

Mindful Attention to Variability Intervention and Successful Pregnancy Outcomes

Sigal Zilcha-Mano¹ and Ellen Langer²

¹*University of Haifa*

²*Harvard University*

Objective: Based on a definition of mindfulness as actively noticing novelty (Langer, 1989; Langer, Blank, & Chanowitz, 1978), the present study sought to examine whether mindfulness training (attention to sensation variability) resulted in better childbirth outcomes for both mother and infant.

Method: At Weeks 25–30 of pregnancy, mindful instructions to attend to the variability of their positive and negative physical sensations were given to 1 group of participants and compared with 2 control groups ($N = 105$). The Langer Mindfulness Scale was used to assess the relationship between trait mindfulness and health outcomes.

Results: Findings showed that trait mindfulness predicted the well-being of expecting mothers and better neonatal outcomes. Mindfulness training resulted in better health for the expecting mother.

Conclusion: Findings suggest that mindfulness without meditation can be easily taught and may enhance the pregnancy experience for mother and fetus.

© 2016 Wiley Periodicals, Inc. *J. Clin. Psychol.* 72:897–907, 2016.

Keywords: mindfulness; mindlessness; pregnancy; childbirth

Pregnancy is a dynamic period of rapid change, which poses many physical and psychological challenges for women. Studies have shown that women differ in the extent to which they perceive this period as stressful, and that those who do perceive it as stressful are more vulnerable to adverse consequences for both themselves and their babies (for a review, see Schetter & Tanner, 2012). We suggest that increasing a mother's mindfulness during pregnancy can be an effective way of improving her health as well as the health of her newborn.

The literature on mindfulness comprises two distinct, albeit related, concepts. One is derived from contemplative, cultural, and philosophical traditions, such as Buddhism, and involves the cultivation of a moment-to-moment, nonjudgmental awareness of one's present experience (Kabat-Zinn, 1994). This concept of mindfulness is practiced mainly through formal and informal meditation. The second concept of mindfulness is derived from Western scientific literature and is defined as a mindset of openness to novelty, in which the individual actively constructs categories and distinctions (Langer 1989). The current work focuses on the Western social-cognitive perspective, which defines mindfulness as drawing novel distinctions (Langer, 1982, 2009; Langer et al., 1978; Langer, Hatem, Joss, & Howell, 1989).

Another way of conceptualizing this process is attention to variability, which refers to developing context sensitivity and distinguishing between the various phases of experiences, rather than perceiving them as a single, steadily worsening chain of events. When acting mindlessly, people confuse the stability of their mindset with the stability of the underlying phenomena. By becoming aware that everything is constantly changing and that things look different from diverse perspectives, individuals eventually discover that their symptoms may also constantly change.

Western mindfulness interventions seek to develop in participants context sensitivity, awareness of alternative perspectives of the experiences, and engagement with the present moment, rather than mindlessly focusing on the past. Mindfulness intervention aims to reduce mindlessness, a state of rigid behavior, fixated on inflexible patterns and oblivious to context and

Please address correspondence to: Sigal Zilcha-Mano, Department of Psychology, University of Haifa, Mount Carmel, Haifa 31905, Israel. E-mail: sigalzil@gmail.com

perspective. States of mindlessness can automatically trigger preconceived categories that are not open to critical evaluation and result in rigid behavior that is governed, rather than guided by, rules (Langer, 2009).

For pregnant women, mindless attitudes may include the belief that they should be tired, unhappy, and have painful physical symptoms. General preconceptions about the physical condition of pregnant women can become self-fulfilling prophecies, influencing women's perceptions and the manner in which they report these to other pregnant women. Feedback processes of this type can lead to loss of personal control over one's experience and to learned helplessness (Seligman, 1974). Mindfulness intervention facilitates mindfulness states, helping participants engage actively in reconstructing their environment by creating new categories or distinctions. When one is mindful, one is alert to new contextual cues and not preoccupied with the inability to change one's state. Attention to variability may have especially promising effects during a first pregnancy, a period of many and rapid life changes. Mere attention to variability is the essence of mindfulness interventions; the specific contents of the sensations in which women experience these variations may change and include physical/bodily changes, physiological changes, and emotional changes, adopting new roles in life and changes in existing roles as a result.

Forty years of research suggests that the simple process of noticing new things may have effects on health and well-being (for a review, see Langer, 2009). Western mindfulness has been associated with improved performance (e.g., Gardner & Moore, 2004; Langer & Chanowitz, 1981; Langer & Imber, 1979), higher satisfaction with relationships (e.g., Burpee & Langer, 2005), creativity (e.g., Langer et al., 1989; Langer & Piper, 1987), and better health (e.g., Alexander, Chandler, Langer, Newman, & Davies, 1989; Crum & Langer, 2007; Delizonna, Williams, & Langer, 2009; Langer & Rodin, 1976; Rodin & Langer, 1977). Based on the accumulating body of research focusing on the positive effects of attention to variability for well-being, our premise is that attending to variability during this time of rapid change may be important for the physical and psychological well-being of the expectant mother and the newborn. The present study is an initial step in the process of examining this hypothesis.

Distress, anxiety, and depression pose a risk to not only the expecting mother's health and well-being but also the developing infant. An accumulating body of evidence from both animal and human studies associates elevated levels of these symptoms with prenatal complications, negative birth outcomes, and long-term physiological, emotional, or behavioral disturbances among newborns (for reviews, see Glover, O'Connor, & O'Donnell, 2010; Lupien, McEwen, Gunner, & Heim, 2009; Mastorci et al., 2009; Merlot, Couret, & Otten, 2008; O'Donnell, O'Connor, & Glover, 2009; Viltart & Vanbesien-Mailliot, 2007).

Some adverse outcomes are as follows: spontaneous abortions (e.g., Schaefer, Hiatt, Swan, & Windham, 1997); reduced duration of gestation and preterm birth (birth before 37-weeks gestation; e.g., Dunkel Schetter, 2009); pregnancy complications (e.g., Da Costa, Brender, & Larouche, 1998); low infant birth weight (birth weight < 2,500 g; e.g., Field, Diego, & Hernandez-Reif, 2008); lower Apgar scores (e.g., Pagel, Smilkstein, Regen, & Montano, 1990); neuroendocrine dysregulation (e.g., Wadhwa, Dunkel-Schetter, Chicz-DeMet, Porto, & Sandman, 1996); fetal heart rate variability (e.g., DiPietro, Hodgson, Costigan, Hilton, & Johnson, 1996); increased use of neonatal intensive care unit services (e.g., Dole, Savitz, & Hertz-Picciotto, 2003); more difficult labor and delivery (e.g., Nielsen Forman, Videbeck, Hedegaad, Dalby Salvig, & Secher, 2000; Ritter, Hobfoll, Lavin, Cameron, & Hulsizer, 2000); and postpartum depression (Da Costa, Dritsa, Larouche, & Brender, 2000). Stress has also been shown to be a significant contributor to poor quality of mother-infant attachment (e.g., Miller, Pallant, & Negri, 2006) and deficits in the child's cognitive and behavioral functioning in infancy and childhood (for reviews, see Austin & Leader, 2000; Henrichs et al., 2011).

We believe that these symptoms can be exacerbated by the mindless perception of pregnancy as a time of fixed, unchanging negative emotions, which has a negative effect on emotional well-being (Delizonna et al., 2009). In a mindless state, each new ache or mood may be seen as a sequence of progressively negative events, in practice prolonging their influence. By contrast, mindfulness encourages one to actively notice change and create distinctions between phases, rather than perceiving these phases as one steadily worsening sequence of events (Langer, 1989; Langer et al., 1978, 1989; Langer, 2009; Langer & Moldoveanu, 2000).

The aim of the present study was to take an initial step in the process of examining the relationship between mindfulness (attention to variability) and a healthy pregnancy for both the expecting mother and her newborn. The study examines both mindfulness as a state and mindfulness as a trait and the effects of these on expecting mother's well-being and subsequent birth outcome.

Method

Participants

The sample comprised 105 women in Weeks 25–30 of their first pregnancy at the beginning of the study (mean [M] = 27.04 week, $SD = 1.73$),¹ ranging from 22 to 43 years of age ($M = 28.71$, standard deviation [SD] = 3.74). All the women volunteered to participate in the study. Participants had a mean of 15.28 ($SD = 2.27$) years of education, and 95.4% were married. They were recruited in malls, pregnancy clothing stores, gynecologists' waiting rooms, universities, city streets, online forums and through posters posted in a variety of public places in Israel. A study flow diagram is shown in Figure 1. No differences were found in dropout rates between study conditions. No differences were found on any of the study measurements between those who dropped out and those who remained in the study to its end.

Measures

We used the Mental Health Inventory (MHI; Veit & Ware, 1983) to assess mental health. The MHI is a 15-item self-report scale comprising two subscales, psychological well-being and psychological distress. Each item was answered with reference to the past week on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Cronbach's alphas for both psychological well-being (.79–.89) and psychological distress (.86–.94) were satisfactory for all three measurement points.

We used the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988) to assess positive and negative affects. The PANAS is a 20-item self-report scale comprising two subscales, positive and negative affect, each consisting of 10 items. Each item was answered with reference to the extent to which participants feel the specific feeling at the current moment, using a 5-point scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Cronbach's alphas for both positive affect (.82–.88) and negative affect (.87–.91) were satisfactory for all three measurement points.

We used the Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965), a 10-item self-report, to assess self-esteem. Participants were required to respond to each item on a 4-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Cronbach's alphas were satisfactory for all three measurement points (.83–.86).

We used the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), a five-item self-report scale, to assess general satisfaction with life. Participants were required to respond to each item on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach's alphas were high for all three measurement points (.87–.91).

We used the LMS14 (Pirson, Langer, Bodner, & Zilcha-Mano, 2015), a 14-item self-report scale, to assess trait mindfulness. The LMS14 includes three subscales: novelty seeking (e.g., "I like to figure out how things work"); novelty production (e.g., "I make many novel contributions"); and engagement (e.g., "I am rarely aware of changes; reversed scored item). Pirson et al. (2015) have demonstrated the reliability and validity of the scale. Participants were required to

¹In the present study we chose to follow participants who had reached week 25–30 of their pregnancy based on findings that demonstrate the importance of this period and the risk of experiencing stress during this period for the health of the fetus and of the pregnant woman (Hedegaard, Henriksen, Sabroe, & Secher, 1993), and based on findings identifying this period as a time of relatively rapid changes (Glover et al. 2010).

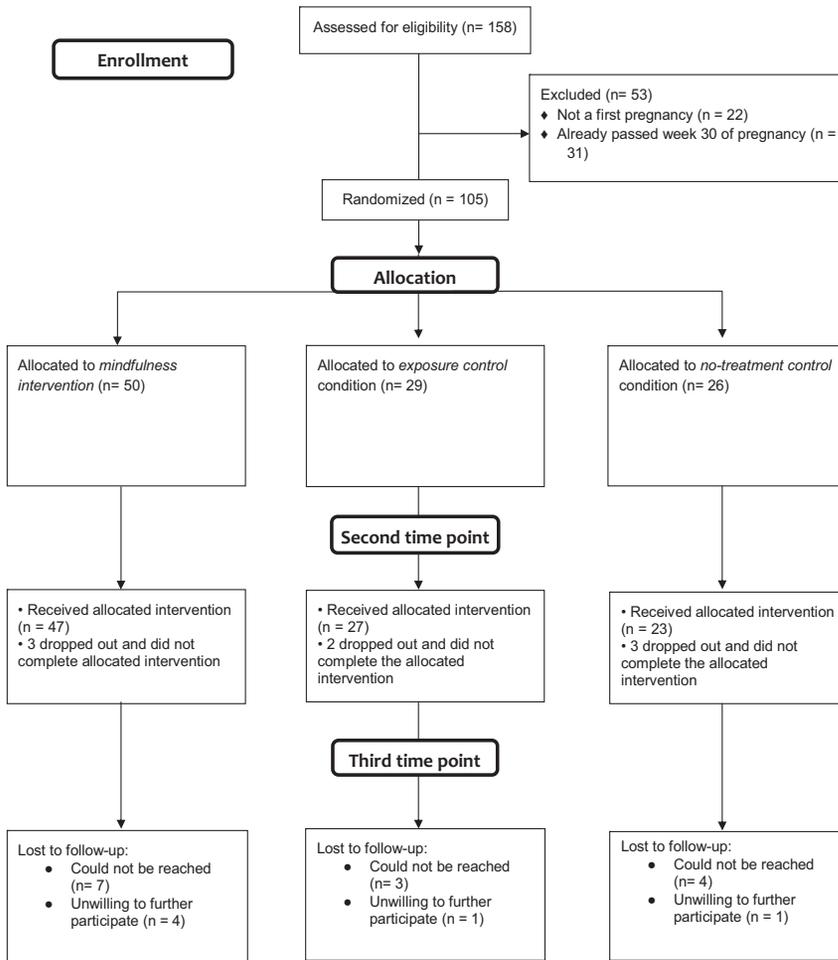


Figure 1. Study flow diagram.

respond to each item on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach's alphas were satisfactory for all three measurement points (.85–.90).

To assess the neonates' health, participants reported the Apgar at birth and 5 minutes later. The medical staff assigned the Apgar scores and communicated them to the parents. The Apgar score is used in delivery wards worldwide to quickly evaluate the clinical status of newborns 1 minute and 5 minutes after birth (Apgar, 1953; Casey, McIntire, & Leveno, 2001; Rüdiger, Wauer, Schmidt, & Küster, 2006). The Apgar score is determined by examining the infant for five criteria: heart rate, respiratory effort, muscle tone, reflex irritability, and color. Each criterion is assigned a value of 0 to 2 (a total range of 0–10), with higher scores meaning better health status (Drage, Kennedy, & Schwarz, 1964). In the present study, the Apgar scores were based on participants' self-report, which in turn was based on information provided to them after the baby's birth and reported on the letter of release they received from hospital. Information from participants' self-report was verified based on the letter of release from hospital, which 64% of participants made available to the research staff; the information was correct in all cases except one.

Procedure

To examine the changes in well-being and affect in pregnant women as the result of mindfulness training, immediately after the first measurement (T1), participants were randomly assigned to

one of the following three groups in a 2:1:1 ratio, so that for every two participants assigned to the *mindfulness intervention* group, one was assigned to the *exposure control* group and one to the *no-treatment control* group. Participants in the mindfulness intervention condition took part in a short mindfulness training program of attention to sensation variability, involving a total of one-half hour of engagement. The program included two parts. In the first part, participants received explicit written instructions to attend to the natural fluctuations in mood and physicality that occur throughout the day. A research assistant verified that participants read and understood the instructions. No face-to-face instruction was provided.

The second part involved completing twice a day a brief diary at random times. The diary contained questions assessing physical functioning and mood, aimed at raising awareness to variations in mood and physicality that occur throughout the day. Participants were contacted on their cell phone at the times they had to complete the diary. The diary was completed on their cell phones via an active web link. Questions referred to physical sensations (e.g., “How much pain do you feel right now?”), positive and negative moods (e.g., “How much anxiety do you feel right now?” and “How much excitement do you feel right now?”), and energy level (“How much energy do you feel right now?”). Questions were answered on a 7-point scale. Compliance rate for diary completion was 81%.

Because experienced symptoms may be positive and negative, we included an *exposure control* condition that exposed participants to positive and negative experiences during pregnancy via reading stories of other women who reported positive and negative experiences. The purpose of this group was to control for exposure to positive outcomes that would naturally result from attention to variability, enabling us to conclude that it was attention to changes (mindfulness) that accounted for any potential differences rather than merely a positivity effect. The amount of time with experimenters in the mindfulness intervention and exposure control was equal.

The stories were created based on semistructured interviews with seven pregnant women who were not included in the study. In the stories, the women described their feelings and physical sensations during pregnancy and reported on the natural fluctuations occurring between positive and negative feelings. Specifically, they portrayed feelings of joy, gratefulness, and happiness together with difficulty and moodiness. We created seven coherent narratives based on these women’s stories and sent them to participants one at a time at fixed intervals during the 2 weeks of intervention, to encourage continual time investment during the 2 weeks.

We also included a no-treatment control group whose participants did not receive any instruction but completed all the measures at the same intervals as those of the previous two groups. No group differences were found in the LMS or any of the demographical measures conducted at the start of the study. The outcomes of the short training were measured 1 week after the end of the training phase, using both qualitative (i.e., narratives) and quantitative (i.e., questionnaires) measures. In addition, using the LMS we assessed the relationship between trait mindfulness and mother and infant health. Participants completed all questionnaires and supplied the narratives by e-mail.

Measurement Time Points

Measures were taken at three points in time: (a) during Weeks 25–30 of pregnancy (T1), (b) 3 weeks later (T2), and (c) 1 month after birth (T3). After completing the questionnaires at T1, participants were randomly assigned to one of the three groups, and participants in the mindfulness intervention and the exposure control groups received the manipulation. T2 was timed to be administered 1 week after the end of the mindfulness training, at Weeks 28–33, and aimed to assess the short-term effects of mindfulness training on participants. T3, timed 1 month after birth, was aimed at assessing the effects of the mindfulness trait on participants’ mental health and on their child’s health.

All participants were asked to write a narrative at T2, describing their experience over the preceding 3 weeks (the time that elapsed between T1 and T2). The instructions were: “Please describe your experience over the past three weeks of pregnancy. You may do so by writing generally about it or by describing specific occurrences, as you wish.”

Results

Mindfulness Trait

To examine the associations between the mindfulness trait and pregnant women's well-being, we computed a series of correlations between the LMS, as measured at T2, and the psychological outcomes, as measured in T3. The LMS scale at T2 correlated positively with outcome measures of well-being ($r_{(74)} = .25, p < .05$), positive affect ($r_{(74)} = .31, p < .01$), self-esteem ($r_{(74)} = .19, p < .05$), and life satisfaction ($r_{(74)} = .27, p < .01$), and negatively with distress ($r_{(74)} = -.21, p < .05$) and negative affect ($r_{(74)} = -.20, p < .05$) at T3.

Next, we analyzed the relationships between the LMS and birth outcomes. The LMS was positively related to Apgar scores immediately and 5 minutes after birth ($r_{(75)} = .24, p < .05$ and $r_{(75)} = .27, p < .05$ respectively). Findings remained significant even after controlling for socioeconomic status for both Apgar scores ($ps < .05$).

Mindfulness Treatment: Quantitative Analysis

To assess the effect of mindful attention to variability training on mental health, we analyzed the data in a 3×2 analysis of variance, with manipulation type (mindfulness intervention, exposure control, and no-treatment control) as a between-subjects variable and time (pretraining, posttraining) as a within-subject factor for each psychological measure. The positive mental health measures were well-being, positive affect, self-esteem, and life satisfaction; the negative mental health measures were emotional distress and negative affect. There were no differences between the two control groups. For all psychological measures, we found no significant main effects for time or manipulation type, all $F(2,66)s < 1.51$, n.s., and no significant interaction effects (manipulation type \times time) all $F(2,66)s < 2.97$, n.s.

In accordance with our a priori directional hypothesis, we tested planned interaction contrasts (manipulation type \times time) on all measures. We expected the mindfulness intervention group to report a greater improvement than the exposure control and no-treatment control groups in positive mental health measures and a lower decrease in negative mental health measures.

As predicted, we found that participants in the mindful intervention group showed better psychological outcomes after the mindfulness training than did participants in the control groups. Participants in the mindfulness intervention group reported a greater increase in levels of well-being, $t_{(66)} = 1.72, p < .05, r = .21$, and positive affect, $t_{(66)} = 1.68, p < .05, r = .20$, and a greater decrease in levels of emotional distress, $t_{(66)} = -2.04, p < .05, r = .24$, and negative affect, $t_{(66)} = -1.76, p < .05, r = .21$, than did participants in the exposure control and no-treatment control groups. Table 1 presents the means and standard deviations of the two groups before and after the manipulation. These results suggest that attention to variability training increased the individuals' positive affect and served as a buffer against deterioration in mental health during pregnancy. The effect of the mindfulness intervention did not persist until T3, a month after delivery ($ps \geq .11$).

Mindfulness Treatment: Qualitative Analysis

We used qualitative methods of inquiry to examine the mechanisms that underlie the resulting changes and assess whether the training functioned as intended. We anticipated that the mindfulness intervention would increase awareness to variation in everyday sensations, and that this understanding would help the women realize that all negative physical and emotional sensations were temporary and transient, resulting in a healthier mindset.

To further explore the influences of short-term attention to variability training on the pregnant women's well-being and affect, we examined the narratives, written during Weeks 28–33 (e.g., at T2, 3 weeks after the start of the manipulation). We used thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006; Crabtree & Miller, 1992), a method that involves identifying themes in the data through a recursive process of careful reading and rereading. Following Braun and Clarke (2006), we familiarized ourselves with the narratives, generated an initial set of codes, collated

Table 1
Means and SDs of the Mental Health Measures as a Function of Study Condition

Intervention		No-treatment control		Exposure control		Mindfulness intervention	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
^a Well-being	Pre	3.93	.97	4.15	.71	3.69	.75
	Post	3.97	.84	3.80	.93	3.90	.75
^a Psychological distress	Pre	1.84	.73	1.97	.86	2.21	.66
	Post	1.93	.52	2.28	.77	2.04	.53
^a Positive affect	Pre	3.56	.70	3.63	.43	3.59	.59
	Post	3.62	.61	3.36	.67	3.71	.55
^a Negative affect	Pre	1.76	.75	1.99	.77	2.02	.72
	Post	1.91	.65	2.36	.73	1.96	.55
Self-esteem	Pre	3.45	.58	3.39	.33	3.50	.41
	Post	3.55	.49	3.50	.40	3.52	.40
Life satisfaction	Pre	5.81	.81	5.15	.94	5.50	1.06
	Post	5.89	.72	5.56	1.20	5.89	.87

Note. M = mean; SD = standard deviation.

^aPsychological measures with significant interaction contrasts.

the codes into potential themes, assembled the data relevant to each potential theme, and finally generated a thematic map of the analysis.²

We found clear differences between the narratives of the mindfulness intervention group and the two control groups. The themes we identified belonged to one central focus, increase in self-awareness, which includes five subthemes: (a) increase in awareness of changes throughout the day in one's physical and emotional sensations; (b) adoption of a more complex view of one's sensations and perception, integrating both negative and positive elements of these experiences; (c) narration of the process of abandoning past mindlessness in favor of a more mindful mindset; (d) sense of relief at discovering the fluctuation of negative sensations; and (e) new insights about oneself at this specific time (i.e., the 3 weeks between T1 and T2). Illustrative quotations are provided in Table 2.

Two independent raters coded the narratives, rating the extent to which each narrative included references to each of the above-mentioned five categories (0 = no references were made, 1 = one reference, 2 = two references, etc.). The raters were blind to study goals and the participants' group. Interrater reliabilities were high, averaging 0.91 for the five categories. As can be seen in Table 3, in three of the five categories, we found significant differences between the mindfulness intervention group and the two control groups. Using planned contrast tests, we found an increase in awareness of changes throughout the day in the mindfulness intervention group relative to the control groups, $t_{(90)} = 2.54, p < 0.01$. The mindfulness intervention group adopted a more complex view of their sensations and perceptions, integrating both negative and positive elements of these experiences, $t_{(90)} = 2.27, p < 0.05$. They also reported more insights about themselves, $t_{(90)} = 2.07, p < 0.05$, and showed a tendency to report feelings of relief at discovering the fluctuation of negative sensations, $t_{(90)} = 1.8, p = 0.06, n.s.$

In sum, the narratives confirmed that the attention to variability training was functioning as intended. Participants described remaining in the present moment and being aware of multiple fluctuations in their sensations, acknowledging that each moment would pass and be replaced by the experience of the next moment throughout pregnancy. Many participants reported that

²In the present study we focused on a set of relevant themes. The narratives were extremely rich in content, as is often the case, and other themes could be found if we were to focus on other topics of interest (episodic details about projects at the participants' workplace, medical examinations, etc.).

Table 2
Illustrative Quotations of the Five Subthemes Identified in the Participants' Narratives

Subthemes	Illustrative quotations
Increase in awareness toward changes throughout the day in one's physical and emotional sensations	I began to feel my belly a lot more and everything that was going on in there, the changes my fetus and I were going through. I noticed the hours when she was more active, the hours she slept, positions in which she was calm and positions that made her kick. Without a doubt, I started to fall in love with my pregnancy and of course with the fetus, too.
Adoption of a more complex view of one's sensations and perceptions, which integrates both negative and positive elements of these experiences	Even when I was anxious, because I couldn't feel my baby moving all morning, I realized that I had been feeling not only anxiety but also a deep, loving care toward him. I also appreciated my boss's concern for me, who gave me chocolate (to get my baby to move), and I was angry at my husband for being so far away from me when I needed him . . . And all these thoughts and feelings at once!
Narration of the process of abandoning past mindlessness in favor of a more mindful mindset	Thanks to this study I have learned to listen to myself and be more aware and positive toward myself and the fetus . . . I don't have to feel bad all the time, and in reality I don't feel bad all the time. When I'm feeling down I ask myself when it started, <i>Have I really felt bad all day?</i> And have I really taken everything into account, or am I just sticking to one specific thing and forget everything else?
Sense of relief at discovering the fluctuation of negative sensations	I understood that even if at a specific moment I feel annoyed, and as though my hormones are raging, in an hour I may feel totally different, calmer, and that if I just give it time things will pass by themselves.
New insights about oneself in this specific period of time	I discovered surprises for better or worse . . . Sometimes it really felt like I was getting to know myself afresh, for better or worse.

Table 3
Means and SDs of the Prevalence of Each Category as a Function of Study Condition

Intervention	<i>No-treatment control</i>		<i>Exposure control</i>		<i>Mindfulness intervention</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
^a Increase in awareness	.50	1.65	.38	.74	1.24	1.42
^a Integrative view of sensations	.35	0.49	.21	1.01	.71	.41
^a Insights about oneself	.61	1.33	1.29	1.19	1.55	1.29
Relief due to increase in awareness	.11	.59	.11	.73	.33	.39
Adopting mindful mindset	.06	.24	.1	.3	.26	.60

Note. M = mean; SD = standard deviation.

^aCategories with significant interaction contrasts.

it helped them form a more comprehensive perception of their pregnancy, cope with difficult times, and prepare themselves for motherhood. Overall, the findings suggest that mindfulness (both trait and state) results in well-being for women during their first pregnancy and can predict positive birth outcomes.

Discussion

The findings of the quantitative data, the narrative analysis, and the LMS together suggest that mindfulness may enhance the pregnancy experience for both mother and fetus and can be taught. The short mindfulness training described in this article was associated with improvement

in participants' ability to cope with distress, negative affect, and the developmental transition to parenthood. This positive adaptation may in turn influence stress responses that can affect long-term physical and mental health outcomes for the expecting mother and her child. The mindfulness trait was found to predict mental health, positive and negative affect, self-esteem, and life satisfaction up to at least 1 month after birth. Perhaps even more important, it was also found to be positively associated with neonatal outcomes.

The results of the present study represent an initial step in the systematic analysis of the causal relationship between mindful attention to variability and successful childbirth. Future studies should address the limitations of the current one. Specifically, they should implement longer training periods (i.e., longer than the total of a half an hour used in the present study), to examine potential long-term effects of a more intensive intervention. Increasing the number of participants in each group and the number of points of measurements would make it possible to detect moderating and mediating effects on the mindfulness training.

Future studies may also follow the women for a longer duration, both before and after training, including the initial stages of attempting to become pregnant and throughout the development of the children in their preschool and elementary school years. This would make it possible to examine the effects of the mindfulness intervention on children's cognitive and emotional development. It is also important to examine additional outcomes of the mindfulness training, relevant to the childbirth (such as complications during delivery, infant birth weight, and subjective estimation of the pain experienced) and pregnancy complications (such as gestational diabetes and preeclampsia).

Conclusion

The present results represent an initial step in the systematic analysis of the causal relationship between mindful attention to variability and successful childbirth. In an area of research in which almost no psychosocial intervention has produced effective change in the general population of pregnant women (for a review, see Clatworthy, 2012), the current findings may be of great importance if they could be replicated in future studies with larger sample sizes. Finding a relationship between attention to variability and successful childbirth has several implications. For pregnant women, the shift between mindlessly viewing a physical symptom as stable and mindfully attending to variability may have important consequences for the management of that symptom, as well as more generally for their and their babies' health in both the short and long terms. No less important is the fact that mindfulness is a low-cost intervention.

Although all populations may benefit from attention to variability (for a review, see Langer, 2009), mindfulness training may be even more effective in situations that are characterized by rapid change but generally tend to be experienced as stable. Attending to sensation or symptom variability may produce three results: (a) the person becomes aware that the sensation, symptom, or problem is not always present and thus the condition is less daunting than it appeared at first; (b) it may raise the question "Why am I experiencing it now?" which may lead to a search for an answer and a possible solution; and (c) regardless of whether the question has been answered successfully, the search it initiates may be mindful and as such independently beneficial for the individual's health (see Langer, 2009).

References

- Alexander, C. N., Chandler, H. M., Langer, E. J., Newman, R. I., & Davies, J. L. (1989). Transcendental meditation, mindfulness and longevity: An experimental study with the elderly. *Journal of Personality and Social Development*, *57*, 950-964.
- Apgar, V. (1953). A proposal for a new method of evaluation of the newborn infant. *Current Researches in Anesthesia and Analgesia*, *32*, 260-267.
- Austin, M., & Leader, L. (2000). Maternal stress and obstetric and infant outcomes: Epidemiological findings and neuroendocrine mechanisms. *The Australian and New Zealand Journal of Obstetrics*, *40*, 331-37.
- Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. New York: Sage.

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101.
- Burpee, L., & Langer, E. (2005). Mindfulness and marital satisfaction. *Journal of Adult Development*, 12, 43–51.
- Casey, B. M., McIntire, D. D., & Leveno, K. J. (2001). The continuing value of the Apgar score for the assessment of newborn infants. *New England Journal of Medicine*, 344, 467–71.
- Clatworthy, J. (2012). The effectiveness of antenatal interventions to prevent postnatal depression in high-risk women. *Journal of Affective Disorders*, 137, 25–34.
- Crabtree, B. F., & Miller, W. F. (1992). A template approach to text analysis: Developing and using code-books. Doing qualitative research. *Research Methods for Primary Care*, 3, 93–109.
- Crum, A. J., & Langer, E. J. (2007). Mind-set matters exercise and the placebo effect. *Psychological Science*, 18, 165–171.
- Da Costa, D., Brender, W., & Larouche, J. A. (1998). Prospective study of the impact of psychosocial and lifestyle variables on pregnancy complications. *Journal of Psychosomatic Obstetrics & Gynecology*, 19, 28–37.
- Da Costa, D., Dritsa, M., Larouche, J., & Brender, W. (2000). Psychosocial predictors of labor/delivery complications and infant birth weight: A prospective multivariate study. *Journal of Psychosomatic Obstetrics & Gynecology*, 21, 137–148.
- Delizonna, L. L., Williams, R. P., & Langer, E. J. (2009). The effect of mindfulness on heart rate control. *Journal of Adult Development*, 16, 61–65.
- Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, 49, 1. 71–75.
- DiPietro, J. A., Hodgson, D. M., Costigan, K. A., Hilton, S. C., & Johnson T. R. B. (1996). Fetal neurobehavioral development. *Child Development*, 67, 2553–2567.
- Dole, N., Savitz D. A., & Hertz-Picciotto I. (2003) Maternal stress and preterm birth. *American Journal of Epidemiology*, 157, 14–24.
- Drage, J. S., Kennedy, C., & Schwarz, B. K. (1964). The Apgar score as an index of neonatal mortality. A report from the collaborative study of cerebral palsy. *Journal of Obstetrics & Gynecology*, 24, 222–230.
- Dunkel Schetter, C. (2009). Stress processes in pregnancy and preterm birth. *Current Directions in Psychological Science*, 18, 205–209.
- Field, T., Diego, M., Hernandez-Reif, M. (2008). Prenatal dysthymia versus major depression effects on the neonate. *Infant Behavior & Development*, 31, 190–193.
- Gardner, F. L., & Moore, Z. E. (2004). A mindfulness-acceptance-commitment-based approach to athletic performance enhancement: Theoretical considerations. *Behavior Therapy*, 35, 707–723.
- Glover V., O'Connor T. G., & O'Donnell, K. (2010). Prenatal stress and the programming of the HPA axis. *Neuroscience & Biobehavioral Reviews*, 35, 17–22.
- Hedegaard, M., Henriksen, T. B., Sabroe, S., & Secher, N. J. (1993). Psychological distress in pregnancy and preterm delivery. *BMI*, 307, 234–239.
- Henrichs, J., Schenk, J. J., Kok, R., Ftitacheb, B., Schmidt, H. G., Hofman, A., . . . Tiemeier, H. (2011). Parental family stress during pregnancy and cognitive functioning in early childhood: The Generation R Study. *Early Childhood Research Quarterly*, 26, 332–343.
- Kabat-Zinn, J. (1994). *Wherever you go there you are: Mindfulness meditation in everyday life*. New York: Hyperion.
- Langer, E. (1989). *Mindfulness*. Reading, MA: Addison-Wesley.
- Langer, E. J. (2009). *Counterclockwise: Mindful health and the power of possibility*. New York: Ballantine Books.
- Langer, E., J., Blank, A., & Chanowitz, B. (1978). The mindlessness of ostensibly thoughtful action: The role of “placebic” information in interpersonal interaction. *Journal of Personality and Social Psychology*, 36, 635–642.
- Langer, E. J., & Chanowitz, B. (1981). Premature cognitive commitment. *Journal of Personality and Social Psychology*, 41, 1051–1063.
- Langer, E., Hatem, M., Joss, J., & Howell, M. (1989). Conditional teaching and mindful learning: The role of uncertainty in education. *Creativity Research Journal*, 2, 139–150.
- Langer, E. J., & Imber, L. G. (1979). When practice makes imperfect: debilitating effects of overlearning. *Journal of Personality and Social Psychology*, 37, 2014–2024.

- Langer, E. J., & Moldoveanu, M. (2000). The construct of mindfulness. *Journal of Social Issues*, 56, 1–9.
- Langer, E. J., & Piper, A. I. (1987). The prevention of mindlessness. *Journal of Personality and Social Psychology*, 53, 280–287.
- Langer, E., & Rodin, J. (1976). The effects of enhanced personal responsibility for the aged: A field experiment in and institutional setting. *Journal of Personality and Social Psychology*, 34, 191–198.
- Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews Neuroscience*, 10, 434–445.
- Mastorci, F., Vicentini, M., Viltart, O., Manghi, M., Graiani, G., Quaini, F., . . . Sgoifo, A. (2009). Long-term effects of prenatal stress: Changes in adult cardiovascular regulation and sensitivity to stress. *Neuroscience & Biobehavioral Reviews*, 33, 191–203.
- Merlot, E., Couret, D., & Otten, W. (2008). Prenatal stress, fetal imprinting and immunity. *Brain Behavior and Immunity*, 22, 42–51.
- Miller, R. L., Pallant, J. F., & Negri, L. M. (2006). Anxiety and stress in the postpartum: is there more to postnatal distress than depression? *BMC Psychiatry*, 24, 6–12.
- Nielsen Forman, D., Videbeck, P., Hedegaard, M., Dalby Salvig, J., & Secher, N. J. (2000) Postpartum depression: identification of women at risk. *Journal of Obstetrics & Gynaecology*, 107, 1210–1217.
- O'Donnell, K., O'Connor, T. G., & Glover, V. (2009). Prenatal stress and neurodevelopment of the child: focus on the HPA axis and role of the placenta. *Developmental Neuroscience* 31, 285–292.
- Pagel, M. D., Smilkstein, G., Regen, H., & Montano, D. (1990). Psychosocial influences on new born outcomes: a controlled prospective study. *Social Science & Medicine*, 30, 597–604.
- Pirson, M., Langer, E. J., Bodner, T., & Zilcha-Mano, S. (2015). The Development and Validation of the Langer Mindfulness Scale—Enabling a socio-cognitive perspective of mindfulness in organizational contexts (Fordham University Schools of Business research paper). Retrieved from: <http://ssrn.com/abstract=2158921>
- Ritter, C., Hobfoll, S. E., Lavin, J., Cameron, R. P., & Hulsizer, M. R. (2000). Stress, psychosocial resources, and depressive symptomatology during pregnancy in low-income, inner-city women. *Health Psychology*, 19, 576–585.
- Rodin, J., & Langer, E. (1977). Long-term effects of a control-relevant intervention among the institutionalized aged. *Journal of Personality and Social Psychology*, 35, 897–902.
- Rosenberg, M. (1965). Rosenberg Self-Esteem Scale (RSE). Acceptance and Commitment Therapy, Measures package, 61-62.
- Rüdiger, M., Wauer, R. R., Schmidt, K., & Küster, H. (2006). The Apgar score. *Pediatrics*, 118, 1314–1315.
- Schaefer, C., Hiatt, R. A., Swan, S., & Windham, G. (1997). Psychosocial stress and spontaneous abortion. *Annals of Behavior Medicine*, 19S, 70.
- Schetter, C. D., & Tanner, L. (2012). Anxiety, depression and stress in pregnancy: Implications for mothers, children, research, and practice. *Current Opinion in Psychiatry*, 25, 141–148.
- Seligman, M. E. (1974). *Depression and learned helplessness*. New York: John Wiley & Sons.
- Veit, C. T., & Ware, J. E. (1983). The structure of psychological stress and well-being in general populations. *Journal of Consulting and Clinical Psychology*, 51, 730–742.
- Viltart, O., & Vanbesien-Mailliot, C. C. (2007). Impact of prenatal stress on neuroendocrine programming. *The Scientific World Journal*, 7, 1493–1537.
- Wadhwa, P. D., Dunkel-Schetter, C., Chicz-DeMet, A., Porto, M., & Sandman, C. A. (1996). Prenatal psychosocial factors and the neuroendocrine axis in human pregnancy. *Psychosomatic Medicine*, 58, 432–46.
- Watson, D., Clark, L. A., & Tellegan, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063–1070.