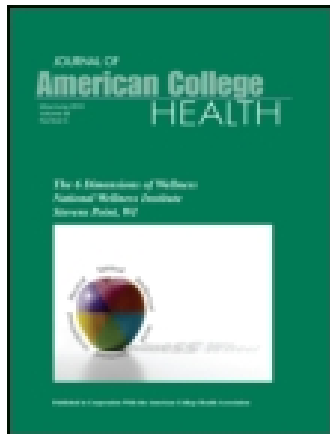


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### Mindfulness and Health Behaviors: Is Paying Attention Good for You?

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# Mindfulness and Health Behaviors: Is Paying Attention Good for You?

Kimberly C. Roberts, MA; Sharon Danoff-Burg, PhD

**Abstract. Objective:** The investigators examined relations between mindfulness and health behaviors in college students, as well as the role of stress in mediating these effects. **Participants:** Participants were 553 undergraduates (385 females; mean age = 18.8 years,  $SD = 2.1$ ) recruited from a university in the north-eastern United States. **Methods:** Participants completed questionnaires assessing mindfulness, perceived health, health behaviors, health-related activity restriction, and stress. Data were collected from September 2007 through December 2007. **Results:** Overall perceived health and health-related activity restriction, as well as some health behaviors (eg, binge eating, sleep quality, and physical activity) were related to the Five-Factor Mindfulness Questionnaire and were partially mediated by stress. **Conclusions:** These results suggest that mindfulness is related to decreased stress, which in turn contributes to increased positive health perceptions and health behaviors. The findings support the utility of mindfulness in promoting physical and psychological health in college students.

**Keywords:** college students, health behaviors, mindfulness, stress

**M**indfulness is a concept that emerged thousands of years ago within Buddhist meditation practices, yet has only recently become familiar to the Western world. Simply defined, mindfulness is a way of paying attention—a “moment-to-moment, non-judgmental awareness”<sup>1(p24)</sup> that involves purposely focusing on the experiences of the present moment. Eastern spiritual tradition suggests that mindfulness may be cultivated through the regular practice of meditation, which has been described as “the measure of our thoughts, our emotions, [and] our body sensations, and embracing all that in awareness.”<sup>1(p26)</sup> However, mindfulness is also found within the general population, including in those with little or no experience with meditation.<sup>2</sup>

The psychological and physical health benefits of mindfulness have been investigated in a number of studies. Grossman et al<sup>3</sup> conducted a meta-analysis of 20 empirical studies that investigated the health benefits of the group intervention known as mindfulness-based stress reduction (MBSR).<sup>4</sup> Similarly, Baer<sup>5</sup> conducted a study using meta-analytic techniques to compare and quantify the findings of 21 studies investigating the effects of MBSR and mindfulness-based cognitive therapy.<sup>6</sup> Combined results from these studies show that mindfulness-based interventions may benefit people suffering from chronic pain, fibromyalgia, cancer, heart disease, anxiety, binge eating disorder, psoriasis, borderline personality disorder, major depressive disorder, and stress. Mechanisms that may explain how mindfulness can lead to improved health include exposure, cognitive change, self-management, relaxation, and acceptance.<sup>5</sup>

Zvolensky et al<sup>7</sup> investigated the role of mindfulness-based attention in predicting perceived health status and functioning in a community sample. Greater levels of mindfulness-based attention, measured by the Mindful Attention Awareness Scale,<sup>8</sup> were associated with perceptions of better physical and psychological functioning among young adults. Further studies aimed at understanding relations among mindfulness, stress, and health may ultimately contribute to the development of strategies to help prevent and treat public health problems. Among college students these include—but are not limited to—sleep disturbance, cigarette smoking, binge eating, lack of physical activity, and risky sexual behavior. These health-related problems and their potential links with mindfulness are discussed below.

A recent study reported that more than one-third of college students surveyed took longer than 30 minutes to fall asleep, woke more than once nightly, and were tired during the day.<sup>9</sup> Other research has shown that mindfulness may help reduce sleep disturbances that are related to stress.<sup>10</sup> Also related to stress is the health-compromising behavior of smoking. Some research suggests that mindfulness may aid in reducing stress-related cigarette smoking,<sup>11</sup> a behavior

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that has steadily increased among college students over the last decade.<sup>12</sup>

In addition to the experience of stress, attempts to avoid cognitive awareness may influence engagement in unhealthy behavior. Binge eating disorders affect people of all ages, but are especially prominent among college students. In fact, binge eating disorder is the most common eating disorder among college students. About 1 in 5 college-age women report that they have had binge eating symptoms, whereas men account for about 40% of cases of binge eating among college students.<sup>13,14</sup> According to Heatherton and Baumeister,<sup>15</sup> binge eating may be motivated by a desire to escape from self-awareness. Unhealthy eating habits and increased alcohol consumption make physical activity especially important for college students. Similarly, lack of exercise is a significant and hazardous health problem in the United States, and physical activity levels sharply decline from high school to college.<sup>16</sup>

Finally, the attempt to avoid cognitive awareness also may lead to engagement in other behaviors that have the potential for deleterious consequences, such as risky sexual activity.<sup>17</sup> This is an important variable to study for many reasons, one of which is its association with sexually transmitted disease (STD). Most (85%) of the most prevalent infectious diseases in the United States are sexually transmitted, and sexually active adolescents (ages 10 to 19) and young adults (ages 20 to 24) are at a higher risk for contracting STDs. Although representing only 25% of the ever sexually active population, people in this age range become infected with nearly one-half of all new STDs.<sup>18,19</sup>

In the present study we predicted that college student participants who scored higher on a measure of mindfulness would report better health and less health-related activity restriction, fewer harmful habits (cigarette smoking, binge eating, risky sexual activity, and poor sleep), and more beneficial ones (physical activity). Specifically, because stress reduction and relaxation are properties that are associated with mindfulness, we hypothesized that cigarette smoking and poor sleep quality would have negative correlations with being mindful. In addition, because being mindful involves increased awareness, we hypothesized that mindfulness would be negatively correlated with binge eating and risky sexual behavior. Based on Zvolensky and colleagues'<sup>7</sup> finding that mindfulness-based attention predicts physical functioning, we hypothesized that being mindful would correlate positively with more physical activity, less health-related activity restriction, and better perceived overall health. Finally, to explain associations among mindfulness, stress, and health, we conducted a series of regression analyses to test whether college students' levels of perceived stress would mediate the correlations between mindfulness and the health variables.

## METHODS

### Participants

Participants were recruited from the Psychology Research Pool at the University at Albany. Due to survey questions

assessing sensitive topics, participation was limited to those aged 18 and older. Additional criteria included the ability to read and write in English. Of the 554 students who completed the study questionnaires, 1 case (.18%) was excluded due to missing data. Outlier analyses did not reveal any significant outliers in the data set; therefore, the final sample consisted of 553 participants.

The final sample consisted of 385 females (69.5%) and 168 males (30.3%); mean age = 18.8 years,  $SD = 2.1$ ). The majority of participants (68.4%) identified their race/ethnicity as Caucasian. Other racial/ethnic groups included Asian (10.1%), African American/black (8.5%), Hispanic/Latino (7.9%), more than 1 race (2.5%), Native Hawaiian/Pacific Islander (0.4%), and unknown/other (2.0%).

### Procedure

Prior to data collection, the study was submitted to the university institutional review board for approval. Once approval was obtained, the study was uploaded to the university's research management system, Sona Systems, in an online survey format. All students enrolled in the Psychology Research Pool between September and December 2007 had equal opportunity to participate in the present study. Students were required to read a statement of informed consent and instructed to print a copy for their own records. Only students who agreed to participate in the study by selecting "Continue" were permitted to view the survey. Participants were also provided with the contact information of local mental health support services.

Participants meeting eligibility requirements signed up for the study through the Sona Systems research participation system. Those who consented to participate were directed to the survey, which was also completed through the Sona Systems Web site. Participants completed questionnaire items assessing mindfulness, overall perceived health, activity restriction, various health-related behaviors (sleep, smoking, binge eating, physical exercise, and risky sexual activity), and stress. Due to the limited protections of Internet access, absolute confidentiality could not be guaranteed; however, participants were instructed to close their browsers upon completion of the survey in order to maximize their privacy.

### Measures

#### Five-Factor Mindfulness Questionnaire

The Five-Factor Mindfulness Questionnaire (FFMQ) was developed by Baer et al<sup>20</sup> and is a 39-item self-report questionnaire that assesses 5 facets related to mindfulness: nonre-activity, nonjudgment, observation, awareness, and describing. Items are rated on a 5-point scale ranging from "never or very rarely true" to "very often or always true." A sample item from the questionnaire includes, "I pay attention to how my emotions affect my thoughts and behavior."

In the present study, the 39 items of the FFMQ were subjected to principal component analysis using SPSS version 16. The analysis revealed the presence of 8 components with eigenvalues exceeding 1, explaining 20%, 13.9%, 9.1%,

6.5%, 5.6%, 2.9%, 2.8%, and 2.6% of the variance, respectively. An inspection of the scree plot showed an apparent break after the fifth component. Consequently, 5 components were retained for further investigation.

Varimax rotation was performed to aid in the interpretation of these components. The rotated solution confirmed the presence of 5, distinct components, with all variables significantly loading on only 1 component. The 5-component solution explained 55.2% of the total variance. Consistent with previous research on the FFMQ,<sup>2</sup> awareness items loaded strongly on component 1, observing items on component 2, nonjudging items on component 3, describing items on component 4, and nonreactivity items on component 5. In addition, good internal consistency ( $\alpha = .89$ ) was demonstrated.

### Youth Risk Behavior Surveillance System

Six items from the Youth Risk Behavior Surveillance System<sup>21</sup> were used to assess cigarette smoking, risky sexual behavior, and physical activity. Each section was scored and analyzed individually. A sample smoking item is, "During the past 30 days, on how many days did you smoke cigarettes?" with responses ranging from "0 days" to "All 30 days." The number of daily cigarettes smoked over the past 30 days was also calculated, with answers ranging from "I did not smoke cigarettes during the past 30 days" to "more than 20 cigarettes per day." Items assessing risky sexual behavior asked about participants' age at the time of their first sexual intercourse experience, number of lifetime sexual partners, and number of sexual partners in the past 3 months. One item assessed physical activity: "During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?" Answers ranged from "0 days" to "7 days."

### Weight and Lifestyle Inventory

Two items from the Weight and Lifestyle Inventory<sup>22</sup> were included to assess physical activity. Participants were asked to rate their daily lifestyle activity on a scale from 1 ("very sedentary") to 10 ("very active"), as well as the extent to which they enjoy physical activity, 1 ("not at all") to 4 ("greatly"). Items were scored and analyzed individually during correlation.

### Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI)<sup>23</sup> was used to assess participants' reports of their sleep patterns and quality. The questionnaire consists of 10 items that are separated into 7 components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the last month. Scoring of answers is based on a 0 to 3 scale, with higher scores denoting poorer sleep quality. Components are scored individually and then tallied to reveal a global score. Those with a global sum of 5 or greater are considered "poor" sleepers. A sample item is, "During the past month, how would you rate your sleep quality overall?" with responses

ranging from 1 ("very good") to 4 ("very bad"). Internal consistency in the present study was adequate ( $\alpha = .73$ ).

### Gormally Binge Eating Scale

Binge eating behavior was assessed using the Gormally Binge Eating Scale.<sup>24</sup> The questionnaire includes 16 items consisting of groups of numbered statements. Respondents are instructed to choose the statement that best describes the way they feel about the problems they have when controlling their eating behavior. Each item is scored using either a 3- or 4-point scale, depending on the question, and then tallied to reveal a global binge eating score. Those scoring 17 or lower are considered nonbingers, 18–26 are considered moderate bingers, and scores of 27 or higher indicate severe binge eating. During correlation, those in the nonbinging, moderate binging, and severe binging categories were reassigned number values of 0, 1, and 2, respectively. Internal consistency was very good ( $\alpha = .90$ ).

### Activity Restriction Items

Several author-constructed activity restriction items were included to assess the extent to which mental and physical health reasons restricted participants' daily activities. Participants were asked to list the approximate number of days of work or school that they missed during the past year due to both physical and mental health reasons. Additional questions included, "To what extent do you feel you have had to restrict your activities because of mental health reasons in the past year" as well as a similar question concerning physical health reasons, with possible responses ranging from 1 ("not at all") to 9 ("completely").

### Overall Health

One item from the Short-Form General Health Survey<sup>25</sup> was included to assess participants' perception of their overall health. The question asked participants to rate their health, in general, on a scale from 1 ("excellent") to 5 ("poor").

### Short-Form Perceived Stress Scale

The Short-Form Perceived Stress Scale<sup>26</sup> was used to assess subjective levels of stress in participants. The 4 items were rated on a 4-point scale ranging from "never" to "very often." A sample item from this scale is, "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?" Internal consistency was acceptable ( $\alpha = .76$ ).

## RESULTS

All data were downloaded from the Sona Systems Web site into an SPSS spreadsheet and checked for noticeable error. The data were then evaluated for disproportionate skew and outliers. There were no significant problems detected during this process. Descriptive statistics were computed to summarize means, standard deviations, and frequencies (see Table 1). To examine associations between mindfulness and health, bivariate correlations were conducted among the total

**TABLE 1. Means, Standard Deviations, and Frequencies of Participant Responses**

	Mean	SD		Mean	SD		
FFMQ	127.11	16.80					
Nonreactivity	21.70	4.80	Weekly physical activity	3.87	2.180		
Observing	27.22	5.92	Enjoyment of physical activity	3.04	0.858		
Nonjudging	26.94	6.55	Perceived activity restriction	1.65	1.780		
Awareness	25.84	6.02	No. of days work/school missed	2.70	3.560		
Describing	25.52	5.91	Perceived overall health	2.29	0.826		
Binge eating	1.39	0.57	Daily physical activity	6.54	2.020		
Stress	6.53	2.76	Sleep quality	6.14	3.170		
No. of days smoked in past 30 days	0	1–2	3–5	6–9	10–19	20–30	30
	72.7%	8.2%	3.6%	3.8%	2.4%	4.2%	5.1%
No. of cigarettes smoked per day	0	<1	1	2–5	6–10	11–20	>20
	72.2%	6.9%	5.3%	8.9%	2.4%	0%	3.6%
Age at first sexual intercourse	Never	≤12	13	14	15	16	≥17
	24.5%	1.0%	2.2%	8.5%	13.2%	19.5%	31.2%
No. of lifetime sex partners	0	1	2	3	4	5	≥6
	24.7%	21.9%	14.3%	9.9%	5.9%	6.1%	17.1%
No. of sex partners in past 3 months	0	1	2	3	4	5	≥ 6
	7.2%	48.9%	11.3%	4.6%	1.3%	0.6%	0.9%

mindfulness score (FFMQ) and the health variables (see Table 2). Mediation analyses, using stress as the mediator variable, were then conducted in order to explain associations between mindfulness and the various health variables (see Table 3).

**Descriptive Statistics**

Descriptive statistics are displayed in Table 1. Mean levels of mindfulness (total score and subscale scores) were similar to levels in other studies using the FFMQ with college students.<sup>2</sup> Mean levels of binge eating, stress, and daily physical activity also were similar to levels in other studies with undergraduate samples.<sup>27,28</sup> Consistent with findings suggesting that college students are among the most sleep-deprived people in the United States, the mean global PSQI score was greater than 5 and therefore denotes poor overall sleep quality among participants. The perception of activity restriction was low, and perceived overall health had a mean response slightly above the scale midpoint at “very good.” Nearly 73% of students reported they had not smoked during the past month, and 27.3% reported smoking on at least 1 day in the past 30 days. Of those who reported smoking at least 1 cigarette during the past 30 days, the majority of these respondents indicated that they had smoked 2 to 5 cigarettes.

Approximately one quarter (24.5%) of students in our sample reported that they had never engaged in sexual intercourse. With regard to risky sexual behavior, the majority of sexually active respondents reported having sexual intercourse with 1 partner during their lifetime (21.9%); however, this was closely followed by reports of 6 or more lifetime partners (17.1%). About one-third (31.2%) of sexually active respondents indicated that they had first engaged in sex-

ual intercourse at 17 years of age or older. Approximately half (48.9%) of the respondents reported engaging in sexual intercourse with 1 person during the past 3 months.

**Correlations Between Mindfulness and Health**

Bivariate correlations among the total mindfulness score on the FFMQ and the health variables are reported in Table 2. As expected, mindfulness was significantly negatively associated with binge eating, poor sleep quality, and higher stress. Also consistent with hypotheses, mindfulness was found to be negatively correlated with activity restriction (number of days of work and school missed for mental/physical health reasons), and perceptions of poor overall health. Perceived daily physical activity level was significantly associated with mindfulness in the expected positive direction, as well as the extent to which physical activity was enjoyed and the number of days reported to be physically active in the past week. Smoking and risky sexual behavior were not significantly related to mindfulness as a whole construct, but post hoc analyses revealed that they were correlated with the awareness subscale. Specifically, number of cigarettes smoked per day ( $r = -.091, p < .05$ ), number of days smoked during the past 30 days ( $r = -.102, p < .05$ ), and number of lifetime sex partners ( $r = -.091, p < .05$ ) were all negatively associated with this facet of mindfulness.

**Stress as a Mediator Between Mindfulness and Health**

Five mediation models were tested, using the methods set forth by Baron and Kenny.<sup>29</sup> According to these methods, a number of conditions must be met in establishing mediation. First, it must be shown that the initial variable (mindfulness) is correlated with the outcome (health variable). Second, the

TABLE 2. Bivariate Correlations Among FFMQ and Health-Related Variables (N = 553)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Higher stress	—														
2. Poor sleep quality	.413***	—													
3. Binge eating	.278***	.250***	—												
4. No. of days of work/school missed for physical/mental health	.201***	.205***	.152***	—											
5. Perceived activity restriction	.300***	.262***	.178***	.536***	—										
6. Perceived poor health	.333***	.270***	.143***	.285***	.318***	—									
7. No. of days smoked in past 30 days	.002	.148***	.039	.171***	.138***	.160***	—								
8. No. of cigarettes smoked per day	-.009	.130**	.016	.172***	.159***	.148***	.929***	—							
9. Age of first sexual intercourse	-.060	-.016	.033	.042	.029	-.091*	.072	.098*	—						
10. No. of lifetime sex partners	.067	.093*	.085*	.197***	.152***	.048	.273***	.295***	.428***	—					
11. No. of sex partners in past 3 months	.017	.052	.069	.138***	.086*	-.051	.182***	.187***	.624***	.707***	—				
12. Weekly physical activity	-.061	-.035	-.082	-.041	-.120**	-.215***	-.090*	-.087*	.016	.025	.085*	—			
13. Enjoyment of physical activity	-.129**	-.134**	-.084*	-.114**	-.188***	-.292***	-.079	-.091*	.145***	.069	.103*	.472***	—		
14. Daily physical activity	-.168***	-.157***	-.175***	-.094*	-.144***	-.330***	-.125**	-.121**	.109*	.066	.144***	.608***	.638***	—	
15. Mindfulness (FFMQ)	-.514***	-.325***	-.338***	-.151***	-.239***	-.293***	-.047	-.024	.060	-.087	-.003	.087*	.146**	.175***	—

Note. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

**TABLE 3. Mediated Pathways**

Model tested	Path A			Path B			Path C			Path C'								
	B	SE	$\beta$	T	B	SE	$\beta$	T	B	SE	$\beta$	T	ab	Z				
Mindfulness–Stress: Sleep	-.085***	.006	-.514	-13.54	.401***	.055	.350	7.255	-.061***	.008	-.325	-7.533	-.027*	.009	-.141	-2.932	-.034(.005)	-0.648***
Mindfulness–Stress: Binge eating	-.085***	.006	-.514	-13.54	.032**	.010	.158	3.294	-.011***	.001	-.338	-8.126	-.009***	.002	-.257	-5.345	-.003(.001)	-3.120**
Mindfulness–Stress: Activity restriction	-.085***	.006	-.514	-13.54	.167***	.031	.259	5.301	-.026***	.005	-.239	-5.565	-.011*	.005	-.106	-2.177	-.014(.003)	-5.040***
Mindfulness–Stress: Perceived health	-.085***	.006	-.514	-13.54	.074***	.014	.247	5.140	-.015***	.002	-.293	-6.933	-.008**	.002	-.166	-3.452	-.006(.001)	-4.950***
Mindfulness–Stress: Physical activity	-.085***	.006	-.514	-13.54	-.086*	.037	-.119	-2.345	.021***	.005	.175	4.025	.014*	.006	.114	2.263	.007(.003)	2.290*

Note. Unstandardized regression coefficients, their standard errors, beta weights, *t* values, indirect effects, their standard errors in parentheses, and significance tests of the indirect effect for each mediated path are reported ( $Z_{crit} = 11.961$  at  $p < .05$ ).  
\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

mediator (stress) must be correlated with the initial variable, and is treated as an outcome variable in order to demonstrate such a relation. Next, it must be shown that the mediator affects the outcome variable. In a multiple regression equation, both the initial and mediator variables are used as predictors of the outcome variable. The mediator and outcome may be correlated simply because they are both caused by the initial variable. Therefore, it is necessary to include the initial variable in the regression equation in order to control for its effects and thereby determine the true effect of the mediator on the outcome. Finally, in order to establish full mediation, the effect of the initial variable on the outcome must be insignificant once the mediator is included in the model. If all but this final condition are met and only a decrease is shown in the relation between the initial and outcome variables, then partial mediation is indicated.

In the present study, partial mediation effects were found for 5 of the outcome variables (Table 3). The Sobel<sup>30</sup> test was then performed on each of these mediation effects to determine the significance of the indirect effect of the mediator for each path. The resulting ratio, approximately distributed as a Z statistic, was then tested to determine if the difference was enough to be statistically significant and unlikely to have occurred by chance. A statistically significant Z value indicated the presence of partial mediation. In our study, all 5 tests were significant, confirming that stress partially mediated relations between mindfulness and sleep quality, binge eating, activity restriction, perceived overall health, and physical activity (Table 3).

### COMMENT

The first goal of this study was to investigate whether mindfulness, as measured by the FFMQ, would be correlated with perceived health in our sample, as well as with specific behaviors that influence health. It was predicted that participants who scored higher on mindfulness would report better perceived health and less health-related activity restriction, as well as engage in fewer harmful behaviors and practice more beneficial ones. If such relations were observed, the second goal was to examine whether stress was a factor in mediating this effect.

Consistent with the findings of Zvolensky et al<sup>7</sup> we found that higher levels of mindfulness were associated with perceptions of better physical and psychological functioning (ie, perceptions of overall health, stress, and activity restriction). Results of the present study also showed that some health behaviors were related to mindfulness in the expected directions. Individuals who were more mindful reported better sleep quality, engaged in less binge eating, and were more physically active. Stress was shown to partially mediate these relations, suggesting that mindfulness is related to decreased stress, which in turn contributes to increased positive health perceptions and behaviors.

Why would increased levels of mindfulness be related to less stress and better health? Baer<sup>5</sup> suggests that relaxation, defined as a reduction in tension, is one of the key mechanisms underlying mindfulness and its positive effects. A num-

ber of studies have supported these purported links and explored additional mechanisms. Coffey and Hartman<sup>31</sup> found an inverse relationship between mindfulness and distress as a result of increased emotional regulation (ie, having the ability to manage negative emotion), increased nonattachment (ie, viewing happiness as independent from specific external circumstances), and decreased rumination (ie, engaging in negative, frequently self-focused thought about the past or future). Shapiro et al<sup>32</sup> found that increased mindfulness as a result of MBSR was significantly related to reductions in perceived stress and rumination. Carmody and Baer<sup>33</sup> found that using mindfulness skills in everyday life led to reductions in symptoms and perceived stress. Carlson et al<sup>34</sup> conducted a study in which individuals with breast or prostate cancer participated in MBSR. The increased mindfulness skills that resulted from the program were associated with decreased blood pressure and altered cortisol and immune patterns, consistent with less stress and mood disturbance. Finally, Loughlin and Zuckerman<sup>35</sup> found that mindful participants reported less stress-related physical symptoms, and that their reports were more in line with their actual physiological health as measured by the human hormone dehydroepiandrosterone.

As noted above, mindfulness was significantly associated with some but not all of the behaviors assessed in this study. Although cigarette smoking and risky sexual behavior were not significantly related to mindfulness as a whole construct (FFMQ total score), a post hoc analysis revealed that they were negatively correlated with the awareness subscale. These results are consistent with past research on the utility of mindful awareness in reducing stress-related cigarette smoking,<sup>11</sup> as well as McKirnan's cognitive avoidance model of risky sexual behavior,<sup>17</sup> which suggests that individuals may engage in risky sexual activity in order to escape from cognitive awareness.

The findings of our study support the utility of mindfulness in promoting physical and psychological health. Because mindfulness was shown to be associated with reduced stress, these results are particularly relevant to college student populations. College can be a tremendously stressful time for students. Peer pressure, competition, separation from family, newfound freedom, exams, and choosing a major and career are all factors that contribute to college stress and in some cases lead to problems with health. According to the American Institute of Stress,<sup>36</sup> 75% to 90% of the visits made to primary care physicians by college students are due to stress or stress-related disorders. Our results suggest the value of teaching mindfulness-based interventions and techniques to college students in order to decrease stress and, consequently, the health problems and negative behaviors that may be associated with stress. Indeed, previous studies<sup>37,38</sup> using college student samples have shown mindfulness-based interventions to reduce perceptions of stress and anxiety.

There are several limitations of this study and potential future directions for research that warrant consideration. First, the cross-sectional design of this study does not allow us to draw conclusions about causal pathways. Second, the



present study was conducted with a relatively homogenous group of young, primarily European American college students. Future investigations should draw from more diverse populations (eg, age, ethnicity, geographic location). Third, it is possible that the statistical significance of some correlations in this study may be a product of the large sample size. Fourth, although the FFMQ is a well-developed and useful measure of mindfulness, future studies could evaluate alternative measures of mindfulness in relation to perceptions of health and health behaviors.

Grossman<sup>39</sup> proposed a number of critical issues related to measuring mindfulness in psychosomatic and psychological research. These concerns include the semantic confusion of mindfulness scale items among participants and significant discrepancies between individuals' self-ratings of mindfulness and their actual mindfulness levels. Because our study was conducted with college students with generally little to no experience with mindfulness meditation, the semantic interpretation of questionnaire items may have been erroneous.<sup>39</sup> In addition, self-ratings of mindfulness may pose limitations as they may be affected by individual biases and inaccurate estimations. Self-ratings of health processes and behaviors may also be problematic in the present study, as some questions asked participants to recall and numerically estimate specific occurrences over the past year. This wide time frame might have affected participants' ability to report accurate estimates.

Future studies may benefit from manipulating levels of mindfulness, through various mindfulness-based interventions, in a laboratory setting and evaluating the corresponding effects on physical and psychological health processes and behaviors. Objective health status and behaviors could then be observed, in addition to self-reported measures, in order to gain a more accurate understanding of mindfulness and its effects on health.

### Conclusion

The present study demonstrated a link between mindfulness and health perceptions and behaviors in a college population. Results suggested that mindfulness is related to decreased stress, which in turn contributes to increased positive health perceptions and health behaviors. Understanding these relations among mindfulness, health perceptions, and health behaviors may ultimately contribute to the development of strategies to prevent and treat serious public health problems that college students often face.

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### NOTE

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### REFERENCES

1. Kabat-Zinn J. Bringing mindfulness to medicine. *Advances*. 2005;21:22–27.
2. Baer R, Smith GT, Lykins E, et al. Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*. 2008;20:1–14.
3. Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits. *J Psychosom Res*. 2004;57:35–43.
4. Kabat-Zinn J. *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain and Illness*. New York, NY: Delacorte; 1990.
5. Baer R. Mindfulness training as a clinical intervention: a conceptual and empirical review. *Clin Psychol Sci Pract*. 2003;10:125–140.
6. Teasdale JD, Segal ZV, Williams JM. How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behav Res Ther*. 1995;33:25–39.
7. Zvolensky MJ, Solomon S, McLeish A. Incremental validity of mindfulness-based attention in relation to the concurrent prediction of anxiety and depressive symptomatology and perceptions of health. *Cogn Behav Ther*. 2006;35:148–158.
8. Brown KW, Ryan RM. The benefit of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol*. 2003;84:822–848.
9. Forquer LM, Camden AE, Gabriau KM, Johnson CM. Sleep patterns of college students at a public university. *J Am Coll Health*. 2008;56:563–565.
10. Carlson LE, Garland SN. Impact of mindfulness-based stress reduction (MBSR) on sleep, mood, stress, and fatigue symptoms in cancer outpatients. *Int J Behav Med*. 2005;12:278–285.
11. Davis JM, Fleming MF, Bonus KA, Baker TB. A pilot study on mindfulness based stress reduction for smokers. *BMC Complement Altern Med*. 2007;7:1–7.
12. Weschler H, Rigotti N, Lee H, Gledhill-Hoyt J. Increased levels of cigarette use among college students: a cause for national concern. *JAMA*. 1999;281:1613–1618.
13. Hudson JI, Hiripi E, Pope HG, Kessler RC. The prevalence and correlates of eating disorders in the national comorbidity survey replication. *Biol Psychiatry*. 2007;61:348–358.
14. National Institute of Mental Health. Binge eating among college students. Available at: [http://www.waldenbehavioralcare.com/college\\_binge\\_eating.asp](http://www.waldenbehavioralcare.com/college_binge_eating.asp). Published 2007. Accessed April 24, 2009.
15. Heatherton T, Baumeister R. Binge eating as escape from self-awareness. *Psychol Bull*. 1991;110:86–108.
16. McIntosh A, Bhandari MW, Holcomb D. College students' declining physical activity levels and increasing self-reported stress levels. Presented at: Obesity and Physical Activity Posters, APHA 135th Annual Meeting and Expo; November 37, 2007; Washington, DC.
17. McKirnan DJ, Ostrow DG, Hope B. Sex, drugs, and escape: a psychological model of HIV-risk sexual behaviours. *AIDS Care*. 1996;8:655–669.
18. Weinstock H. Sexually transmitted diseases among American youth: incidence and prevalence estimations. *Perspect Sex Reprod Health*. 2004;36:6–10.
19. Centers for Disease Control and Prevention. Sexually transmitted diseases. Available at: <http://www.cdc.gov/std>. Published 2007. Accessed April 21, 2009.
20. Baer R, Smiths G, Hopkins J, Krietemeyer J, Toney L. Using self-report assessment methods to explore facets of mindfulness. *Assessment*. 2006;13:27–45.
21. Centers for Disease Control and Prevention. Youth risk behavior surveillance system. Available at: <http://www.cdc.gov/yrbbs>. Published 2005. Accessed April 21, 2009.
22. Wadden TA, Foster GD. Weight and Lifestyle Inventory (WALI). *Surg Obes Relat Dis*. 2003;2:180–199.

23. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;2:192–213.
24. Gormally J, Black S, Daston S, Rardin, D. The assessment of binge eating severity among obese persons. *Addict Behav.* 1982;7:47–55.
25. Stewart AL, Hays RD, Ware JE. The MOS short-form General Health Survey. *Med Care.* 1988;26:724–735.
26. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24:385–396.
27. Mitchell KS, Mazzeo SE. Binge eating and psychological distress in ethnically diverse undergraduate men and women. *Eat Behav.* 2004;5:157–169.
28. Danoff-Burg S, Mosher CE, Grant CA. Relations of agentic and communal personality traits to health behavior and substance use among college students. *Pers Individ Diff.* 2005;40:353–363.
29. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research. *J Pers Soc Psychol.* 1986;51:1173–1182.
30. Sobel ME. *Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models.* Washington, DC: American Sociological Association; 1982.
31. Coffey KA, Hartman M. Mechanisms of action in the inverse relationship between mindfulness and psychological distress. *Complement Health Pract Rev.* 2008;13:79–91.
32. Shapiro SL, Oman D, Thoresen CE, Plante TG, Flinders T. Cultivating mindfulness: effects on well-being. *J Clin Psychol.* 2008;64:840–862.
33. Carmody J, Baer RA. Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *J Behav Med.* 2008;31:23–33.
34. Carlson LE, Speca M, Faris P, Patel KD. One year pre-post intervention follow-up of psychological, immune, endocrine, and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. *Brain Behav Immun.* 2007;21:1038–1049.
35. Loughlin RE, Zuckerman M. Mindfulness as a moderator of the relationship between dehydroepiandrosterone and reported physical symptoms. *Person Individ Diff.* 2008;44:1193–1202.
36. American Institute of Stress. Why is there more stress today? Available at: <http://www.stress.org/americas.htm>. Published 2008. Accessed September 27, 2009.
37. Oman D, Shapiro SL, Thoresen CE, Plante TG, Flinders T. Meditation lowers stress and supports forgiveness among college students: a randomized controlled trial. *J Am Coll Health.* 2008;56:569–578.
38. Deckro GR, Ballinger KM, Hoyt M, et al. The evaluation of a mind/body intervention to reduce psychological distress and perceived stress in college students. *J Am Coll Health.* 2002;50:281–287.
39. Grossman P. On measuring mindfulness in psychosomatic and psychological research. *J Psychosom Res.* 2008;64:405–408.