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# Yoga Practice in a College Sample: Associated Changes in Eating Disorder, Body Image, and Related Factors Over Time

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## ABSTRACT

Yoga practice is associated with improvements in eating disorder (ED) symptoms and body dissatisfaction. This study continued to evaluate this relationship while also assessing changes in variables negatively associated with ED symptoms (self-compassion, mindfulness, body appreciation, self-efficacy) that are emphasized throughout yoga. Men were also included in this study given studies have predominantly focused on women. Participants ( $N = 99$ , 77.8% women) were recruited from a university-implemented yoga course and completed assessments at the beginning (Time 1 (T1)) and end (Time 2 (T2)) of an eight-week yoga course meeting three times a week for fifty minutes. Body dissatisfaction ( $ps < .05$ ) and ED pathology ( $p = .02$ ) were lower at T2. Body appreciation ( $p < .001$ ), self-compassion ( $p = .01$ ), yoga self-efficacy ( $p = .004$ ) were higher at T2. Some gender differences emerged. Men reported greater reductions in concern with being overweight, (Overweight Preoccupation) from T1 ( $M = 2.46$ ,  $SD = 0.61$ ) to T2 ( $M = 2.13$ ,  $SD = 0.61$ ) compared to women, T1 ( $M = 2.75$ ,  $SD = 0.98$ ) to T2 ( $M = 2.69$ ,  $SD = 0.97$ ) associated with yoga practice. Men also reported greater improvements in body satisfaction (Appearance Evaluation) from T1 ( $M = 3.60$ ,  $SD = 0.49$ ) to T2 ( $M = 3.90$ ,  $SD = 0.34$ ) compared with women, T1 ( $M = 3.48$ ,  $SD = 0.58$ ) to T2 ( $M = 3.39$ ,  $SD = 0.52$ ) associated with yoga practice. Results suggest yoga may be associated with concurrent changes in protective and risk factors for ED in a college population.

## Clinical Implications

- Frequent yoga practice may be associated with reductions in eating disorder symptoms.
- Yoga practice may be associated with reductions in body dissatisfaction.
- Men reported greater improvements in body dissatisfaction associated with yoga practice.
- Yoga practice may be associated with improvements in self-compassion, body appreciation, and self-efficacy.

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## Introduction

Yoga has been incorporated as an adjunct to treatment for many psychological (Büssing, Michalsen, Khalsa, Telles, & Sherman, 2012) and physiological concerns (Banerjee et al., 2007; Field, 2011; Park, Braun, & Siegel, 2015), and is one of the most popular complementary medicine practices in the United States. Notably, yoga has also been incorporated as part of eating disorder (ED) treatment (Frisch, Herzog, & Franko, 2006) and empirical support for the use of yoga during ED treatment is amassing (see Carei, Fyfe-Johnson, Breuner, & Marshall, 2010; Hall, Ofei-Tenkorang, Machan, & Gordon, 2016; McIver, O'Halloran, & McGartland, 2009; Pacanowski, Diers, Crosby, & Neumark-Sztainer, 2017).

Studies assessing yoga as a preventative method against ED symptomology and body dissatisfaction (a key risk factor for ED) also yield promising results (Cook-Cottone, Talebkah, Guyker, & Keddie, 2017; Scime & Cook-Cottone, 2008). For instance, incorporating yoga with an ED prevention curriculum resulted in reductions in ED symptoms among youth (Cook-Cottone et al., 2017; Scime & Cook-Cottone, 2008). Youth also reported decreases in body surveillance and greater body appreciation after participation in physical education courses incorporating yoga (Cox, Ullrich-French, Howe, & Cole, 2017). In college samples, yoga practice was associated with improvements in ED risk factors such as self-objectification and appearance evaluation (Ariel-Donges, Gordon, Bauman, & Perri, 2018; Cox et al., 2017), and protective factors (e.g. body appreciation and mindfulness; Ariel-Donges et al., 2018; Cox & McMahon, 2019; Cox et al., 2017).

While researchers demonstrate yoga incorporated during ED treatment and prevention is effective, understanding skills emphasized during yoga practice, which negatively or positively relate to ED symptoms will enable researchers to examine mediating and moderating factors of how yoga is beneficial. Therefore, in addition to assessing changes in ED symptoms and body dissatisfaction associated with frequent yoga practice (to support extant literature), the current study assessed changes in skills including mindfulness, self-compassion (SC), body appreciation, and yoga self-efficacy.

Mindfulness may be one way yoga positively impacts ED symptoms and body dissatisfaction. Yoga improves mindfulness by encouraging practitioners to non-judgmentally identify their thoughts and work to coordinate breath with body movement (Ariel-Donges et al., 2018; Cox & McMahon, 2019; Eastman-Mueller, Wilson, Jung, Kimura, & Tarrant, 2013; Freeman, 2004). Such skills learned throughout yoga may enable practitioners to become less critical of themselves in the moment which may facilitate reductions in body dissatisfaction, ED symptoms, and enhance body appreciation.

Indeed, mindfulness is negatively associated with ED symptoms (Butryn et al., 2013; Lavender et al., 2009), body dissatisfaction (Butryn et al., 2013; Pidgeon & Appleby, 2014; Lavender, Gratz, & Anderson, 2012), and body surveillance (Dijkstra & Barelds, 2011) and positively associated with body satisfaction (Dijkstra & Barelds, 2011; Lavender et al., 2012). Mindfulness interventions have yielded positive outcomes in ED samples (Baer, Fischer, & Huss, 2005; Butryn et al., 2013; Kristeller, Baer, & Quillian Wolever, 2006). In studies assessing changes in mindfulness related to yoga, state mindfulness improved (Cox et al., 2017) and predicted lower self-objectification, a risk factor for ED development. Cox and McMahon (2019) also found improvements in mindfulness related to yoga practice predicted improvements in body appreciation.

Additionally, yoga's focus is akin to self-compassion (SC), which involves kindness towards oneself (self-kindness), non-judgmental awareness of individual flaws and strengths (mindfulness), and the belief that one's experience is universal (common humanity; Neff, 2003a, 2003b). Yoga may enable participants to perceive their body more kindly and respond more compassionately to self-criticism instead of pushing their body's limit, often an unfortunate feature of ED pathology (e.g. over-exercise). Yoga may also encourage participants to appreciate how others may feel similarly about their body appearance and abilities; everyone works hard to master, without perfection, poses.

Preliminary research indicates a link between SC and yoga practice, with yoga practitioners experiencing improvements in SC, which predicted improvements in perceived quality of life (Gard et al., 2012). To date, no other studies have examined changes in SC associated with yoga practice, which would be beneficial given SC is negatively associated with body dissatisfaction and ED symptoms (Breines, Toole, Tu, & Chen, 2014; Kelly, Vimalakanthan, & Miller, 2014; Wasylkiw, MacKinnon, & MacLellan, 2012) and unrealistic expectations of one's body positively associated with body appreciation (Tylka & Wood-Barcalow, 2015b). Further, including SC during ED treatment is associated with earlier improvements in ED symptoms (Kelly, Carter, & Borairi, 2014). Additional support that yoga practice is associated with improvements in SC may provide further rationale to assess SC as an additional mechanism of action predicting symptom change.

Body appreciation, another protective factor against ED and body dissatisfaction (Andrew, Tiggemann, & Clark, 2015; Cotter, Kelly, Mitchell, & Mazzeo, 2015), is also encouraged during yoga. Body appreciation is defined as an individual's ability to perceive positive qualities of their body beyond appearance (e.g. body functionality) while accepting perceived flaws, showing one's body respect, and rejecting unrealistic expectations of their body (Avalos, Tylka, & Wood-Barcalow, 2005; Foroughi, Zhu, Smith, & Hay, 2019). Body appreciation is also closely associated with embodiment which

increases as individuals engage in tasks focusing on body functionality, competence, and mind-body connection (Mahlo & Tiggemann, 2016; Menzel & Levine, 2011). Yoga may enhance body appreciation, as yoga philosophy often emphasizes gratitude for one's abilities on the mat while focusing on form and function over appearance and perfection. Indeed, Ariel-Donges et al. (2018) and Cox and McMahon (2019) experimentally demonstrated frequent yoga practice predicted increases in body appreciation.

One additional and minimally explored mechanism of yoga is associated with prevention or reduction of ED symptoms and body dissatisfaction is an individual's perception of their competence and growth during yoga practice, i.e. yoga self-efficacy. While an individual's perception of their yoga abilities may not in and of itself predict or prevent lower ED symptoms or body dissatisfaction, perceptions of competence or growth related to yoga practice may be associated with a greater self-efficacy, which may lead to greater body appreciation, SC, and increased willingness to engage in physical activity such as yoga. Research demonstrates self-efficacy predicts engagement in physical activity and positive body image (Kołolo, Guskowska, Mazur, & Dzielska, 2012) as well as embodiment (Cook-Cottone, 2015, 2016; Piran, 2015) often associated with positive body image, and reduced ED symptomology (Kinsaul, Curtin, Bazzini, & Martz, 2014). In a recent study, Cox, Ullrich-French, Cole, and D'Hondt-Taylor (2016) found yoga practice was associated with greater confidence in their body's abilities as well as increased motivation to engage in physical activity for health-related versus appearance reasons.

However, researchers have studied the impact of yoga on ED symptoms and body image among women (Carei et al., 2010; Pacanowski et al., 2017) more so than men (see Cox et al., 2017; Flaherty, 2014). In the few studies focusing on men, similar positive effects observed in women are identified. Flaherty (2014) notes yoga practice is associated with lower body dissatisfaction in men. In an experimental study, yoga practice was associated with increases in state mindfulness which predicted decreased self-objectification among men and women (Cox et al., 2016). Further, Conboy and colleagues (2013) reported perceived increases in body awareness related to yoga practice among men. Therefore, findings suggest yoga may also be beneficial in reducing body dissatisfaction and risk factors among men.

In sum, there were several aims of the current study. Aim one was to further assess changes in body dissatisfaction and ED symptomology associated with yoga practice in a college sample, who are often considered at higher risk for ED pathology (Eisenberg, Nicklett, Roeder, & Kirz, 2011). Aim two was to assess changes in body appreciation, SC, and mindfulness associated with yoga practice. Such factors are emphasized considerably during yoga practice and predict lower ED symptomology and body

dissatisfaction (Ariel-Donges et al., 2018; Cox et al., 2017; Field, 2011). While the current study design limits our ability to make firm assertions about mechanisms of action or claim the yoga course was the sole influence of change in the variables of interest, findings will help us understand which factors could be assessed as mediators or moderators in future studies. Lastly, the novelty and ecological validity of this study was increased by the inclusion of men who also experience negative body image and struggle with ED (Grogan & Richards, 2002; McCabe & Ricciardelli, 2004; Tiggerman, Martins, & Kirkbride, 2007). Since yoga courses are not limited by gender, it is imperative to include men in studies especially since the majority of studies have examined benefits of yoga among women.

## **Hypotheses**

### ***Hypothesis one***

Participants would report a change (increase) in yoga self-efficacy and knowledge, SC, body appreciation, and mindfulness from Time 1 (T1) to Time 2 (T2).

### ***Hypothesis two***

Participants would report a change (decrease) in ED pathology and body dissatisfaction from T1 to T2.

***Exploratory hypotheses.*** Men will report lower ED symptoms than women as per previous findings using the EDE-Q (Lavender, De Young, & Anderson, 2010). Women and men will report similar changes in ED symptoms, body image, and other factors at T1 and T2.

## **Method**

### ***Participants***

Participants were recruited from a one-credit yoga course offered by a public Midwestern university. A total of 99 participants completed at least one part of the study with the majority identifying as female ( $n = 76$ , 76.7%) and Caucasian ( $n = 88$ , 89.8%). Full demographics are in [Table 1](#).

### ***Procedure***

Participants were recruited at two time points during the spring semester of 2017. Time 1 (T1) was the first day of the eight-week yoga course. Time 2 (T2) occurred on the second to last or last day of the course. The yoga classes, which met three times a week for 50 minutes, included discussions on

**Table 1.** Demographics.

	N	%	
	83	100	
Gender			
Cisgender Women	63	77.8	
Cisgender Men	18	22.2	
Ethnicity			
Caucasian	73	90.1	
African American	2	2.5	
Hispanic	4	4.9	
American Indian	2	2.5	
Sexual Orientation			
Heterosexual	75	98.7	
Bisexual	1	1.3	
Grade			
Freshman	18	22.2	
Sophomore	20	24.7	
Junior	15	18.5	
Senior	28	34.6	
Practiced Yoga Before			
Yes	37	46.3	
No	43	53.8	
	Female <i>M(SD)</i>	Male <i>M(SD)</i>	<i>t</i> -test of Gender Differences
Age	20.00 (1.46)	20.78 (1.67)	$t(79) = -2.08, p = .04$
BMI	23.59 (3.55)	25.84 (2.88)	$t(79) = 0.52, p = .61$
Years of Yoga	2.18 (1.75)	1.50 (1.61)	$t(36) = 0.88, p = .38^{a,b}$
Hours of Yoga Per Week	0.83 (1.08)	0.50 (0.55)	$t(37) = 0.73, p = .47^a$
Hourly Exercise/Week	6.74(6.26)	9.00 (13.04)	$t(75) = -1.01, p = .32^b$

<sup>a</sup>only included participants who have tried yoga before at T1<sup>b</sup>assessed prior to T1

yoga philosophy (first 10 minutes), with instruction on breathing, mindfulness, and yoga poses occurring simultaneously during the following 40 minutes. At T1 and T2, participants responded to a packet of questionnaires assessing ED symptoms, body dissatisfaction, body appreciation, self-compassion, mindfulness, and yoga self-efficacy. The T1 packet included a demographics questionnaire. The T2 packet inquired about participants' participation, enjoyment, and knowledge gained during the yoga course. Participants were entered into a raffle for a \$25 Target gift card for completing T1 and given \$5 for completing T2.

## Measures

### Demographic questionnaire

Participants reported age, ethnicity, sexual orientation, gender identity, grade, exercise frequency, and height (inches) and weight (pounds) to obtain BMI. Previous yoga practice was assessed (e.g. which forms, frequency of participation, knowledge, etc.). See Table 1.



### **Eating disorder pathology**

ED symptoms were assessed using the *Eating Disorder Examination-Questionnaire* (EDE-Q; Fairburn & Beglin, 2008). The EDE-Q is a self-report measure widely used in research with norms for women (Luce, Crowther, & Pole, 2008) and men (Lavender et al., 2010) in clinical and non-clinical settings (Aardoom, Dingemans, Op't Landt, & Van Furth, 2012; Welch, Birgegård, Parling, & Ghaderi, 2011). The EDE-Q demonstrates acceptable test-retest reliability (Luce et al., 2008) and internal consistency. The EDE-Q can be averaged to provide an overall score (Global EDE-Q) and also has four subscales. Only the Global EDE-Q was utilized given recent research suggesting a single factor loading (Allen, Bryne, Lampard, Watson, & Fursland, 2011). Internal consistency was acceptable at both time points; T1 ( $\alpha = .92$ ) and T2 ( $\alpha = .93$ ).

### **Body dissatisfaction**

Three subscales from the *Multidimensional Body-Self Relations Questionnaire-Appearance Subscales* (MBSRQ-AS; Cash, 2000) were utilized to assess body image. The MBSRQ-AS utilizes a 5-point Likert scale; each subscale consists of averages of items in the scale. The first subscale, *Appearance Evaluation* (AE) assesses individuals' perception of physical attractiveness. Higher scores indicate greater body satisfaction. The *Appearance Orientation* (AO) scale assessed the amount of investment an individual has in their appearance with higher scores suggesting more perseveration. The last scale, *Overweight Preoccupation* (OP) assesses distress about being overweight; higher scores suggest greater concern. The MBSRQ demonstrates promising internal consistency and test-retest reliability (Cash, 2000; Vossbeck-Elsebusch et al., 2014). Internal consistency for most AE, T1 ( $\alpha = .87$ ) and T2 ( $\alpha = .91$ ) and AO T1 ( $\alpha = .84$ ) and T2 ( $\alpha = .81$ ) were acceptable, with OP being T1 ( $\alpha = .75$ ) and T2 ( $\alpha = .78$ ) marginally acceptable.

### **Body appreciation**

Body appreciation was assessed using the *Body Appreciation Scale-2* (BAS-2; Tylka & Wood-Barcalow, 2015a). The BAS-2 is a 10-item self-report scale using a 5-point Likert score and demonstrates adequate internal consistency and retest reliability. Internal consistency at T1 ( $\alpha = .86$ ) and T2 ( $\alpha = .96$ ) were good.

### **Self-compassion**

Self-compassion was assessed using the *Self-Compassion Scale* (SCS; Neff, 2003b) which demonstrates adequate validity and reliability over time (Neff, Rude, & Kirkpatrick, 2007) in addition to good discriminant and convergent validity. The SCS is a 26-item, 5-point Likert, self-report questionnaire



consisting of an overall score (average of all items) and six subscales. Only the overall SCS score was used for this study. Internal consistency was acceptable at T1 ( $\alpha = .86$ ) and T2 ( $\alpha = .90$ ).

### **Mindfulness**

Mindfulness was assessed using an average of all items of the *Five Facet Mindfulness Questionnaire* (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The 39-item self-report scale assesses participants' ability to observe, describe, respond non-judgmentally and without becoming reactive, and also stay present in the moment. Internal consistency for the FFMQ at T1 ( $\alpha = .84$ ) and T2 ( $\alpha = .91$ ) were adequate.

### **Yoga self-efficacy**

*Yoga Self-Efficacy Scale* assessed participant's yoga skills and knowledge (YSES; Birdee, Sohl, & Wallston, 2015). The YSES is a 12-item, 10-point Likert scale. Higher scores indicated greater knowledge and confidence in practicing yoga. While total YSES scores were used, subscales examined mindfulness, breath-work, and abilities in postures. Internal consistency for T1 ( $\alpha = .94$ ) and T2 ( $\alpha = .95$ ) were excellent.

### **Yoga knowledge and experience**

At T1, participants responded to a 7-point Likert scale where higher scores implied greater knowledge of yoga. At T2, enjoyment was assessed using a 10-point Likert scale; higher scores indicated greater enjoyment. Participants also reported how many classes they missed.

### **Statistical analyses**

Prior to running main analyses, demographic data were assessed and T-tests and Chi-Square tests were conducted to assess for differences between T1 and T2 completers and non-completers for validity purposes. T-tests were also run to assess differences between participants who have never tried yoga compared to individuals who have practiced yoga prior to participating in the study. T-tests were also conducted to look at gender differences on demographic factors (See Table 1). Assumptions for later analyses were assessed by examining histograms, skew, and kurtosis. Global EDE-Q was positively skewed and AE was negatively skewed. Square root and reflected square root transformations were conducted respectively to meet assumptions for analyses. Correlations (Pearson and Spearman's Rho, when variables were not normally distributed) were run to evaluate the relationship between dependent variables of the study. To assess changes over time, repeated measures ANOVAs were conducted using only participants who had completed T1 and T2. Bootstrapping was used to protect against Type II

error. If BMI correlated with a dependent variable it was included as a covariate. While there were gender differences in age ( $p = .04$ ), age was not included as a covariate as it was not correlated with any dependent variable ( $p > .05$ ).

## Results

To address validity concerns given some drop out in participation from T1 to T2 (predominantly due to absences on one of the days participants completed assessments), differences between participants who completed both time points (completers,  $n = 83$ , 73.5%) versus participants who did not complete both time points (non-completers,  $n = 30$ , 26.5%) were assessed. Comparisons between completers and non-completers are limited; demographics questionnaires were only included at T1 to decrease participant burden. As a result, comparisons between individuals who completed both time points and non-completers can only be based on individuals who responded at T1 but not T2 ( $n = 18$ , 15.9%). There were no significant differences in completers and non-completers on the dependent variables or average exercise weekly (all  $ps > .05$ ).

Around half of the participants,  $n = 43$ , (53.8%) reported never trying yoga prior to the yoga course. A greater portion of women (54.1%) reported practicing yoga before compared to men (22.2%), Fisher's exact test,  $p = .03$ . Of the 37 participants who have tried yoga before, four participants (10.3%) reported trying Bikram, 13 (33.3%) Flow, one (2.6%) Iyengar, one (2.6%) Sivananda, 15 (38.5%) Vinyasa, one (2.6%) Yin, and eight (20.5%) reported doing Pilates. Most participants who have practiced yoga before reported minimal knowledge of yoga ( $M = 2.47$ ,  $SD = 2.04$ ). Interestingly, there were no differences between participants who have practiced yoga before or who have never tried yoga (all  $ps > .05$ ) on dependent variables at T1. At T2, class attendance was reported to be high; students missed on average 1.72 classes ( $SD = 1.32$ ). Class enjoyment, rated on a 0 to 10 scale (10 is most enjoyment), was also high. Gender differences were also assessed; the only significant difference between men and women was age (See [Table 1](#)). Men ( $M = 1.71$ ,  $SD = 1.31$ ) and women ( $M = 1.70$ ,  $SD = 1.34$ ) missed a similar amount of courses  $t(73) = -0.21$ ,  $p = .94$ . ( $M = 9.05$ ,  $SD = 1.46$ ) and men ( $M = 9.44$ ,  $SD = 0.71$ ) and women ( $M = 8.92$ ,  $SD = 1.62$ ) reported no statistically significant differences in enjoyment of yoga,  $t(75) = -1.34$ ,  $p = .18$ . Men ( $M = 5.36$ ,  $SD = 5.05$ ) and women ( $M = 5.97$ ,  $SD = 7.42$ ) reported similar overall exercise (including yoga),  $t(74) = 0.32$ ,  $p = .75$ .

Correlations were run assessing relationships between dependent variables. See [Table 2](#).

Repeated measures ANOVAs assessed differences in variables over time (within-subjects), gender differences (between subjects), and whether change

**Table 2.** Correlations between dependent variables at T1.

	BMI <sup>#</sup>	BAS-2	FFMQ	SCS	YSES	AE	AO	OP
BAS-2	-.19							
FFMQ	-.13	.36***						
SCS	-.12	.57***	.64***					
YSES	-.09	.35*	.22	.32**				
AE	-.28*	.75***	.24*	.404***	.24*			
AO	-.18	-.22	-.11	-.26*	.04	-.11		
OP	.12	-.33**	-.20	-.32**	.06	.37***	.40***	
EDE-Q <sup>#</sup>	.11	-.61***	-.20	-.45***	-.20	-.57***	.30**	.77***

BMI = Body Mass Index, BAS-2 = Body Appreciation Scale –2, FFMQ = Five Facet Mindfulness Questionnaire, SCS = Self-Compassion Scale, YSES = Yoga Self-Efficacy Scale, AE = Appearance Evaluation, AO = Appearance Orientation, OP = Overweight Preoccupation, EDE-Q = Eating Disorder Examination-Questionnaire, \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ , <sup>#</sup> = Spearman's Rho statistic

varied by gender. Hypothesis 1, suggesting YSES, SC, BAS-2, and FFMQ would be higher at T2 than T1 was partially supported. YSES, SC, and BAS-2 were higher at T2 compared to T1 (all  $ps < .05$ ). FFMQ did not significantly change ( $p = .37$ ). Interaction and between subject factor effects were not significant (all  $ps > .05$ ).

Hypothesis two, that yoga practice would be associated with lower ED symptoms, AO, and OP and higher AE<sup>1</sup> was also partially supported. Gender differences were noted in overall EDE-Q scores ( $p = .02$ ). Interactions effects of AE and gender ( $p = .001$ ) and OP and gender ( $p = .04$ ) demonstrated steeper improvements in AE and reductions in OP among men than women. Global EDE-Q, AO, and OP (all  $ps < .05$ ) were lower and AE ( $p < .001$ ) was higher at T2 compared to T1. See Table 3 for *M*, *SD*, ANOVA results, effect size ( $\omega^2$ ) and power.<sup>2</sup>

## Discussion

It was hypothesized eight weeks of regular yoga practice would be associated with increases in perceived yoga skills and knowledge, self-compassion (SC), body appreciation, and mindfulness, as well as decreases in ED symptoms and negative body image. In addition to assessing associated changes over time, this study assessed overall differences between women and men and whether change over time differed due to gender (interaction effects).

Results indicated a probable association between frequent yoga practice and ED symptoms such that participants reported lower ED symptoms at the end of the eight weeks compared with the first week. In line with previous research, men generally reported lower ED symptoms than women (Lavender et al., 2010; Smith et al., 2017). This finding is promising, as Neumark-Sztainer, MacLehose, Watts, Pacanowski, and Eisenberg (2018) suggest yoga may be an efficient and accessible way to decrease ED risk given the popularity of yoga.

**Table 3.** Repeated measures ANOVA assessing within and between subject differences and interaction effects.

Variable	Time 1 M (SD)	Time 2 M (SD)	Analysis	<i>F</i>	$\omega^2$	Power
YSES						
Total	72.54 (14.41)	78.26 (14.66)	Within (Time)	9.17**	.11	.85
Women	71.86 (13.96)	77.16 (15.29)	Between (Gender)	1.02	<.01	.17
Men	74.59 (16.97)	81.59 (12.41)	Gender x Time	0.18	<.01	.07
SCS						
Total	2.99 (0.56)	3.08 (0.62)	Within (Time)	6.73**	.07	.73
Women	2.98 (0.61)	3.04 (0.36)	Between (Gender)	0.47	<.01	.10
Men	3.04 (0.69)	3.20 (0.26)	Gender x Time	0.99	<.01	.17
BAS-2						
Total	36.18 (6.74)	37.87 (7.40)	Within (Time)	15.21***	.16	.97
Women	35.64 (7.23)	36.86 (7.57)	Between (Gender)	3.33	.03	.40
Men	37.94 (4.56)	41.11 (5.95)	Gender x Time	2.98	.03	.40
FFMQ						
Total	3.25 (0.42)	3.26 (0.48)	Within (Time)	0.82	<.01	.15
Women	3.24 (0.47)	3.22 (0.52)	Between (Gender)	0.85	<.01	.15
Men	3.30 (0.23)	3.38 (0.26)	Gender x Time	1.69	<.01	.20
AE <sup>a</sup>						
Total	3.43 (0.68)	3.49 (0.75)	Within (Time)	2.62	<.01	.36
Women	3.37 (0.83)	3.36 (0.80)	Between (Gender)	10.91***	.12	.90
Men	3.60 (0.49)	3.90 (0.34)	Gender x Time	12.37***	.13	.94
AO						
Total	3.43 (0.56)	3.33 (0.53)	Within (Time)	7.87**	.08	.79
Women	3.48 (0.58)	3.39 (0.52)	Between (Gender)	2.49	.02	.34
Men	3.27 (0.46)	3.13 (0.55)	Gender x Time	0.25	<.01	.08
OP						
Total	2.68 (0.97)	2.55 (0.93)	Within (Time)	9.99**	.11	.88
Women	2.75 (0.98)	2.69 (0.97)	Between (Gender)	3.30	.03	.43
Men	2.46 (0.61)	2.13 (0.61)	Gender x Time	4.31*	.04	.54
EDEQ						
Total	1.49 (1.16)	1.34 (1.26)	Within (Time)	6.34**	.07	.70
Women	1.67 (1.24)	1.56 (1.34)	Between (Gender)	7.32**	.08	.76
Men	0.87 (0.50)	0.62 (0.47)	Gender x Time	0.88	<.01	.15

YSES = Yoga Self-Efficacy Scale, SCS = Self-Compassion Scale, BAS-2 = Body Appreciation Scale-2, FFMQ = Five Facet Mindfulness Questionnaire, AE = Appearance Evaluation, AO = Appearance Orientation, OP = Overweight Preoccupation, EDEQ = Eating Disorder Examination-Questionnaire.

Time = Within-Subjects analysis (T1 versus T2), Gender = Between-Subjects Analyses (Women vs. Men), Gender x Time = Interaction of Gender by Time.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

<sup>a</sup>BMI was included as a covariate as it was correlated with AE but was noted to not be significant,  $F(1, 72) = 1.32$ ,  $p = .25$ .

One of the most studied ED risk factors, body dissatisfaction, was assessed by examining changes associated with yoga practice in concern of being overweight, perception of attractiveness, and degree of focus on their appearance. Specifically, participants reported reduced concern with their physical appearance, likely associated with frequent yoga practice, at T2. While men and women reported lower fear of becoming overweight (OP) and more favourable body image perceptions (AE) at T2, men appeared to report greater improvements over time compared to women. The difference noted between men and women may relate to social experiences; males are raised to focus on their body's abilities and strengths (Daniel & Bridges, 2010;

Tatangelo & Ricciardelli, 2013). A practice emphasizing body functionality may elicit greater benefits in men as a result.

Further, body dissatisfaction among males typically results from concerns of being muscular versus thin or lower weighted like women (Grogan, 2006). It may be men perceived greater improvements in muscularity while women did not note the physical changes in line with gender specific body image goals (Grogan, 2006). Hausenblas and Fallon (2006) also note greater improvements in body image factors among men compared to women related to exercise supporting our findings. An alternative explanation may be that more men reported never practicing yoga prior to taking the yoga course which may have been associated with larger improvements in variables due to the novelty of the experience.

This study was one of the first to demonstrate changes in perceived yoga skills associated with eight weeks of regular yoga practice. This is notable since perceptions of body competency may relate to greater body appreciation. Researchers hypothesize practices which increase body awareness, body capabilities, and demonstrable improvements in body functionality may predict greater body appreciation, embodiment, and motivation to engage in physical activity for intrinsic purposes (e.g. Cook-Cottone, 2015, 2016; Piran, 2015) which may be protective against ED and body dissatisfaction.

While previous research has indicated positive relationships between mindfulness and yoga practice (Butryn et al., 2013; Cox & McMahon, 2019; Eastman-Mueller et al., 2013), we failed to observe such a relationship. The style of yoga practiced may have influenced mindfulness scores (Birdee et al., 2015). The nature of the course, which was offered for course credit, may have also impacted results; individuals who seek yoga at yoga studios or gyms may have had different objectives than individuals seeking course credit as in our sample (Douglass, 2009; Delaney and Anthiis, 2010; Mahlo & Tiggemann, 2016). Further the FFMQ assesses trait mindfulness while researchers reporting improvements in mindfulness related to yoga assessed state mindfulness. (Cox & McMahon, 2019; Cox et al., 2016) which could have also explained the differing results of this study compared with previous research.

SC is another ability emphasized through the practice of yoga. Practitioners are instructed to accept their body's performance with minimal judgment and with kindness. We observed SC was higher at Time 2 compared to T1 which may have been associated with yoga practice, supporting previous research (e.g. Gard et al., 2012). This is encouraging since SC is negatively related to ED risk (Kelly, Vimalakanthan, & Carter, 2014), disordered eating (Breines et al., 2014), and body dissatisfaction (Wasylikiw et al., 2012). It is possible teachings of yoga, which emphasize greater acceptance and reductions in critical evaluation of one's abilities lead to increases in SC. Research demonstrates early improvements in SC are associated with improvement during ED treatment (Kelly et al., 2014). As such,

yoga may be one viable method of improving SC thus reducing ED risk and body dissatisfaction.

Body appreciation was also higher at T2 compared to T1; women and men in this study reported higher gratitude for their body's functionality, potentially associated with eight weeks of yoga practice. It has been hypothesized the more an individual perceives their body as functional and a vessel to achieve values versus as an object, the less likely they are to experience body dissatisfaction and thus, disordered eating (Cook-Cottone, 2015; Piran, 2015). Similar to SC, as participants learn to appreciate their body's ability to move, they may be at lower risk for ED pathology and body dissatisfaction. Our study provides further evidence for previous research noting improvements in body appreciation related to yoga practice (Ariel-Donges et al., 2018; Cox et al., 2017).

As with any research study, there are important limitations which should be addressed. First, this study was quasi-experimental and did not recruit controls or a comparison group which reduces our ability to claim yoga itself was responsible for changes demonstrated over time. We can only surmise associations in change over time related to yoga. However, repeated measures ANOVA were used given that within subject designs account for variance between and within factors, are associated with less "noise" in assessing change, and may better control against random uncontrolled differences in conditions seen in independent designs (Field, 2013).

While this is one of the first studies to include men while assessing yoga and ED related factors, the sample size was small. Due to a smaller sample size, repeated measures ANOVA yielded suboptimal power in assessing gender differences and interaction effects. Therefore, differences between genders, which support some research findings (Lavender et al., 2010), should be considered with caution. Regardless, assessment of the impact of yoga on body image, disordered eating, and related factors among men is essential as men are also at risk for ED development (McCabe & Ricciardelli, 2004; Graham et al., 2005) and also present in ED treatment settings that offer yoga.

Another limitation of the study was that participants chose to enroll in the yoga courses. This may limit the generalizability of the findings especially as some participants did not complete all time points. However, this study possesses ecological validity since it is examining a sample participating in yoga volitionally, which is the usual motivator for practice. Reasons why an individual is practicing yoga may be important (Douglass, 2009; Mahlo & Tiggemann, 2016). Given this sample was seeking course credit, participants' goals may have been different than individuals who are going to yoga studios or even practicing yoga as an adjunct to ED treatment. Participants completing questionnaires at both time points could have also been more interested in yoga, however most missed data occurred due to absence on recruitment days.

The majority of the sample identified as White/Caucasian. While the sample reflects the regional demographics of the area, this may limit the generalizability of our results. Previous research suggests ethnic minorities use complementary alternative medicine practices less than Caucasian individuals (Graham et al., 2005). Understanding the effect of yoga in such populations and the disparity of use represents an important avenue for future research. Future studies could also assess impact of yoga on other populations (e.g. body functionalities, ages).

In all, regular yoga practice appears to be associated with decreases in ED pathology and negative body image as well as concurrent increases in self-compassion, body appreciation, and perceived yoga skills and abilities in a college sample. The concurrent decreases in ED symptoms and improvements in protective factors associated with yoga practice is promising; both independently predict ED pathology (Tylka & Wood-Barcalow, 2015b). Incorporating yoga into physical education, as health requirements, or offering courses in college or similar settings could yield numerous benefits. Such findings are also supported by existing prevention and intervention studies on yoga (Ariel-Donges et al., 2018; Cox & McMahon, 2019; Halliwell, Dawson, & Burkey, 2019). In sum, yoga appears to be associated with improvements in many protective factors (i.e., self-compassion and body appreciation), risk factors (i.e., body dissatisfaction), and ED symptoms among young adults. Future research should continue to assess mechanisms of action by which yoga practice is associated with reductions in ED symptoms and risk to incorporate the most effective elements in the practice for ED prevention and treatment.

## Notes

1. AE is scored such that high scores suggest lower body dissatisfaction while higher scores on all other subscales of the MBSRQ-AS indicate greater body dissatisfaction.
2. Between-subjects and some interaction analyses yielded results that were low-powered and should be considered cautiously.

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## Conflicts of interest

In accordance with Taylor & Francis policy and our ethical obligation as researchers, the authors report that no conflicts of interest.

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