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Development and validation of the Mindful Parenting in Infancy Scale (MPIS)

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Abstract

Although mindfulness in parenting has been recognized as important for some time, there is a dearth of measurement tools, especially for caregivers of infants. Two studies were conducted: (1) developing and providing an initial psychometric evaluation of the Mindful Parenting in Infancy Scale (MPIS) and (2) reproducing initial findings with an independent sample of infants and caregivers. In Study 1, 37 caregivers of infants (3–12 months of age) responded to MPIS, providing indicators of parenting stress and infant temperament. Study 2 caregivers ($N = 57$) responded to identical measures, with infant electroencephalogram (EEG) recorded during the Still Face Procedure, along with a baseline condition. Study 1 results indicated good internal consistency, with Study 2 providing additional support for reliability. Correlations with parenting stress markers were also significant across both investigations, indicative of greater stress with lower levels of mindfulness. A number of correlations with temperament scores were also significant, and in the hypothesized direction, across both studies. Importantly, the MPIS score was predictive of infant frontal EEG asymmetry in a path model examined in the context of Study 2. Thus, the present investigation provides support for MPIS as a promising brief measurement tool based on results obtained with two independent samples.

1 | INTRODUCTION

Mindfulness has become a central concept in many areas of psychology in recent years, largely because it has been construed as an attribute of consciousness that promotes well-being. The notion of mindfulness is rooted in Buddhist and related traditions, defined as the act of conscious attention and awareness that are actively cultivated—the state of being attentive to and aware of what is taking place in the present (Brown & Ryan, 2003). Mindful actions in parenting are characterized by intentionality in parent–child interactions, such as careful listening and attention to the child, low reactivity, a nonjudgmental attitude, emotional awareness, compassion for the self and child (Duncan et al., 2009; Kabat-Zinn & Kabat-Zinn, 1998), linked with more adaptive parenting practices, and in turn fewer behavior problems in children (Parent et al., 2016). The mindful parenting model is based on the idea that in the caregiving context, mindfulness promotes well-being through increased parenting coping, and as such, mindfulness-related techniques have been employed for the purposes of stress reduction in the parental role. Additional research examining links between mindful parenting and child outcomes on behavioral and biological/physiological levels is critical given the widespread use of mindfulness enhancing techniques as vehicles for intervention/preventative services, and the present study addresses this gap in research, also considering the contribution of parenting stress.

Thus, mindfulness has been targeted by intervention efforts aimed at parenting, with several addressing parenting infants (Altmaier & Maloney, 2007; Burgdorf et al., 2019; Chaplin et al., 2018; Potharst et al., 2017; Reynolds, 2003). Burgdorf et al. (2019) conducted a meta-analytic review, including 25 independent studies. These authors reported a small, post-intervention reduction in parenting stress ($g = 0.34$), with a moderate reduction observed at 2-month follow-up ($g = 0.53$) and a small improvement in child outcomes ($g = 0.27$).

Despite this proliferation in mindfulness-based parenting interventions, measurement efforts have not kept up, especially for infants. The Interpersonal Mindfulness in Parenting (IM-P) scale, originally designed for use with adolescents (Duncan, 2007), and the Mindfulness in Parenting Questionnaire (MIPQ), intended for caregivers with children in the 2–16 years of age range (McCaffrey, 2015; McCaffrey et al., 2017), appear to be the only options. The IM-P has been used more extensively, including studies with infants, and it should be noted most of these were conducted with international samples (Burgdorf & Szabó, 2021; Kim et al., 2019; Laurent et al., 2017; Lo et al., 2018; Moreira & Canavarro, 2017; Potharst et al., 2020). Although some of the studies including infants modified the IM-P to make the instrument content appropriate for the younger children, these adjustment have not been uniform and often minimal in scope (e.g., "child" was changed to "baby" and "parenting" or "raising" to "nurturing"; Potharst et al., 2020). Moreover, studies focused on infants have often included broad age ranges (e.g., 0–2 years; Burgdorf & Szabo), significant because of the rapid rate of development in the first year of life. Nonetheless, IM-P content is relevant to further measurement efforts with infants, as evaluations with older children provided evidence of links between mindfulness indicators and positive parenting—parenting practices that encompass proactive guidance, appropriate reinforcement, emotional warmth, and parental support, and lower levels of child externalizing problems (Dodsworth, 2018). The 27-item IM-P adaptation for infants demonstrated links with physiological stress markers, wherein higher scores were associated with steeper maternal cortisol recovery slopes observed during a mildly stressful experimental manipulation—the Still Face task. Work with this instrument inspired the present effort addressing an important gap in research, presenting measurement development (Study 1) and validation (Study 2) of the first brief parenting mindfulness instrument designed specifically for caregivers of infants.

In addition to a psychometric evaluation, in both studies links with parenting stress and infant temperament were considered, in light of prior research and because of their respective importance to child behavioral/emotional outcomes. In addition to established associations with mindfulness in parenting

(Fernandes et al., 2020; Gouveia et al., 2016; Moreira & Canavarro, 2018; Moreira et al., 2019), parenting stress has been consistently shown to impact quality of parent–child interactions and child behavior problems (Belsky, 1984; Cherry et al., 2019; Hattangadi et al., 2020; Ward & Lee, 2020). For example, parenting stress can interfere with parent's ability to respond appropriately to the child in difficult situations and undermines responsive parenting more broadly (Belsky, 1984; Robers, 1989; Ward & Lee, 2020). Under stress, parents face the risk of becoming more rejecting, controlling, and reactive, expressing less warmth, which can ultimately result in poorer quality parent–child exchanges and relational fit (Belsky, 1984; Crnic et al., 2005; Crnic & Ross, 2017; Le et al., 2017). Infant temperament development was shown to be influenced by maternal mindfulness (van den Heuvel et al., 2015) as well as parenting stress (Gartstein & Hancock, 2019). Etiology of temperament is important to explore further because negative emotionality and positive affectivity, as well as the self-regulatory component, have been linked with behavior problems and onset of symptoms/disorders (Delgado et al., 2018; Gartstein et al., 2012; Leve et al., 2005). Relations with maternal mindfulness are especially critical, as mindful parenting is malleable and emendable to intervention efforts (Potharst et al., 2017; Reynolds, 2003). Study 2 provided an opportunity to quantify links between parenting stress, maternal mindfulness, and neurophysiological aspects of temperament—namely frontal electroencephalogram (EEG) asymmetry measured during a mildly stressful task previously utilized in mindful parenting research (i.e., Still Face paradigm). Briefly, left frontal EEG asymmetry is associated with approach, positive affect, and resilience, whereas relative right frontal activation is thought to provide neurophysiological basis for negative affect and withdrawal-related emotions/motivation (Curtis & Cicchetti, 2007; Hane et al., 2008; Reznik & Allen, 2018). Parenting/parent–child interactions have been linked with asymmetry (Hane & Fox, 2006; Swingler et al., 2014), including in the context of the Still Face procedure (Gartstein, 2019).

It was hypothesized that the new brief parenting mindfulness questionnaire—Mindful Parenting in Infancy Scale (MPIS)—would be demonstrated as internally consistent across both investigations. Study 1 and Study 2 were also expected to support construct validity via links with overall parenting stress and its components: competence, attachment to child, restriction in parental role, relationship with spouse/partner, depressive symptoms, and infant temperament, at the factor (i.e., negative emotionality, positive affectivity/surgency, regulatory capacity/orienting) and fine-grained (i.e., scale) level. Importantly, for Study 2, we expected to find significant indirect effects, wherein overall parenting stress would be related to mindfulness in parenting, in turn predicting frontal EEG asymmetry. Given previously observed relations between maternal mindfulness and behavioral manifestations of infant temperament (van den Heuvel et al., 2015), examination of neurophysiological underpinnings of temperament represents the next logical step in research, with the contribution of parenting stress considered given extensive literature showing links to mindfulness in parenting (Fernandes et al., 2020; Gouveia et al., 2016; Moreira & Canavarro, 2018). Thus, the primary focus was on the association between mindful parenting and frontal alpha asymmetry, with the stress-related effects considered with respect to mindfulness in parenting, consistent with earlier research (Fernandes et al., 2020; Moreira & Canavarro, 2018).

2 | STUDY 1 METHOD

2.1 | Participants

Mothers with infants 3–12 months of age were enrolled in a temperament parent guidance program evaluation, wherein information regarding the psychobiological model of temperament was

shared in an effort to improve goodness-of-fit between caregivers' demands/expectations and child temperament. Recruitment was carried out via social media (i.e., Facebook) advertisements, local birth centers/parent–infant programs, and pamphlets distributed in locations frequented by families with infants (e.g., pediatricians, local mall, and farmers market). All mothers were English-speaking, because some of the included instruments have not been translated into other languages, and over 18 years of age in order to provide informed consent. Children with significant medical or birth complications, including infants born preterm (<37 weeks of gestation) and/or with identified developmental delays/disabilities, were excluded as these conditions have been associated with temperament-related effects (Gartstein et al., 2006; LowKapalu & Gartstein, 2016). Parents were provided with a detailed account of assessment-related demands and told that they would receive general temperament information following the initial (pre-intervention) evaluation. They were also told that although this parent guidance has not been previously delivered/evaluated, we expected that the temperament-related information would be beneficial to caregivers (e.g., with respect to the parent–child relationship). Participants were provided a gift card, a $10 value, upon completion of the post-intervention evaluation. All of the data presented herein were collected prior to the intervention, during a baseline assessment. A total of 37 mothers of infants agreed to participate in the study (mean infant age = 8.12 months, SD = 2.76 months; 17 girls) and were included in the analyses. The present study was conducted according to the Declaration of Helsinki guidelines, with written informed consent obtained from a parent or guardian for each child before any assessment or data collection. This study was approved by the Washington State University Institutional Review Board (IRB), with all data collection conducted in a manner consistent with American Psychological Association (APA) ethical standards.

The mean age of participating mothers was 29.8 years (range = 21–35.5 years, SD = 3.59). The sample was predominantly White (94.3%), with 5.7% identifying as Asian, consistent with local demographics. All women endorsed being married or cohabitating, with the majority of the sample (78%) reporting an income >$30,000. The mean level of education for mothers was 16.97 (range = 12–24 years, SD = 2.83), indicating majority had attended at least some college.

2.2 | Procedure

The Mindful Parenting in Infancy Scale (MPIS) was developed based on the existing general mindfulness and mindfulness in parenting literature, in consultation with infancy and mindfulness experts, as well as parents of infants. Specifically, we have considered contents of the IM-P items (Duncan, 2007) and were guided by the Duncan et al. (2009) model of mindful parenting focusing on (1) present-centered attention and emotional awareness during parenting interactions; (2) openness and non-judgmental receptivity to child; and (3) regulation of reactivity to child's behavior. Moreover, our aim was to develop a brief inventory containing questions specifically relevant to parenting infants (Table 1). The final ten items included in MPIS following consultation with parents of infants were constructed using a 7-point scale quantifying frequency, ranging from 1-never to 7-always, with the score computed as a sum of all items (reverse-scoring four of these; Table 1).

Once mothers agreed to participate, consent forms and questionnaires were mailed. Mothers were asked to complete the packet of questionnaires prior to being exposed to the temperament parent guidance, and the analyses conducted in this study were based on the information obtained via this initial assessment.

TABLE 1 Mindful Parenting in Infancy Scale (MPIS) items

1. I find myself not being as attentive as I could be to my child, because my mind is preoccupied with other things[a]
2. When I'm upset with my child, I notice how I am feeling before I take action
3. I notice how changes in my child's mood affect my mood
4. I always do what is best for my child, even if it inconveniences me
5. I often react too quickly to what my child does[a]
6. I am aware of how my moods affect the way I treat my child
7. Even though it sometimes makes me uncomfortable, I allow my child to express him/herself
8. When I become upset with my child, I am able to calm down, and not have it affect my mood or the way in which I care for my child
9. I rush through activities with my child without being fully attentive to him/her[a]
10. I have difficulty accepting my child's growing independence[a]

[a]Reverse-coded items.

2.3 | Measures

2.3.1 | Demographics questionnaire

Parents were asked questions regarding age, education, income, ethnicity, marital status, and occupation.

2.3.2 | Maternal stress and symptoms

The Parenting Stress Index (PSI) Parent Domain (Abidin, 1995) consists of 54 items that are rated on a 5-point Likert scale (from 1-strongly agree to 5-strongly disagree) with higher scores indicative of greater stress. PSI Parent Domain includes Competence, Attachment to the Child, Role Restriction, Depression, and Spouse/Partner Relationship subscales, summed to compute a Total Parenting Stress score, as previously described (Oddi et al., 2013). PSI is an established instrument with good psychometric properties (Abidin, 1995; Oddi et al., 2013).

2.3.3 | The Infant Behavior Questionnaire-revised (IBQ-R)

This parent-report measure contains 191 items that rely on a 7-point Likert scale (Gartstein & Rothbart, 2003), asking the parent to report the frequency of different child behaviors in the past 1–2 weeks (e.g., "How often during the last week did the baby smile or laugh when given a toy?"). This measure yields 14 scales shown to form three over-arching factors: Positive Affectivity/Surgency (Activity Level, Smiling/Laughter, Approach, High Intensity Pleasure, Perceptual Sensitivity, and Vocal Reactivity), Negative Emotionality (Fear, Distress to Limitations, Sadness, and negatively loading Falling Reactivity), and Regulatory Capacity/Orienting (Duration of Orienting, Soothability, Cuddliness/Affiliation, and Low Intensity Pleasure). The IBQ-R was demonstrated as reliable for mothers and fathers, and samples from different cultures, with Cronbach's α values from .77 to .96 (Gartstein et al., 2003; Parade & Leerkes, 2008). Predictive and construct validity were also supported

TABLE 2 Descriptive statistics

Variable	Study 1 Mean	Study 1 SD	Study 1 Range	Study 2 Mean	Study 2 SD	Study 2 Range
PSI—Competence	2.10	0.59	1.31–3.92	2.02	0.49	1.09–3.46
PSI—Attachment to the Child	1.66	0.49	1.00–3.00	1.58	0.50	1.00–3.67
PSI—Role Restriction	3.23	0.25	2.71–3.14	2.81	0.71	1.43–4.75
PSI—Depression	2.83	0.25	2.44–3.44	2.11	0.65	1.00–4.00
PSI—Spouse/Partner Relationship	2.96	0.17	2.71–3.14	2.44	0.74	1.00–4.33
PSI—Total Stress	12.79	1.07	11.03–16.26	10.97	2.25	6.01–18.63
IBQ-R—*Surgency/Positive Affectivity*	28.82	3.53	16.97–34.06	30.58	3.89	22.35–38.40
IBQ-R—Activity	4.23	0.69	2.69–5.67	4.68	0.77	2.60–6.33
IBQ-R—Smiling/Laughter	4.88	0.90	2.67–6.80	4.95	1.02	2.75–7.00
IBQ-R—High Intensity Pleasure	5.81	0.90	2.18–7.00	6.04	0.75	4.00–7.00
IBQ-R—Approach	5.04	1.29	1.50–6.75	5.66	0.97	3.50–6.95
IBQ-R—Vocal Reactivity	4.78	0.86	2.58–6.20	5.05	0.88	2.92–7.00
IBQ-R—*Negative Emotionality*	5.57	1.77	1.95–9.84	4.56	2.33	−1.58 to 8.75
IBQ-R—Distress to Limitations	3.62	0.88	1.64–5.81	3.81	0.84	2.00–5.88
IBQ-R—Fear	2.42	0.86	1.00–4.50	2.53	0.83	1.25–4.63
IBQ-R—Sadness	3.32	1.07	1.40–6.30	3.40	0.88	1.29–5.07
IBQ-R—Falling Reactivity	5.16	0.86	2.92–6.77	5.16	0.83	3.25–6.69
IBQ-R—*Regulatory Capacity/Orienting*	16.26	1.89	12.22–20.40	19.32	2.26	14.70–26.70
IBQ-R—Duration of Orienting	3.64	0.92	1.90–5.33	3.58	0.93	1.92–6.42
IBQ-R—Soothability	4.52	0.89	2.25–6.06	5.08	0.74	2.73–6.78
IBQ-R—Cuddliness	5.18	1.08	1.73–6.75	5.51	0.72	3.35–6.65
IBQ-R—Low Intensity Pleasure	5.12	1.02	2.46–7.00	5.16	0.87	3.25–7.00
Baseline Frontal Alpha Asymmetry	–	–	–	0.08	0.42	−0.85 to 1.11
SFP Frontal Alpha Asymmetry	–	–	–	0.10	0.36	−1.17 to 0.97

Abbreviations: IBQ-R, Infant Behavior Questionnaire-Revised; PSI, Parent Stress Inventory; SFP, Still Face Paradigm.

(Gartstein & Bateman, 2008; Gartstein et al., 2010; Gartstein & Marmion, 2008). Scale scores were computed as an average of included items, with factor scores as sums of component scales.

2.4 | Analytic strategy

Study 1 analyses began with an evaluation of internal consistency for the newly developed scale, computing Cronbach's α across the 10 items, as well as computing descriptive statistics. Although MPIS was designed to produce a single index, and we expected a unidimensional structure, two exploratory factor analytic strategies (principal axis and maximum likelihood) were employed to ensure this structure was tenable. Next, simple correlations were computed between the MPIS and parental stress indicators: Competence, Attachment to the Child, Role Restriction, Depression, Spouse/Partner Relationship, and the Total Parenting Stress score. We subsequently examined associations between MPIS and infant temperament, also relying on simple correlations, considering IBQ-R factors and scales: Positive Affectivity/Surgency (Activity Level, Smiling/Laughter, Approach, High Intensity Pleasure, Perceptual Sensitivity, and Vocal Reactivity), Negative Emotionality (Fear, Distress to Limitations, Sadness, and negatively loading Falling Reactivity), and Regulatory Capacity/Orienting (Duration of Orienting, Soothability, Cuddliness/Affiliation, and Low Intensity Pleasure).

3 | STUDY 1 RESULTS

Descriptive statistics for all of the included variables are provided in Table 2. MPIS was demonstrated as internally consistent (α = .80), with the two factor analytic approaches employed herein failing to provide support for multidimensional structure. That is, factors beyond the first one were associated with a considerable drop in eigenvalues/variance accounted (e.g., from 41% to 14%), and the latter factors also did not appear to be readily interpretable.

Pearson product moment correlations between MPIS and PSI indicators were computed next (Table 3), with all but one reaching statistical significance and in the predicted direction—higher levels of mindfulness in parenting were associated with lower levels of overall parenting stress, depressive symptoms related to the parental role, fewer concerns with competence/efficacy in parenting, less problematic attachment/bonding with the child, and fewer concerns around relationship with spouse or partner. Multiple significant associations were also observed with infant temperament (Table 3). Specifically, higher levels of mindfulness in parenting were related to higher Positive Affectivity/Surgency and Regulatory Capacity/Orienting. On the fine-grained level, Approach and High Intensity Pleasure were associated with significant effects, and a trend-level effect was observed for Smiling/Laughter, all in the same direction—higher MPIS scores related to higher levels of these positive emotionality-related attributes. With respect to regulation-related dimensions, significant correlations were obtained for Duration of Orienting and Low Intensity Pleasure.

4 | STUDY 1 DISCUSSION

Study 1 provided initial evidence of internal consistency, supporting a unidimensional structure of MPIS. In addition, construct validity of the newly developed scale was also demonstrated, with a number of hypothesized relations between MPIS, parenting stress, and infant temperament indicators.

TABLE 3 Simple correlation between PSI, IBQ-R, and MPIS

Scale	Study 1	Study 2
PSI—Competence	−.49**	−.33*
PSI—Attachment to the Child	−.46**	−.31*
PSI—Role Restriction	−.27	−.09
PSI—Depression	−.58**	−.40**
PSI—Spouse/Partner Relationship	−.35*	−.21
PSI—Total Stress	−.61**	−.35*
IBQ-R—*Positive Affectivity/Surgency*	.42*	.36**
IBQ-R—Activity Level	−.13	.16
IBQ-R—Smiling/Laughter	.32#	.13
IBQ-R—Approach	.38*	.39**
IBQ-R—High Intensity Pleasure	.41*	.21
IBQ-R—Perceptual Sensitivity	.24	.36**
IBQ-R—Vocal Reactivity	.18	.23
IBQ-R—*Negative affect*	.13	.15
IBQ-R—Fear	.14	.27*
IBQ-R—Distress to Limitations	−.08	.07
IBQ-R—Sadness	.07	.07
IBQ-R—Falling Reactivity	−.09	−.01
IBQ-R—*Regulatory Capacity/Orienting*	.63**	.13
IBQ-R—Duration of Orienting	.48**	.08
IBQ-R—Soothability	.18	.14
IBQ-R—Cuddliness/Affiliation	.01	.08
IBQ-R—Low Intensity Pleasure	.56**	.07
Baseline Asymmetry		−.06
SFP Asymmetry		.27#

Abbreviations: IBQ-R, Infant Behavior Questionnaire-Revised; MPIS, Mindful Parenting in Infancy Scale; PSI, Parent Stress Inventory; SFP, Still Face Paradigm.

**$p < .01$.; *$p < .05$.

#$p < .10$.

As anticipated, greater levels of parenting stress across multiple domains were associated with diminished mindfulness in the caregivers' approach to the infant. Moreover, links with temperament provided initial support for a potential protective function of a more mindful approach to parenting in infancy, associated with greater expressions of joy and stronger emerging regulation for the child. These findings were also in line with the existing literature, including relations between mindfulness and parenting stress, and research documenting reductions in stress levels for parents following mindfulness-based interventions (Burgdorf et al., 2019). Prior research also examined links between maternal mindfulness during pregnancy and infant temperament, demonstrating a positive association with attention-based regulation measured later in infancy (at 10 months of age), and the present findings provide further support for this connection. Overall, results of Study 1 were considered promising enough to undertake Study 2, replicating and extending this initial investigation of MPIS and its

psychometric properties, also contributing to our understanding of parenting mindfulness as it relates to caregivers' characteristics and infant outcomes.

5 | STUDY 2 METHOD

5.1 | Participants

Mothers with infants 6–12 months of age were recruited in the same manner as for Study 1: via social media (i.e., Facebook) advertisements, local birth centers/parent–infant programs, and pamphlets distributed in locations frequented by families with infants (e.g., pediatricians, local mall, and farmers market). Children with significant medical or birth complications, including infants born preterm (<37 weeks of gestation) and/or with identified developmental delays/disabilities, were again excluded, as were non-English-speaking caregivers and parents under 18 years of age. All families received an infant T-shirt (about $10 value) incentive at the end of their laboratory visit for participation in the study. Of the 79 families approached regarding this study, 59 participated (mean infant age = 8.44 months, SD = 1.51 months, 34 girls), with remaining parents citing a lack of time as a reason for declining. Infants with sufficient usable EEG data across baseline and emotion-eliciting tasks (N = 50) contributed to this study. Excluded cases did not provide sufficient EEG data for analyses because of failure to complete the required recording due to excessive infant distress, uninterpretable EEG data as a result of distress/motor activity-related artifacts, or equipment malfunction. This study similarly adhered to the Declaration of Helsinki guidelines, with written informed consent obtained from a parent or guardian for each child before any assessment or data collection. It was also approved by the university IRB, with data collection following APA ethical standards. Once mothers agreed to participate, consent forms and questionnaires were mailed.

Families involved in this study were largely White (90%), with a number of Asian/Asian-American (3.3%), Latinx (1.7%), Native American (1.7%), and multi-racial (3.3%) participants. Mothers were primarily married (90.9%), between 21 and 42 years of age (28.72 years, SD = 4.64 years), and well educated (M = 16.01 years, SD = 2.04 years), with family income generally above $30,000 (81.1%). Children who did not contribute usable EEG data and their parents did not differ from those whose EEG data were included on any variables of interest (i.e., mindfulness, parenting stress or infant temperament scores) and were demographically similar (e.g., married, high educational attainment, White).

5.2 | Procedure

Caregivers responding to the parenting stress and infant temperament questionnaires, as well as the MPIS, prior to the laboratory visit (within 2 weeks) conducted to collect EEG data. Following electrode placement, EEG was recorded in the context of a baseline episode, as well as a two-trial version of the Still Face procedure (Haley & Stansbury, 2003; Tronick et al., 1978), wherein the mother is instructed to ignore the infant for 2 minutes on two separate occasions, interspersed with, and then followed by a "reunion" episode. Mothers were asked to review the IRB approved consent form prior to the laboratory visit, wherein it was signed after additional explanations provided by trained research assistants.

5.2.1 | EEG recording

Infants were seated in a highchair with an EEG cap (Cortech Solutions, Inc.; Wilmington, NC) placed on their heads. After the cap's placement, small amounts of electro-conductive gel were introduced in each electrode site. Individual "pin-type" electrodes (BioSemi—Cortech Solutions, Inc.) were then "snapped" into each corresponding site. All of the EEG data were collected via the BioSemi Active Two amplifiers with initial screening via the BioSemi acquisition software at a sampling rate of 1024 Hz. The EEG was referenced to Cz online. Baseline EEG was recorded for 60 s, while infants watched a segment of Baby Einstein, Baby Mozart video, wherein colorful objects are displayed as classical music is played (Perone & Gartstein, 2019a,b). The duration of EEG recording and the stimuli are consistent with existing infant baseline EEG studies (Bell & Fox, 1992; Benasich et al., 2008; Marshall et al., 2002; Morasch & Bell, 2011).

During baseline, mothers were instructed to limit their interaction with the infant to directing their infants' attention to the screen. As a repeated version of the Still Face Procedure (SFP; Haley & Stansbury, 2003; Tronick et al., 1978) was administered, EEG recording during the 2nd trial was utilized because it was expected to result in the greatest regulation challenge for the infant. Baseline and components of SFP procedure were time-locked to the EEG recording via E-Prime software (Psychology Software Tools, Inc.), preprogrammed to transmit triggers initiated by specific keyboard presses into the EEG acquisition software. Operated by a trained research assistant, E-Prime transmitted unique numerical triggers into the BioSemi acquisition software, marking each task's beginning and end points. All of the E-Prime triggers were assigned unique numerical values, allowing baseline and the second SFP episode to be extracted for further processing.

5.2.2 | EEG processing

The EEG was processed in MATLAB using EEGLAB. The continuous EEG was down-sampled to 256 Hz, and a high-pass filter at 1 Hz and a 60-Hz notch filter were applied, to remove high frequency and low frequency noise, respectively. Excessively noisy electrodes were removed and interpolated, and the EEG was then re-referenced to the average. Epochs were rejected if the absolute voltage of any electrode exceeded 100 microvolts for more than 100 ms. Time–frequency decomposition was performed on the remaining epochs using fast Fourier transformation (FFT) with a 1 s Hanning window for 3–50 Hz. Only infants with at least 10dfts of baseline and Still Face EEG data were included. Power was calculated in alpha (6–9 Hz), consistent with prior research (Bell & Fox, 1992; Buss et al., 2003; Degnan et al., 2011) and subsequently natural log-transformed. F3 and F4 were used to calculate asymmetry scores: subtracting the natural log of alpha power on the left (F3) from the natural log of alpha power on the right (F4), because these frontal sites have been most frequently utilized in the existing research (Reznik & Allen, 2018). Lower levels of alpha reflect cortical activation; thus, lower asymmetry scores reflect right lateralization, and higher scores signal left lateralization (Buss et al., 2003; Hane & Fox, 2006).

5.3 | Measures

The PSI (Abidin, 1995) and the IBQ-R (Gartstein & Rothbart, 2003) were also administered to mothers in Study 2, along with the MPIS, all completed prior to the EEG data collection laboratory visit.

Still Face Procedure (SFP; Tronick et al., 1978), as described by Haley and Stansbury (2003), was administered collecting EEG data. That is, the repeated version of SFP was used to challenge infant regulatory capacity in response to the caregiver's emotional unavailability (i.e., mother displaying a flat facial expression and abstaining from communication). The second SFP trial is a standard option commonly employed (DiCorcia et al., 2016; Handal et al., 2017; Lowe et al., 2017) since the initial publication documenting this procedural adaptation (Haley & Stansbury, 2003). The second trial of SFP was initially introduced to facilitate the assessment of physiological responsiveness (e.g., cortisol levels) in the context of a challenging situation and was leveraged to collect EEG data herein (Gartstein, 2019). SFP began with the experimenter instructing the mother to play with her infant utilizing stacking cups (provided by the experimenter) for 2 minutes and then to display a "still face" (i.e., emotionless, flat facial expression) for an equivalent duration (or stopping after 15 seconds of hard crying), refraining from any vocal expressions. The SFP trial was followed by a 2-minute "reunion" sequence, after which the SFP was repeated. The task ended with another 2-minute "reunion" sequence. The SFP often results in distress (including hard crying), reducing the amount of analyzable EEG data. Nonetheless, sufficient usable EEG data (about 1 minute) were available for 50 cases.

5.4 | Analytic strategy

Study 2 analyses began with approaches that paralleled Study 1, computing Cronbach's α and descriptive statistics and performing factor analyses via principal axis and maximum likelihood. In addition, confirmatory factor analysis (CFA) was performed to further establish the unidimensional structure of MPIS. Simple correlations between the MPIS and parental stress indicators, as well as infant temperament scores, were again computed. In addition, relations between mindfulness in parenting and EEG asymmetry observed in the context of SFP were examined, controlling for infant sex, age, and baseline asymmetry. Specifically, structural equation modeling (SEM) was utilized to examine a path model including indirect effects, with overall parenting stress predicting MPIS, in turn contributing to infant asymmetry. These analyses were conducted in Mplus (Muthén & Muthén, 2017), with full information maximum likelihood (FIML) used to accommodate missing data.

6 | STUDY 2 RESULTS

Descriptive statistics for all of the included variables are provided in Table 2. Acceptable internal consistency for MPIS was demonstrated ($\alpha = .67$), with the two exploratory factor analytic approaches failing to indicate for multidimensional structure, as in Study 1. The CFA provided further support for a unidimensional structure, with majority of fit indices reflecting good fit: $\chi^2 = 42.56$; $p = .18$; root mean square error of approximation (RMSEA) = .06; comparative fit index (CFI) = .92; Tucker–Lewis index (TLI) = .90; and standardized root mean square residual (SRMR) = .07. Although RMSEA was not <.05, the remaining indicators were consistent with a one-factor solution (Hu & Bentler, 1999). A similar pattern of simple correlations emerged in the 2nd investigation with an independent sample. All but two PSI indicators were significantly correlated with MPIS in the hypothesized direction: higher levels of mindfulness in parenting were associated with lower overall parenting stress, depression related to the parental role, fewer competence/efficacy in parenting concerns, and less problematic attachment/bonding with the child. A number of significant correlations with infant temperament indicators also emerged, including Positive Affectivity/Surgency, and the narrowly defined dimensions of Approach, Perceptual Sensitivity, and Fear. Greater mindfulness in parenting was associated with

higher levels of these temperament attributes. In addition, the correlation with EEG asymmetry measured in the context of SFP approached significance. Importantly, as hypothesized, the anticipated indirect relationship involving overall parental stress, mindfulness in parenting, and SFP EEG asymmetry was observed, controlling for infant sex, age, and baseline asymmetry values (Figure 1). Specifically, direct effects between the total PSI score and MPIS, between MPIS and SFP frontal asymmetry, and between total PSI score and SFP frontal asymmetry were tested, as well as an indirect effect between overall parenting stress and EEG asymmetry. This path model (Figure 1) was associated with good fit based on multiple indices: $\chi^2 = 2.74$, $p = .43$; RMSEA = .01; SRMR = .05; CFI = 1.00; and TLI = 1.00, with a statistically significant indirect effect (0.12, $p < .05$).

7 | STUDY 2 DISCUSSION

As expected, Study 2 provided additional support for internal consistency as well as the unidimensional structure of the newly development parental mindfulness questionnaire—MPIS. There were also largely consistent links between caregiver mindfulness and stress domains examined in Study 1 and Study 2: Total Stress, Competence, Attachment to the Child, and Depression, in the predicted direction, with higher levels of stress related to diminished mindfulness in caregiving. The pattern of results observed for parenting mindfulness and temperament associations was less consistent by comparison, possibly as a result of a somewhat older sample included in Study 2. Fewer significant associations found in Study 2 could also be explained by somewhat lower internal consistency of the

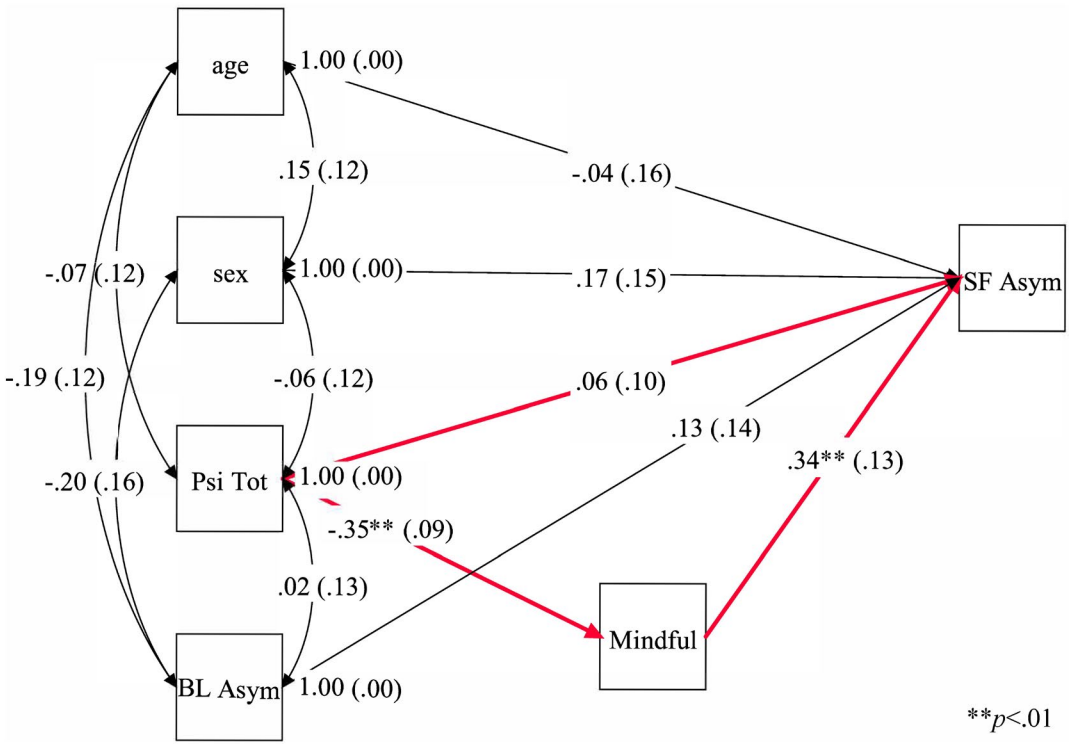

FIGURE 1 Mindful parenting mediates effect of parenting stress on asymmetry during Still Face. BL Asym - Baseline frontal EEG asymmetry; Mindful -MPIS total score; Psi Tot - PSI total score; SF Asym - Stiff Face frontal EEG asymmetry

MPIS in that sample, which likely decreased the statistical power. It may also be that Study 1 sample presented with a more challenging temperament profile, due to the fact that a parent guidance program was offered, which in turn contributed to a greater number of significant associations between mindful parenting and temperament. Although infants were not screened for temperament, creating a "high-risk" sample with a greater proportion of infants with "difficult" temperament, parents were told that they would receive general temperament information we expected to be beneficial to caregivers/parent–child relationship. Thus, it is possible that parents self-selected into this temperament parent guidance program when their infants presented with greater behavioral/emotional challenges. Nonetheless, similar relations were noted between higher levels of mindfulness and positive affectivity, as well as some of the associated fine-grained attributes. As already noted, these associations are consistent with the existing literature (Burgdorf et al., 2019; van den Heuvel et al., 2015) and expand our knowledge related to mindfulness in parenting and its likely protective function.

Importantly, Study 2 expands the scope of the initial investigation, considering links with a neurophysiological marker of temperament—frontal alpha asymmetry (Buss et al., 2003; Hane & Fox, 2006). Results of the SEM analysis provided support for this association, with higher levels of mindfulness contributing to greater left frontal activation in the context of a mild stressor. This pattern of results, observed controlling for infant sex, age, and baseline asymmetry, also speaks to the protective role of caregiver mindfulness, as relative left frontal activation is generally interpreted as indicative of approach emotions/motivation, as well as regulation efforts and resilience (Curtis & Cicchetti, 2007; Gartstein, 2019), especially in the context of responding to a challenging situation (Coan et al., 2006).

8 | GENERAL DISCUSSION

Overall, results of this investigation indicate that MPIS is a promising tool for measuring mindfulness in parenting of infants. Study 1 demonstrated good internal consistency, unidimensional structure, as well as anticipated associations with overall parenting stress, its component domains (Competence, Attachment to the Child, Role Restriction, Depression, Spouse/Partner Relationship), and infant temperament on the factor and fine-grained scale level. Greater mindfulness in parenting was associated with lower parenting stress in general, fewer depressive symptoms and concerns with competence/efficacy in parenting, attachment/bonding with the child, and the relationship with spouse or partner. With respect to infant temperament, higher levels of mindfulness in parenting were related to higher Positive Affectivity/Surgency and Regulatory Capacity/Orienting, as well as multiple component fine-grained dimensions (e.g., Approach, Duration of Orienting). Study 2 provided a replication and extension of this work, also demonstrating acceptable internal consistency (Ursachi et al., 2015), unidimensionality, as well as hypothesized links with parenting stress and infant temperament. Importantly, Study 2 provided an opportunity to explore links between parenting mindfulness and infant brain activity, specifically, an established neurophysiological correlate of temperament (i.e., approach/avoidance emotions and motivation). SEM/path analysis indicated that mindfulness in parenting predicted greater left frontal activation, indicative of approach, positive affectivity, as well as regulation efforts and resilience (Buss et al., 2003; Curtis & Cicchetti, 2007; Gartstein, 2019; Hane & Fox, 2006). At the same time, the path model indicated mindfulness was compromised by higher levels of overall parenting stress, consistent with the connections between the two noted in the literature (Fernandes et al., 2020; Moreira & Canavarro, 2018).

Along with initial validation for the newly developed MPIS, results of this investigation provide further support for links between mindfulness and stress in parenting (Burgdorf et al., 2019), making additional connections to critical components contributing to overall stress, including Competence,

Attachment to the Child, Role Restriction, Depression, and Spouse/Partner Relationship addressed by the PSI. These relations are important because stress in the parental role, as well as the component aspects, has been consistently linked with child outcomes (Cherry et al., 2019; Crnic et al., 2005; Robers, 1989). For example, an extensive literature indicates maternal depression can have a detrimental effect of social-emotional development, including infant temperament (Gartstein & Hancock, 2019; Lusby et al., 2016). The present findings also provide evidence of associations between parental mindfulness and infant temperament, consistent with existing research (van den Heuvel et al., 2015), and extending these findings. van den Heuvel et al. (2015) identified links between greater dispositional mindfulness and lower levels of negative emotionality, and in the current investigation, more mindful parenting was associated with higher levels of Positive Affectivity/Surgency and Regulatory Capacity/Orienting related dimensions, albeit not completely consistent across Study 1 and Study 2. Although our findings are not entirely in line with those of van den Heuvel et al. (2015), they parallel this earlier study insofar as both investigations suggest that more mindful parents are likely to experience their infants as not "difficult" in terms of temperament, presenting fewer challenges in caregiving. Of interest, mothers endorsing greater mindfulness in parenting rated their infants higher in approach across Study 1 and Study 2, reporting a reward-orientation, excitement, and positive anticipation of pleasurable activities for their children. The latter pattern of results is consistent with the Potharst and colleagues study (2017), who found increased Positive Affectivity/Surgency in infants after their mothers participated in a mindful parenting group training program. The authors reported a medium effects size for Positive Affectivity/Surgency, with no significant effects noted for other temperament domains (Potharst et al., 2017).

Although it may be that mothers who view themselves as more mindful as caregivers attend to these infant temperament attributes to a greater extent, reporting higher levels of both, results of Study 2 provide additional support for this link on the neurophysiological level. That is, higher levels of mindfulness in parenting were associated with greater relative left frontal alpha activation in the context of an emotion-regulation challenge for infants. Thus, infants of more mindful caregivers demonstrated brain activity indicative of greater approach motivation, linked not only with positive affectivity, but also with regulation and resilience (Bell & Fox, 1992; Curtis & Cicchetti, 2007; Gartstein et al., 2020). These findings contribute to the emerging literature making connections between parenting and infant brain activity. For example, infants with less responsive mothers exhibited greater right frontal asymmetry, emotional reactivity, and less positive affect in a joint attention task (Hane & Fox, 2006). Infants who exhibited greater left frontal activation during baseline, and also had highly responsive mothers, were able to better regulate their emotions during an arm-restraint task at 5 months (Swingler et al., 2014). Although quality of caregiving was not examined herein, more mindful mothers likely exhibit greater sensitivity and responsiveness while interacting with infants (Parent et al., 2016).

Results of this study make an important contribution to the existing literature by providing support for a newly developed measure of mindfulness in parenting infants, and examining links between mindful parenting, parenting stress, and infant temperament on the behavioral and neurophysiological level. Nonetheless, a number of limitations warrant attention. First, both studies included relatively small and homogeneous samples, and future research should evaluate MPIS with larger, more representative groups of parents and infants, as well as more high-risk families. Second, as noted, parenting and parent–infant interactions were not examined directly, and future studies should consider associations between MPIS scores and caregiving quality (e.g., sensitivity/responsiveness). Third, we did not evaluate parenting mindfulness for fathers, who also play an important role as caregivers, and this should be undertaken in future research. Cronbach's α computed for Study 2, although still acceptable, was lower than the internal consistency estimate in Study 1, which may be a function of the brevity of the scale, as internal consistency issues have been noted with other short mindfulness

measures (Coatsworth et al., 2010; Potharst et al., 2018, 2019). On a related note, this brief format also precludes the ability to identify component dimensions of mindful parenting, which may be desirable in some instances. Finally, the studies presented herein were cross-sectional in nature, precluding a conclusive evaluation of direction for hypothesized effects. For example, challenging temperament profiles (e.g., high negative emotionality/distress proneness, relative right frontal EEG activation) could increase parental stress and diminish mindfulness—possibilities that should be examined via longitudinal designs in the future.

MPIS is a promising brief measurement tool that can be utilized in a variety of research as well as clinical applications with infants and caregivers, for example, in the context of mindfulness-oriented intervention programs. This instrument was designed specifically for infants, addressing mindfulness in parenting during this foundational developmental period. It was intentionally designed to be brief, containing only 10 items, to facilitate widespread use in both otherwise extensive research protocols and clinical services, wherein limited time afforded for interactions with a healthcare provider may be prohibitive of administering a longer questionnaire. Although additional research with this measurement tool is warranted, as noted earlier, this initial evaluation provides support for further use.

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CONFLICTS OF INTEREST

The author does not have any conflicts of interest to disclose with respect to the work conducted and reported herein.

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