impairments in appetite awareness, which improved to the level of the normal-eating group by the end of camp ($M_{Pre} = 13.55$, $SD_{Pre} = 5.01$; $M_{Post} = 11.41$, $SD_{Post} = 4.37$), $Z = -2.95$, $n = 22$, $p < .01$.

Negative correlations were found between campers' total scores on the Post HSQ-C and both the Pre, $r_s(62) = -.32$, $p < .05$, and Post AAS-C, $r_s(71) = -.36$, $p < .01$, as well as between their FUP HSQ-C and FUP AAS-C scores, $r_s(56) = -.26$, $p < .05$. These findings indicate that, both directly after the intervention and at follow-up, overall more favorable ratings of the Hunger Scale practice were found among campers with higher levels of self-reported appetite awareness.

Discussion

To our knowledge, this pilot study represents the first implementation and empirical investigation of *in vivo* appetite monitoring (AM) at a weight management camp for overweight and obese youth. We found that it was feasible to implement mealtime AM, called "Hunger Scale practice," at a 5-day residential camp with a focus on family-based weight management strategies. Furthermore, campers and parents reported moderate to high levels of acceptability, utility, actual and predicted use, and memory of the Hunger Scale at follow-up. Several results from campers' and parents' ratings of the Hunger Scale practice are noteworthy. First, parents of 11-12 year olds gave the highest overall ratings of the practice, particularly compared to parents of 13-14 year olds. These findings are consistent with qualitative and quantitative reports from

counselors that the 11-12 year old age group responded most favorably to the intervention, and that levels of acceptability and engagement were lowest among 13-14 year olds (Marx et al., August 2012).

More positive responses to the Hunger Scale practice were also found for campers who, according to baseline parent reports, were engaging in disordered compared to normal eating over the past 6 months. This finding can be interpreted in several ways. First, assuming accuracy of the parents' accounts, this finding may mean that campers with disordered eating were more likely to recognize the potential of the Hunger Scale to normalize their eating, and responded more positively to the practice. Alternatively, there may be a lack of correspondence between actual and reported child eating behaviors, such that parent reports may have instead reflected parents' level of concern about their child's eating and/or better parental awareness of what qualifies as disordered eating. In this case, children whose parents were more worried and/or cognizant of their eating as pathological may have been more worried themselves about their eating and weight. Thus, these campers may have been more receptive to intervention strategies, such as the Hunger Scale, taught at camp.

Finally, there was consistency in campers' ratings and reported use of the Hunger Scale between the end of the intervention and follow-up. This finding suggests, first, that initially getting campers to like and practice using this tool may increase their likelihood of using it at home; and, second, that it may be possible to identify characteristics of campers who are more inclined to like and benefit from the Hunger Scale than others.

To assess changes in self-reported appetite awareness with the Hunger Scale practice, the Appetite Awareness Scale for Children (AAS-C) was developed and

administered to campers. Preliminary evidence of acceptable internal consistency and test-retest reliability of the AAS-C was demonstrated, suggesting that children ages 9-14 can feasibly and reliably report on their sensitivity to internal appetite cues.

On the AAS-C, campers reported significant improvements in appetite awareness from the beginning to the end of camper week, which were maintained 2 to 4 months after camp. Several camper characteristics were found to differentiate campers' initial levels of appetite awareness and changes in their awareness. First, consistent with parents of campers classified as disordered-eating giving more positive ratings of the Hunger Scale practice, disordered-eating campers reported greater improvement in appetite awareness than campers categorized as eating normally. Upon further examination, normal-eating campers reported higher levels of appetite awareness at the beginning of camper week, and showed no change by the end of the week. In contrast, disordered-eating campers initially reported poorer appetite awareness, which improved to slightly above the level reported by normal-eating campers at post-camp. This result is encouraging given the goal of AAT is to "normalize" eating (i.e. decrease overeating and improve control over eating) (Craighead, 2006). Finding that children identified as overeating and/or binge eating endorsed greater improvement in appetite awareness and were also seen by their parents as responding better to and engaging more in the Hunger Scale practice suggests that the training was effective with those who needed it most.

In addition, campers who reported higher levels of appetite awareness (pre- and post-camp) gave more positive overall ratings of the Hunger Scale at the end of camper week. This finding may indicate that using the Hunger Scale is easier and more comfortable for campers who already feel more in touch with their appetite cues, and so

they rate it more favorably. Campers who feel more out of touch, on the other hand, may find using the Hunger Scale less intuitive initially and thus more effortful or unpleasant and, hence, rate it somewhat lower. However, it appears that the disordered-eating campers, who were more “out of touch” initially, did improve their awareness, ultimately reaching the levels of the normal-eating campers by post-camp and maintaining their improvement at follow-up.

Overall, it was encouraging to detect improvement in appetite awareness with this brief (5-day) and minimally intensive (primarily mental monitoring) AM intervention. This finding adds to prior studies demonstrating that training can improve children’s sensitivity to appetite sensations (Bloom, et al., 2013; Boutelle, et al., 2011; Gunnarsdottir, et al., in preparation; S. L. Johnson, 2000). In addition, this recent interest in interventions that target appetite awareness, as well as evidence of deficits in appetite awareness among overweight youth (Barkeling, et al., 1992; Barkeling, King, Naslund, & Blundell, 2007; Bruce, et al., 2010; Carnell & Wardle, 2008, 2009; Jansen, et al., 2003; Mehra, et al., 2011; Roth, et al., 2005; Webber, et al., 2009), suggest a need for a measure that quickly, reliably, and validly assesses this ability in youth. The AAS-C represents the first self-report measure of appetite awareness for children and adolescents. Thus, this initial evidence that children and adolescents can feasibly, quickly (in less than 5 minutes), and reliably report on their ability to perceive their appetite sensations is promising.

Still, the current pilot study has several limitations. For one, the lack of a control group does not allow us to determine whether changes in camper appetite awareness are due to the Hunger Scale practice, other aspects of camp, or to other external events. There

are also disadvantages of using a self-report measure of appetite awareness, including typical self-report biases (e.g., social desirability, memory biases), as well as the possibility that campers' perception of their appetite awareness does not correspond with their actual abilities.

Now that the feasibility of implementing a brief, minimal mealtime Hunger Scale practice in a camp setting has been demonstrated, we note a number of ways to further develop and improve this intervention, such as encouraging greater family use (e.g., implementing mealtime practice at family weekends, having families role-play collaborative practice at meals), tailoring the practice to specific settings or populations (e.g., schools, age groups), making it more fun and interactive (e.g., a Hunger Scale mascot, apparel), and increasing the intensity of the practice (e.g., written monitoring on erasable Hunger Scale placemats).

Continued investigation of the psychometric properties of the AAS-C is also needed, including assessing convergent validity by correlating the AAS-C with measures of related constructs (e.g., the Eating in the Absence of Hunger questionnaire), assessing construct validity through correlations with experimental and physiological measures of appetite awareness, and looking at the relationship between child and parent self-reports to investigate possible shared genetic and environmental influences on self-reported appetite awareness.

Conclusion

In conclusion, first, this pilot study demonstrates the feasibility of implementing meal-based appetite monitoring (AM) at a residential camp for overweight and obese youth. Positive ratings of the acceptability, use, utility, and memory of the intervention

are promising. Although AM, to our knowledge, has not been implemented in a camp setting, food monitoring is practiced at many intensive camps and has been linked to improved weight loss (Kelly & Kirschenbaum, 2010). Several advantages of AM, noted above, together with the findings of this pilot study, suggest AM is likely to be a helpful self-regulatory strategy to teach children at camps or in other settings where they frequently eat (e.g., schools). Due to significant limitations in the study design, replication of these results using a randomized controlled trial is needed.

Second, this study finds preliminary evidence that the AAS-C, the first direct self-report measure of appetite awareness for children and adolescents, is feasible to administer to this age group and is reliable. Using the AAS-C, campers reported significant improvements in appetite awareness at the end of camp that were maintained at follow-up. A brief, cost-effective measure of appetite awareness in this age group has many potential research and clinical applications. Continued examination of the psychometric properties of the AAS-C is needed.

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Appendix A

Appetite Awareness Scale for Children

Answer the following questions based on what has been true for you *over the past month* by circling one number for each question.

1. I continue to eat after I feel full.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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2. I eat when I am not hungry.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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3. I don't notice I'm full until I'm stuffed.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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4. I can't really tell when I feel full.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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5. I don't notice that I'm a little too full until after I've stopped eating.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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6. When I start eating I don't stop until the food is gone or I'm really full.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
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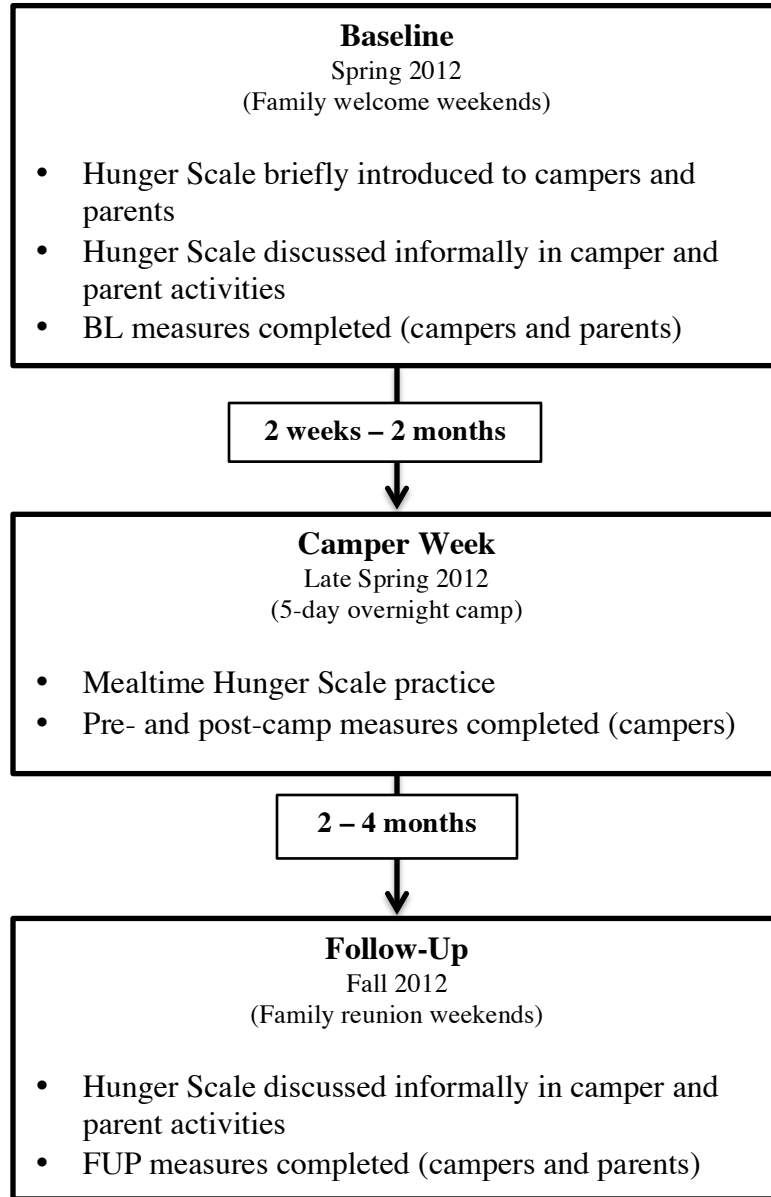


Figure 1. Timeline of camp activities and intervention and data collection procedures.

Table 1

Baseline Sample Characteristics

Age (years) (N = 88)	<i>n</i>	%
9-10	28	31.8
11-12	32	36.4
13-14	28	31.8
Sex (N = 88)	<i>n</i>	%
Girls	56	62.8
Boys	32	37.2
Race (N = 88)	<i>n</i>	%
White	19	21.6
Black	59	67.0
Multi-racial/other	11	11.4
Household income (N = 88)	<i>n</i>	%
Less than \$30,000	16	20.5
\$30,000 - \$70,000	46	59.0
More than \$70,000	16	20.5
Weight category^a (n = 73)	<i>n</i>	%
Overweight	6	8.2
Obese	67	91.8
Eating behavior^b (n = 66)	<i>n</i>	%
Normal-eating	37	56.1
Disordered-eating	29	43.9
	<i>M</i>	<i>SD</i>
BMI (n = 73)	34.04	9.34
BMI percentile (n = 73)	98.38	2.13
AAS-C^c (n = 52)	13.63	5.95

Note. BMI = body mass index; AAS-C = Appetite Awareness Scale for Children.

^a Overweight defined as BMI percentile between 85 (inclusive) and 95 (non-inclusive), and obese greater than 95 (inclusive). ^b Eating behavior classification determined by parent responses on the Questionnaire of Eating and Weight Patterns (QEW-P). ^c Based on finding that internal consistency improved without 1 item, mean for 5-item AAS-C reported.

Table 2

Hunger Scale Questionnaires (HSQs): Items and Descriptive Statistics

Post HSQ - Camper Version (Post HSQ-C) (n = 74)	<i>M</i>	<i>SD</i>
1. Did you like learning to use the Hunger Scale?	3.81	1.21
2. How often do you think about the Hunger Scale when you decide to eat something?	3.37	1.11
3. Does the Hunger Scale help you remember to stop eating before you get stuffed?	4.04	1.18
4. How often will you think about the Hunger Scale after you leave camp?	3.51	1.11
5. Do you think the Hunger Scale will help other kids your age?	4.17	1.17
<hr/>		
Follow-up HSQ - Camper Version (FUP HSQ-C) (n = 59)	<i>M</i>	<i>SD</i>
1. Do you remember learning about the Hunger Scale at camp?	4.75	0.82
2. After camp, did you ask your family to help you remember to use the Hunger Scale?	3.05	1.53
3. How often does your family talk about the Hunger Scale and help you remember to check-in with your stomach?	2.83	1.38
4. Since camp, how often do you think about the Hunger Scale before you start eating or think about eating?	3.22	1.34
5. Since camp, how often does thinking about the Hunger Scale help you to stop eating before you get stuffed?	3.79	1.20
<hr/>		
Follow-up HSQ - Parent Version (FUP HSQ-P) (n = 52)	<i>M</i>	<i>SD</i>
1. Do you remember learning about the Hunger Scale at the first family weekend?	4.77	0.67
2. After camp, did your child ask you to help them remember to use the Hunger Scale?	3.36	1.43
3. How often do your family and your child talk about and use the Hunger Scale now?	3.39	1.18
4. How helpful is the Hunger Scale in helping your child remember to not get too hungry before eating?	3.73	1.38
5. How helpful is the Hunger Scale in helping your child remember to stop eating before he or she is too stuffed?	3.84	1.17

Table 3

Mean Differences in Measures by Camper Eating Behavior Classification

Measure	Eating Behavior Classification						Mann-Whitney U Test
	Normal-Eating			Disordered-Eating			Z
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
BL AAS-C	20	12.20	5.77	24	14.33	6.42	-1.23
Pre AAS-C	33	12.12	4.29	23	13.26	5.08	-1.01
Post AAS-C	29	11.69	3.81	25	11.32	4.34	-0.17
FUP AAS-C	23	12.26	4.75	19	11.63	4.60	-0.27
AAS-C change (Pre-Post)	28	0.11	2.83	22	2.14	2.83	-2.39*
AAS-C change (Post-FUP)	17	-0.06	3.67	19	-0.32	2.65	-0.14
Post HSQ-C	30	17.81	4.14	25	20.23	4.44	-2.38*
FUP HSQ-C	23	17.17	3.65	18	19.17	5.52	-2.00*
FUP HSQ-P	19	19.45	3.87	18	19.78	3.89	-0.23

Note. Eating behavior classification determined by parent responses on the parent version of the Questionnaire of Eating and Weight Patterns (QEWP-P).

BL = baseline; FUP = follow-up; Pre = pre-camp; Post = post-camp; AAS-C = Appetite Awareness Scale for Children; HSQ-C = Hunger Scale

Questionnaire-Camper Version; HSQ-P = Hunger Scale Questionnaire-Parent Version.

**p* < .05

Table 4

Differences in Hunger Scale Questionnaire (HSQ) Ratings by Camper Age Group

Measure	Age Group									Kruskal Wallis Test $\chi^2(2)$
	9-10			11-12			13-14			
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Post HSQ-C										
Total	26	19.13	4.56	29	19.77	3.29	19	17.24	4.44	3.84
FUP HSQ-C										
Total	16	18.13	5.32	24	18.26	4.47	19	16.42	4.75	2.01
FUP HSQ-P										
Item 1	15	4.67	0.82	23	4.83	0.65	12	4.79	0.58	0.93
Item 2	15	3.20	1.47	23	3.89†	1.19	12	2.64†	1.50	6.55*
Item 3	15	3.20	1.21	23	3.87†	1.06	12	2.77†	1.09	7.59*
Item 4	15	3.80	1.21	23	3.96	1.22	12	3.23	1.69	1.46
Item 5	15	4.00	1.13	23	4.09	0.95	12	3.23	1.42	3.61
Total	15	18.78	4.44	23	20.63†	4.03	12	16.50†	4.46	7.62*

Note. Post = post-camp; FUP = follow-up; HSQ-C = Hunger Scale Questionnaire-Camper Version; HSQ-P = Hunger Scale Questionnaire-Parent Version.

* $p < .05$. †Mann Whitney U Test indicated significant difference at Bonferroni-adjusted alpha level of .0167 (.05/3) per test.