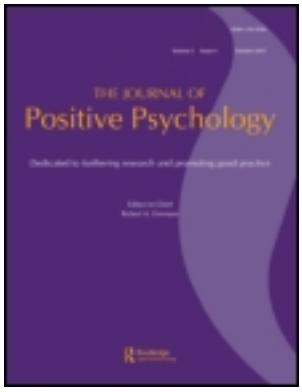

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Effects of a yoga-based intervention for young adults on quality of life and perceived stress: The potential mediating roles of mindfulness and self-compassion

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Effects of a yoga-based intervention for young adults on quality of life and perceived stress: The potential mediating roles of mindfulness and self-compassion

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The purpose of this pilot study was to investigate the effects of a yoga-based program on quality of life, perceived stress, mindfulness, and self-compassion in young adults. These variables were measured in 33 self-selected participants of a four-month residential yoga intervention before and after the program. Forty-three demographically matched controls completed the same questionnaires at two time points with a four-month interval inbetween. Participation in the program predicted increases in quality of life and decreases in perceived stress, mediated by mindfulness and self-compassion. Multiple mediator models revealed that the effect of group on quality of life was simultaneously mediated by mindfulness and self-compassion, while the effect of group on perceived stress was only mediated by self-compassion. These positive effects on perceived stress and quality of life suggest that yoga-based interventions may be of value in cultivating subjective well-being in young adults. Furthermore, yoga-based and mindfulness-based interventions may share underlying mechanisms.

Keywords: yoga; mindfulness; self-compassion; quality of life; perceived stress; young adults

Introduction

While the field of psychology has historically focused on the diagnosis and treatment of mental illness, the more recent advent of the positive psychology movement (Seligman & Csikszentmihalyi, 2000) has led to a burgeoning interest in gaining a deeper understanding of happiness. Happiness is often operationalized as subjective well-being, a concept comprising three components – life satisfaction, positive affect, and negative affect (Diener, 1984, 2000; Diener, Suh, Lucas, & Smith, 1999). Subjective well-being has been shown to be positively correlated with good health, long life, fulfilling relationships, high income, and work performance (Lyubomirsky, King, & Diener, 2005). Individuals with high levels of the life satisfaction component of subjective well-being, which can also be conceptualized as quality of life (Frisch, 2012), have been reported to exhibit heightened cognitive and social functioning (Suldo & Huebner, 2006). In addition, life satisfaction has been conceptualized as a buffer or protective psychological strength, that can help individual's mitigate adverse life events without externalizing negative behavior (Suldo & Huebner, 2004).

Low levels of life satisfaction have been shown to be predictive of both poor work and scholastic performance (Frisch et al., 2005; Judge & Watanabe, 1993), poor health (Diener & Chan, 2011), substance abuse (Gilman & Huebner, 2003), aggressive behavior (Valois, Zullig, Huebner, & Drane, 2001), and peer relationship problems (Gilman & Huebner, 2000). Furthermore, a negative relationship has been found between life satisfaction and both mental health issues and suicidality in young adults (Valois et al., 2001). While low levels of life satisfaction are related to many negative outcomes, high levels of stress are also well known to negatively impact health (Bekkouche, Holmes, Whittaker, & Krantz, 2009; Pedersen, Bovbjerg, & Zachariae, 2009), as well as cognitive (McEwen & Sapolsky, 1995) and emotional functioning (Lazarus, 2006), and can be a strong contributor to psychopathology (Grant, McMahon, Dufy, Taylor, & Compas, 2009; Kessler & Wang, 2008).

There is a substantial body of evidence demonstrating that mindfulness-based programs, such as mindfulness-based stress reduction (MBSR) (Kabat-Zinn, 1990), can decrease stress and anxiety (Carmody & Baer, 2008; Shapiro, Brown, & Biegel, 2007), while increasing cognitive performance (Jha, Krompinger, & Baime, 2007; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010) and psychological well-being (Branstrom, Kvillemo, Brandberg, & Moskowitz,

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2010). Mindfulness is defined as 'paying attention in a particular way: on purpose, in the present moment, and non-judgmentally' (Kabat-Zinn, 1990), and in recent years, its underlying mechanisms have been increasingly studied (Hölzel et al., 2011). Changes in mindfulness have been shown to highly correlate with increased psychological well-being and decreased stress (Carmody & Baer, 2008) and mediate the relationship between MBSR participation and decreases in stress and mental health symptoms (Carmody & Baer, 2008; Nyklicek & Kuijpers, 2008). Mindfulness-based programs therefore have great potential to foster resiliency against mental illness and promote psychological well-being.

Similarly, there is growing evidence that yoga also improves mental health, decreasing symptoms such as anxiety and stress, while increasing psychological well-being (Ross & Thomas, 2010). Although there is some preliminary evidence that yoga increases mindfulness (Conboy, Wilson, & Braun, 2010; Shelov, Suchday, & Friedberg, 2009), its role as a mediator of the effect of yoga on stress and well-being has not yet been investigated.

The Kripalu Center for Yoga and Health developed a four-month yoga-based residential program to target 18–25 year olds, with the aim of providing them with skills to handle the transition to independence and improve their quality of life. The Semester Intensive Program (SI) combines daily yoga practice with a didactic curriculum based on yoga philosophy. Kripalu yoga is a form of classical yoga influenced by the teachings of Swami Kripalu, who emphasized the cultivation of 'witness consciousness' and compassion for the self and others (Faulds, 2005).

'Witness consciousness' is defined as 'the ability to closely observe what is occurring without reactivity or judgment' (Faulds, 2005), a description that closely matches mindfulness as defined by Kabat-Zinn (1990). Witness consciousness is cultivated through and supported by the practice of five skills during yoga practice, the shorthand term for which is 'BRFWA', an acronym for 'Breath-Relax-Feel-Watch-Allow' (*Kripalu Yoga 200 Hour Teacher Training Manual*, 2011). Conceptually, four of these skills – Breath, Feel, Watch, and Allow – have considerable similarity to the two components of mindfulness: (1) paying attention to the present moment, (2) non-judgment of experience (Kabat-Zinn, 1990). 'Breath' refers to focusing attention on the sensation of the breath, which is aligned with the first component of mindfulness. 'Feel' refers to increasing awareness of sensations, thoughts, and feelings as they occur, which is an extension of the focus on breath and is also aligned with the focused attention aspect of mindfulness. 'Watch' and 'Allow' refer to a stance of acceptance and non-judgment, respectively, and are aligned with the second component of mindfulness.

Compassion is frequently viewed as another key quality underlying the transformations that accompany contemplative practices. Compassion is at the foundation of Kripalu yoga; the literal translation of the Sanskrit word 'kripalu' is 'being compassionate' (Faulds, 2005). Self-compassion has been described 'as being open to and moved by one's own suffering, experiencing feelings of caring and kindness toward oneself, taking an understanding, non-judgmental attitude toward one's inadequacies and failures, and recognizing that one's own experience is part of the common human experience' (Neff, 2003). Self-compassion has been shown to predict subjective well-being (Neely, Schallert, Mohammed, Roberts, & Chen, 2009), mental and physical health (Raque-Bogdan, Ericson, Jackson, Martin, & Bryan, 2011), and scholastic performance (Neff, Hsieh, & Dejitterat, 2005). Furthermore, self-compassion is thought to counter negative 'self-talk' and has been shown to be negatively correlated with self-reported depression and anxiety in both adolescents and young adults (Neff & McGehee, 2009). Both self-compassion and mindfulness have been identified as mediators of the positive effect of mindfulness-based cognitive therapy (MBCT) on depressive symptoms in patients with recurrent depression (Kuyken et al., 2010). Furthermore, positive correlations between changes in self-compassion and changes in well-being following a MBSR intervention have been reported (Birnie, Speca, & Carlson, 2010). However, another study found that changes in self-compassion following a MBSR course predicted changes in perceived stress but not in satisfaction with life (Shapiro, Astin, Bishop, & Cordova, 2005).

Here we tested the hypothesis that participation in the SI is predictive of increases in quality of life, mindfulness, and self-compassion, with concomitant decreases in perceived stress. Furthermore, we tested whether the effects of participation in the SI program on quality of life and perceived stress are mediated by mindfulness and self-compassion. To test these hypotheses, we administered questionnaires measuring quality of life, perceived stress, mindfulness, and self-compassion to SI participants and demographically matched controls before and after the program period.

Methods

Participants

One hundred and one participants were enrolled in the study: 53 participants of the SI and 48 controls, who did not participate in the program, and were matched for age, gender, and education. Of the 53 enrolled SI participants, 50 participants completed the intervention, of which 33 (73% female; 88% Caucasian; age range 18–26 years, $M = 22.06$ years, $SD = 2.34$; M education $= 14.91$ years, $SD = 1.67$) completed

questionnaires before and after the course period. Of the 48 control participants, 43 (74% female, 79% Caucasian; age range 18–26 years, $M = 21.33$ years, SD = 2.58; M education = 14.65 years, SD = 1.59) completed both sets of questionnaires.

Participants of the SI were recruited via an invitation letter after registering for the program and did not receive reimbursement for participating in the study. Control participants were recruited from colleges in the Boston area, through on-campus and on-line advertisements, and received $5 for completing the first and $15 for completing the second questionnaire. All subjects gave informed consent for participation. The study was approved by the Partners Human Research Committee, Massachusetts General Hospital (protocol 2006P001488).

Semester intensive program

The Kripalu Semester Intensive Program (SI) is a manualized four-month yoga-based residential educational immersion program for 18–25 year olds. The SI aims to increase subjective and objective well-being. Students had on average three to five hours of daily yoga practice comprising postures (asanas), breathing practices (pranayamas), and meditation in addition to three to five hours of daily didactic course work concerning the development of life skills and the integration of yoga practice into daily life activities.

Kripalu yoga is a form of classical yoga based on the Yoga Sutra's of Patanjali (Shearer, 2002) and strongly influenced by the teachings of Swami Kripalu, who emphasized the cultivation of 'witness consciousness' and compassion for the self and others (Faulds, 2005). These concepts, as well as 'BRFWA' (*Kripalu Yoga 200 Hour Teacher Training Manual*, 2011), were conveyed throughout the program.

Procedure

Participants were administered questionnaires pre-program and post-program ($M\ \Delta$ time = 112.48 days, SD = 18.01). Control subjects completed the same questionnaires at two time points within a similar time interval ($M\ \Delta$ time = 110.78, SD = 13.00). There was no significant difference in the time interval between course participants and controls ($t(55.90) = 0.458$, $p = 0.648$).

Measures

Quality of life was assessed with the 32-item Quality of Life Inventory (QOLI) (Frisch, Cornell, Villanueva, & Retzlaff, 1992), which assesses an individual's satisfaction in 16 different domains of life (i.e. relationships, work, self-esteem), and the importance they attribute to each of these categories. The QOLI has been shown to have strong test-retest reliability and internal consistency (Frisch et al., 1992).

Perceived stress was measured with the 10-item version of the Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983), a validated and widely used self-report questionnaire for assessing the extent to which situations during the past month have been perceived as stressful. The scale has high internal consistency and test – retest reliability (Cohen et al., 1983).

Mindfulness was assessed with the Five Facet Mindfulness Questionnaire (FFMQ), a 39-item scale (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) designed to measure five facets of mindfulness: Observing (attending to or noticing internal and external stimuli), describing (noting or mentally labeling these stimuli with words), acting with awareness (attending to one's current actions), non-judging of inner experience (refraining from evaluations), and non-reactivity (allowing thoughts and feelings to come and go). Responses to the items are given on a 5-point Likert-type scale. The five subscales have shown good internal consistency (Baer et al., 2006). The subscales of the FFMQ are typically not used to calculate a sum score as they do not load on a single higher order factor. However, to conduct mediation analyses with only one mediator in the model representing mindfulness, a sum score of the FFMQ was calculated, similar to Carmody and Baer (2008).

Self-compassion was measured with the 26-item Self-Compassion Scale (SCS) (Neff, 2003), which assesses one's ability to be forgiving and kind to oneself in difficult circumstances. The SCS includes six subscales – self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification – from which a total score of general self-compassion can be derived, as they all load on a single higher order factor. The SCS has been shown to be valid and reliable (Neff, 2003).

Design and analysis

A quasi-experimental pre-post design with an intervention group and a non-randomized matched control group was employed. To evaluate the effectiveness of a program, data acquired with such a design can be analyzed either with an ANCOVA with the pre time-point as covariate or with a t-test/ANOVA on the gain (post minus pre) score, which is equivalent to the group × time interaction in a repeated measures ANOVA (Kenny, 1975). There is no consensus on which method is preferable for quasi-experimental designs, with arguments in favor of an ANCOVA (Van Breukelen, 2006) and against it (Dimitrov & Rumrill Jr, 2003). Generally, an ANCOVA is preferred because

it has greater power than an ANOVA on gain scores. However, if the assumption of no group-effect at pre-test is not met, this method can lead to biased results (Van Breukelen, 2006). Some authors recommend employing both methods of analysis, to have increased confidence if both methods lead to the same conclusion but only differ in effect size (e.g. Van Breukelen, 2006). Here we follow this approach.

ANCOVAs with the post-measurement as dependent variable, group as factor, and pre-measure as covariate were performed. To test the assumption of no group-effects at pre-test, independent samples *t*-tests (two-tailed) on all dependent variables were calculated. The assumption of homogeneity of regression slopes was tested by running ANCOVAs with group, pre-measure, and the interaction term group × pre-measure as predictors, and post-measure as the dependent variable. To compare gain (post minus pre) scores between groups, independent samples *t*-tests were employed. To determine the effect of self-compassion on perceived stress and quality of life after the intervention, two post hoc regression analyses were conducted on data of SI participants: one regression analysis with PSS-post score as dependent variable and PSS-pre score as covariate and total SCS-pre score as predictor, and one with QOLI-post score as dependent variable and QOLI-pre score as covariate and total SCS-pre score as predictor. ANCOVAS, regression analyses, and *t*-tests (two-tailed) were performed with SPSS 17 (SPSS Inc., Chicago, IL, USA), and significance was defined as $p < 0.05$.

To conduct mediation analyses with only one mediator in the model representing mindfulness, similar to Carmody and Baer (2008), a sum score of the FFMQ was calculated. Next, residual post scores for total FFMQ, total SCS, PSS, and QOLI were calculated by regressing out respective pre-scores. Mediation models with single and multiple mediators were tested using a macro by Preacher and Hayes (2008) which implements a bootstrapping procedure to create confidence intervals for indirect effects in the mediation model. In contrast to the widely used causal steps method (Baron & Kenny, 1986), this method focuses on the size and direction of indirect effects of potential mediators rather than on the significance of direct effects (Preacher & Hayes, 2008). It is recommended above the causal steps method as it has higher power and requires less assumptions (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Results

Participant matching

There were no significant differences between the experimental and control groups on the matching variables of gender ($\chi^2(1) = 0.038$, $p = 0.868$), ethnicity ($\chi^2(1) = 1.022$, $p = 0.312$), age ($t(74) = 1.312$, $p = 0.193$), and education ($t(73) = 0.673$, $p = 0.503$). At the pre time point, there were also no group differences on quality of life, perceived stress, any of the FFMQ subscales, and the SCS subscales over-identification, isolation, and mindfulness (Table 1). There were group differences on total SCS and on the SCS subscales self-judgment, common humanity, and self-kindness (Table 1).

PSS scores of both SI ($M = 15.30$, SD = 5.83) and control ($M = 17.53$, SD = 8.14) participants fell within the normal range of young adults ages 18–25 ($M = 16.14$, SD = 6.86) (Cohen & Janicki-Deverts, in press). QOLI scores of both SI ($M = 2.28$, SD = 1.63) and control ($M = 1.91$, SD = 1.37) participants were also within the normal range, as compared to an undergraduate population ($M = 2.63$, SD = 1.11) (Frisch et al., 1992).

ANCOVA

Independent samples *t*-tests on pre-test scores confirmed the ANCOVA assumption of no group effect at the pre time point for most variables (Table 1). For total self-compassion and the SCS subscales self-judgment, common humanity, and self-kindness, this assumption was not met. The assumption of homogeneity of regression slopes was not met for the FFMQ subscales non-judge and acting with awareness, indicated by significant group × pre-measure interactions. ANCOVAs with the post-measurement as dependent variable, group as factor, and pre-measure as covariate revealed significant effects of group for all variables (Table 2).

t-tests on gain scores

Independent samples *t*-tests (two-tailed) were also performed on the gain scores (post-test minus pre-test). These tests revealed significant differences in gain scores between SI participants and controls on the quality of life index, all subscales of the FFMQ, total self-compassion, as well as the the self-judgment, self-kindness, and mindfulness subscales of the SCS (Table 2).

For five out of the eight variables for which ANCOVA assumptions were met, ANCOVAs and the *t*-tests on gain scores led to the same conclusion, namely that participation in SI significantly improved scores. For the SCS subscales over-identification and isolation, and for the PSS, the ANCOVAs and *t*-tests yielded different results but point in the same direction. The ANCOVAs revealed significant group effects for all three variables, whereas the *t*-tests were not

Table 1. Means, standard deviations, and independent samples *t*-tests (two-tailed) for all variables at pre-test.

	SI		Controls		*t*-test		
	M	SD	*M*	SD	*t*	df	*p*
FFMQ–Observe	27.81	5.83	26.44	4.71	1.131	74	0.262
FFMQ–Describe	27.24	6.56	27.35	5.73	–0.075	74	0.940
FFMQ–Non-judge	27.55	6.94	26.52	6.68	0.651	74	0.517
FFMQ–Non-react	21.06	4.85	19.98	3.69	1.102	73	0.274
FFMQ–Act with Awareness	26.45	5.26	26.26	5.62	0.152	74	0.880
SCS–Total Self-Compassion	3.26	0.65	2.80	0.68	2.928	72	0.005
SCS–Self-judgment	2.82	0.88	3.35	0.97	–2.413	72	0.018
SCS–Over-identification	2.76	0.85	3.11	1.05	–1.531	72	0.130
SCS–Common Humanity	3.24	0.81	2.70	0.68	3.116	72	0.003
SCS–Isolation	2.68	0.83	3.10	1.10	–1.774	72	0.080
SCS–Self-kindness	3.15	0.89	2.53	0.77	3.155	72	0.002
SCS–Mindfulness	3.43	0.75	3.12	0.70	1.808	72	0.075
Quality of Life Index	2.28	1.63	1.91	1.37	1.057	71	0.294
Perceived Stress Scale	15.30	5.83	17.53	8.14	–1.276	69	0.206

Note: SI = Semester intensive participants, FFMQ = Five Facet Mindfulness Questionnaire, SCS = Self-Compassion Scale.

significant, or in the case of the PSS only showed a trend toward significance ($p = 0.079$).

Post hoc regression analyses with PSS-post score as dependent variable and PSS-pre score as covariate and total SCS-pre score as predictor, and with QOLI-post score as dependent variable and QOLI-pre score as covariate and total SCS-pre score as predictor were conducted. Total SCS-pre score was not a significant predictor for PSS ($b = 1.02$, $t(26) = 0.51$, $p = 0.617$), nor for QOLI ($b = –0.10$, $t(26) = –0.23$, $p = 0.821$), indicating that post-intervention levels of perceived stress and quality of life did not depend on pre-intervention levels of self-compassion.

Mediation analysis

To test if the effects of group on quality of life and perceived stress were mediated by mindfulness and self-compassion, we used a bootstrapping method with 5000 iterations as described by Preacher and Hayes (2008).

First, we tested four separate mediation models, two with residual QOLI and two with residual PSS as dependent variables. For each of the dependent variables, one model contained total residual SCS and one model contained total residual FFMQ as potential mediator. All models had group (SI versus control) as independent variable. These analyses revealed that the effect of group on quality of life was significantly mediated by mindfulness (95% CI 0.678–1.856) and self-compassion (95% CI 0.271–1.344). The effect of group on perceived stress was also significantly mediated by mindfulness (95% CI −9.419 to −3.706) and self-compassion (95% CI −7.098 to −1.928).

Second, we tested two multiple mediator models. The first model contained group as the independent variable, total residual FFMQ and total residual SCS as potential mediators, and residual QOLI as the dependent variable (Figure 1a). Bootstrapping revealed significant indirect effects for self-compassion and mindfulness. Confidence intervals of 95% for the true effects are 0.105–1.114 and 0.109–1.115, respectively, indicating that the effect of group on quality of life was mediated by both mindfulness and self-compassion. The indirect effects of mindfulness and self-compassion did not significantly (95% CI −0.796 to 0.820) differ in magnitude.

The second model was identical to the previous one, but contained residual PSS as the dependent variable (Figure 1b). For this model, bootstrapping revealed a significant indirect effect for self-compassion only. Confidence intervals of 95% for the true effects of mindfulness and self-compassion are −4.709 to 0.002 and −6.545 to −1.530, respectively, indicating that the effect of group on perceived stress was only mediated by self-compassion, not by mindfulness. Although the indirect effect of mindfulness was not significant, and that of self-compassion was, the magnitudes of both effects were not significantly different (95% CI −1.891 to 6.192).

It is important to note that the indirect effects of both potential mediators on the dependent variables are the unique effects of each potential mediator above and beyond any other mediator in the model. As the total residual FFMQ and the total residual SCS are strongly correlated ($r(70) = 0.711$, $p < 0.001$), indirect mediation effects for each potential mediator in the model are compromised.

Discussion

This pilot study examined the effects of a four-month residential yoga-based program on quality of life, perceived stress, mindfulness, and self-compassion.

Table 2. Means and standard deviations for all variables at the post-test and for the gain scores (post minus pre). Independent samples *t*-tests (two-tailed) on gain scores and ANCOVAs with post-test variable as dependent variables and respective pre-test variable as covariate and group as independent variable. Reported ANCOVA results are for the group predictor.

	SI post		Control post		SI gain		Control gain		*t*-test on gain			ANCOVA on post-test score			
	M	SD	M	SD	M	SD	M	SD	*t*	df	*p*	*F*	df	*p*	h_p^2
FFMQ–Observe	31.20	4.71	25.20	5.14	3.39	4.13	–1.24	3.31	5.42	74.00	<0.001	41.15	1, 73	<0.001	0.360
FFMQ–Describe	30.48	5.70	27.21	5.84	3.24	4.71	–0.14	3.38	3.49	55.62	0.001	15.40	1, 73	<0.001	0.174
FFMQ–Non-judge	32.21	5.04	25.32	6.98	4.67	6.48	–1.21	4.77	4.38	56.70	<0.001	31.62	1, 73	<0.001[a]	0.302
FFMQ–Non-react	24.64	3.30	20.16	4.01	3.57	4.41	0.18	4.30	3.34	73.00	0.001	25.63	1, 72	<0.001	0.263
FFMQ–Act with awareness	29.55	4.35	25.43	5.62	3.09	5.75	–0.83	3.72	3.60	74.00	0.001	17.91	1, 73	<0.001[a]	0.197
SCS–Total Self-Compassion	3.62	0.61	2.80	0.63	0.36	0.74	0.00	0.63	2.20	72.00	0.031	19.57	1, 71	<0.001[a]	0.216
SCS–Self-judgment	2.30	0.93	3.38	0.93	–0.52	0.96	0.03	0.84	–2.62	72.00	0.011	16.88	1, 71	<0.001[a]	0.192
SCS–Over-identification	2.54	0.80	3.22	0.98	–0.22	0.87	0.11	0.85	–1.62	72.00	0.110	7.46	1, 71	0.008	0.095
SCS–Common Humanity	3.55	0.86	2.73	0.77	0.31	0.78	0.03	0.74	1.58	72.00	0.119	8.42	1, 71	0.005[a]	0.106
SCS–Isolation	2.45	0.83	3.03	0.88	–0.23	1.02	–0.07	0.92	–0.71	72.00	0.479	4.96	1, 71	0.029	0.065
SCS–Self-kindness	3.68	0.75	2.65	0.76	0.54	0.98	0.11	0.85	1.99	72.00	0.050	22.09	1, 71	<0.001[a]	0.237
SCS–Mindfulness	3.75	0.56	3.07	0.68	0.32	0.69	–0.05	0.65	2.35	72.00	0.021	16.84	1, 71	<0.001	0.192
Quality of Life Index	2.81	1.14	1.40	1.73	0.51	1.46	–0.51	1.51	2.85	70.00	0.006	14.33	1, 69	<0.001	0.172
Perceived Stress Scale	13.27	5.54	18.98	7.89	–2.03	6.86	1.22	8.00	–1.79	68.00	0.079	9.07	1, 67	0.004	0.119

Notes. SI = Semester intensive participants, FFMQ = Five Facet Mindfulness Questionnaire, SCS = Self-Compassion Scale.
[a]Invalid ANCOVA because assumptions were not met.

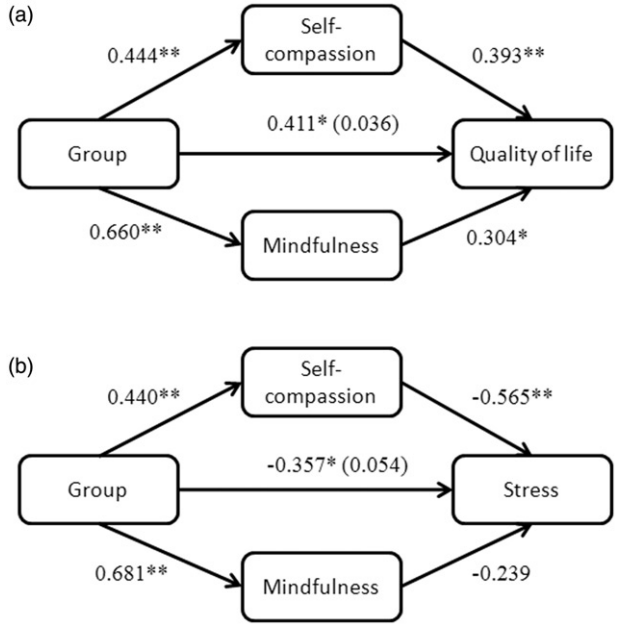

Figure 1. Mediation models for the effect of group (semester intensive versus controls) on (a) quality of life and (b) perceived stress, mediated by self-compassion and mindfulness (the sum of all facets of the five facet mindfulness questionnaire). For potential mediators and outcomes, residual post-scores were used. Values are standardized regression coefficients of direct effects. Between brackets the indirect effect of group on perceived stress.
Note: $*p < 0.055$, $**p < 0.005$.

Aligned with our hypothesis, participation in the program significantly predicted increases in quality of life, mindfulness, and self-compassion, along with decreases in perceived stress. Our findings also support that mindfulness and self-compassion mediate the effects of participation in the SI on quality of life and perceived stress.

Quality of life and perceived stress

Our findings are aligned with previous studies which have shown that yoga can increase quality of life (Thomley, Ray, Cha, & Bauer, 2011) and decrease stress (Ross & Thomas, 2010). Some caution must be used in interpreting our results regarding perceived stress, as the t-test just missed significance, though the ANCOVA was significant. However, because both tests point in the same direction, and the ANCOVA has more power, we feel confident concluding that the SI program is effective for reducing perceived stress.

Quality of life is often considered synonymous with the life satisfaction component of subjective well-being (Frisch, 2012). Subjective well-being is known to be related to fulfillment in relationships, longevity, general health, income, and work performance (Lyubomirsky et al., 2005). Individuals with high levels of the life satisfaction have been shown to have increased cognitive and social functioning (Suldo & Huebner, 2006). In contrast, low levels of the life satisfaction have been reported to predict poor work and academic performance (Frisch et al., 2005; Judge & Watanabe, 1993), health problems (Diener & Chan, 2011), substance abuse (Gilman & Huebner, 2003), violent and aggressive behavior (Valois et al., 2001), and problems in relationships with peers (Gilman & Huebner, 2000). Furthermore, a negative relationship has been found between life satisfaction and both mental health and suicidality in young adults (Valois et al., 2001).

Life satisfaction has been described as protective psychological buffer that can help individual's mitigate stressful life events without externalizing negative behavior (Suldo & Huebner, 2004). High levels of stress have been demonstrated to negatively affect health (Bekkouche et al., 2009; Pedersen et al., 2009), as well as cognitive (McEwen & Sapolsky, 1995) and emotional functioning (Lazarus, 2006), and are strongly related to psychopathology (Grant et al., 2009; Kessler & Wang, 2008).

In our study, we observed increases in quality of life and decreases in perceived stress following a yoga-based intervention in a young adult population, which represents a demographic with higher rates of mental health difficulties and levels of stress than the general public (Reavley & Jorm, 2010). According to a recent survey of college students, stress was reported to be the number one factor affecting academic performance (Reavley & Jorm, 2010). By increasing quality of life and decreasing stress, yoga-based programs may have the potential to increase subjective well-being, scholastic performance, and foster resiliency toward mental illness in young adults.

Mindfulness

It is well established that the practice of mindfulness-meditation increases the skill of mindfulness (Carmody & Baer, 2008; Nyklicek & Kuijpers, 2008); however, relatively little is known about the impact of other contemplative traditions on this skill. Our finding that participation in the SI program predicts an increase in mindfulness is consistent with some recent reports suggesting that yoga-based programs can also increase the skill of mindfulness (Conboy et al., 2010; Shelov et al., 2009). This increase in mindfulness might be attributed to the emphasis on the cultivation of 'witness consciousness' in the SI program. As discussed above, 'witness consciousness' (Faulds, 2005) has significant conceptual overlap with mindfulness.

Our finding that mindfulness predicted quality of life is aligned with previous research showing that mindfulness has a positive association with both

subjective well-being (Branstrom et al., 2010; Brown, Kasser, Ryan, Alex Linley, & Orzech, 2009; Schutte & Malouff, 2011) and life satisfaction (Schutte & Malouff, 2011). Similarly, our finding that mindfulness predicts perceived stress is aligned with recent research (Branstrom et al., 2010). Although not measured in the current study, based on previous research showing negative associations between mindfulness and post-traumatic avoidance symptoms, and anxiety (Branstrom et al., 2010), as well positive associations with cognition, attention, working memory, and executive functioning (Jha et al., 2007; Zeidan et al., 2010), one might hypothesize that yoga-based interventions could affect these domains as well.

Self-compassion

Thus far, only one uncontrolled pilot study of highly experienced yoga practitioners has assessed the impact of yoga on self-compassion; however, only changes in the mindfulness subscale of the SCS were observed (Conboy et al., 2010). In contrast, we reported favorable outcomes on all SCS subscales except common humanity, along with increased total self-compassion. Increases in self-compassion may have resulted from the instruction to students to bring awareness and acceptance to their unique physical attributes as they moved through yoga postures, rather than emphasizing the achievement of a 'perfect' pose.

Our finding that self-compassion predicts quality of life is aligned with previous studies that reported positive associations between self-compassion and well-being (Neely et al., 2009; Neff & McGehee, 2009). Furthermore, our finding that self-compassion predicts perceived stress is also aligned with previous report (Shapiro et al., 2005). Self-compassion also has been shown to be positively related to mental and physical health (Raque-Bogdan et al., 2011), scholastic performance (Neff et al., 2005), optimism (Neff, Rude, & Kirkpatrick, 2007), positive affect (Neff et al., 2007), and resilience (Neff & McGehee, 2009), and negatively to self-reported anxiety and depression (Neff & McGehee, 2009). Although the aforementioned variables were not measured in the current study, one might hypothesize that yoga-based interventions have the potential to positively affect these variables through increased levels of self-compassion.

Mediation

Although the effects of yoga-based programs on mindfulness (Conboy et al., 2010; Shelov et al., 2009), quality of life (Thomley et al., 2011), and stress (Ross & Thomas, 2010) have been reported previously, until now the potential mediating role of mindfulness and self-compassion on outcome has not been investigated. Here we report evidence that the effects of the SI on perceived stress and quality of life are mediated by mindfulness and self-compassion. The mediating role of mindfulness and self-compassion has previously been shown in mindfulness-based programs (Branstrom et al., 2010; Kuyken et al., 2010; Nyklicek & Kuijpers, 2008). As mindfulness-based and yoga-based interventions seem to share similar mechanisms, hypotheses about the outcome of yoga-based programs could be based upon existing knowledge of mindfulness-based programs (i.e. that yoga-based interventions could improve depressive symptoms and psychological well-being; Hollis-Walker & Colosimo, 2011; Kuyken et al., 2010; Shahar, Britton, Sbarra, Figueredo, & Bootzin, 2011). Despite this apparent similarity, mindfulness- and yoga-based interventions might have unique mechanisms that need to be further explored.

The effect of the SI on quality of life was mediated by mindfulness and self-compassion in both single and multiple mediator models. In contrast, while perceived stress was mediated by mindfulness and self-compassion individually in singe mediator models, when both mindfulness and self-compassion were simultaneously entered as potential mediators in the model, only self-compassion significantly mediated the effect of participation in the SI on perceived stress. Although it should be treated with caution because of the high correlation between mindfulness and self-compassion in the present study, our finding that perceived stress was mediated by self-compassion but not mindfulness in the multiple mediator model has very interesting potential theoretical and practical implications. Somewhat related, a recent study found self-compassion to be a better predictor of quality of life than mindfulness, although in a sample from a different population (18–73 year olds seeking self-help for anxiety, fear, and worry, of which 87.3% had moderate-severe levels of anxiety or depression; Van Dam, Sheppard, Forsyth, & Earleywine, 2011). Further studies with measurements at multiple time-points and larger samples are necessary to determine the relative contributions of mindfulness and self-compassion as mediators of positive outcome.

Finally, care must be used in interpreting the mediation results. Although widely done, it is important to note that causality between mediator and dependent variables cannot be inferred when measured at the same time-point (Stone-Romero & Rosopa, 2008). In addition to the causal models we tested here, other models could also be consistent with the reported covariance pattern.

Limitations

As with every quasi-experimental study, the main limitation of our study is the presence of threat to

internal validity (Kenny, 1975). While we tried to minimize differences between groups by recruiting a demographically matched control group, a significant limitation of this study lies in the experimental group's pre-existing interest and intention to participate in a four month residential yoga-based intervention. In contrast, controls were not asked about their interest in yoga or participation in other types of self-help programs. It is likely that this difference between groups has affected our results, as a recent study revealed that self-selection, personal commitment, and motivation are all important contributors to the success of happiness interventions (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011). Furthermore, while the between-group comparisons at the pre time-point demonstrated that the groups did not differ on most of the outcome variables, there were significant baseline differences in total Self-compassion and the SCS subscales Self-judgment, Common Humanity, and Self-kindness. Because of this baseline difference, self-compassion might be a confound in the present study, although, post-hoc regression analyses indicated that self-compassion at the pre-time-point did not predict post intervention QOLI and PSS scores. In addition, there is the possibility that the groups might have differed on variables that were not measured. While it was impossible for practical reasons to randomly assign participants to the 4-month residential SI, future studies investigating the effect of yoga programs should employ random intervention allocation to rule out group differences.

Although the dropout rate in the SI program was relatively low (three out of 53 SI participants), 17 out of the 50 course completers did not complete questionnaires at the post time point. This was likely due to the lack of financial compensation for SI participants to complete the questionnaires, and possibly due to the fact that many participants were very busy during this interval, as they were transitioning from this intensive residential program to their next steps in life. Another limitation was the absence of an appropriate control program, making it impossible to determine if the improvements in the assessed variables were truly the result of the yoga components of the SI or due to more generic aspects of the program such as social support, healthy diet, and outdoors activities. To rule out this limitation, future studies should employ active control groups.

While the present data are intriguing, future studies will be needed to investigate the effects of shorter, non-residential yoga-programs on subjective well-being and health, which would be more accessible, cost-effective, and feasible interventions. While this pilot study indicates what the possible short-term effects of a residential yoga-based program for young adults might be, the long-term effects are yet to be investigated. To evaluate the possible preventive effects of yoga programs for mental health difficulties in young adults, future studies should specifically recruit individuals that are particularly at risk, and should have a follow-up period that allows for the assessment of long-term effects. Lastly, it would be useful to compare yoga- and mindfulness-based programs in the same study to directly compare their effects and underlying mechanisms.

Conclusion

In summary, our data suggest that participation in the yoga-based Kripalu Semester Intensive program results in increases in quality of life, mindfulness, self-compassion, and decreases in perceived stress in young adults. This is the first time that a yoga-based program has been reported to increase self-compassion, and that the effects of such a program on quality of life and perceived stress are mediated by mindfulness and self-compassion.

These preliminarily findings have potential implications for both the cultivation of subjective well-being and the clinical treatment and prevention of mental illness in young adults. Furthermore, our data suggest that yoga-based and mindfulness-based programs might share similar mechanisms, which could create an alternative option for individuals that have interest in acquiring the skills of mindfulness and self-compassion, but are resistant to formal meditation techniques or have a preference for more physically engaging practices. Finally, this similarity makes it possible to generate hypotheses about the effects of yoga-based programs based on the larger body of knowledge about the effects of mindfulness-based programs.

Further investigation of the mechanisms underlying yoga- and mindfulness-based programs will facilitate the development of more targeted and efficient programs to foster subjective well-being and increase resilience.

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