

A Mindfulness-Based Intervention for Pregnant African-American Women

Huaiyu Zhang · Eugene K. Emory

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Abstract Research has shown that prenatal maternal stress occurs commonly during pregnancy, and associated physical, psychological, and financial challenges are often compounded for African-American women from urban, low-income environments. The current study focused on a mindfulness-based intervention for a group of urban, low-income, pregnant African-American women. This randomized controlled pilot study involved a 2×3 mixed model design, comparing treatment as usual (TxAU) with the Mindful Motherhood intervention on several outcomes at pre-intervention, post-intervention, and one month post-intervention. A total of 65 adult participants (31 TxAU and 34 Mindful Motherhood) met the inclusion criteria and participated in the study. Due to significant attrition in both assessments and intervention participation, dose-effect analyses were employed to test treatment effects on outcome variables with multiple linear regressions. Preliminary findings support the efficacy of the Mindful Motherhood training in improving levels of mindfulness, reducing reactive cortisol response, and reducing pregnancy-related stress at post-intervention and improving pregnancy-related positive experience and reducing depressive symptoms at one month follow-up. However, none of these effects appeared to have lasting impact on the participants, and treatment did not appear to impact perceived stress or baseline salivary cortisol levels. This pilot study is believed to be the first empirical research on a mindfulness-based intervention with a group of urban, low-income, pregnant African-American women. These preliminary results support the efficacy of mindfulness-based interventions with this minority

population and encourage efforts to optimize recruitment and retention of underprivileged participants.

Keywords African-American women · Pregnancy · Stress · Depressive symptoms · Mindfulness · Intervention

Introduction

A number of psychological, physiological, and anatomical challenges exist for pregnant women that can be experienced as stressful (Dunkel Schetter 2011; Voegtline et al. 2013). Disturbances of energy, sleep, concentration, and fatigue often accompany pregnancy. Sometimes, these symptoms develop into clinical depression (Tsai et al. 2012). Empirical measures of psychological and hormonal disturbances during pregnancy have included self-report of perceived stress and cortisol levels, respectively (Dunkel Schetter and Tanner 2012; Hobel et al. 2008; Keim et al. 2011). A tentative conclusion that can be drawn from this work is that maternal stress and mood disturbance during pregnancy can have significant implications for postpartum maternal and child outcomes. Improving maternal and child outcomes following pregnancy may rest in part on improving maternal psychological health through stress reduction methods.

Among the various treatment approaches, mindfulness-based interventions have gained increasing attention due to their commonly observed effect on stress reduction (Baer et al. 2012; Jensen et al. 2012). In the broader research context, the association between mindfulness and psychological health has been more extensively studied, with growing evidence linking higher levels of mindfulness to higher levels of desirable psychological outcomes such as life satisfaction, effective emotion regulation, and empathy (Davis and Hayes 2011; Keng et al. 2011). One advantage of the mindfulness paradigm is that it can be practiced in different forms, e.g., sitting meditation and mindful movement (Allen et al. 2006). One can also be mindful

H. Zhang (✉)
Department of Psychiatry and Behavioral Sciences, Emory
University School of Medicine/Grady Health System, 13D021, 80
Jesse Hill Jr. Drive SE, Atlanta, GA 30303, USA
e-mail: huaiyu.zhang@emory.edu

E. K. Emory
Department of Psychology, Emory University, Atlanta, GA, USA

during daily activities. Moreover, levels of mindfulness are negatively correlated with levels of undesirable experiences including depressive symptoms, emotional regulation difficulties, and experiential avoidance (Keng et al. 2011). Given the potential psychological and emotional benefits associated with mindfulness practices, concerted efforts have recently been made to enhance levels of mindfulness through mindfulness-based interventions (Davis and Hayes 2011). Recently, both original investigations and systematic reviews have generally shown the promise of these treatments in boosting degrees of mindfulness (Jensen et al. 2012; Keng et al. 2011).

In research with nonclinical populations, mindfulness-based stress reduction programs have been shown to significantly reduce perceived stress in randomized controlled trials (Jensen et al. 2012; Klatt et al. 2009). However, in one newly published randomized controlled trial with university employees, low dose mindfulness training failed to reduce perceived stress (Malarkey et al. 2013), suggesting that more intensive intervention might be required for mindfulness training to have a significant impact with this group. Treatment effects of mindfulness-based interventions on cortisol levels are mixed in comparison to the generally consistent findings for perceived stress. Studies with clinical and nonclinical populations have reported change in salivary cortisol levels after a full course of mindfulness-based stress reduction training, and notably, awakening saliva was collected in most of these studies (Brand et al. 2012; Jensen et al. 2012; Witek-Janusek et al. 2008). In contrast, treatment studies that did not exclusively collect morning awakening saliva samples generally failed to find a significant main effect of mindfulness-based interventions on cortisol levels (Galantino et al. 2005; Nyklíček et al. 2013). These findings highlight the importance of saliva sample collection time in impacting the accuracy of cortisol measurement. Despite considerable research on baseline cortisol levels, studies of mindfulness treatment effects on cortisol response to stress have however been less frequently examined (Brown et al. 2012; Tang et al. 2007). For instance, a recent correlational study by Brown et al. (2012) reported higher levels of mindfulness with lower levels of cortisol response to a moderately stress-provoking condition. These studies highlight the importance of investigating short-term hormonal response in addition to studying baseline cortisol levels.

Moreover, the impact of mindfulness-based interventions on the effect of depressive symptom reduction has been among the most intensively studied topics. Mindfulness-based cognitive therapy was found to effectively reduce depressive symptoms in a sample of subclinical participants (Kaviani et al. 2012). Systematic reviews and meta-analyses (Coelho et al. 2013; Galante et al. 2013) have revealed that in randomized controlled clinical trials, participants with a history of depression who attended mindfulness-based stress reduction training or mindfulness-based cognitive therapy fared better in relapse prevention than a control group.

Given the potential that mindfulness-based interventions has to alleviate maternal stress, improve maternal mood, and promote maternal well-being, some researchers have developed mindfulness-based programs that specifically target pregnant women and new mothers (Duncan and Bardacke 2010; Vieten and Astin 2008). To date, there have been four published studies of mindfulness-based interventions with pregnant women (Duncan and Bardacke 2010; Dunn et al. 2012; Fisher et al. 2012; Vieten and Astin 2008). One published randomized controlled trial of mindfulness intervention with pregnant women reported reduction in anxiety and negative affect (Vieten 2012). The three other studies, none of which was a randomized controlled trial, also reported reduction in anxiety, along with reduction in depressive symptoms and negative affect. These three studies also reported improvements in positive affect, empowerment, and a sense of community (Duncan and Bardacke 2010; Dunn et al. 2012; Fisher et al. 2012). The net result of these pilot studies is that mindfulness-based treatments may have clinical efficacy in alleviating maternal stress during pregnancy. Among a host of potential design limitations, threats to internal and external validity need to be addressed. With the exception of Vieten (2012), the studies reported suffer from lack of randomized controlled designs. Another critique of the four pregnancy-based mindfulness studies shows that the samples were primarily middle-high SES women of Caucasian descent, which raise the question of the efficacy of the techniques with pregnant women who constitute the largest cohort of those with complicated pregnancies and other high risk factors such as low birth weight, prematurity, neonatal mortality, and morbidity. Further, enhancing mindfulness skills is a targeted outcome of most studies, but none of the four mindfulness-based pregnancy programs treated this critical construct as a dependent variable.

If mindfulness-based intervention programs have promise for reducing perinatal morbidity, efforts directed at populations at high risk for poor outcome should also be targeted. A number of demographic factors contribute to elevated perinatal risk during pregnancy including poverty, stress, pre- and postpartum depression, feelings of loneliness, and social isolation (Bloom et al. 2013; Goyal et al. 2010). African-American women represent one population that is particularly hard hit by demographic factors which lead to nonoptimal obstetric and perinatal outcome with higher rates of perinatal death, low birth weight and prematurity, developmental morbidity, physical health problems, and psychosocial difficulties (Dunkel Schetter and Tanner 2012; Holland et al. 2009; Rosenthal and Lobel 2011). Poor perinatal outcome has become an intractable problem within the African-American community with limited success using established intervention protocols. Notably, a closely related population, female

African-American youth, appears to benefit from mindfulness-based interventions with improvements in emotion regulation, stress reduction, physical health, and interpersonal relationships (Mendelson et al. 2010; Sibinga et al. 2011). In addition, mindfulness-based interventions with pregnant African-American women may also help reduce the pervasive stigma attached to mental health problems and provide a beneficial cost-effective adjunct to existing services for women experiencing heightened stress during pregnancy (Leis et al. 2011; Kabat-Zinn 1990, 1994; Woods-Giscombé and Black 2010). Thus, the focus of this pilot randomized controlled clinical trial of mindfulness-based intervention was with pregnant African-American women; the success of which might offer a novel approach to dealing with a national health crisis.

In sum, existing evidence has suggested that mindfulness-based interventions might be a good fit for urban, low-income, pregnant African-American women by reducing maternal stress and empowering them with a perspective of self-acceptance and mindfulness attention to the present moment experience. Research with this population would not only help reduce the health disparities that they have suffered from but also might enhance the physical and mental well-being of their babies. The general purpose of this pilot study was to conduct a randomized controlled trial with urban, low-income, pregnant African-American women, to examine the effect of a mindfulness-based maternal stress reduction program (i.e., Mindful Motherhood; Vieten 2012) on maternal well-being. Based on the information presented in the maternity and mindfulness literature, the following predictions were made: (1) The Mindful Motherhood group would experience greater improvement in levels of mindfulness than the treatment as usual (TxAU) group at post-intervention and one month post-intervention; (2) the Mindful Motherhood group would evidence more reduction in levels of general maternal stress than the TxAU group at post-intervention and one month post-intervention. Specifically, indicators of general maternal stress in this hypothesis included perceived stress, baseline cortisol levels, and reactive cortisol response; (3) the Mindful Motherhood group would endorse more pregnancy-related positive experience and less pregnancy-related stress than the TxAU group at post-intervention and one month post-intervention; and (4) the Mindful Motherhood group would report lower levels of depressive symptoms than the TxAU group at post-intervention and one month post-intervention.

Method

Participants

The study participants were recruited from two settings: (1) a state-supported pregnancy program, which provides routine

services to Temporary Assistance for Needy Family recipients and (2) a large, urban, university-affiliated hospital that provides health care to low-income, predominantly minority patients. Overall, a total of 1,440 prospective participants were approached by undergraduate research assistants for recruitment. Those who agreed to participate signed the consent form for screening, assessments, and intervention. Once the consent form was obtained, the research assistants conducted a 10-minute screening to assess the eligibility and collect basic demographics (i.e., age, ethnicity, and income). Exclusion criteria included active psychosis, history of psychosis, current intake of psychotropic medication, and severe cognitive impairments. The inclusion criteria of the study included English speakers, age range from 18 to 45, carrying singleton pregnancies, with 12–31 weeks of pregnancy, and self-identified as African-Americans. Sixty-five pregnant females met the inclusion criteria, participated in the T1 assessment, and were randomly assigned to the TxAU condition ($n=31$) or the Mindful Motherhood condition ($n=34$). The demographic background and pregnancy information of the participants are shown in Table 1.

Design

The current study was a pilot randomized controlled trial with a 2×3 mixed model design. The between-subjects variable was group condition (TxAU and Mindful Motherhood) and the within-subjects variable was assessment time (pre-intervention (T1), post-intervention (T2), and one month post-intervention follow-up (T3)).

Table 1 Demographic characteristics and pregnancy information of the participants

Demographic characteristics	Descriptive statistics
Age (mean, SD)	25.3, 4.6
Weeks of pregnancy (mean, SD)	21.5, 5.1
Complication during pregnancy (%)	32.3
Relationship status (%)	
Single or never married	29.4
With partner, not living together	19.1
With partner, living together, not married	38.2
Married	13.2
Have children (%)	84.6
Unemployed (%)	84.6
Individual monthly income (%)	
\$0–\$249	32.3
\$250–\$499	30.8
\$500–\$999	29.2
>\$999	7.7

All the participants were randomly assigned to one of the following two groups during T1 assessment: TxAU and Mindful Motherhood. The TxAU group received routine care as usual. In addition to receiving routine care, the Mindful Motherhood group was presented with the Mindful Motherhood intervention within two weeks of T1 assessment. All the Mindful Motherhood group sessions in the current study were led by one facilitator. The facilitator of the group, who was also the principal investigator of the current study, was an advanced Ph.D. student in clinical psychology with online training of the Mindful Motherhood intervention. The Mindful Motherhood intervention is an eight-session mindfulness- and acceptance-based intervention program for pregnant and postpartum women, and it focuses on experiences related to pregnancy and early parenting (Vieten 2009, 2012; Vieten and Astin 2008). The protocol of the Mindful Motherhood intervention was adapted from empirically supported mind-body interventions, including mindfulness-based stress reduction, mindfulness-based cognitive therapy, acceptance and commitment therapy, and dialectical behavior therapy. The Mindful Motherhood intervention aims at “helping new mothers become more aware of their present moment experience, increasing their ability to tolerate and regulate distressing affect without resorting to unhealthy behaviors, and cultivating the mothers’ capacity to be fully present more often, with themselves and their child(ren) (Vieten 2012, p. 4).” In the current study, each cycle of the eight sessions was provided over the course of four weeks with two sessions each week. Each group session consisted of 1–6 participants. Although the original design was for the Mindful Motherhood group participants to attend all the eight sessions, only a small percentage of participants completed a full course of training, and the detailed description of training and assessment participation is shown in Table 2.

Procedure

Individuals who met the inclusion criteria were scheduled for initial assessment (T1), second assessment (T2) that occurred approximately four weeks after T1, and third assessment (T3) that occurred approximately four weeks after T2. For the Mindful Motherhood group, an eight-session mindfulness training was conducted between T1 and T2 assessments. Each assessment lasted approximately one hour. During each assessment, the following measures were administered to the participants: the *Toronto Mindfulness Scale*, the *Perceived Stress Scale*, the *Pregnancy Experience Scale — Brief Version*, and the *Beck Depression Inventory — II*. In addition, participants were instructed to listen to a two-minute audio clip of a baby’s cry, which was employed in this study as a mild stressor that was ecologically valid. Participants were paid

Table 2 Participant intervention and assessment attendance and attrition rates

Group condition	Number of sessions	Number of participants		
		T1	T2	T3
TxAU	0	31	17	11
Mindful Motherhood	0	6	—	—
	1	7	2	2
	2	4	2	2
	3	5	3	2
	4	3	2	2
	5	1	—	—
	6	2	1	—
	7	3	3	1
	8	3	3	2
Total	—	65	33	22
Attrition rate (%)	—	—	48	66

TxAU treatment as usual, T1 initial assessment, T2 post-intervention assessment, T3 one month post-intervention follow-up assessment

\$10–\$30 for each prenatal visit. Additionally, at T1 assessment, we gathered demographic information by administering the *Demographic Information Questionnaire* and randomly assigned each participant into one of the two group conditions.

Furthermore, saliva samples were collected upon the participants’ arrivals, prior to the audio clip, and immediately after the audio clip during each visit. Although efforts were made to optimize morning saliva sample collection in order to control for the impact of collection time and to improve the reliability of the cortisol measure (Franz et al. 2010), due to research assistants’ and participants’ schedule restrictions, only 59.6 % of the total number of interviews had the first saliva samples collected between 8:30 A.M. and 12:00 P.M. During each saliva collection, each participant was asked to wet a cotton stick in her mouth, and the saliva sample was squeezed from the cotton stick into a tube using a syringe. Collected saliva samples were immediately stored at -20°C until the time of cortisol assays. The cortisol assays were performed using the Salimetrics cortisol kits (Salimetrics, PA), and the Stat Fax 2100 Microplate Reader (MIDSCI, MO) was used to test the salivary cortisol levels (2011).

Measures

Demographic Information

Demographic Information Questionnaire The Demographic Information Questionnaire assesses background information,

including education, occupation, sex, age, birthplace, and economic status. For the current study, questions with regard to weeks of pregnancy and pregnancy complications were added to the questionnaire.

Mindfulness

Toronto Mindfulness Scale The Toronto Mindfulness Scale (Lau et al. 2006) was used to assess participants' levels of mindfulness. The Toronto Mindfulness Scale is a 13-item self-report measure of an individual's ability to attune him/herself to his/her internal experiences with a stance of curiosity and willingness. It is a five-point Likert scale ranging from 0 (*not at all*) to 4 (*very much*). Sample items are "I remained open to whatever thoughts and feelings I was experiencing" and "I was receptive to observing unpleasant thoughts and feelings without interfering with them." Total scores range from 0 to 40, with higher scores indicating higher levels of mindfulness. The Toronto Mindfulness Scale has been shown to sensitively detect different levels of mindfulness with practice. Adequate internal consistency was reported in literature ($\alpha=0.76$) and found in the current study ($\alpha=0.85$). Good construct validity is suggested by as the developers reported moderate correlations between the Toronto Mindfulness Scale with measures of self-awareness and openness (Lau et al. 2006).

General Maternal Stress

Perceived Stress Scale The Perceived Stress Scale is a 14-item measure, which asks participants to rate the extent to which they have felt their life to be stressful within the past month (Cohen et al. 1983). It measures the degree of self-appraised stress in one's life. It is a five-point Likert scale with 1 representing *never* and 5 representing *very often*. Sample items from the scale include "In the last month, how often have you been upset because of something that happened unexpectedly?" and "In the last month, how often have you found that you could not cope with all the things that you had to do?" Seven items were reversely coded so that higher total scores on the Perceived Stress Scale reflect higher subjective stress. The Perceived Stress Scale has demonstrated good internal consistency and construct validity (Roberti et al. 2006). In the current study, the Cronbach's α of the Perceived Stress Scale was 0.87. The total score of the scale was used to evaluate the level of subjective stress.

Physiological Measures The cortisol levels from the salivary samples collected at the beginning of each assessment were regarded as *baseline cortisol levels*, and the cortisol level changes in response to the administration of the audio clip of a baby's cry were regarded as *reactive cortisol response*. The audio clip is a pre-recorded MP3 clip of a real baby's cry, which lasts for approximately two minutes. The MP3 clip was

downloaded from a video clip in the public domain. To the best of the authors' knowledge, this was the first attempt in the maternal stress literature to employ a baby's cry as an ecologically valid stress stimulus that is universally experienced by new mothers. The length of the clip was determined by an effort to balance caregivers' realistic response latency and time interval for detectable cortisol level change (Beaven et al. 1964; Buske-Kirschbaum et al. 2003).

Pregnancy-Related Experience

Pregnancy Experience Scale — Brief Version The Pregnancy Experience Scale — Brief Version is a short version of the *Pregnancy Experiences Scale*, a measure of maternal appraisal of daily ongoing experience specific to pregnancy (DiPietro et al. 2008). This scale was implemented in this study to measure pregnancy-related positive experience (i.e., uplifts) and pregnancy-related stress (i.e., hassles). The Pregnancy Experience Scale — Brief Version consists of ten commonly endorsed uplifts and ten commonly endorsed hassles. All items are rated on a four-point Likert scale from 0 (*not at all*) to 3 (*a great deal*). Sample items from the uplifts subscale are "how much the baby is moving" and "feeling about being pregnant at this time." Sample items from the hassles subscale are "your weight" and "clothes/shoes don't fit." The total scores on either the uplift or the hassle subscale are sum of responses on the ten items on either subscale. Frequency of uplifts or hassles was defined as the total number of items that were not endorsed as 0 on either subscale. Intensity of uplifts or hassles was defined as the quotient of the total score divided by frequency on each subscale. The uplift intensity has been used to measure pregnancy-related positive experience and the hassle intensity was used to measure pregnancy-related stress. The Pregnancy Experience Scale — Brief Version has been indicated to have good internal reliability, test-retest reliability, and convergent validity (DiPietro et al. 2008). In the current study, the Cronbach's α for the uplift subscale and the hassle subscale were 0.84 and 0.82, respectively.

Depressive Symptoms

Beck Depression Inventory — II The Beck Depression Inventory — II is a 21-item scale that measures the severity of depressive symptoms (Beck et al. 1996). Participants are expected to rate on a four-point Likert scale with total scores ranging from 0 to 63. Sample items are "Sadness: (0) I do not feel sad, (1) I feel sad much of the time, (2) I am sad all of the time, (3) I am so sad or unhappy that I can't stand it" and "Pessimism: (0) I am not discouraged about my future, (1) I feel more discouraged about my future than I used to be, (2) I do not expect things to work out for me, (3) I feel my future is hopeless and will only get worse." High internal consistency ($\alpha=0.90$) and good construct validity were reported for the

Beck Depression Inventory – II (Beck et al. 1996; Dozois et al. 1998). The Cronbach's α of the scale in the current study was 0.91. The total scores of the scale were used to assess levels of depressive symptoms in the current study.

Data Analyses

Data were entered into the SPSS 20.0 software and were checked and corrected for data entry errors by research assistants prior to analyses. The correlations among these maternal outcome measures at T1 assessment time point are shown in Table 3. Results of relevant descriptive statistics of outcome measures are shown in Table 4. High attrition rates did not only occur in assessments but also in intervention sessions, such that only three out of the 34 participants randomly assigned to the Mindful Motherhood condition completed the eight-session training. Given the small number of intervention completers, it was not statistically meaningful to compare the three intervention completers to the TxAU group. Nevertheless, because there was wide variability in the number of training sessions that the Mindful Motherhood group participants attended, dose-effect analyses were employed to test the treatment effect on outcome variables (Sachse et al. 2011). *Dose* in this study refers to the number of intervention sessions completed. Specifically, multiple linear regressions were used to analyze the effect of number of training sessions on outcome measures controlling for pre-intervention levels of the same outcome measures. The statistically significant results from multiple linear regressions are summarized in Table 5.

Results

The first hypothesis pertained to the impact of intervention condition on levels of mindfulness, which were measured

using the Toronto Mindfulness Scale. Multiple linear regressions showed that the number of sessions had a positive association with levels of mindfulness controlling for pre-intervention levels of mindfulness at T2 assessment time point, $B=0.821$, $t(30)=1.69$, $p=0.05$, partial eta square=0.087 (medium effect size). However, the effect of session numbers on levels of mindfulness was not sustained at the T3 assessment time point. Thus, findings partially support the hypothesis in that there was a dose effect of mindfulness training on levels of mindfulness post-intervention. However, the dose effect did not last following post-intervention assessment.

The second hypothesis related to the impact of intervention condition on general maternal stress. To differentiate from pregnancy-specific measures, in the current study, measures of general maternal stress included perceived stress, baseline cortisol levels, and levels of reactive cortisol response. Perceived stress was measured using the Perceived Stress Scale. Multiple linear regressions did not reveal association between session number and levels of perceived stress at T2 or T3 assessment time point. Likewise, no associations were found between session number and baseline cortisol levels at T2 or T3 assessment time point. With regard to levels of reactive cortisol response, only T2 assessment time point data were analyzed due to lack of data for T3 assessment time point. Interestingly, the results supported that the number of sessions was negatively associated with reactive cortisol response at T2 assessment time point controlling for pre-intervention levels of reactive cortisol response, $B=-0.021$, $t(22)=-2.90$, $p<0.01$, partial eta square=0.227 (large effect size). Thus, the second hypothesis was largely unsupported except the indication that the levels of reactive cortisol response were impacted by session number post-intervention. However, the intervention did not seem to have an impact on the other stress indicators, including levels of baseline cortisol and perceived stress.

The third hypothesis was concerned about whether or not intervention impacted pregnancy-related positive experience and pregnancy-related stress, which were measured respectively using the intensity of pregnancy-related uplift subscale and the intensity of pregnancy-related hassle subscale from the Pregnancy Experience Scale — Brief Version. Multiple linear regressions revealed that the number of sessions was positively associated with perceived levels of intensity of pregnancy-related uplifts at T3 assessment time point controlling for pre-intervention levels of uplift intensity, $B=0.047$, $t(19)=1.78$, $p<0.05$, partial eta square=0.141 (large effect size). However, the effect was not shown at T2 assessment time point. For the intensity of pregnancy-related hassles, the results of multiple linear regressions confirmed the significant negative association between the number of sessions and intensity of pregnancy-related hassles at T2 assessment time point, $B=-0.067$, $t(29)=-2.54$, $p<0.01$, partial $\eta^2=0.182$

Table 3 Pearson correlations of maternal outcome measures at T1 assessment

	1	2	3	4	5	6	7
1	—	0.018	−0.098	0.014	0.220	0.207	0.001
2	—	—	−0.036	0.341**	−0.028	0.281*	0.733**
3	—	—	—	−0.133	−0.025	−0.148	0.045
4	—	—	—	—	−0.016	0.125	0.116
5	—	—	—	—	—	0.132	−0.317*
6	—	—	—	—	—	—	0.312*
7	—	—	—	—	—	—	—

1 Toronto Mindfulness Scale, 2 Perceived Stress Scale, 3 baseline cortisol ($\mu\text{g/dL}$), 4 reactive cortisol response ($\mu\text{g/dL}$), 5 Pregnancy Experience Scale — Brief Version: uplift intensity, 6 Pregnancy Experience Scale — Brief Version: hassle intensity, 7 Beck Depression Inventory — II

**Differences are significant at $p<0.01$; *differences are significant at $p<0.05$

Table 4 Descriptive statistics of outcome measures divided by group condition

	Group condition	T1			T2			T3		
		N	M	SD	N	M	SD	N	M	SD
Toronto Mindfulness Scale	TxAU	31	30.1	9.44	17	31.1	9.94	11	35.1	8.89
	MM	34	30.1	11.1	16	35.1	6.78	11	35.3	5.10
Perceived Stress Scale	TxAU	31	39.5	8.22	17	38.9	8.62	11	40.6	8.48
	MM	34	43.9	10.2	16	39.7	7.46	11	40.8	11.4
Baseline cortisol levels ($\mu\text{g/dL}$)	TxAU	30	0.314	0.167	17	0.307	0.188	11	0.259	0.189
	MM	33	0.298	0.138	13	0.259	0.115	10	0.238	0.089
Reactive cortisol response ($\mu\text{g/dL}$)	TxAU	27	-0.027	0.053	16	-0.003	0.114	–	–	–
	MM	33	-0.006	0.077	12	-0.023	0.181	–	–	–
Pregnancy Experience Scale — Brief Version: uplift intensity	TxAU	30	2.34	0.510	17	2.40	0.375	11	2.47	0.250
	MM	34	2.20	0.545	16	2.35	0.437	11	2.55	0.340
Pregnancy Experience Scale — Brief Version: hassle intensity	TxAU	30	2.00	0.494	16	2.19	0.610	11	2.15	0.602
	MM	34	2.05	0.525	16	1.85	0.441	11	2.03	0.570
Beck Depression Inventory — II	TxAU	30	14.2	8.97	17	15.2	7.70	11	19.3	9.82
	MM	34	18.9	11.2	16	17.3	10.2	11	17.5	11.0

MM Mindful Motherhood, TxAU treatment as usual, T1 initial assessment, T2 post-intervention assessment, T3 one month post-intervention follow-up assessment

(large effect size). Although not statistically significant, there was a trend of continuation of the relationship between the number of sessions and intensity of pregnancy-related hassles at T3 assessment time point, $B=-0.051$, $t(19)=-1.50$, $p=0.075$, partial eta square=0.105 (large effect size). Thus, the results partially support the hypothesis in that session number appeared to positively predict pregnancy-related positive experience one month post-intervention and negatively predict pregnancy-related stressful experiences post-intervention. However, the dose effect of mindfulness training was not shown repeatedly with multiple linear regression analyses.

The fourth hypothesis related to the impact of intervention condition on levels of depressive symptoms, which were measured using the Beck Depression Inventory – II. Analyses from multiple linear regressions revealed a negative association between the number of sessions and depressive symptoms at T3 assessment time point

controlling for pre-intervention levels of the same variable, $B=-0.883$, $t(19)=-1.89$, $p<0.05$, partial eta square=0.159 (large effect size). However, a similar effect was not shown at T2 assessment time point. Thus, although dose effect was not shown immediately post-intervention, the number of training sessions appeared to reduced the levels of depressive symptoms one month post-intervention.

Discussion

We examined the efficacy of a mindfulness-based intervention with urban, low-income, pregnant African-American women. Preliminary findings indicate that the training (1) improved levels of mindfulness, (2) reduced reactive cortisol response and pregnancy-related stress following treatment, (3) improved pregnancy-related positive experience, and (4) reduced depressive symptoms one month post-intervention.

Table 5 Summary of statistically significant results from multiple linear regressions

Assessment	Outcome measures	df	B value	t value	Partial eta square	Effect size
T2 assessment (post-intervention)	Toronto Mindfulness Scale	30	0.821	1.69*	0.087	Medium
	Reactive cortisol response ($\mu\text{g/dL}$)	22	-0.021	-2.90**	0.227	Large
	Pregnancy Experience Scale — Brief Version: hassle intensity	29	-0.067	-2.54**	0.182	Large
T3 assessment (1 month post-intervention follow-up)	Pregnancy Experience Scale — Brief Version: uplift intensity	19	0.047	1.78*	0.141	Large
	Beck Depression Inventory — II	19	-0.883	-1.89*	0.159	Large

*Differences are significant at $p<0.05$; **differences are significant at $p<0.01$

Mindfulness is a key outcome variable in this area of research, although it is not always included in other studies on mindfulness-based interventions. This study included mindfulness as an outcome variable with multiple linear regressions analyses. Although there was no relationship between levels of mindfulness and the number of sessions attended at one month post-intervention, the immediate post-intervention levels of mindfulness were dependent on the number of sessions participants attended. An indication of the effectiveness of the training in boosting levels of mindfulness is reflected by the medium effect size for the number of sessions attended and levels of mindfulness at post-intervention assessment. This result is consistent with other recent studies using the Toronto Mindfulness Scale to measure mindfulness (Bieling et al. 2012; Gayner et al. 2012; Jacobs et al. 2013). It deserves mention that in light of other research showing health benefits associated with mindfulness, such as improvement in effective emotion regulation and reduction in depressive symptoms (Davis and Hayes 2011; Keng et al. 2011), African-American women are at high risk for nonoptimal perinatal outcomes and depression. Thus, with urban, low-income African-American women who are expectant mothers, a high level of clinical efficacy might be achieved through learning mindfulness-based practice. Therefore, although there is no literature to date on using the Toronto Mindfulness Scale in studies involving African-American participants, findings from the current study suggest the applicability of this assessment tool in evaluating a key factor of mindfulness-based interventions with more diverse populations. However, it is important to investigate this further given that these findings may also indicate that the treatment effect is temporary and begins to fade away at one month post-intervention. Therefore, it would be helpful for future studies to determine whether or not a full course of intervention would optimize the maintenance of treatment gains.

Reactive cortisol response was found to be associated with the number of sessions that participants attended, although the second hypothesis that Mindful Motherhood intervention would alleviate general maternal stress was largely unsupported. Such findings are not completely unexpected, given that in the mindfulness literature, results regarding treatment effects of mindfulness training on cortisol level have been mixed (Jensen et al. 2012; Nyklíček et al. 2013). In brief, it appears that most studies reporting a treatment effect on cortisol level reductions compared awakening salivary levels, whereas the majority of the studies that failed to detect treatment effects did not. In the current study, logistical barriers made it prohibitively difficult to obtain early morning salivary samples; thus, collection times ranged from morning to afternoon when expectant mothers could get to our laboratory. Current

thinking is that awakening salivary levels are least likely to be impacted by daily activities and are a more reliable measure of hypothalamic-pituitary-adrenal (HPA) axis than those gathered at other time points (Brand et al. 2012; Jensen et al. 2012). In addition, cortisol levels change drastically throughout the course of pregnancy (Jung et al. 2011); thus, the relationship between prenatal cortisol levels in response to the mindfulness-based intervention may have been confounded by pregnancy-related HPA axis activity.

Our finding indicates that a baby's cry did not increase respondents' cortisol levels, but session number had a very large effect size on reactive cortisol response. Attending more training sessions was associated with a greater reduction in post-intervention reactive cortisol. Although this has been a less frequently researched area, preliminary data seem to indicate that reactive cortisol response is an informative tool for measuring the relationship between hormonal stress response and mindfulness-based interventions (Brown et al. 2012). It is possible that reactive cortisol response might be a more desirable measure of physiological stress during pregnancy, as higher prenatal cortisol levels are not necessarily associated with greater stress levels during that time. However, a more effective stressor, such as the Trier Social Stress Test, may be needed in order to assess whether or not the treatment effect on reactive cortisol response can be duplicated in the context of a moderately stress-provoking situation.

Unexpectedly, the current study failed to detect any intervention effect on levels of perceived stress. Perceived stress, as a critical stress indicator, has been used intensively in the mindfulness literature (Baer et al. 2012; Jensen et al. 2012), and plethora of evidence has suggested that mindfulness-based interventions are effective in reducing perceived stress. Nevertheless, given its nonspecificity for pregnancy-related stress, it remains unknown as to whether or not perceived stress is the most suitable measurement of stress for pregnant women. In addition, African-Americans may experience unique types of stress, and they may also endure higher levels of stress than their white counterpart; therefore, an intervention that has shown good efficacy in stress reduction with one group of recipients might not have the similar effect with a different group (Castro et al. 2010; Kim et al. 2009; Warren et al. 2010).

The third hypothesis, focusing on intervention effect on pregnancy-related positive experience and stress, was partially supported by the findings from this current investigation. The results revealed an interesting set of relationships between the overall number of mindfulness sessions and maternal psychological well-being. When the number of sessions was higher, women reported more positive pregnancy-related experience and less pregnancy-related stress. Thus, this study finds that when mindfulness meditation training is targeted to motherhood among expectant women, specificity of effects can be

observed. Pregnancy-related psychological stress is reduced but perceived stress of a more general nature is unaffected. The tentative nature of this finding requires further exploration in a larger-scale study before conclusive statement can be made. We are however encouraged by the possibility that mindfulness meditation training could include specificity among its treatment effects. A previous study reported a similar effect of using pregnancy-specific anxiety measures to detect mindfulness-based treatment effects (Duncan and Bardacke 2010). However, validity issues related to the study design made it difficult to determine the exact source of the presumed intervention effect.

The fourth hypothesis pertaining to intervention effect on levels of depressive symptoms was partially supported. In fact, the number of training sessions was negatively associated with depressive symptoms at one month follow-up. However, they were not associated at the post-intervention. Significant findings are consistent with the mindfulness literature that supports the treatment effect on reduction in depressive symptoms (Coelho et al. 2013; Galante et al. 2013). However, because the treatment effect on depressive symptoms was delayed and did not last at post-intervention assessment time point, it would be worthwhile to improve the intervention design in a manner that can result in a faster and longer-lasting impact on prenatal depressive symptoms.

The current study suffered from serious attrition rates, such that only about half of the participants completed the post-intervention assessment. As a result, the assumption of random assignment between the two groups has been seriously compromised, and the generalizability of the current study results is limited. In addition to the impact on assessment data, most participants in the Mindful Motherhood group did not complete the full course of treatment. Hence, we decided to use dose-effect analyses to determine whether or not this intervention might have effect on outcome variables of interest. Nonetheless, because of the variability in the number of sessions completed by intervention group participants, even those analyses that revealed significant associations between outcome variables and the number of sessions completed, results may have reflected differences in confounding participant characteristics rather than treatment effects and should be interpreted with caution.

Such limitations are not necessarily unique to this study alone. In fact, several other investigations of importance have observed that underprivileged African-Americans tend to under-utilize mental health services and have higher attrition rates (Alvidrez et al. 2010; Austin and Wagner 2010). Among the barriers to treatment observed are stigma associated with seeking psychological services, lack of knowledge about psychological services, problems with affordability, lack of trust, and problems with cultural understanding (Alvidrez et al. 2010, 2009; Austin and Wagner 2010; Leis et al. 2011). Further, a qualitative investigation that focused on a sample

most relevant to the current study (i.e., urban, low-income, perinatal African-American women) revealed that the participants generally held negative perceptions regarding mental health services, viewed mental health care providers as being emotionally unavailable and detached, and believed that mental health services are unhelpful (Leis et al. 2011). Taken together, these studies indicate that the aforementioned factors need to be taken into consideration when attempting to employ mindfulness-based interventions with samples of disadvantaged pregnant women from minority groups.

Despite these methodological limitations, to the best of our knowledge, this pilot study is the first empirical investigation examining a mindfulness-based intervention with a group of urban, low-income, pregnant African-American women. While preliminary findings from the current study indicate the potential efficacy of the Mindful Motherhood intervention in improving levels of mindfulness and pregnancy-related positive experiences, as well as reducing stress response, pregnancy-related stress, and depressive symptoms, until further investigations replicate and extend these findings, caution should be taken about making strong claims about effectiveness given that none of these effects appeared to have lasting impact on participants, and treatment did not seem to be associated with perceived stress or baseline salivary cortisol levels.

At the same time, this preliminary study opens up a variety of avenues for future research. First, for intervention studies with African-American participants, factors that contribute to treatment barriers need to be considered and efforts need to be made to improve participation and adherence (Dutton et al. 2013; Kaslow et al. 2010). Such barriers should be addressed at different stages of research, including study design, recruitment and retention efforts, intervention implementation, and follow-up assessment. Second, because Eastern meditation strategies may appear unfamiliar to a group of urban, low-income, minority population, modifications of the Mindful Motherhood Training protocol are recommended to make the treatment more culturally relevant for a group of Western minority population that struggle with various life- and pregnancy-related stressors. For instance, it is suggested that examples and stories relevant to the lives of these populations be employed when explaining key mindfulness concepts. In addition, connections can be made between the contemplative traditions of Christianity and Buddhism to reduce potential cognitive barriers. Finally, it is desirable to replicate the current study with optimal participant retention in both assessment and intervention. Given the drawbacks of the high attrition rates in the current study, it would be important to retest the research hypotheses by directly comparing the two groups, i.e., the TxAU group and the intervention group that have completed a full course of training, on the outcome variables. The results and conclusions based on a randomized controlled clinical trial with sufficient participation would be more compelling.

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