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Yoga and Body Image: Findings from a Large Population-Based Study of Young Adults

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Abstract

This study explored the potential for yoga to promote body satisfaction in a general population of young adults. The sample included 1,664 participants (M age: 31.1, $SD = 1.6$ years) in Project EAT, a 15-year longitudinal study. Data from the third and fourth waves (EAT-III and EAT-IV), collected five years apart, were utilized. Practicing yoga (≥ 30 minutes/week) was reported by 16.2% of young adults. After adjusting for EAT-III body satisfaction and body mass index, yoga practitioners had higher concurrent body satisfaction at EAT-IV than those not practicing yoga (difference: 1.5 units (95% CI: 0.1 – 2.8), $p = .03$). Among participants within the lowest quartile of prior (EAT-III) body satisfaction, there was preliminary evidence that body satisfaction at EAT-IV was higher among yoga practitioners than in other young adults. Findings suggest that yoga may be associated with body satisfaction, particularly among young adults with low prior body satisfaction.

Keywords

Yoga; body image; eating disorders; young adults; population-based sample

Introduction

Body dissatisfaction is prevalent during adolescence and continues into young adulthood (Bucchianeri, Arikian, Hannan, Eisenberg, & Neumark-Sztainer, 2013). Body dissatisfaction

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Conflicts of interest: None

has the potential to negatively impact quality of life (Wilson, Latner, & Hayashi, 2013) and has been found to predict low self-esteem and depressive mood (Johnson & Wardle, 2005; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006). Furthermore, body dissatisfaction longitudinally predicts the use of disordered eating behaviors (Cooley & Toray, 2001; Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006; Stice, 2002) and excessive weight gain (Neumark-Sztainer et al., 2007; van den Berg & Neumark-Sztainer, 2007). To avoid these negative outcomes, it is imperative to identify strategies that have the potential to positively impact body satisfaction (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Neumark-Sztainer, Paxton, et al., 2006; Neumark-Sztainer et al., 2007; Stice, 2002).

Yoga is a practice that involves physical poses, focused breathing, mindfulness, and meditation (Cook-Cottone, 2015; Iyengar, 1966; Kraftsow, 2002). Yoga focuses on developing a positive relationship with one's body; the underlying tenets of yoga, including movement in accordance with the needs of one's body in the present moment, enhanced body awareness, and promotion of self-compassion, suggest that yoga could be helpful in promoting greater body satisfaction (Cook-Cottone, 2016; Daubenmier, 2005; Dittmann & Freedman, 2009; Douglass, 2011; Impett, Daubenmier, & Hirschman, 2006; Mahlo & Tiggemann, 2016). Cook-Cottone and Douglass (2017) have described the potential for yoga communities and the spaces in which yoga is practiced to enhance positive embodiment. Furthermore, the practice of yoga appears to be increasingly popular in the United States (Yoga Journal & Yoga Alliance, 2016), particularly among women, who are at high risk for body dissatisfaction (Bucchianeri et al., 2013; Lauche et al., 2017), suggesting its potential as a public health intervention to improve body satisfaction. An important question that remains to be addressed is whether yoga is associated with improvements in body satisfaction over time. A related question is whether yoga has the potential to benefit those in greatest need, i.e., those with lower levels of body satisfaction.

Intervention studies suggest that yoga may have positive implications for decreasing eating disorder symptoms, enhancing body awareness/attunement, decreasing self-objectification, and improving overall body satisfaction (Carei, Fyfe-Johnson, Breuner, & Brown, 2010; Impett et al., 2006; Klein & Cook-Cottone, 2013; McIver, McGartland, & O'Halloran, 2009; McIver, O'Halloran, & McGartland, 2009; Neumark-Sztainer, 2012; Pacanowski, Diers, Crosby, & Neumark-Sztainer, 2017). However, intervention studies exploring yoga and body satisfaction have been limited in number, have often had study design limitations (e.g., small samples), and findings have not always been consistent, either across measures within studies, or across studies, suggesting a need for further research (Neumark-Sztainer et al., 2012).

Population-based studies on yoga practice can provide valuable information to supplement intervention studies, with regard to who is engaging in yoga in the broader population and the potential impact of yoga, as practiced in the community, on outcomes of interest. For example, population-based studies allow for the opportunity to examine associations between yoga practice, at the frequency with which it is practiced in the general population, and outcomes of interest such as body satisfaction. Furthermore, while there is clearly a need to study clinical populations with eating disorders in order to learn about the potential

for yoga to help in the treatment of eating disorders, in determining the potential for yoga to help with prevention it is important to examine yoga in non-clinical samples.

Few studies that have examined yoga use in the general population have included measures of body image, and where they have, directions of association have not always been consistent (Delaney & Anthis, 2010; Lauche et al., 2017; Neumark-Sztainer, Eisenberg, Wall, & Loth, 2011; Sharpe, Blanck, Williams, Ainsworth, & Conway, 2007). In a large population-based study of women in Australia, yoga/meditation was found to be associated with higher body satisfaction in non-overweight women; however, no association was found in women with obesity (Lauche et al., 2017). In Project EAT-III, an earlier wave of the longitudinal cohort presented here, we examined cross-sectional associations between the practice of yoga/Pilates and body satisfaction and found that young adults, particularly women, who practiced yoga/Pilates were more likely to be satisfied with their bodies, although associations were not statistically significant after adjusting for body mass index (BMI; Neumark-Sztainer, Eisenberg, et al., 2011). However, yoga and Pilates were assessed in the same survey item; thus, we were not able to isolate associations between yoga and body satisfaction, which was a study limitation as Pilates is a different practice to that of yoga.

These above-mentioned population-based studies have all been cross-sectional. Authors of these studies have noted the limitations inherent in using cross-sectional data to examine associations between yoga practice and body satisfaction. One limitation is that people who feel good about their bodies may be more likely to participate in yoga. To the best of our knowledge, no population-based studies with a longitudinal component have examined how yoga practice is associated with changes in body satisfaction over time.

Furthermore, studies have not examined the differential effect of yoga on individuals with different levels of prior body satisfaction. It is of interest to examine whether participation in yoga can help those at greatest need for interventions to improve body image, i.e., those in the population with low levels of body satisfaction. It is also important to ensure that young adults with lower prior levels of body satisfaction, who may be more vulnerable, are not increasing their risk for further decreases in body satisfaction by practicing yoga. For example, practicing in a yoga class could make vulnerable individuals feel worse about their bodies if they make comparisons with the teacher or other students whom they perceive as more flexible, stronger, or thinner than they are. Messages given in yoga classes are unlikely to focus on appearance, but often focus on aspects of improving the body's functionality. While focusing on functional aspects of the body may have positive benefits for body image and related outcomes (Abbott & Barber, 2010; Wasylkiw & Butler, 2014), Mulgrew and Tiggemann (2016) found that exposure to images of idealized models displaying physical competence (e.g., a body that looks strong and fit) may be harmful to one's body image.

Given the high prevalence of body dissatisfaction in the general population of young adults, the adverse outcomes associated with body dissatisfaction, the growing popularity of yoga, and the underlying tenets of yoga, it is worthwhile to explore the potential for utilizing yoga as a tool for improving body satisfaction in the general population, and particularly among those with low prior levels of body satisfaction. If found to be associated with improvements

in body satisfaction, yoga could be utilized as an option for promoting greater body satisfaction, and preventing adverse outcomes associated with body dissatisfaction, in the general population.

Thus, the current study aims to address the following research questions: (a) In a population-based sample of young adults, how is practicing yoga associated with body satisfaction in cross-sectional analyses and in analyses adjusted for prior levels of body satisfaction?; and (b) Do associations between yoga and concurrent levels of body satisfactions differ by prior levels of body satisfaction?

Given the underlying tenets of yoga and the extant literature on yoga and body image, we hypothesized that practicing yoga would be associated with higher levels of body satisfaction and that these associations would be attenuated but remain significant after adjustment for prior levels of BMI and body satisfaction. A priori hypotheses were not made for the second research question; on the one hand, individuals with low levels of body satisfaction could be expected to increase their body satisfaction by participating in yoga classes as there is more room for improvement in body satisfaction and yoga has the potential to address body image concerns through practices that address the physical, mental, and emotional parts of one's being. On the other hand, engaging in yoga could make individuals with low levels of body satisfaction even more dissatisfied if they feel that they cannot do the physical poses, are exposed to yoga teachers who do not use body-sensitive language, or if they make upward comparisons with others in their yoga classes that make them feel worse about their bodies. Determining if, for whom, and in what direction, yoga is associated with changes in body satisfaction is important for the design of yoga offerings for young adult populations.

Method

Study overview

Project EAT (Eating and Activity in Teens and Young Adults) is a large, population-based study on eating and weight-related outcomes that followed young people from adolescence to young adulthood (Larson, Neumark-Sztainer, Story, van den Berg, & Hannan, 2011; Neumark-Sztainer, Eisenberg, et al., 2011; Neumark-Sztainer, Paxton, et al., 2006; Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002; Neumark-Sztainer, Wall, Eisenberg, Story, & Hannan, 2006; Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011). At the original assessment (1998–1999), 4,746 adolescents attending public middle and high schools in Minneapolis-St. Paul, Minnesota, completed surveys and anthropometric measures. Follow-up mailed and online surveys were completed at five-year intervals (Projects EAT-II, III, and IV).

Data used in the current analysis come from the 1,664 young adults who participated in both Project EAT-III and Project EAT-IV given that data were used from both of these assessments. While the study primarily utilizes data collected during Project EAT-IV, adjustments are made for body satisfaction and body mass index (BMI) collected during Project EAT-III. This sample includes 703 young adult men and 954 women (seven respondents did not report their gender) with a mean age of 31.1 ($SD = 1.6$) years in Project

EAT-IV. All study protocols were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee.

Survey development

The EAT-IV survey assessed topics relevant to weight-related health and was modified from surveys used in previous study waves to assess age-appropriate issues and explore topics of emerging interest. Given the growing interest in yoga across the U.S., questions on yoga were added to EAT-IV (Neumark-Sztainer et al., 2017). The EAT-IV survey was pilot tested among young adults in their late-20s to mid-30s. Two focus groups were conducted to gather feedback on specific survey items. Next, a revised survey was pilot tested with a different sample of 65 young adults to examine test-retest reliability and internal consistency of scales in order to further refine items and reduce survey length. Finally, scale psychometrics were examined in the EAT-IV survey sample and estimates of item test-retest reliability, reported below, were determined in a subgroup of 103 participants who completed the survey twice during a 1- to 4-week period.

Survey measures

Yoga practice—At EAT-IV, young adults indicated if they had ever done yoga (yes/no) (test-retest agreement = 94%). Young adults who reported they had ever done yoga and who reported doing so in the last year were asked the following question about the frequency of their practice: “On average, how frequently did you do yoga over the past year?” Seven response options ranged from “less than ½ hour/week” to “10+ hours/week.” Among study participants with no missing data on relevant yoga questions ($n = 1655$), 70.0% reported not practicing yoga in the past year, 13.8% practiced less than 30 minutes/week, 5.2% practiced between 30 minutes to less than 1 hour, 7.1% practiced between 1 hour to less than 2 hours, 2.8% practiced 2–3 hours, 0.7% practiced 4–6 hours, 0.2% practiced 7–9 hours, and 0.1% practiced 10 or more hours per week. Respondents engaging in yoga 30 minutes/week (on average, over the past year) were identified as practicing yoga (test-retest agreement = 92%). This dichotomization was chosen to best approximate the distribution of yoga practice in the population and to avoid sparse data among those who practice a high number of hours of yoga per week.

Body satisfaction—Using a modified form of the Body Shape Satisfaction Scale (Pingitore, Spring, & Garfield, 1997), participants reported satisfaction with 13 body parts including height, weight, body shape, and overall body fat at EAT-III and IV. Five Likert-type response categories ranged from *very dissatisfied* to *very satisfied*. Item responses were summed, such that higher scores were indicative of greater satisfaction (potential range: 12–65, Cronbach's $\alpha = .93$; test-retest $r = .82$). In analyses examining the differential effect of yoga among young adults with low levels of body satisfaction as compared to other young adults, body satisfaction at EAT-III was dichotomized at the 1st quartile (scores: 12–33) vs the 2nd–4th quartiles (scores: 34–65). This dichotomous representation was chosen for ease of interpretation. Sensitivity analyses were conducted with linear and categorical (seven categories) representations of EAT-III body satisfaction and found little substantive difference.

Covariates—Weight status and sociodemographic variables were included as covariates in examining associations between yoga practice and body satisfaction, given their potential role as confounders. Weight status was assessed in EAT-III using self-reported height and weight, from which body mass index (BMI: kg/m²) was calculated. Self-report of height and weight (test-retest $r = .95$ for height and $r = .98$ weight) were previously validated against measured height and weight in an EAT-III subsample ($n = 125$). Results showed high correlations between self-reported and measured BMI in males ($r = .95$) and females ($r = .98$; Quick, Wall, Larson, Haines, & Neumark-Sztainer, 2013; Sirard, Hannan, Cutler, & Neumark-Sztainer, 2013). We utilized prior weight status (at EAT-III), rather than current weight status, given that previous analyses suggested that yoga practice is associated with current BMI and with changes in BMI over time (Neumark-Sztainer et al., 2017). Participants reported their ethnicity/race (test-retest $\kappa = .70 - .83$) on the original EAT-I survey (Neumark-Sztainer, Story, Hannan, & Croll, 2002). On the EAT-IV survey, participants reported their gender (test-retest agreement = 97%), birthdate from which age was calculated (test-retest $r = .98$), educational attainment (test-retest $r = .92$) and household income (test-retest $r = .96$).

Analysis

Descriptive statistics were used to estimate the mean level of body satisfaction at EAT-IV among those who did and did not report practicing yoga at least 30 minutes/week in the past year. A *first* set of linear regression models was fit with EAT-IV body satisfaction as the dependent variable and yoga practice at EAT-IV as the independent variable to estimate associations adjusted for sociodemographic characteristics (gender, age, ethnicity/race, educational level, and household income). In order to estimate the association between body satisfaction and yoga independent of prior BMI, we fit the same linear regression described above but additionally adjusting for BMI at EAT-III.

A *second* set of linear regression models was fit that included adjustment for body satisfaction at EAT-III (additionally adjusted for sociodemographic characteristics). Body satisfaction at EAT-III was dichotomized into low (lowest quartile) vs. medium/high (highest 3 quartiles). As above, these models were fit both with and without BMI at EAT-III. As a sensitivity analysis, we refit these models using yoga practice as a continuous variable. The average frequency of yoga practice in the past year was included as a continuous covariate with the midpoint of each category serving as the value for that category. These models with a continuous predictor were fit both among the entire study population and among those who reported practicing yoga 30 minutes/week, on average, over the past year.

A *third* set of models assessed whether dichotomous body satisfaction at EAT-III interacted with yoga practice. We note that these interaction models should be viewed as exploratory. There was some evidence of an interaction ($p = .01$) when dichotomized at the lowest quartile. This analysis was repeated with different parameterizations of EAT-III body satisfaction, using a continuous and categorical (7-level) representation of body satisfaction at EAT-III, which resulted in non-significant interactions ($p = .12$ and $p = .13$, respectfully). Each of the three parameterizations of body satisfaction at EAT-III suggested the largest associations were observed among those with the lowest levels of body satisfaction at EAT-

III. The dichotomous representation was chosen for ease of interpretation; however, we caution against over-interpretation.

Statistical adjustments were made to account for attrition from the original EAT-I sample ($N = 4,746$) and to help adjust for selection bias. In all analyses, except for the presentation of crude numbers, data were weighted using a response propensity method. Response propensities (i.e., the probability of responding to the EAT-IV survey) were estimated using a logistic regression of response at 15-year follow-up on predictor variables from the school-based survey. The weighting method resulted in estimates representative of the demographic make-up of the original school-based sample, thereby allowing results to be more fully generalizable to the original population of young people, prior to any attrition.

Specifically, the weighted sample was 47.8% white, 18.6% African American, 19.7% Asian, 5.7% Hispanic, and 8.2% mixed or other ethnicity/race. The sample was well-distributed across the five categories of educational attainment: 30.3% equivalent of high school degree or less; 12.3% vocational, technical; 15.1% associate degree; 29.2% bachelor's degree, and 13.2% graduate or professional degree.

Results

Practicing yoga (≥ 30 minutes/week over the past year) was reported by 16.2% (unweighted $n = 268$) of young adults (22.9% of women and 7.3% of men) at EAT-IV. Young adults practicing yoga at this level had higher levels of body satisfaction than those not practicing in cross-sectional analyses adjusted for sociodemographic characteristics (Table 1; Model 1). Associations were further examined with adjustment for prior BMI (assessed at EAT-III) and remained elevated, though attenuated (Table 1, Model 2).

Cross-sectional associations between yoga and body satisfaction could be due to individuals with higher prior levels of body satisfaction being more likely to choose to engage in yoga. To address possible confounding, associations between yoga practice and concurrent body satisfaction were further examined, adjusting for prior levels of body satisfaction. Young adults practicing yoga had higher levels of body satisfaction than other young adults after adjusting for prior body satisfaction, both without adjustment for prior BMI (difference in EAT-IV body satisfaction = 2.1, 95% Confidence Interval (CI): 0.7, 3.4), $p < .01$ and with adjustment for prior BMI (difference in EAT-IV body satisfaction = 1.5, 95% CI (0.1, 2.8), $p = .03$).

Additional analyses examined associations between yoga and body satisfaction in which yoga was treated as a continuous predictor (with values at the midpoint of each category), with adjustments for sociodemographic characteristics and prior body satisfaction and BMI. In analyses on the entire population, including those who did not participate in yoga, the association was 0.7 (95% CI: 0.2, 1.3), implying that for every additional hour of yoga practiced each week, body satisfaction increased by 0.7 units ($p = .01$). When this analysis was conducted with yoga practice as a continuous variable, but only among those who practice at least 30 minutes each week, there was a similar association: 0.7 (95% CI: -0.1, 1.4), albeit this association was not statistically significant ($p = .09$). This finding again

implies that among those who practice yoga, each additional hour of practice of yoga per week is associated with a 0.7-unit increase in body satisfaction.

Finally, in order to determine if yoga was associated with body satisfaction among those with prior low levels of body satisfaction, analyses were stratified by prior level of body satisfaction (dichotomized as the 1st vs. 2nd–4th quartile of prior body satisfaction). As shown in Table 3, associations were most pronounced among those who previously had low levels of body satisfaction (at EAT-III). Among those with low levels of body satisfaction at EAT-III, body satisfaction at EAT-IV was 4.7 units higher among young adults practicing yoga as compared to other young adults, adjusting for sociodemographic characteristics. After further adjustment for BMI at EAT-III, body satisfaction at EAT-IV was 4.1 units higher among those practicing yoga as compared to others. In contrast, among young adults with higher levels of body satisfaction at EAT-III, practicing yoga was not associated with improvements in body satisfaction by EAT-IV. Differences between the associations among young adults with low body satisfaction at EAT-III and those with high body satisfaction (i.e., the interaction between practicing yoga and body satisfaction at EAT-III) were statistically significant (p -value for interaction = .01); however, the interpretation of this result should be viewed with caution as the significance depends on the parameterization of EAT-III body satisfaction in the model.

Discussion

This study was designed to learn more about the potential for yoga to promote a positive body image in young adults. More specifically, utilizing a population-based sample of young adults, this study examined whether practicing yoga is associated with body satisfaction, both cross-sectionally and in analyses adjusted for prior levels of body satisfaction. This study further set out to determine if associations between yoga and current levels of body satisfaction are stronger for those with a history of low body satisfaction. Findings clearly indicate that practicing yoga, for at least 30 minutes a week over the past year, is associated with higher levels of body satisfaction. These associations remained in analyses adjusted for prior levels of body satisfaction and BMI levels. Furthermore, associations between yoga practice and body satisfaction were stronger among young adults with prior low levels of body satisfaction, suggesting that yoga may be helpful for young adults in greatest need, i.e., those starting with lower levels of body satisfaction. Of note, regression to the mean does not seem like a plausible mechanism to explain these results, given that the primary association of interest is the difference in body satisfaction among those who do and do not practice yoga. Among the group with low levels of body satisfaction at baseline, regression to the mean would occur similarly among those who do and do not practice yoga and would not be expected to impact our results. However, these findings should be viewed as preliminary as they are dependent, to some extent, on choice of model parameterization (e.g., continuous vs. dichotomous representation of body satisfaction at EAT-III).

Findings from the current study complement a prior study examining perceptions of the impact of yoga on body image. In a study of 542 yoga students and teachers in the U.S., Park and colleagues asked about perceived positive and negative effects of practicing yoga; specifically, respondents were asked to rate the extent to which they experienced changes in

each of 20 psychosocial dimensions due to their yoga practice. One of the dimensions assessed was body appreciation. Approximately 85% of respondents indicated that they perceived that yoga had a positive impact on their level of body appreciation (Park, Riley, & Braun, 2016). In the current Project EAT study, participants were not asked about the impact of yoga on body satisfaction, rather changes in body satisfaction were compared among those practicing and not practicing yoga. In combination, findings from these two studies suggest that yoga may be perceived by practitioners as having a positive influence on their body image, and that practicing yoga is associated with positive changes in body satisfaction. Perceptions of positive change are likely to lead continuation of one's yoga practice, whereas actual positive changes in body satisfaction are likely to lead to improved quality of life and to decrease the risk for adverse outcomes associated with low levels of body satisfaction.

Findings from the current study are particularly promising in terms of their public health implications, given that these associations were found even though the majority of young adults practiced only low-to-moderate amounts of yoga and the cut-off used in this study to define yoga practice was quite low at 30 minutes or more a week. Klein and Cook-Cottone (2013) reviewed the literature on yoga and eating disorders; their summary of the findings pointed to the potential importance of frequency and duration of practice in having an impact on outcomes of relevance to eating disorders. Although Cook-Cottone (2013) has indicated that the necessary dosage of yoga needed for a meaningful impact is not clear, she noted that nearly all randomized, controlled trials resulted in benefits, with the exception of a study in which the intervention length was limited to 45 minutes per week for six weeks. In the current study, analyses using yoga practice as a continuous variable found that as the frequency of yoga practice increased, body satisfaction improved. Given that very few of the study participants practiced more than three hours a week, these findings should be interpreted cautiously and further research is needed to determine if there is an upper-level limit.

Additionally, as previously reported, with regard to the current study population of Project EAT-IV participants, there was variation in the type and intensity of yoga being practiced, in the settings in which yoga was usually practiced (Neumark-Sztainer et al., 2017), and probably in the types of language and messages around body image being used by the instructors; this type of variation is likely to decrease the strength of associations. Given the current popularity of yoga, community-based yoga classes and home-based guided yoga practices have been proposed as an excellent venue for the prevention of eating disorders and other weight-related problems (Neumark-Sztainer, 2014; Neumark-Sztainer et al., 2017); findings from the current study provide empirical evidence to support this approach.

Previous studies have identified body dissatisfaction as a strong risk factor for both disordered eating behaviors and obesity (Neumark-Sztainer et al., 2007; Stice & Shaw, 2002), while findings from the current study show that individuals with low prior levels of body satisfaction who practice yoga show improvements in body satisfaction. While further research is needed, we speculate that training yoga teachers on how to be sensitive to body image concerns in their students and in how to develop a body image friendly class would lead to even stronger results. Providing an environment that takes the focus off of the

external, and moves the focus to the internal feel of the poses may also be important; for example, practicing yoga in a non-mirrored room may lead to reduced social physique anxiety as compared to practicing in a room with mirrors (Frayeh, 2015). Additionally, having individuals with more diverse body shapes teaching yoga classes and participating is likely to lead to fewer harmful social comparisons; thus it is promising that there has been increased focus on attracting and meeting the needs of individuals of varied shapes, sizes, and physical abilities within the yoga field (Cook-Cottone & Douglass, 2017; Cook-Cottone, Kane, Keddie, & Hauqli, 2013; Moore, 2016; Sanford, 2011; Stanley, 2017). Cooke-Cottone and Douglass (2017) additionally recommend that yoga studios provide referral information for yoga students at risk for eating disorders.

Given the growing popularity of yoga, a strength of this study was its population-based design, which provides information on how yoga is being practiced in the general public. The sample was also large and diverse, and was comprised of young adults, an understudied group who are at high risk for weight-related problems (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). The incorporation of survey items assessing various aspects of yoga into a larger longitudinal study in which body satisfaction and BMI were assessed at various time points is another study strength. We are unaware of any other population-based studies that have examined associations between yoga practice and body satisfaction, taking into account prior levels of body satisfaction.

Study limitations should also be taken into account in interpreting the findings. An important limitation of this study is that we did not have a strong measure of yoga practice at earlier time points, which would have allowed for more robust longitudinal analyses. Although we were able to adjust for prior body satisfaction, we cannot be certain about the temporality of relationships, in that participants may have improved their body satisfaction between assessments, which made it more comfortable for them to initiate a yoga practice. Future research should address this study limitation by assessing yoga participation and then following up with assessments of body image, thus allowing for a true longitudinal analysis. Additionally, there was attrition from the original EAT-I sample. We utilized weighting to make generalizations back to the original sample; however, residual selection bias may exist. Finally, although a sound measure of body satisfaction was employed, body satisfaction is only one aspect of positive body image, which is a multi-faced construct involving more than body satisfaction or appearance evaluation (Tylka & Wood-Barcalow, 2015). Additional assessments of positive body image (e.g., body appreciation, body responsiveness, body pride, body acceptance by others; Piran, 2015; Tylka & Wood-Barcalow, 2015; Webb, Wood-Barcalow, & Tylka, 2015) and embodiment (e.g., experiencing one's body from the inside, rather than in accordance with how one's external body appearance; Piran & Teall, 2012), would have been desirable to learn more about different aspects of body image and potential mechanisms of action. Indeed, Mahlo and Tiggemann (2016) found that yoga practice was associated with a more positive body image and that the impact of yoga on a positive body image was mediated via greater embodiment and reduced self-objectification.

In conclusion, findings from this study suggest that practicing yoga may have positive implications for body satisfaction, particularly for those with a history of low body satisfaction. Intervention implications may be even stronger given that women tend to have

lower levels of body satisfaction than men (Bucchianeri et al., 2013), and are also more likely to practice yoga. Given the magnitude of body dissatisfaction in the general public of young adults, the harmful consequences of body dissatisfaction, and the growing popularity and availability of yoga within many communities, further research on this topic is warranted. Given that the majority of yoga practitioners in the current study were women, further research on male populations is needed to determine if findings are similar. Furthermore, to learn more about the implications of yoga practice for men, qualitative work on male samples, may provide important insight.

Recommendations for research on yoga and the promotion of a positive body image, in addition to the prevention of disordered eating behaviors and eating disorders, have previously been described (Neumark-Sztainer, 2014). Further research should employ longitudinal designs, include rigorous intervention studies, and explore mechanisms by which yoga influences body image and the impact of this influence on other outcomes, including disordered eating, eating disorders, and obesity. Cook-Cottone (2013) has stressed a need for more research exploring the dosage needed to have a meaningful impact, in terms of variables such as frequency (e.g., times per week), length (e.g., minutes per session), duration, and consistency of practice. Further work is also needed to determine how best to focus on body functionality within yoga classes to ensure that the practice is helpful in terms of body satisfaction. Acknowledging and accepting one's current state of body functionality, recognizing how the state of one's body functionality changes over time, and meeting one's body where it is at while practicing yoga may be most helpful, and least likely to inadvertently lead to harm. Of particular importance to the promotion of a positive body image is the training of yoga instructors with regard to language, class flow, and environments designed to promote a positive body image, and the evaluation of the impact of such training on both teachers and their students.

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Highlights

- 16.2% of young adults reported practicing yoga at least 30 minutes/week.
- Practicing yoga was associated with higher levels of body satisfaction.
- Yoga practitioners with prior low body satisfaction showed greater increases.

Table 1
Cross-sectional associations between yoga practice (≥ 30 minutes/week) and body satisfaction (potential range: 12–65) at Project EAT-IV in young adults (n = 1655)

	Model 1 ^a			Model 2 ^b		
	Body Satisfaction at EAT-IV	Confidence Interval	p-value	Body Satisfaction at EAT-IV	Confidence Interval	p-value
Yoga Practice						
Yes (n = 268)	43.7	42.3, 45.0		42.6	41.3, 43.8	
No (n = 1387)	40.6	39.8, 41.3		40.7	40.0, 41.3	
Difference ^c	3.1	1.6, 4.6	< .01	1.9	0.5, 3.2	< .01

^aModel 1 adjusts for sociodemographic characteristics (gender, age, ethnicity/race, educational level, and household income)

^bModel 2 adjusts for and prior body mass index (assessed at EAT-III) and sociodemographic characteristics

^cDifference in mean body satisfaction between those who practice yoga and those who do not practice yoga

Table 2

Associations between yoga practice (≥ 30 minutes/week) and body satisfaction at EAT-IV in young adults adjusted for level of body satisfaction at EAT-III (*n* = 1655)

	Model 1 ^a		Model 2 ^b	
	Body Satisfaction at EAT-IV	Confidence Interval	Body Satisfaction at EAT-IV	Confidence Interval
Regular Yoga Practice				
Yes (<i>n</i> = 268)	42.8	41.5, 44.0	42.2	41.0, 43.5
No (<i>n</i> = 1387)	40.7	40.1, 41.3	40.7	40.1, 41.4
Difference ^c	2.1	0.7, 3.4	1.5	0.1, 2.8
				.03

^aModel 1 adjusts for body satisfaction at EAT-III and sociodemographic characteristics (gender, age, ethnicity/race, educational level, and household income)

^bModel 2 adjusts for body mass index (BMI) at EAT-III, body satisfaction at EAT-III, and sociodemographic characteristics

^cDifference in mean body satisfaction between those who practice yoga and those who do not practice yoga

Table 3

Associations between yoga practice (≥ 30 minutes/week) and body satisfaction at EAT-IV by level of body satisfaction at EAT-III^a ($n = 1649$)

	Model 1 ^b		Model 2 ^c	
	Body Satisfaction at EAT-IV	Confidence Interval	Body Satisfaction at EAT-IV	Confidence Interval
Low body satisfaction at EAT-III ($n = 430$):				
Yoga Practice				
Yes ($n = 62$)	36.7	34.8, 38.6	38.3	36.2, 40.4
No ($n = 368$)	32.0	30.8, 33.2	34.2	33.0, 35.4
Difference ^d	4.7	2.5, 6.9	4.1	1.8, 6.4
				< .01
High body satisfaction at EAT-III ($n = 1219$):				
Yoga Practice				
Yes ($n = 206$)	45.1	43.6, 46.6	43.7	42.3, 45.2
No ($n = 1013$)	44.0	43.2, 44.8	43.2	42.5, 44.0
Difference ^d	1.1	-0.6, 2.8	0.5	-1.1, 2.1
				.53

^aParticipants were categorized by level of body satisfaction at EAT-III: low (body satisfaction:12-33) and high (body satisfaction: 34-65)

^bModel 1 adjusts for sociodemographic characteristics (gender, age, ethnicity/race, educational level, and household income)

^cModel 2 adjusts for body mass index (BMI) at EAT-III and sociodemographic characteristics

^dDifference in mean body satisfaction between those who practice yoga and those who do not practice yoga