The Effects of Yoga on Eating Disorder Symptoms and Correlates: A Review

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Abstract

Background: Yoga is a popular adjunct therapy for eating disorders (EDs). A systematic review and synthesis of the yoga literature is needed to guide treatment recommendations and future research. This article provides a review of studies that used yoga for preventing and treating EDs. **Method:** Databases were searched for peer-reviewed articles about yoga practice and ED symptoms and correlates. **Results:** Of the 14 articles reviewed, 40% used cross-sectional designs to examine risk and protective factors for EDs among yoga practitioners, and 60% used longitudinal designs to assess the effectiveness of yoga interventions for preventing and treating EDs. Yoga practitioners were reported to be at decreased risk for EDs, and ED risk and symptoms were reduced or unchanged after yoga interventions. **Conclusions:** Well-controlled studies are needed to understand whether the positive effects of yoga on ED symptoms and correlates are related to the type of yoga practiced, the amount/frequency of practice, and/or other variables.

Key Words: yoga, eating disorder, body image, review, treatment, prevention

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Eating disorders (EDs) comprise a class of psychopathology marked by problematic food-related attitudes, emotions, and behaviors (National Eating Disorder Association, 2012). They are diagnosed using the American Psychiatric Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders (DSM)*. The DSM fourth edition includes three categories of EDs: (a) anorexia nervosa (AN; refusal to maintain recommended body weight), (b) bulimia nervosa (BN; a cycle of binge eating and compensatory behaviors), and (c) EDs not otherwise specified (EDNOS; APA, 2000). Binge eating disorder (BED) is a type of EDNOS marked by the binge eating associated with BN but without compensatory behaviors. The search for effective ED interventions is ongoing; EDs were introduced relatively recently in the DSM third edition, and currently recommended treatments are only moderately effective (APA, 1980; Crow & Nyman, 2004). Of the 14 million Americans suffering from AN or BN, 2.8 million will never fully recover and 400,000 will die prematurely from ED-related causes (APA, 2000; Keel & Brown, 2010; Steinhausen & Weber, 2009). This article provides a systematic review of the extant literature regarding yoga in the context of EDs, with the intention of encouraging empirically rigorous research regarding the use of yoga interventions for individuals with EDs.

Yoga is increasingly recommended and implemented to address ED concerns (Boudette, 2006; Douglass, 2009). It can feasibly be integrated into currently recommended treatments and used as a mind–body practice to improve conditions characterized by a disordered mind–body relationship. Yoga has been recommended to address ED symptoms and correlates or the risk, protective, and maintenance factors implicated in the etiology and maintenance of EDs (see Stice, 2002, for a review). Outside of the context of treating EDs, yoga practice has been shown to improve self-esteem and body awareness, two ED protective factors (Elavsky & McAuley, 2007; Littleton & Ollendick, 2003; Myers & Crowther, 2008; Rani & Rao, 1994).

EDs often co-occur with anxiety, depression, obsessive-compulsive disorder, and posttraumatic stress disorder (Altman & Shankman, 2009; Brewerton, 2007; Hudson, Hiripi, Pope, & Kessler, 2007; Polivy & Herman, 2002). In samples without EDs, yoga has been shown to have therapeutic effects on these conditions (Brown & Gerbarg, 2005; Ross & Thomas, 2010; Shannahoff-Khalsa, 2004; Uebelacker et al., 2010). Given the association between yoga practice and improvements in comorbid symptoms and disorders, yoga is a viable option to address food-related and body image concerns (see Douglass, 2011) and is increasingly considered to be an adjunct therapy for individuals with EDs.

Although yoga has been integrated into ED treatment for many years, empirical data regarding the effectiveness of this approach are in the formative stages. Nevertheless, it is important to review and synthesize what is known about yoga as a potential adjunct treatment for EDs to guide treatment recommendations and to identify future directions for research. In this article we systematically review, summarize, and synthesize the existing empirical literature about the use of yoga in the context of EDs. Limitations regarding the current evidence base are examined and suggestions for further study are offered.

Methods

Electronic Searches

Peer-reviewed articles published since 1980, when EDs were identified as a diagnostic category in the *DSM*, were searched in December 2012. Databases used included PsychINFO,

PsychARTICLES, Psychological and Behavioral Sciences Collection, Alt HealthWatch, MEDLINE, and CINHAL Plus. Searches used the key term yoga in combination with each of the following keywords: *eating disorders, disordered eating,* and *body image*. References from selected articles were also explored.

Article Selection

In our search, 115 unique citations were identified. Corresponding titles and abstracts were reviewed to assess relevance. Methods sections were examined to ensure that two inclusion criteria were met: (a) study methodology explored at least one yoga element (i.e., breath manipulation [*pranayama*], physical postures [*asana*], relaxation, and meditation; Anderson & Sovik, 2008), and (b) data were collected about at least one ED outcome. Studies that met inclusion criteria were reviewed regardless of research design.

Investigations using mindfulness-based therapies for eating and other disorders (e.g., Dialectic Behavior Therapy, Mindfulness-Based Eating Awareness Training) were excluded from our review. These practices emphasize awareness training and may incorporate breath work, relaxation, formal meditation, and cognitive-behavioral interventions, but they are not labeled or presented to consumers as "yoga." Consequently, they were viewed as qualitatively distinct programs that have been reviewed previously (see Wanden-Berghe, Sanz-Valero, & Wanden-Berghe, 2011).

Fourteen studies were considered for this review on the basis of the above-referenced criteria.

Data Collection

Sample characteristics, type and dosage of yoga, ED-related outcomes, and methodology were evaluated for each study. Reviewer bias was reduced, and study quality was determined by following the PRISMA Group's and Jadad et al.'s (1998) recommendations for methodologically rigorous reviews. Each author and a graduate student independently scored each of the 14 studies by using Sackett's Levels of Evidence, a categorization system for evaluating the quality of research. Levels range from 1 to 5 and signify high to low methodological rigor. Levels correspond with the following study designs: Level 1, randomized controlled trials (RCTs); Level 2, low-quality RCTs and individual cohort studies; Level 3, case-controlled studies; Level 4, case series and poor-quality case-control studies; and Level 5, expert opinion. Specifiers "A" or "B" accompany Levels 1 to 3 to distinguish systematic reviews and original studies, respectively. Sackett's original levels do not specifically classify cross-sectional designs. This review classified cross-sectional research as Level 4, considering that these designs provide stronger evidence than expert opinion but are less methodologically rigorous than case-controlled and longitudinal designs.

Reviewers recorded whether each study reported (a) appropriate random assignment, (b) thorough description of blinded outcome assessment, (c) sample size justification (statistical power), (d) adequate description and acceptable levels of attrition, (e) an intention-to-treat analysis, (f) acceptable treatment adherence, (g) intervention manual/protocol, (h) measured and adequate treatment integrity, (i) well-described outcome measures, and (j) acceptable reliability. Reviewers compared independent assessments of these methodological characteristics and discussed inconsistencies until consensus was reached.

Results

Study characteristics are delineated and findings are explicated according to outcome type. Study characteristics and methodological rigor are then summarized. These data are detailed in Tables 1 and 2, respectively. Note that in Table 2 studies are organized based on research design: cross-sectional designs or longitudinal designs examining a researcher-manipulated yoga intervention.

Methodology of Reviewed Studies

Studies were assigned Sackett Levels of either 4 or 2B, indicative of low and moderate methodological rigor, respectively. It is important to note that several of the studies that met criteria for Sackett's Level 2B varied substantially in terms of methodological rigor (see Table 1). Therefore, it is recommended that Table 2 be used for a more detailed explication of research design.

Level 4 studies. These studies include cross-sectional investigations of yoga practitioners' ED-related characteristics and do not involve administration of a proscribed yoga intervention (Daubenmier, 2005; Delaney & Anthis, 2009; Dittmann & Freedman, 2009; Neumark-Sztainer, Eisenberg, & Loth, 2011; Prichard & Tiggemann, 2008; Zajac & Schier, 2011). One study used correlational analyses (Prichard & Tiggemann, 2008). The remaining five cross-sectional studies used a between-subjects design in which yoga practitioners were compared with individuals who did not practice yoga or practiced a different type of yoga (Daubenmier, 2005; Delaney & Anthis, 2010; Dittmann & Freedman, 2009; Neumark-Sztainer et al., 2010; Zajac & Schier, 2011).

Level 2B studies. These studies include longitudinal investigations in which a yoga-based intervention was administered as prevention or treatment for EDs or ED-related factors (Carei, Fyfe-Johnson, Breuner, & Brown, 2010; Cook-Cottone, Beck & Kane, 2008; Cook-Cottone, Jones, & Haugli, 2010; Dale et al., 2009; McIver, O'Halloran, & McGartland, 2009; Mitchell, Mazzeo, Rausch, & Cooke, 2007; Scime & Cook-Cottone, 2008; Scime, Cook-Cottone, Kane, & Watson, 2006). Four of these studies used an uncontrolled within-subjects approach in which all participants received yoga instruction and their baseline and postintervention ED characteristics were compared (Cook-Cottone et al., 2008; Cook-Cottone et al., 2010; Dale et al., 2009; Scime et al., 2006). Another study used a poorly controlled quasiexperimental design with an untreated comparison group (Scime & Cook-Cottone, 2008). Three Level 2B studies included random assignment to yoga treatment and control groups and baseline and postintervention between-groups comparisons (Carei et al., 2009; McIver et al., 2009; Mitchell et al., 2007). Several of these studies had one or more minor methodological flaws, including poorly described method of randomization, no intention-to-treat analysis, and no intervention manual (see Table 1).

Table 1.
Methodological Quality by Study

Criteria	Zajac & Schier (2011)	Daubenmier (2005)	Dittmann & Freedman (2009)	Delaney & Anthis (2010)	Neumark-Sztainer, Eisenberg, Wall, & Loth (2010)	Prichard & Tiggemann (2008)	Scime, Cook-Cottone, Kane, & Watson (2006)	Cook-Cottone, Jones, & Haugli (2010)	Cook-Cottone , Beck, & Kane (2008)	Scime & Cook-Cottone (2008)	Dale et al. (2009)	Mitchell, Mazzeo, Rausch, & Cooke (2007)	McIver, O'Halloran, & McGartland (2009)	Carei, Fyfe-Johnson, Breuner, & Brown (2009)
Was method of randomization well described & appropriate?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	Y	Y
Was outcome assessment described as blinded (B) or unblinded (UB)?	NR	NR	UB	NR	NR	NR	NR	UB	UB	NR	UB	NR	NR	B
Was method of blinding for outcome assessments well described & appropriate?	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NA	NR	NR	Y
Was sample size justified?	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
Was there a complete description of withdrawals & dropouts?	NA	NA	NA	NA	NA	NA	N	N	Y	Y	N	Y	Y	Y
Were withdrawals & dropouts < 10%?	NA	NA	NA	NA	NA	NA	NR	NR	N	Y	N	N	N	Y
Was there intention-to-treat analysis?	NA	NA	NA	NA	NA	NA	N	N	N	N	N	Y	Y	Y
Was adherence to yoga intervention (attendance or completion of sessions) > 70%?	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
Was there a manual or protocol used for yoga instruction?	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y
Was treatment integrity measured?	NA	NA	NA	NA	NA	NA	NA	NA	Y	NR	NR	NA	N	Y
If so, was treatment integrity adequate?	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NA	NA	NR
Were outcome measures described?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
If so, were they of adequate reliability (r > .70)?	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	Y	NR	NR
Sackett level	4	4	4	4	4	4	2B	2B	2B	2B	2B	2B	2B	2B

Note. *Y = yes; *N = no; *NR = not reported; *NA = not applicable; *2B = cohort study/lower quality RCT; *4 = case series, poor cohort case controlled, Survey=

Yoga types. All studies included asana practice, but most did not specify whether other elements of yoga were practiced (e.g., pranayama, meditation). Participants engaged in an array of yoga styles. Unspecified or mixed forms of yoga were practiced in 36% of the studies (Delaney & Anthis, 2010; Dittmann & Freedman, 2009; Neumark-Sztainer et al., 2010; Prichard & Tiggemann, 2008; Zajac & Schier, 2011), and one study combined yoga practice and Pilates (Neumark-Sztainer et al., 2010). Hatha yoga was practiced in 29% of studies. The remaining articles either did not report a specific yoga style (7%; McIver et al., 2009) or used one of the following traditions: Iyengar or Ashtanga (7%), Forrest (7%), Integral (7%), and Viniyoga (7%).

Yoga dosage. The duration and frequency of yoga practiced (dosage) varied across studies. Average time spent practicing yoga per week ranged from 25 to 300 minutes. Most yoga sessions ranged from 45 to 120 minutes. Administered yoga interventions lasted 8 to 12 weeks, with the exception of one that entailed 1,170 minutes of practice during the course of a 6-day workshop (Dale et al, 2009). Yoga sessions were generally offered 1 time per week except in one study that involved twice-weekly yoga instruction (Carei et al., 2009). Two studies did not report yoga dosage (Dittmann & Freedman, 2009; Zajac & Schier, 2011).

Study Outcomes

The following subsections present each study and corresponding results grouped by ED risk or protective factors, and symptoms.

Body dissatisfaction. Negative body image has consistently been identified as a risk and maintenance factor for EDs (Stice, 2002). It often triggers dieting, which has causal implications for pathological eating. ED prevention and treatment efforts often aim to improve body satisfaction (Littleton & Ollendick, 2003). Nine studies have considered whether body image concerns are differentially related to engagement in yoga versus other forms of physical activity, as well as why individuals select particular forms of exercise.

Zajac and Schier (2011) surveyed adult female yoga (type unspecified) and aerobics practitioners in Poland (yoga, $n = 30$; aerobics, $n = 40$) and Canada (yoga, $n = 30$; aerobics, $n = 38$) to assess body image distress and motivation for exercising by using a cross-sectional design. Participants were recruited from yoga studios and fitness centers. Comparisons of Polish and Canadian yoga and aerobics practitioners revealed that Polish yoga practitioners had significantly lower average body image distress scores than did Polish aerobics practitioners and Canadian yoga or aerobics practitioners. Canadian yoga practitioners had comparatively but not significantly lower body image distress ratings than did their aerobics-practicing counterparts. Correlational analyses found that yoga practitioners were less motivated by weight management and more motivated by health/stress management than were aerobics practitioners, regardless of nationality.

Daubenmier (2005) used a cross-sectional design to compare body image ratings among yoga practitioners ($n = 51$), aerobics practitioners ($n = 45$), and those who did neither yoga nor aerobics ($n = 51$). Participants were asked to complete surveys regarding their physical activity and ED characteristics. Yoga practitioners reported engaging in an average of 300 minutes of Iyengar or Ashtanga yoga per week for approximately 6 years. Aerobics practitioners participated in 45- to 60-minute step classes for roughly 6 years. Yoga practitioners were found to have higher levels of body satisfaction than any of the other participants, and more yoga experience was associated with higher body satisfaction.

Dittman and Freedman (2009) assessed whether the association between yoga practice and ED risk factors is influenced by motivation for practicing. This cross-sectional study surveyed female yoga practitioners about their reasons for doing yoga and their experience of ED factors. Participants reported practicing an unspecified amount of various types of yoga at least 1 time per week. They were classified as having spiritual ($n = 99$) or physical/appearance motivations ($n = 30$). The overall sample exhibited high levels (scores > 3 on a 1–5, low–high Likert scale) of body satisfaction. Spiritually motivated practitioners reported higher levels of body satisfaction than did those with physical motivations. Many participants in this sample were experienced practitioners with practice histories ranging from 4 to 40 years (average = 12 years).

Other research suggests that type of yoga practiced is important (Delaney & Anthis, 2010). Distinct schools of yoga are thought to differentially emphasize elements of yoga practice and philosophy, with some forms of yoga being characterized by fast movements synchronized with breath (e.g., Vinyasa) and others by postures being held for longer periods of time (e.g., Hatha).

Delaney and Anthis (2010) conducted a cross-sectional survey of female yoga practitioners to assess whether different types of yoga vary in their therapeutic utility for those with ED concerns. Participants were classified as having a low ($n = 42$), medium ($n = 30$), or high ($n = 20$) level of emphasis on the mind–body relationship with respect to which yoga classes they attended. High mind–body classes tended to be physically demanding, requiring precise control of the body, and included emphasis on the nonphysical self through activities such as studying yogic texts. These classes included Jivamukti, Ashtanga, Kripalu, Iyengar, and Kundalini traditions. The medium mind–body category consisted of lower physical demand, less intense spiritual elements, and an emphasis on breath, and included only Hatha yoga. The low mind–body group focused on asana and poses and minimized spiritual elements. The authors described these classes as those typically taught in health clubs, including Vinyasa, Power Vinyasa, Gentle Yoga, Yoga Sculpt, and Bikram Yoga.

Participants reported yoga practices ranging from 207 to 253 minutes per week and had practiced for 6.64 to 9.57 years. Those in the medium and high mind–body groups reported higher levels of body awareness and body part satisfaction, compared with those in the low mind–body group, with differences between the medium and low groups being statistically significant. It is unclear why high mind–body yoga was associated with slightly less body satisfaction compared with medium mind–body yoga. The small group size and the coding of class type using class descriptions rather than direct observation of classes decreased the ability to detect meaningful effects.

Although these studies suggest that yoga practitioners are relatively satisfied with their bodies, it is unclear whether yoga practice or other extraneous variables may be responsible for these effects. A longitudinal study of diet, exercise, and related outcome variables (Project Eating and Activity in Teens and Young Adults III) found female yoga/Pilates practitioners and nonpractitioners to be equally dissatisfied with their bodies, after controlling for body mass index (BMI) and physical activity level (Neumark-Sztainer et al., 2010). Participants were grouped based on whether they reported participating in yoga and/or Pilates at least 1 time per week (practitioners, $n = 274$; nonpractitioners, $n = 2{,}013$). Practitioners were predominantly female (81%) and practiced an average of 122 minutes of unspecified forms of yoga/Pilates per week. Considering yoga and Pilates practitioners together is problematic, however, because they are distinct practices (Kristal, 2009).

Several longitudinal studies of yoga-based interventions have also been conducted. A multicomponent ED prevention program involving 8 to 12 weekly sessions of Hatha yoga (45 minutes long), psychoeducation, journaling, and group discussion has been the subject of several pre–post intervention evaluations. The first found that fifth-grade females ($n = 45$) recruited from public schools in western New York reported significantly lower levels of body dissatisfaction following 10 weeks of the program (Scime et al., 2006). This finding was replicated in a sample of fifth-grade females that included minority ($n = 25$) and White participants ($n = 25$) matched on the basis of BMI and socioeconomic status (Cook-Cottone et al., 2010). These findings were supported by a study in which outcomes of intervention participants ($n = 75$) were compared with those of untreated controls ($n = 69$). Significant pre- to posttest decreases in body dissatisfaction were also found when an 8-week version of the program was used as relapse prevention for ED outpatients ($N = 24$) recruited from local ED treatment providers (Cook-Cottone et al., 2008).

Mitchell et al. (2007) recruited a sample of college women to explore the impact of yoga on body image and other ED outcomes. Women dissatisfied with their bodies were randomly assigned to 1 of 3 groups: integral yoga ($n = 33$), cognitive dissonance discussion ($n = 30$), or no treatment ($n = 30$). The yoga and cognitive dissonance groups met 1 time per week for 6 weeks, for 45 minutes each. Participants completed a variety of pre- and postintervention measures. Significantly lower body dissatisfaction scores were reported for the dissonance group compared with the no-treatment controls. No significant body dissatisfaction decreases were found for the yoga group relative to the dissonance and control groups.

Self-objectification. *Self-objectification* refers to the perception of oneself as an object rather than a person as the result of focusing on one's outward appearance to the exclusion of internal aspects (Fredrickson & Roberts, 1997). As such, an individual experiences him- or herself as the object of another's gaze rather than possessing a subjective sense of self. Self-objectification is predictive of eating pathology and other ED risk factors and is a common target for ED interventions (Augustus-Horvath & Tylka, 2005).

Surveys were used to explore self-objectification among yoga practitioners in two cross-sectional studies. Prichard and Tiggeman (2008) compared correlations between self-objectification, additional ED outcomes, motivations for exercise, and types of physical activity for a group of adult female yoga and aerobics practitioners ($N = 570$). Yoga practitioners reported an average of 25 minutes of unspecified forms of yoga per week. Aerobics practitioners reported 152 minutes of aerobics per week. Yoga practice was found to be positively correlated with health-based exercise motivations and negatively correlated with both appearance-based motivation and self-objectification. Aerobics was associated with higher levels of self-objectification and ED behaviors and lower body esteem. For aerobics practitioners, the relationship between self-objectification and physical activity was mediated by participants' exercise-based motivations. This relationship was only partially mediated by yoga practitioners' motivations. Investigators posited that yoga practitioners who do yoga to enhance appearance may not experience the potential protective quality of yoga for decreasing ED susceptibility.

Daubenmier (2005) also observed a relationship between self-objectification and type of physical activity. Levels of self-objectification among yoga practitioners were compared with levels among aerobics practitioners. Yoga practitioners had significantly lower levels of self-objectification than did aerobics practitioners, with greater yoga experience associated with less self-objectification.

Drive for thinness. ED inventories typically measure drive for thinness, or the motivation to lose weight, because this factor predicts ED risk and relates to the two key features of AN and BN: fear of gaining weight and behaviors intended to prevent weight gain (APA, 2000; Garner, 1991; Tylka, 2004). Five longitudinal studies compared levels of drive for thinness before and after yoga interventions. Four studies reported completion of a yoga program to be associated with significant pre- to postintervention reductions in drive for thinness among samples of fifth-grade White and minority girls (Cook-Cottone et al., 2010; Scime et al., 2006; Scime & Cook-Cottone, 2008), and adult females with EDs (Cook-Cottone et al., 2008). Yoga-treated participants were less susceptible to the media influences thought to encourage individuals to strive to attain an unrealistic physique (Fredrickson & Roberts, 1997; Scime et al., 2006). Drive for thinness was unchanged from pre- to posttest among fifth-grade girls who did not complete the program (Scime & Cook-Cottone, 2008).

Mitchell et al. (2007) found that drive for thinness scores increased from pre- to posttest among untreated control participants and decreased for yoga-treated participants; however, these differential response patterns were not statistically significant. Only dissonance-treated participants exhibited a significant pre-post reduction in drive for thinness.

Body and emotional awareness. The extreme eating and exercising behaviors that mark EDs require individuals to ignore internal cues such as hunger, satiety, fatigue, and associated affect. Not surprisingly, alexithymia (impaired emotion recognition), poor interoceptive awareness, and poor body awareness and responsiveness correlate with ED behaviors and attitudes (Daubenmier, 2005; Myers & Crowther, 2008; Taylor, Parker, Bagby, & Bourkes, 1996).

Five studies explored associations between yoga and ED-related mind–body disconnectedness. Dittmann and Freedman (2009) reported that yoga practitioners have high levels of body awareness and responsiveness. Yoga practitioners exhibited high levels of intuitive eating indicative of their awareness and responsiveness to hunger and satiety. Yoga practitioners were also found to have higher levels of body awareness and responsiveness than did nonpractitioners (Daubenmier, 2005).

Delaney and Anthis (2010) detected significantly higher levels of body awareness among yoga practitioners whose practices place a moderate as opposed to a low level of emphasis on the mind–body relationship. The type of yoga influenced the relationship between yoga practice and body awareness. Dittmann and Freedman (2009) found yoga practitioners' motivation for practicing to be important. Specifically, practitioners with spiritual motivations for doing yoga had greater body awareness, body responsiveness, and intuitive eating compared with those with appearance-related motivations.

Longitudinal studies suggest a relationship between yoga practice and body awareness. Dale et al. (2009) administered a 6-day Forrest yoga workshop (1,170 minutes of yoga instruction supplemented with cooking classes, nutrition education, and group discussion) to a group of 5 adult females with a history of ED. Interoceptive awareness and other ED outcomes were measured before and after the workshop. Reported postintervention levels of interoception were significantly higher compared with baseline reports. The fact that this workshop entailed multiple components and no comparison group renders it difficult to discern whether improvements were attributable to yoga or to another aspect of the intervention.

Mitchell et al. (2007) reported statistically significant improvement in the related construct of alexithymia for the dissonance group in their study. However, only nonsignificant change was detected for those assigned to the yoga intervention and control groups.

ED protective factors. Research supports the notion of maximizing protective factors, such as self-competence and self-esteem, to mitigate the effects of ED risk (O'Dea, & Abraham, 2000; Peck & Lightsey, 2008; Stice, 2002). Several studies suggest that a yoga-based intervention for ED served as a protective factor for fifth-grade girls, who reported significant improvements in self-competence (Cook-Cottone et al., 2010) and physical and social self-concepts after completion of this program (Cook-Cottone et al., 2010; Scime & Cook-Cottone, 2008).

Emotion regulation is also considered a protective factor against EDs given that ED symptoms are thought to be coping strategies for tolerating negative affect (Soukup, Beiler, & Terrell, 1998; Stice, 2002). The ability to self-regulate affect may be a functional alternative to disordered eating. Findings from the 6-day yoga workshop (Dale et al., 2009) revealed that workshop completion was associated with improved emotion regulation and reduced affect problems among participants with a history of EDs.

ED symptoms and characteristics of yoga practitioners. Findings from cross-sectional studies on yoga practitioners' ED-related characteristics are mixed. Daubenmier (2005) found adult female yoga practitioners to be less likely to engage in disordered eating than were their non-yoga practicing counterparts. Yoga and Pilates practitioners considered as a single group were found to engage in some forms of weight management. The small sample of male practitioners in this study was found to engage in significantly more unhealthy weight management behaviors (e.g., fasting, laxative use) and binge eating than were female participants (Neunmark-Sztainer et al., 2010). Gender differences are difficult to explain given the lack of comparable studies. It is possible that males and females respond differently to yoga, or plausible that men who participate in yoga and Pilates may be at increased risk for EDs. These questions require further study.

ED symptoms and yoga interventions. Some pre–post-test studies of yoga interventions suggest that yoga has no effect on ED symptoms. Mitchell et al. (2007) reported no difference in caloric restraint or binge eating behaviors between body-dissatisfied females treated with a yoga intervention and their untreated counterparts. Bulimia symptoms also persisted among a sample of eating-disordered females despite their participation in a yoga ED prevention program (Cook-Cottone et al., 2008). Other research suggests that completion of a preventative yoga program for fifth-grade females without EDs was associated with pre–post decreases in bulimia symptoms (Cook-Cottone et al., 2010; Scime & Cook-Cottone, 2008).

Two RCTs support the therapeutic utility of yoga for individuals with existing ED symptoms. McIver et al. (2009) randomly assigned a community sample of women with self-reported BED to an unspecified yoga condition (n = 45) or a wait-list control group (n = 45). An assessment of ED outcomes occurred before and after participants completed 12 weeks of once weekly, 1-hour yoga sessions. Those in the intervention group reported significantly less binge eating following the yoga treatment, compared with baseline, and improvement was sustained at 3-month follow-up. No change was observed for the wait-list control group throughout the course of the study.

Carei et al. (2009) examined the effects of a yoga intervention for individuals with clinical-level EDs. Fifty young adults (93% female) with a diagnosis of AN, BN, or EDNOS were recruited from outpatient ED treatment programs through which they continued receiving weekly nutritional counseling and physical examinations. Participants were randomly assigned to a yoga group (n = 24) or a wait-list control group (n = 26). The yoga intervention involved 60 minutes of Viniyoga instruction 2 times per week for 8 weeks. ED outcome data were collected at baseline, 9 weeks, and 12 weeks. ED symptoms, depression, and anxiety significantly decreased from baseline to 9 weeks for both groups. The yoga group reported continued reductions in ED symptoms at 12 weeks and controls reported an increase in symptoms. Preoccupation with food was measured before and after each yoga session. These data were combined for both groups after the wait-list controls received the yoga intervention. Preoccupation with food significantly decreased for the entire sample after each yoga session, compared with presession ratings.

It is somewhat controversial to offer interventions involving physical activity to individuals with AN, because activities may lead to weight loss—an adverse effect for individuals already at an unhealthily low weight. The fact that Carei et al.'s (2010) intervention did not affect BMI suggests that Viniyoga

Table 2.
Summary of Reviewed Studies

First author (year)	Study design	Participants (*n*)	Gender (average)	Minutes of yoga/week	Yoga type	Results
Cross-sectional studies						
Zajac (2011)	Between-subjects (yoga vs. aerobics)	Yoga & aerobics practitioners from Canada (30 & 38) & Poland (30 & 40)	F (28)	Unspecified	Mixed	Yoga group more motivated by health/stress management and less by weight management; Polish yoga group had lowest body image distress
Daubenmier (2005)	Between-subjects (yoga vs. aerobics vs. neither)	Practitioners of yoga (43), aerobics(45), or neither (51)	F (37)	300	Iyengar & Ashtanga	Compared with nonyoga groups, yoga practitioners had greater body awareness/responsiveness, body satisfaction; lower self-objectification and disordered eating; higher levels of yoga experience associated with less self-objectification, greater body satisfaction
Dittmann (2009)	Between–subjects (physical vs. spiritual)	Yoga practitioners with physical (99) or spiritual (30) motivations	F (47)	≥1 time/week (min NR)	Mixed	Yoga practitioners have high levels of body awareness/responsiveness, intuitive eating, body satisfaction
Delaney (2010)	Between–subjects (high, med., low mind–body)	Practitioners of high (20), medium (30), & low (42) mind–body yoga	F (45)	207–253	Mixed	Medium mind–body yoga associated with greater body awareness/satisfaction than low group
Neumark-Sztainer (2010)	Between-subjects (yoga vs. nonyoga)	Yoga/Pilates practitioners (274) & nonpractitioners (2,013)	M&F (25)	120	Mixed yoga & Pilates	F practitioners report less body dissatisfaction but no different from nonpractitioners when BMI and physical activity level controlled; M practitioners engage in more extreme weight control behaviors regardless of BMI and physical activity
Prichard (2008)	Correlational	Fitness center yoga or aerobics practitioners (571)	F (36)	25	Mixed	Yoga associated with more health motivations for exercise, fewer appearance-related motivations, lower levels of self-objectification

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(Table 2 continued)

First author (year)	Study design	Participants (*n*)	Gender (average)	Minutes of yoga/week	Yoga type	Results
Longitudinal studies						
Scime (2006)	Within-subjects pre-post	5th graders in wellness group (45)	F (10)	45/10 weeks	Hatha	Decreased body dissatisfaction, drive for thinness, and media influence at posttest (d = .32–1.52)
Cook-Cottone (2010)	Within-subjects pre-post	5th graders in wellness group (25 Caucasian; 25 minority)	F (10)	45/10 weeks	Hatha	Improvements in drive for thinness, body dissatisfaction, bulimia, perceived competence, physical self-concept, social self-concept at posttest, regardless of race
Cook-Cottone (2008)	Within-subjects pre-post	AN, BN, & BED outpatients (24)	F (20)	45/8 weeks	Hatha	Reduced drive for thinness and body dissatisfaction at posttest but no change in bulimia symptoms (d = .58–.876)
Scime (2008)	Between-subjects (yoga vs. comparison)	5th graders in yoga (75) or control group (69)	F (10)	45/10 weeks	Hatha	Compared with controls, yoga participants exhibited greater improvements in body dissatisfaction, drive for thinness, bulimia symptoms, social self-concept (η^2partial from .03 to .122)
Dale (2009)	Within-subjects pre-post	Yoga practitioners with self-reported history of ED symptoms (5)	F (30)	1,170 min/ 6 days	Forrest	Improvements in interoception, emotion regulation, affective problems at posttest (η^2partial from .86 to .91), and improvements maintained at 1-month follow-up
Mitchell (2007)	RCT	Body-dissatisfied undergraduates given yoga (33), dissonance (30), or no treatment (30)	F (20)	45/6 weeks	Integral	Yoga and control groups exhibited no significant changes in drive for thinness, body dissatisfaction, restraint, binge eating, alexithymia
McIver (2009)	RCT	Community sample with BED symptoms in yoga (45) or control group (45)	F (41)	45/12 weeks	Unspecified	Reduced binge eating after yoga (d = 2.2)
Carei (2009)	RCT	Outpatients with AN, BN, & BED randomly assigned to yoga (24) or wait list (26)	M&F (17)	120/8 weeks	Viniyoga	Improvements in global EDE score from baseline to postintervention for both yoga and control groups, but improving trend continued for yoga participants while controls regressed from posttest to follow-up (η^2partial from .16 to .80); food preoccupation decreased from before to after each yoga session (d = .4–.8)

Note. *M/F = male/female; *NR =not reported; *results are at least significant at $p < .05$ unless otherwise noted.

may provide a safe approach for individuals with AN despite the physicality of the practice. Further research is needed to document the effects of various types of yoga practice on BMI and to replicate the Carei et al. findings. It is critical that individuals with EDs be medically cleared and monitored during any form of exercise.

Discussion

This review suggests a number of potential benefits of yoga practice and yoga interventions for individuals with EDs and their correlates. Given the absence of a pattern of worsening symptoms or adverse effects for known risk and protective factors, yoga may be safe for most with regard to EDs. It is important to interpret these findings with caution given the substantial variation in study quality/rigor, design, participant characteristics, and variations in types and dosage of yoga. There is considerable need for additional, high-quality research that provides specific information about the forms of yoga practiced and dosage effects.

Of the 14 reviewed studies, 40% suggest that yoga practitioners are less predisposed to EDs and ED risk factors, including body dissatisfaction, self-objectification, drive for thinness, poor body awareness, and responsiveness than are nonpractitioners (Daubenmier, 2005; Dittmann & Freedman, 2009; Zajac & Schier, 2011; and others). One cross-sectional study reported seemingly discrepant findings when yoga and Pilates practitioners were considered together.

Most yoga interventions were associated with fewer ED risk factors and symptoms, such as body dissatisfaction, drive for thinness, media influence, poor interoception, bulimic behaviors, binge eating, and food preoccupation (Carei et al., 2010; Cook-Cottone et al., 2008; Cook-Cottone et al., 2010; Dale et al., 2009; McIver et al., 2009; Scime & Cook-Cottone, 2008; Scime et al., 2006) and higher levels of ED protective factors, including self-competence, positive physical and social self-concepts, and emotion regulation (Cook-Cottone et al., 2010; Dale et al., 2009; Scime & Cook-Cottone, 2008). Findings from several controlled studies suggested yoga interventions are preferred to no treatment (Carei et al., 2010; McIver et al., 2009; Scime & Cook-Cottone, 2008). One study reported no significant effects of yoga on ED measures (Mitchell et al., 2007). A comparatively low dosage of yoga was administered, however, suggesting that a minimum dosage of practice may be necessary for yoga to be beneficial.

Limitations and Directions for Future Research

The most salient limitation in the reviewed research involves the absence of RCTs to test yoga interventions for the prevention and treatment of EDs. Most studies used cross-sectional designs and were hampered by the methodological weakness of including small, predominantly female convenience samples. Most intervention-based studies did not include control groups and implemented multifaceted interventions from which the specific effects of yoga practice could not be teased. Of the three RCTs reviewed, two evidenced problems with treatment standardization (McIver et al., 2010; Mitchell et al., 2007). Results may have been unknowingly influenced by characteristics of the yoga instructor, dynamics within group classes, and variability in yoga instruction. Carei et al. (2009) controlled for these potential confounds by recording private sessions delivered by a single instructor and following a treatment manual. Even with these precautions, the dosage yoga participants received could not be rigidly controlled because participants had the opportunity to practice yoga outside the context of the intervention.

More research is needed to address the gaps, inconsistencies, and limitations of the current knowledge base. Investigations that include diverse, gender-balanced samples will enable the exploration of potential gender-specific effects (Neumark-Sztainer et al., 2010). RCTs with samples large enough to compare effects of yoga across diagnoses (e.g., AN versus BN) and severity levels (e.g., clinical versus subclinical) are also needed.

It is prudent to identify which factors influence the effectiveness of yoga interventions so that treatment can be prescribed accordingly if yoga is to be considered an empirically supported adjunct therapy for EDs. Treatment guidelines can be informed by carefully designed research that addresses the efficacy of yoga and the associated issues within ED intervention practices. This research should include comparisons of yoga to other physiological interventions, such as stretching and walking. Finally, studies comparing various dosages of the same form of yoga and investigations of different styles of yoga are needed to discern whether a particular type and/or dosage of yoga is associated with maximal ED-related benefits.

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