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## Yoga and Pilates: Associations with body image and disordered eating behaviors in a population-based sample of young adults

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### Abstract

**Objective**—To examine associations between participating in mind-body activities (yoga/Pilates) and body dissatisfaction and disordered eating (unhealthy and extreme weight control practices and binge eating) in a population-based sample of young adults.

**Method**—The sample included 1030 young men and 1257 young women (mean age: 25.3 years, SD=1.7) who participated in Project EAT-III (Eating and Activity in Teens and Young Adults).

**Results**—Among women, disordered eating was prevalent in yoga/Pilates participants and non-participants, with no differences between the groups. Men participating in yoga/Pilates were more likely to use extreme weight control behaviors (18.6% vs. 6.8%,  $p=.006$ ) and binge eating (11.6% vs. 4.2%,  $p=.023$ ), and marginally more likely to use unhealthy weight control behaviors (49.1% vs. 34.5%;  $p=.053$ ), than non-participants after adjusting for sociodemographics, weight status, and overall physical activity.

**Discussion**—Findings suggest the importance of helping yoga/Pilates instructors recognize that their students may be at risk for disordered eating.

Physical activity incorporating both the mind and body, such as yoga or Pilates, has gained popularity within the United States during recent decades (1–8). Various psychological, behavioral, and physical benefits are commonly attributed to the practices of mind-body activities (3,9–16). Many eating disorder treatment programs now include mind-body activities (17,18) and some small studies suggest that participation in such activities can be helpful in alleviating eating and weight-related concerns (19–21). However, little is known about young adults in the general population who practice mind-body activities and their risk for eating disorders. On the one hand, this group might be expected to be more accepting of their bodies and less likely to engage in disordered eating practices, such as unhealthy weight control and binge eating behaviors, given that an important tenet of mind-body practice is to be in touch with oneself and be more self-accepting. On the other hand, individuals with body dissatisfaction and those engaging in disordered eating may be

### Conflicts of Interest

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attracted to mind-body activities either to help themselves with these issues or as a form of weight management.

Given the popularity of mind-body activities, the high prevalence of body dissatisfaction and disordered eating behaviors, and the potential for mind-body activities to help with body dissatisfaction and disordered eating behaviors (22), it is important to explore their potential links. If individuals engaging in mind-body activities report body dissatisfaction and disordered eating behaviors, such mind-body classes may offer a venue for messages and activities aimed at the prevention of these risk factors for eating disorders. Thus, the current study examines associations between engaging in yoga and Pilates mind-body activities and body dissatisfaction, unhealthy and extreme weight control behaviors, and binge eating in a population-based sample of young adults.

## Methods

### Sample and Study Design

Data for this cross-sectional analysis were drawn from Project EAT-III (Eating and Activity in Teens and Young Adults), the third wave of a population-based study designed to examine dietary intake, physical activity, weight control behaviors, weight status, and factors associated with these outcomes among young adults. The sample for the current study included 1030 men and 1257 women; about 30% were in early young adulthood (mean age:  $23.1 \pm 0.7$  years) and about 70% were in middle young adulthood (mean age:  $26.3 \pm 0.9$  years). All study protocols were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee.

At the original assessment (1998–1999), 4,746 junior and senior high school students from 31 public schools in the Minneapolis/St. Paul metropolitan area completed surveys and anthropometric measures (22,23). Ten years later (2008–2009), participants were mailed letters inviting them to complete online or paper versions of the Project EAT-III survey and a food frequency questionnaire and were offered 50 dollars for survey completion. Complete follow-up survey data were collected from 66.4% of those for whom correct contact information was available, representing 48.2% of the original cohort, for a final sample of 2287 young adults. Statistical adjustments were made to account for attrition (described in statistical analysis section, below). The final weighted sample was 48.4% white, 18.6% African American, 5.9% Hispanic, 19.6% Asian, 3.3% Native American, and 4.3% mixed or other race/ethnicity and was well-distributed across five levels of socioeconomic status (SES).

### Survey Development and Measures

The Project EAT survey used in previous study waves was modified to increase the relevance of items for young adults (24). Additionally, a greater focus was placed on physical activity in Project EAT-III than in previous waves and questions on specific activities (e.g. yoga/Pilates) were added to the survey. The revised survey was pre-tested by 27 young adults in focus groups and test-retest reliability over a 1–3 week period was examined in a sample of 66 young adults.

Participation in yoga or Pilates was assessed using a modified version of the Seasonal Physical Activity Questionnaire from the Growing Up Today Study (25). Participants were first asked to report if they had done yoga or Pilates during the past year (yes/no). If they responded yes, they were also asked to recall the typical amount of time per week spent doing yoga or Pilates, within each season over the past year, (None/Zero, Less than ½ hour, ½ hour - less than 2 hours, 2–3 hours, 4–6 hours, 7–9 hours, 10+ hours). Each response was assigned a midpoint value (e.g. 2–3 hours = 2.5 hours), in order to create an average score

reflecting hours of participation per week during the year (Test-retest  $r=0.65$ ). For analyses, this score was used to categorize young adults according to whether they reported doing yoga or Pilates 1) at least half-hour per week or 2) less than a half-hour per week.

Body dissatisfaction was assessed with a modified version of the Body Shape Satisfaction Scale (26). Young adults were asked to report their satisfaction with 13 different body parts (e.g., height, weight, stomach and hips) using five Likert response categories that ranged from *very dissatisfied* (1) to *very satisfied* (5). Responses to these items were summed to determine an overall body satisfaction score (Cronbach's  $\alpha=0.93$ ; Test-retest  $r=0.89$ ); those with scores in the lowest tertile of the distribution were considered to have body dissatisfaction and were compared to all other respondents.

Unhealthy and extreme weight control behaviors were assessed with the question: "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year?" (yes/no for each method). Responses categorized as unhealthy weight control behaviors included 1) fasted, 2) ate very little food, 3) used a food substitute (powder or a special drink), 4) skipped meals, and 5) smoked more cigarettes. Those reporting the use of one or more unhealthy weight control behaviors were coded as using unhealthy weight control behaviors (Test-retest agreement = 83%). Extreme weight control behaviors included 1) took diet pills, 2) made myself vomit, 3) used laxatives, and 4) used diuretics. Those reporting the use of one or more of these behaviors were coded as using extreme weight control behaviors (Test-retest agreement = 97%).

Binge eating was assessed with the question: "In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge eating)" (yes/no). If participants responded yes, they were asked, "During the times when you ate this way, did you feel you couldn't stop eating or control what or how much you were eating" (yes/no). Those reporting yes to both of these questions were coded as engaging in binge eating with loss of control. (Test-retest agreement = 92% [first question] and 84% [second question]).

Weight status was assessed using self-reported height and weight, from which body mass index (BMI,  $\text{kg}/\text{m}^2$ ) was calculated. Self-report of height and weight were validated in a subsample of 63 male and 62 female participants in Project EAT-III for whom height and weight measurements were completed by trained research staff. Results showed very high correlations between self-reported BMI and measured BMI in males ( $r=0.95$ ) and females ( $r=0.98$ ).

Total Physical Activity was assessed using questions adapted from the widely used Godin Leisure-Time Exercise Questionnaire (27,28). Three survey items individually assessed strenuous, moderate and mild activity, asking "In a usual week, how many hours do you spend doing the following activities?" (Response options included: None, Less than 1/2 hour, 1/2 hour – 2 hours, 2 1/2 – 4 hours, 4 1/2 – 6 hours, 6+ hours). Strenuous activity was described as activity during which the heart beats rapidly, moderate activity was described as not exhausting and mild activity was described as an activity requiring little effort. Examples of specific activities were given after each question. Similar to the yoga/Pilates variable, each response was assigned a midpoint value and responses were then summed to compute total weekly hours of physical activity (Test-retest  $r=0.80$ ).

### Statistical analysis

Logistic regression was used to test the hypothesis that yoga/Pilates involvement was associated with disordered eating behaviors and body dissatisfaction. Three models were run for each dependent variable. Model 1 only included the yoga/Pilates indicator with no other

adjustment. Model 2 adjusted for demographic covariates (age group, race/ethnicity and SES). Model 3 adjusted for these demographic variables plus BMI, which was lower among yoga/Pilates participants than non-participants, and total hours of physical activity, which was higher among yoga/Pilates participants than non-participants. Standardized probabilities of each outcome were obtained based on the fitted logistic regression models using the predicted probability associated with participation in yoga/Pilates for a person with average values on the adjustment variables. All analyses were stratified by gender and were performed in SAS 9.2.

Because attrition from the original Project EAT sample did not occur at random, in all analyses, the data were weighted using the response propensity method (29). Response propensities (i.e., the probability of responding to the EAT-III survey) were estimated using a logistic regression of response to EAT-III (yes/no) on a large number of predictor variables available from the wave 1 survey. Weights were additionally calibrated so that the weighted sample sizes used in analyses would accurately reflect the actual observed number of males and females. The weighting method results in estimates representative of the demographic make-up of the original Project EAT school-based sample, thereby allowing results to be more fully generalizable to a population-based sample of young people.

## Results

Among study participants, 17.6% (n=221) of the young women and 5.2% (n=53) of the young men reported an average of 30 minutes or more of yoga/Pilates per week. These young adults were classified as yoga/Pilates participants in all further analyses. Among yoga/Pilates participants, the average time spent in yoga or Pilates was 2.0 hours/week (SD=1.4) for young women and 2.2 hours/week (SD=1.7) for young men.

Unhealthy weight control behaviors were reported by 55.2% (n=694) of young women and by 33.1% (n=341) of young men. Extreme weight control behaviors were reported by 21.2% (n=267) of young women and 7.8% (n=80) of young men. Binge eating with loss of control was reported by 15.2% (n=190) of young women and 7.1% (n=72) of young men.

Young women who participated in yoga/Pilates were less likely to report body dissatisfaction than non-participants (36.1% vs. 51.4%,  $p<.001$ ; Table 1: Model 1). The proportions of young women reporting unhealthy weight control behaviors, extreme weight control behaviors and binge eating did not differ significantly by yoga/Pilates participation. For example, the predicted probability of extreme weight control behaviors was 20.5% for young women participating in yoga/Pilates and 21.4% for those not participating ( $p=.752$ ). These associations were unchanged after controlling for demographic characteristics (Table 1: Model 2). Upon further controlling for BMI and physical activity (Table 1: Model 3), all associations between yoga/Pilates participation and the dependent variables were non-significant among young women.

Among young men, a different pattern of associations was found. In unadjusted analyses, the predicted probability of extreme weight control behaviors was significantly higher among young men reporting yoga/Pilates participation (17.0%) vs. non-participants (7.4%,  $p=.014$ ; Table 2: Model 1). Associations were similar after adjusting for demographic characteristics (Table 2, Model 2). After adjusting for BMI and total physical activity, associations were strengthened; yoga/Pilates participants had a higher adjusted probability of using extreme weight control behaviors (18.6% vs 6.8%,  $p=.006$ ) and binge eating (11.6% vs. 4.2%,  $p=.023$ ), and marginally higher adjusted probability of using unhealthy weight control (49.1% vs. 34.5%;  $p=.053$ ), compared to those not involved in yoga/Pilates (Table 2: Model 3).

## DISCUSSION

Findings from the current study indicate that a substantial number of young adults within the general population practice yoga or Pilates mind-body activities on a regular basis, particularly young women. Findings further show that young adults in a population-based sample who engage in these mind-body activities are not protected from engaging in disordered eating behaviors. Rather, our findings suggest that young adults participating in these activities are at equal or higher risk for these behaviors. Among young women, disordered eating behaviors were prevalent among those engaging and not engaging in yoga or Pilates, with no differences between the groups. Young men engaging in yoga or Pilates were found to be at increased risk for unhealthy weight control behaviors, extreme weight control behaviors, and binge eating behaviors as compared to non-participants, in analyses adjusting for sociodemographic characteristics, weight status, and overall level of physical activity. Findings suggest the importance of helping yoga and Pilates instructors recognize that students participating in their classes may be engaging in disordered eating behaviors and providing training on how to help their students feel good in their bodies and avoid disordered eating behaviors. Given that mind-body classes already offer a framework for helping students be in touch with their bodies in a healthy way, these classes may provide a venue for the prevention and early recognition of eating disorder symptoms.

The population-based nature of the study sample allows for greater generalizability than previous studies, which have tended to use smaller convenience samples to examine mind-body activities and disordered eating (19,21). Furthermore, the current study examined associations between yoga/Pilates and disordered eating independent of current weight status and involvement in other physical activities. However, study limitations include the cross-sectional nature of the study, the use of self-reported measures, our inability to separate out yoga from Pilates as they were assessed together, and the lack of information on types of practices or locations (e.g., yoga studios as compared to fitness centers). Given the popularity of yoga and Pilates, the high prevalence of individuals displaying body dissatisfaction and engaging in disordered eating behaviors in the current study, and the physical and psychological benefits found to be associated with these mind-body practices in smaller intervention studies (13,16,30–33), further study is warranted.

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Table 1

Body dissatisfaction and disordered eating in young adult women by yoga/Pilates participation: unadjusted and adjusted analyses <sup>a</sup>

	Body dissatisfaction	Unhealthy weight control	Extreme weight control	Binge eating
	%	%	%	%
Yoga participation				
Model 1 <sup>b</sup>				
Yes	36.1	56.1	20.5	13.5
No	51.4	54.9	21.4	15.5
p-value	<b>&lt;.001</b>	.747	.752	.454
Yoga participation				
Model 2 <sup>c</sup>				
Yes	37.7	60.4	23.6	14.1
No	49.9	56.0	22.7	17.6
p-value	<b>.002</b>	.264	.775	.246
Yoga participation				
Model 3 <sup>d</sup>				
Yes	39.8	61.2	22.7	14.0
No	42.8	54.7	20.3	14.9
p-value	.500	.114	.497	.756

<sup>a</sup> Proportions for each outcome are based on 221 yoga/Pilates participants and 1036 non-participants. Adjusted proportions (Models 2 and 3) represent proportions of outcomes assuming equality of respective control variables across yoga/Pilates participation.

<sup>b</sup> Model 1: Unadjusted Model

<sup>c</sup> Model 2: Adjusted for race, SES, and age group

<sup>d</sup> Model 3: Adjusted for race, SES, age group, BMI, and weekly hours of physical activity



**Table 2**

Body dissatisfaction and disordered eating in young adult men by yoga/Pilates participation: unadjusted and adjusted analyses <sup>a</sup>

	Body dissatisfaction	Unhealthy weight control	Extreme weight control	Binge eating
	%	%	%	%
Yoga participation				
Model 1 <sup>b</sup>				
Yes	18.0	39.4	17.0	12.5
No	26.8	32.9	7.4	6.8
p-value	.160	.326	<b>.014</b>	.122
Yoga participation				
Model 2 <sup>c</sup>				
Yes	18.6	45.9	18.8	10.2
No	24.6	34.7	7.2	4.8
p-value	.342	.114	<b>.006</b>	.073
Yoga participation				
Model 3 <sup>d</sup>				
Yes	22.9	49.1	18.6	11.6
No	23.6	34.5	6.8	4.2
p-value	.931	<b>.053</b>	<b>.006</b>	<b>.023</b>

<sup>a</sup>Proportions for each outcome are based on 53 yoga/Pilates participants and 977 non-participants. Adjusted proportions (Models 2 and 3) represent proportions of outcomes assuming equality of respective control variables across yoga/Pilates participation.

<sup>b</sup>Model 1: Unadjusted Model

<sup>c</sup>Model 2: Adjusted for race, SES, and age group

<sup>d</sup>Model 3: Adjusted for race, SES, age group, BMI, and weekly hours of total physical activity