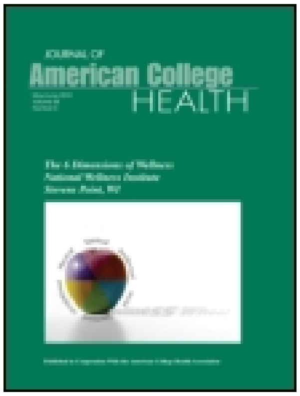

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The Benefits of Dispositional Mindfulness in Physical Health: A Longitudinal Study of Female College Students

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Major Article

The Benefits of Dispositional Mindfulness in Physical Health: A Longitudinal Study of Female College Students

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Abstract. Objective: This article examines the relationship between dispositional mindfulness, health behaviors (eg, sleep, eating, and exercise), and physical health. **Participants**: Participants included 441 college women. **Methods**: Women completed self-report surveys at the beginning and end of a 10-week academic quarter. The study was conducted over 5 academic quarters from fall 2008 to fall 2010. **Results**: Findings indicated that higher levels of dispositional mindfulness were related to healthier eating practices, better quality of sleep, and better physical health. Dispositional mindfulness contributed to better physical health even after controlling for traditional health habits. Finally, bidirectional mediational relationships were found between healthy eating and dispositional mindfulness as well as between sleep quality and dispositional mindfulness when physical health was the outcome variable. **Conclusions**: Findings suggest that incorporating mindfulness training into programming on college campuses may be beneficial, as results indicate that dispositional mindfulness is related to positive physical health among college students.

Keywords: health behaviors, holistic health, mindfulness, physical health

In the past few decades, research on mindfulness has gained increasing attention.[1] The practice of mindfulness is defined as "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally."[2] Both physical and emotional health benefits of mindfulness have been demonstrated in previous research.[3–5] Mindfulness interventions are associated with a wide range of psychological and physical health benefits among both clinical and nonclinical populations. Previous research has shown that mindfulness training is related to decreased symptoms of impulsive/binge eating, improved sleep patterns, and lowered stress.[1,5–11]

Dispositional, or trait mindfulness, refers to the level of mindfulness a person has during everyday activities, as opposed to state mindfulness, the level of mindfulness a person obtains during, or subsequent to, engaging in mindfulness meditation exercises.[12] Although mindfulness meditation training may eventually lead to increased dispositional mindfulness, there is also evidence suggesting that state and trait (ie, dispositional mindfulness) are distinct constructs worthy of independent examination.[13,14] In comparison to the relatively large body of research examining levels of mindfulness following interventions,[1,8,10] there is very little research that examines dispositional mindfulness in non–treatment-seeking samples.

Decades of research have attested to the importance of sleep, exercise, and a healthy diet in relationship to physical health.[15–19] College students tend to have a diet high in fat, sugar, and sodium, and low in fruit and vegetable intake.[20,21] Combined with high levels of alcohol intake and consumption of fast food, rates of obesity have risen in the past several years and are of increasing concern among college populations.[21,22] Similarly, many college students lead sedentary lifestyles. According to the National College Health Assessment (NCHA),[21] one quarter of female college students reported no physical exercise over the past 7 days and less than half (46%) reported exercising for 20 minutes or more 3 times or more in the past week.[21] Also according to the NCHA,[21] stress, minor physical illness (eg, colds and flu), and sleep difficulties are the top 3 factors reported by students as

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negatively affecting academic performance.[21] Indeed, among a study of college undergraduates, only 11% of students surveyed reported good sleep patterns.[23] Good sleep hygiene, adequate physical activity, and healthy diet were chosen for examination in the current study, as they represent behavioral indices that affect multiple health outcomes and, among college students, are often neglected.[21]

It is clear that mindfulness influences a variety of health indices, including pain, medical symptomatology, and functional quality of life.[3–5] These findings are consistent with Buddhist philosophy that views well-being from a holistic perspective. From this perspective, the healthy functioning of all aspects of a person is necessary for well-being, including spirit, mind, social interactions, and environment. When 1 or more of these aspects is deficient, the individual will feel personally unfulfilled or unwell and seek to restore wholeness.[24–26] Also in Buddhist thought, meditation plays a central role in cultivating the qualities and attitudes conducive to psychological and physical health.[25,26] Accordingly, from a Buddhist perspective, higher dispositional mindfulness would be related to better overall health.

Given the extant literature and empirical data, the relationship between dispositional mindfulness, traditional health habits (ie, sleep, exercise, eating habits), and physical health among college students warrants further study. This type of research could provide useful information for college health care providers in understanding if and how mindfulness may be related to the well-being of students. Further, this research is timely given the growing emphasis on mindfulness interventions in mental health care.[3–5]

In summary, research suggests that physical health is related to both traditional health habits (eg, exercise, sleep, eating) and dispositional mindfulness.[15–23] However, there is a dearth of research that has concurrently and prospectively examined these factors in non–treatment-seeking samples of college students. The purpose of the current study was to better elucidate these relationships using a longitudinal design. Specifically, 3 research questions were examined in this study. First, what are the bivariate relationships among traditional health habits (ie, exercise frequency, sleep quality, and healthy eating), dispositional mindfulness, and physical health? Second, does dispositional mindfulness prospectively predict physical health status above and beyond the contributions of traditional health habits? Finally, does dispositional mindfulness prospectively mediate the relationships between traditional health habits and physical health?

METHODS

Participants

Participants included 441 women from a medium-sized midwestern university who attended both Time 1 (T1) and Time 2 (T2) sessions. This sample was derived from a larger sample of 600 women who participated in the T1 session, 451 (75%) of whom returned for the T2 study session, approximately 8 weeks later. Ten women were excluded from analyses as a result of incomplete data. The study was conducted over 5 academic quarters from fall 2008 to fall 2010. The sample was predominantly young (age $M = 19.06$, $SD = 3.55$, range = 18–64), first-year students (72%), and Caucasian (89%). The majority (72%) of women reported family incomes over \$50,000 a year. Institutional review board approval was obtained prior to the start of the study. All participants provided written informed consent and were provided with debriefing and referral information.

Measures

Participants completed surveys at 2 time points. At both T1 and T2, participants completed the Mindfulness Attention Awareness Scale (MAAS),[14] Leisure-Time Exercise Questionnaire (LTEQ),[27] Eating Attitudes Test (EAT-26),[28,29] a sleep questionnaire created for the present study, and the Cohen and Hoberman Inventory of Physical Symptoms (CHIPS).[30] To explore prospective relationships between traditional health variables and dispositional mindfulness and physical health, T1 measures of traditional health habits and mindfulness and the T2 measure of physical health were used for the following analyses.

Dispositional Mindfulness

The MAAS[14] was used to assess participants' levels of dispositional mindfulness. Unlike some other measures of mindfulness that assess mindfulness during formal sitting meditation (eg, Toronto Mindfulness Scale),[31] the MAAS assesses how mindful individuals are in their everyday lives. Thus, the MAAS is a scale for the general adult population that does not require a specialized meditation- or mindfulness-specific vocabulary.[14] Participants were instructed to rate each of the 15 items on this measure, which contains items such as "I find myself doing things without paying attention," on a scale from (1) *Almost Always* to (6) *Almost Never*. Consistent with the dimensional conceptualization of mindfulness in which every individual is, to some extent, more or less mindful, higher scores on the MAAS indicate higher levels of dispositional mindfulness. The MAAS has a strong 1-dimensional factor structure and good psychometric properties.[32] The internal consistency and 8-week test–retest reliability of the MAAS in the present study were $\alpha = .88$ and $r = .66$, $p < .01$, respectively.

Exercise Frequency

The LTEQ[27] was used to assess participants' habitual weekly exercise behavior. Respondents reported the frequency with which they engage in strenuous, moderate, and mild levels of physical activity for periods of 15 minutes or more during a typical week. A total exercise score was calculated by weighting, then summing, each frequency dimension by its associated metabolic equivalent task value (a unit representing the metabolic equivalent of physical activity in multiples of resting oxygen consumption) using the following equation: [Strenuous $\times$ 9] + [Moderate $\times$ 5] + [Mild $\times$ 3]. Higher scores on the LTEQ indicate greater frequency of exercise. Godin and Shepherd[19] reported that the LTEQ has good 2-week test-retest reliability ($r = .74$). Eight-week test–retest reliability of the LTEQ from the current study was acceptable ($r = .17$, $p < .01$).

Healthy Eating Habits

The EAT-26[28,29] was used to assess eating habits. The EAT-26 is the most widely used standardized measure of symptoms and concerns characteristic of eating disorders and overall eating patterns and behaviors. Participants are asked to respond to the 26 individual items on a scale ranging from (1) *Always* to (6) *Never*. An example item is "I vomit after I have eaten." The EAT-26 assesses a broad range of symptoms (ie, dieting, bulimia and food preoccupation, and oral control) and provides a total score for eating attitudes and behavior derived as a sum of the composite items, ranging from 0 to 78. Higher scores on this measure are indicative of healthier eating attitudes and behaviors. The internal consistency and 8-week test–retest reliability for the total EAT-26 in the present sample were $\alpha = .91$ and $r = .85$, $p < .01$, respectively.

Sleep Quality

A brief sleep questionnaire was created for use in the present study. The questionnaire, which was used to assess general sleep quality, consisted of 3 items, including (1) "I am generally satisfied with the amount of sleep I get each night"; (2) "When I wake up, I feel well rested"; and (3) "I often feel tired throughout the day." Participants were asked to rate each statement on a 5-point scale ranging from (1) *Strongly Disagree* to (5) *Strongly Agree*. Item 3 was reverse coded then combined with the first 2 items and averaged to create a total score in which higher scores indicate better quality of sleep. Given the novelty of this measure, an exploratory principal component analysis was conducted. Results suggested a 1-factor component that accounted for 73% of the variability. Item–total correlates were all above .47, and the Kaiser-Meyer-Olkin measure of sampling adequacy (.67) and Bartlett's test of sphericity ($\chi^2 = 221.49$, $p < .001$) were adequate. The internal consistency and 8-week test–retest reliability for this scale were $\alpha = .81$ and $r = .62$, $p < .01$, respectively.

Physical Health

The CHIPS[30] was used to assess both a baseline measure of participants' physical health at T1 and physical health at T2. The CHIPS, a 33-item measure, contains items that assess physical symptomatology (eg, "back pain," "headache," "stomach pain") and were selected to exclude symptoms of an obviously psychological nature (eg, felt nervous or depressed). Participants were instructed to rate each item on a scale ranging from (0) *Not at All* to (4) *Extreme Bother*. The CHIPS was reverse coded so that higher scores indicated better-perceived physical health functioning and an absence of physical health symptomatology. The CHIPS has good psychometric properties.[30] The internal consistency of the CHIPS in the present study was .92 and .93 at T1 and T2, respectively. Eight-week test–retest reliability for the CHIPS in the present study was good, $r = .74$, $p < .01$.

Procedure

These data were drawn from a larger survey study assessing a variety of experiences of college women over a 10-week period (unpublished data). The sample for the current study consisted of primarily first year students who signed up to participate in a study titled "An Exploration of Women's Social Experiences." Variables assessed within the larger study included: sexual assault history, body esteem, self-esteem, and physical health variables. A 10-week interim period was selected so that prospective data could be collected within 1 academic quarter. Women were recruited through introductory psychology courses using an online sign-up system. All women over the age of 18 were eligible to participate; no additional inclusion or exclusion criteria were used. Both T1 and T2 group-testing sessions were identical in format, which included informed consent, survey completion, and debriefing. All research was conducted in compliance with the university's internal review board.

RESULTS

Descriptive Statistics

Descriptive statistics for all measures are presented in Table 1.

What Are the Bivariate Relationships Among Traditional Health Habits, Dispositional Mindfulness, and Physical Health?

Correlational analyses (see Table 2) suggested that better T1 sleep quality and healthier eating were positively

TABLE 1. Descriptive Statistics for All Measures ($N = 441$)

Measure	M	SD	Possible range	Sample range
Mindfulness	3.95	0.87	1–6	1.47–6
Exercise frequency	57.22	30.77		0–190
Healthy eating	114.99	20.04	26–156	50–150
Sleep quality	2.73	0.85	1–5	1–5
Baseline physical health	106.75	18.76	0–132	24–132
Physical health[a]	107.99	19.70	0–132	35–132

Note. No possible range is provided for exercise frequency because of the metabolic equivalent task value calculation used to determine scores on this measure (see Methods).
[a]Assessed at Time 2. All other variables assessed at Time 1.

TABLE 2. Correlations Among Variables of Interest (N = 441)

	1	2	3	4	5	6
1. Physical health[a]	–	.74***	.34***	.29***	.37***	−.01
2. Baseline physical health		–	.40***	.39***	.45***	.03
3. Healthy eating			–	.17***	.36***	−.12*
4. Sleep quality				–	.33***	.07
5. Mindfulness					–	.06
6. Exercise frequency						–

[a]Assessed at Time 2. All other variables assessed at Time 1.
*p = .05; **p = .01; ***p = .001.

TABLE 3. Summary of Hierarchical Regression Analysis Predicting Physical Health (N = 441)

Variable	β	$SE\ \beta$	F	R^2
Model 1			56.96*	.11
Healthy eating	0.34*	0.04		
Model 2			44.30*	.16
Healthy eating	0.30*	0.04		
Sleep quality	0.24*	1.03		
Model 3			38.63*	.21
Healthy eating	0.22*	0.05		
Sleep quality	0.17*	1.05		
Mindfulness	0.29*	1.09		

*$p < .001$.

correlated with better T2 physical health. Additionally, higher levels of T1 dispositional mindfulness were related to healthier T1 eating, better T1 sleep quality, and better T2 physical health. T1 frequency of exercise was not significantly related to T1 dispositional mindfulness, T1 quality of sleep, T1 eating habits, or physical health at T2.

Does Dispositional Mindfulness Contribute to Physical Health Status Above and Beyond the Contributions of Traditional Health Habits?

A hierarchical linear regression analysis was conducted (see Table 3). In Block 1 of the analysis, traditional physical health–promoting habits (ie, healthy eating, sleep quality, and exercise frequency) reported at T1 were regressed onto physical health reported at T2 and were jointly predictive of physical health, $F(3, 441) = 29.50$, $p < .001$, $R^2 = .17$. Dispositional mindfulness measured at T1 was entered into the second block, which was also significant, $\Delta F(4, 441) = 22.75$, $p < .001$, $\Delta R^2 = .04$. In the presence of T1 healthy eating, sleep quality, and exercise frequency, higher levels of T1 dispositional mindfulness significantly predicted better physical health ($\beta = .23$, $p < .001$) at T2. Thus, above and beyond that predicted by healthy eating, sleep quality, and exercise frequency, higher levels of dispositional mindfulness reported at T1 were prospectively predictive of better physical health at T2.

Does Dispositional Mindfulness Mediate the Relationships Between Traditional Health Habits and Health Status?

Using Kenny et al's[33] 4-step model, 2 mediation analyses were conducted for healthy eating and sleep quality. A mediation analysis for exercise frequency was not conducted because it was unrelated to both dispositional mindfulness and physical health in the correlational analyses.

Healthy Eating

First, a significant relationship between T1 healthy eating and T2 physical health was confirmed ($\beta = .34$, $p < .001$, $R^2 = .11$). Further, a significant relationship between T1 healthy eating and T1 dispositional mindfulness ($\beta = .36$, $p < .001$, $R^2 = .13$) and T1 dispositional mindfulness and T2 physical health were found ($\beta = .37$, $p < .001$, $R^2 = .13$). Finally, a regression analysis was utilized, such that T1 healthy eating and T1 dispositional mindfulness were regressed simultaneously onto T2 physical health (overall $R^2 = .18$). In the presence of T1 mindfulness, the regression coefficient between T1 healthy eating and T2 physical health decreased, but remained significant ($\beta = .24$, $p < .001$). In order to assess whether partial mediation existed, a Sobel test was conducted.[34] The Sobel test revealed that partial mediation was present, $S = 5.75$, $p < .001$. Partial mediation was also supported with T1 healthy eating as the mediator between T1 mindfulness and T2 physical health, $S = 5.81$, $p < .001$, suggesting a bidirectional mediation (see Figures 1 and 2).

Sleep Quality

A second prospective analysis of mediation was conducted in order to determine whether T1 mindfulness also mediated the relationship between T1 sleep quality and T2 physical health. First, a significant relationship between T1 sleep quality and T2 physical health was confirmed ($\beta = .29$, $p < .001$, $R^2 = .08$). Further, significant relationships between T1 sleep quality and T1 mindfulness ($\beta = .33$, $p < .001$, $R^2 = .10$) and T1 mindfulness and T2 physical health were found ($\beta = .37$, $p < .001$, $R^2 = .13$). Finally, a regression analysis was utilized, such that T1 sleep quality and T1 mindfulness were regressed simultaneously onto T2 physical health (overall $R^2 = .16$). In the presence of T1 mindfulness, the regression coefficient between T1 sleep quality and T2 physical health decreased, but remained significant ($\beta = .19$, $p < .001$). In order to assess whether partial mediation existed, a Sobel test was conducted.[34] The Sobel test revealed that partial mediation was present, $S = 5.16$, $p < .001$. Partial mediation was also supported with T1 sleep quality as the mediator between T1 mindfulness and T2 physical health, $S = 4.94$, $p < .001$, suggesting a bidirectional mediation (see Figures 3 and 4).

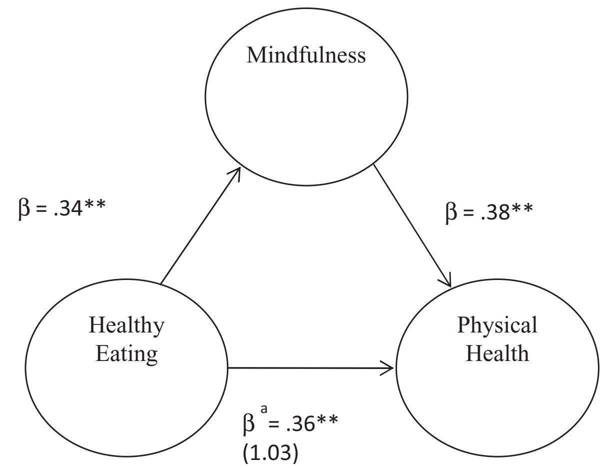

FIGURE 1. Partial mediation effect of mindfulness on the relationship between healthy eating and physical health. **$p = .001$. [a]Standardized beta coefficient without mindfulness in the model. [b]Standardized beta coefficient with mindfulness in the model.

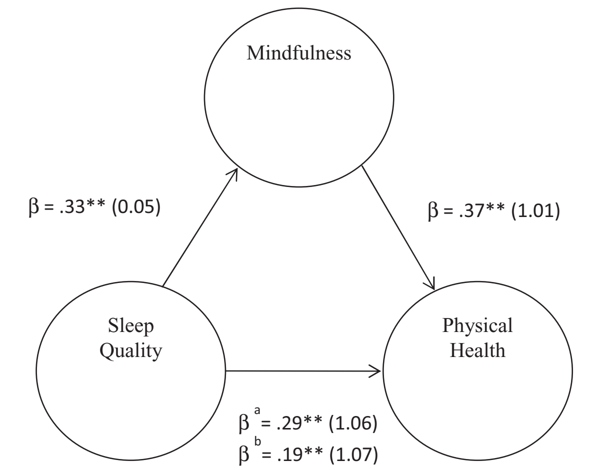

FIGURE 3. Partial mediation effect of mindfulness on the relationship between sleep quality and physical health. **$p = .001$. [a]Standardized beta coefficient without mindfulness in the model. [b]Standardized beta coefficient with mindfulness in the model.

COMMENT

The purpose of this study was to assess the relationships among traditional health habits, dispositional mindfulness, and physical health using prospective methodology within a non–treatment-seeking sample of college students. Similar to previous research,[15] better physical health was related to better sleep quality and healthier eating patterns as well as higher levels of dispositional mindfulness. Of note, exercise frequency was unrelated to both dispositional mindfulness and physical health. This finding may have emerged due to possible methodological limitations of the scale used, which lacks specificity. For example, although this is a commonly used measure of exercise frequency, it may be more important, in the context of this research, to examine the mere presence or absence of intentional exercise or the specific motivations (eg, desire for good health as opposed to

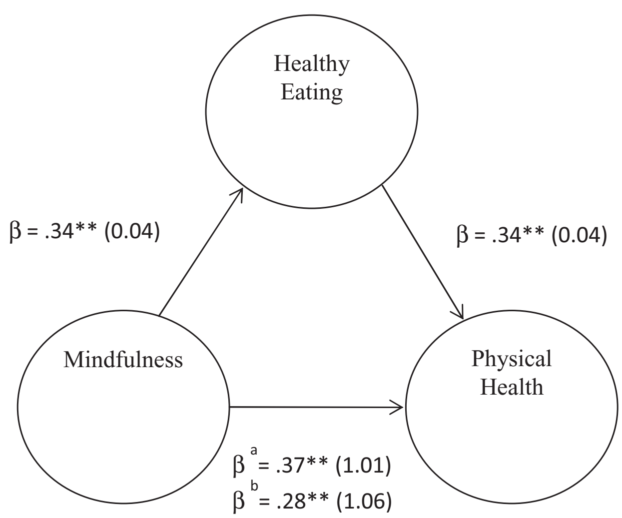

FIGURE 2. Partial mediation effect of healthy eating on the relationship between mindfulness and physical health. **$p = .001$. [a]Standardized beta coefficient without healthy eating in the model. [b]Standardized beta coefficient with healthy eating in the model.

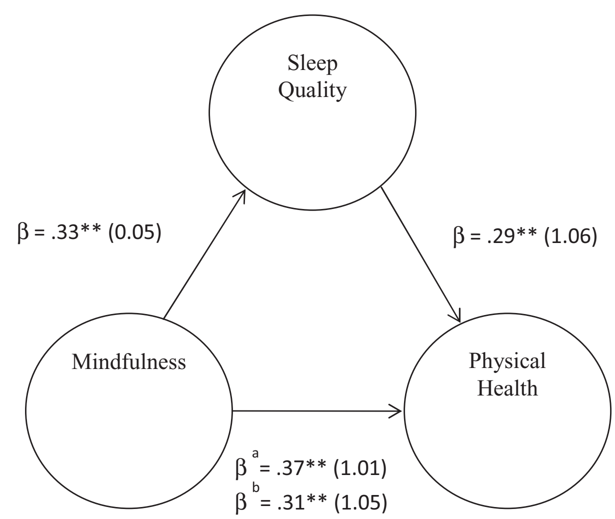

FIGURE 4. Partial mediation effect of sleep quality on the relationship between mindfulness and physical health. **$p = .001$. [a]Standardized beta coefficient without sleep quality in the model. [b]Standardized beta coefficient with sleep quality in the model.

desire for thinness) for exercise, rather than exercise frequency. Further, the low test–retest reliability of the measure with the current sample suggests that there may have been some problems with the use of this measure in the context of the current study.

Results also showed that T1 dispositional mindfulness predicted physical health status at T2 above and beyond the contribution of T1 health habits. The relative contribution of mindfulness to physical health after considering traditional health variables was modest given the small to medium effect sizes obtained. However, when bivariate correlations are considered, mindfulness was as strongly, if not more strongly, related to physical health than were well-supported traditional health habits.[15–19] Although it is beyond the scope of the current study to identify the mechanisms by which this occurs, several possible explanations are offered that could be examined in further research. First, mindfulness as an overall construct may be broad enough to exert influence on certain health behaviors. Important tenets of mindfulness such as a focus on the present and attention to internal experiences (ie, thoughts and feelings) are concepts that could potentially influence an individual's daily lifestyle choices such as exercise, eating, and sleep. Thus, it is possible that mindfulness is a contributing factor to the underlying etiology of health behaviors and also an important predictor of better physical health.

An alternative possibility relates to the role of stress and the well-validated finding that mindfulness training is related to increased ability to cope with stressors and decreased perceptions of the negative impact of stress.[8] High chronic levels of stress have been shown to negatively affect a wide range of health-related outcomes, including lowered immune system functioning and increased cardiovascular risk.[35,36] Perhaps through increasing one's ability to cope with daily stressors, increased mindfulness levels contribute to better physical health.

Analyses from the current study also supported a bidirectional partial mediation between T1 dispositional mindfulness, T1 healthy eating, and T2 physical health as well as between T1 dispositional mindfulness, T1 sleep quality, and T2 physical health. These findings suggest that both healthy eating and sleep quality foster the development of dispositional mindfulness, which subsequently affect physical health functioning. Similarly, higher dispositional mindfulness was related to healthier eating and sleep quality, which subsequently were related to physical health. These findings are consistent with those of Howell et al[37] who found that among college students, mindfulness directly predicted well-being and that it also predicted well-being through sleep quality. The results of our study and the study by Howell and colleagues[37] raise an interesting question—is mindfulness or the traditional health variable (ie, sleep quality or healthy eating) the mediator enacting changes in physical health? Brown and Ryan[14] suggest that there are likely bidirectional relationships among health variables and mindfulness, such that at times mindfulness promotes traditional health habits, which may in turn increase mindfulness. Relationships between all variables (ie, physical health, mindfulness, healthy eating, exercise, and sleep) are likely to be complex and directionality cannot be inferred from the current study. Nevertheless, the use of a prospective design in the current study does shed some light on the possible sequencing of these variables as mindfulness as well as the health variables were all measured prior to the physical health variables.

Given that these data suggest that mindfulness may be fostered through health-promoting behaviors, it could be useful for college administrators and health care providers to encourage college students to integrate mindfulness practices into daily routines of sleeping, eating, and exercising. For example, health care providers may suggest that students integrate mindfulness skills into simple daily activities, such as eating or exercising, in order to gain the full benefits of these traditional health practices. Although mindfulness techniques are difficult to master, even among beginning meditators, benefits such as increased immune functioning and feelings of increased well-being are found.[38] One way to encourage these practices among this population may be to incorporate mindfulness training into counseling or residence life programming. Mindfulness techniques can be easily and inexpensively disseminated and once general concepts are explained, individuals can practice mindfulness meditation exercises independently. More research is needed to determine the best way to concisely teach mindfulness techniques to college students that can in turn be applied to a variety of day-to-day activities.

Limitations

Several limitations should be noted. The homogeneity of the sample limits the generalizability of these results to diverse (eg, racial minorities, men) college populations. Also, the 2-month follow-up was relatively short. In light of these limitations, future research should include more diverse samples and multiple follow-up periods of longer duration. Multiple follow-up periods of longer duration will allow researchers to more carefully elucidate the temporal sequencing of the relationships among traditional health habits, mindfulness, and physical health. Limitations in measures utilized in the present study should also be noted. For example, the sleep questionnaire was not a validated measure and was created for the present study and thus findings related to sleep should be interpreted with caution. Nevertheless, the measure had good internal consistency and is similar in content to existing, validated measures of sleep quality. Additionally, given the lack of significant findings related to exercise frequency, future research could attempt to explore the relationship between dispositional mindfulness and exercise utilizing a different measure of exercise behavior.

Conclusions

In sum, this study is the first to explore longitudinally the relationships among traditional health behaviors, mindfulness, and physical health in a college student sample and raises some important questions for subsequent work in this area. The findings from the present study demonstrate the need for future research to assess the benefits of a mindfulness intervention on traditional health habits for the improvement of physical health in college samples. For example, can physical health among college students be improved by increasing traditional health-promoting behaviors (eg, exercise frequency, healthy eating, and sleep quality) through the teaching of mindfulness-based techniques? If mindfulness-based interventions are found to be effective for increasing health-promoting habits, this may be a cost-effective and unique method for improving physical health among college students.

NOTE

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