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Title: Effects of a Mindfulness-based Intervention on diurnal cortisol pattern in disadvantaged families: A randomized controlled trial

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Abstract

Objective: The present study examined the psychophysiological effects of Family-based Mindfulness Intervention (FBMI) on children and parents from disadvantaged families.

Methods: This randomized controlled trial recruited parents and their children from 51 disadvantaged families in Hong Kong and randomized them into FBMI (n = 26) and waitlist control (n = 25) groups. The parent intervention included 6 sessions and the child intervention included 8 sessions with 2 half-hour joint programs. Both interventions lasted 9 hours in total each. All participants completed four salivary cortisol measures after wakeup, before lunchtime, late-afternoon, and before sleep at baseline and end of the intervention. The diurnal cortisol pattern was summarized by the morning cortisol, evening cortisol, mean cortisol, and diurnal cortisol slope.

Results: Compared to the control group, children in the FBMI group showed significant increases in morning cortisol ($d = 0.50$, $p = 0.03$) and significant decreases in diurnal cortisol slopes ($d = 0.50$, $p = 0.04$) at the end of intervention. Parents in the FBMI group displayed significant decreases in evening cortisol ($d = 0.50$, $p = 0.04$) compared to the control group at the end of intervention. No significant treatment effects were found on the mean cortisol.

Discussion: The present findings suggest that FBMI could improve the diurnal cortisol slope and cortisol levels of the children and parents from disadvantaged families, respectively. Future studies should elucidate its potential benefits on neuroendocrine functioning.

Keywords: biomarkers; mindfulness; economic disadvantage; cortisol; families; Chinese

1 Introduction

Economic hardship has been associated with a series of mental health problems of parents and children. The family stress model suggests that economic disadvantage will lead to child and family outcomes through adverse changes in marital quality and parenting styles (Masarik and Conger, 2017). The process begins with external financial pressures such as unemployment and low income, which lead to parental mental health problems such as increased parenting stress and parental depression, which in turn challenge marital quality and parenting practices. The consequent reduction in parenting quality yields negative family functioning and child mental health and behavioral problems (Conger et al., 2010). Children from economically disadvantaged families (EDF) were found to suffer from chronic physiological stress, which affects the activities of the hypothalamic pituitary adrenal axis (dysregulated cortisol) (Obradovic et al., 2010). Child cortisol was also associated with positive parenting and cortisol and parenting mediated the associations between poverty and child executive functions (Blair et al., 2011).

Activation of the hypothalamic-pituitary-adrenal (HPA) axis is linked with increased cortisol secretion, a behavioral feedback of stress perception that is critical to adaptation to environmental stimuli (Jessop & Turner-Cobb, 2008). Salivary cortisol is a commonly used biomarker of stress response given its minimally invasive mode of ambulatory assessment (Kudielka et al., 2012). The typical diurnal cortisol pattern of early-morning rise after awakening followed by a steady decline throughout the day provides vital information about the individuals' physiological stress over time (Chida and Steptoe, 2009). The diurnal cortisol pattern is summarized by various cortisol indicators: wakeup cortisol, evening cortisol, mean cortisol and diurnal cortisol slopes (Fekedulegn et al., 2007; Vreeburg et al., 2009). Disrupted diurnal cortisol patterns in terms of flatter diurnal slopes, lower wake-up cortisol and higher evening and mean cortisol have been associated with poorer immune/inflammation outcomes (Adam et al., 2017).

There has been increasing evidence in mindfulness-based intervention (MBI) in stress reduction. Kabat-Zinn (1990) defines mindfulness as paying attention non-judgmentally to the present moment. Mindfulness can improve attention, promote tolerance to unpleasant sensations, feelings, and thoughts, and facilitate cognitive change. It can enhance stress coping through relaxation and greater acceptance (Baer, 2003). MBI is an evidence-based intervention for people with various physical and mental disorders with robust effects in stress reduction and management (Sharma and Rush, 2014). According to the stress reactivity theory (Creswell, 2015), application of MBI could reduce biological stress reactivity of family members to exposures of stressors. It could promote parents' sensitivity to children's needs and responsive behaviors that facilitate better development. A recent study reported that mothers with higher mindful parenting showed steeper diurnal cortisol slopes. In addition, maternal mindful parenting moderated the effect of life stress on later mother and infant cortisol (Laurent et al., 2016). This implies that cortisol should be included to investigate physiological stress of the parents and children as an outcome measure. A recent meta-analysis suggests that short-term psychological intervention for parents and children from EDF can improve their stress management and mental health (Lo et al., 2020b). However, most of these studies did not include cortisol as their outcome measure.

Evidence of MBI for families and children from EDF is emerging, although a number of limitations are found. For examples, 29 preschool children from EDFs were randomized them into a 12-hour MBI and a treatment-as-usual condition (Poehlmann-Tynan et al., 2016) and children after MBI had significantly improvements in attention and self-regulation. 42 adults from economically disadvantaged background showed improvements in the reduction of stress, anxiety, and depression symptoms after an eight-week MBI (Van der Gucht et al., 2015). Both studies were based on small sample sizes and cortisol has not been included as outcome measures.

Studies applying mindfulness in parallel parent and child intervention programs are very limited. A randomized controlled trial (RCT) on a MBI for 41 healthy school aged children and their parents reported an improvement in child conflict monitoring attention (Felver et al., 2017). Another RCT of MBI included 100 children aged 5 to 7 with attention deficit and hyperactivity symptomology reported moderate improvements in the child inattention and hyperactivity symptoms, and improvements in parents' stress and well-being (Lo et al., 2020a). However, impacts of MBI on physiological stress and cortisol were not included in both studies.

A systematic review (O'Leary et al., 2016) only revealed limited effects for the MBI to improve the diurnal cortisol pattern with no significant improvements in diurnal slopes for various populations. The inconsistency in the current findings not only indicates caution in interpreting the results, but also calls for more robust research design (use of control groups and randomization) in mindfulness literature. There is a need for RCTs on MBI with adequate sample size. To the best of our knowledge, no existing studies have examined the effects of MBI on the diurnal cortisol pattern of both parents and children. The present study is the first RCT to evaluate the physiological effects of family-based mindfulness intervention (FBMI) on the diurnal cortisol pattern. Based on the literature, the following hypothesis was proposed for this study: children and parents from EDFs in the FBMI group would display better diurnal cortisol patterns in terms of higher wakeup cortisol, lower evening cortisol, lower mean cortisol, and steeper diurnal cortisol slopes than those in the control group.

2 Materials and Methods

2.1 Study design and participants

The study sample originated from a two-arm randomized controlled trial (Lo et al., 2019). Participants were recruited from eight primary schools or integrated family service centers from four Hong Kong districts with high percentages of low income population (Hong Kong Council of Social Service, 2013). Eligible families were recruited via social workers and invited to participate in the study after a mindfulness seminar. The inclusion criteria of this study were the families receiving either the Comprehensive Social Security Scheme or full rate School Textbook Assistance Scheme. The exclusion criteria were children with developmental disorders and parents with schizophrenia and bipolar disorder. Out of the recruited 102 eligible families, half of them (N = 51) were included in the present study on cortisol analysis. The included sampled did not differ significantly from the excluded sample except for having higher family income (t = 2.05, p = 0.04). They were randomized into the FBMI (N = 26) and wait-list control groups (N = 25). A CONSORT flowchart is provided in Figure 1. Assessments on cortisol were made for both groups before (T1) and after the intervention (T2). The parents provided written informed consents and the team member who interviewed the families was blinded to the assignment process. Only one child from the FBMI group did not complete the cortisol assessment at T2. Ethical approval was obtained from the human research ethics committee of the author's university.

[Figure 1 about here]

2.2 Procedures

The FBMI includes themes concerning parent stress and stress reactivity, and is designed to promote the use of acceptance and approach coping. Two evidence-based mindfulness training programs were selected for further adaptation in the project. The parent mindfulness training program is a brief version of the Mindful Parenting course developed by Bögels and Restifo (2014). The program lasted for 6 weeks, and each session lasted 1.5 hour. Mindfulness exercises including body scan, mindful stretching, mindfulness of breath and body, mindfulness of sounds and thoughts, befriending exercise, were based on the scripts from *Mindfulness: A Practical Guide to Finding Peace in a Frantic World* with a shorter duration from 10 to 15 minutes (Williams and Penman, 2011). It had been used in a feasibility study of a brief mindfulness-based intervention for parents of children with developmental disabilities (Lo et al., 2017). Themes and goals of six sessions are summarized in Table 1.

The protocol for the child program *Mindfulness Matters* was developed by Snel (2014) for children aged 5 to 8. It lasted for eight 1-hour weekly sessions. In additional to short mindfulness exercises, age-appropriate activities such as storytelling were included. In class 4 and 8, an additional 30-minute exercise was added to help the family members practice mindfulness together and review the learning and progress in each other's presence. Audio files for parents and children were sent to the families through smartphone week by week. Pilot tests were conducted in mid-2014 after two research team meetings and consultation with the original founder. Minor modifications were made in three main components of the mindfulness-based intervention, namely, in-class mindfulness exercises, discussion of relevance to context, and homework exercises. The same protocol was applied to a study for children with ADHD symptomology and their parents (Lo et al., 2020a). Themes and goals of eight child sessions are summarized in Table 2. All instructors in the program held a degree in social work, psychology, education, or nursing and completed a basic eight-week mindfulness training program. They took part in training courses offered by the research team. Participants on the wait-list group received the same intervention after the completion of study.

[Tables 1 and 2 about here]

2.3 Salivary cortisol measures

At baseline and after the intervention, four saliva samples were collected using salivette tubes at the participants' home on a normal weekday: after wake-up around 7:30am, before lunchtime (around noon), late-afternoon (around 5:30pm), and before sleep (around 9:30pm). Instruction sheets and reminder notes were provided to the participants to improve adherence of saliva sampling times. They were advised to avoid food consumption and strenuous exercise 30 mins prior to sample collection. Written instructions and electronic reminders were sent to the parents via WhatsApp the night before collecting the samples to remind them to put the tools aside their bed. The participants were instructed to collect the first sample immediately after wakeup before brushing teeth. Similar reminders were provided at the corresponding sampling time (noon before lunch, 5pm before dinner, and 10pm before sleep) to remind them to collect the saliva samples accordingly. The baseline sample were collected within one week before the first session of the intervention. The post-intervention sample were collected within three days after the last session of the intervention. The wake-up time and sampling time of each sample was reported by the parents in a timesheet. Parents were asked to collect the saliva samples from their children at the same time as from themselves, so the parent and child saliva samples were collected at the same time from the same family based on subjective reports.

The collected salivette tubes were collected from the participants within three days of sampling and kept frozen in the laboratory and cortisol levels were determined after thawing and centrifugation at 3000 rpm for 15 min using the ELIZA kit (Salimetrics, PA, USA). The intra-assay and inter-assay variation was less than 8%. The diurnal cortisol pattern was summarized by four indicators: 1) morning cortisol after wake-up, 2) evening cortisol, 3) mean cortisol over the day, and 4) diurnal cortisol slope. The mean cortisol level was derived by dividing the area under the curve for the four samples using trapezoidal estimation by the overall elapsed time. The diurnal cortisol slope was calculated by regressing the four cortisol samples on the sample collection time. The raw cortisol values showed a non-normal distribution (skewness = 0.51-3.15, kurtosis = 0.89-14.2). Consistent with the practice of previous studies (Bower et al., 2005; Ho, Fong, Chan, & Chan, 2013; Kraemer et al., 2006), all of the cortisol measures in the present study were based on log-transformed cortisol levels (skewness < 1 and kurtosis < 3). A smaller (more negative) diurnal slope denotes a more rapid decline and vice versa.

2.4 Statistical analysis

Chi-square independence tests and independent t-test compared the demographic characteristics, wake-up time, and baseline variables across the two groups. The pre-post changes in the cortisol indicators were analyzed using the latent difference score approach in Mplus 8.1. The latent change of the outcomes were regressed on the binary treatment variable (1 = intervention, 0 = control) while controlling for baseline levels and sampling time of the first saliva sample. Missing data was handled using full information maximum likelihood under the missing-at-random assumption for the intent-to-treat analytic approach. Statistical significance was set at the 0.05 level and Cohen *d* denotes the standardized between-group mean difference with values of 0.20, 0.50, and 0.80 denoting small, medium, and large effect sizes, respectively.

3 Results

3.1 Participant characteristics

Table 3 shows the demographic characteristics and cortisol profiles of the sample across the two groups. Almost all of the parents were female with an average age of around 40 years old and at least secondary education. They reported an average monthly income of 13.7 thousand HKD. The majority of the children were male and 6 to 7 years old. Among the completers, the attendance rates were 96.5% for children and 90.0% for parents and the attrition rate judged from participating in at least three sessions of the program was 3.85%. Both parents and children displayed a decreasing trend in cortisol levels from morning to evening. On average, the participants woke up at around 07:10 and collected the four saliva samples at around 07:25, 12:15, 17:45, and 21:25 at baseline and post-intervention. No significant between-group difference was found in the demographic characteristics and baseline cortisol measures. Similarly, the wake-up time and cortisol sampling time of the participants did not differ significantly across groups and across time points (pre and post intervention). The time difference between wake-up and the morning sample was 15 mins on average and was not significantly different across groups.

[Table 3 about here]

3.2 FBMI effects on the diurnal cortisol pattern

Table 4 presents the intervention effects of the FBMI on the diurnal cortisol pattern for child and parent samples. For the parent sample, there was a significant and moderate intervention effect on the evening cortisol ($\Delta = -0.18$, $p = 0.04$, $d = 0.50$). Parents in the FBMI group reported a non-significant decrease in evening cortisol over time compared to a non-significant increase in the control group (Figure 2). The

FBMI effects on morning cortisol, mean cortisol, and diurnal cortisol slope were small and non-significant (d = 0.03 – 0.23, p = 0.40 - 0.90).

[Table 4 & Figure 2 about here]

For the child sample, there was significant and moderate intervention effects on morning cortisol (Δ = 0.33, p = 0.03, d = 0.50) and diurnal cortisol slope (Δ = -0.023, p = 0.04, d = 0.50). Children in the FBMI group showed a non-significant decrease in diurnal cortisol slope over time compared to a significant increase in the control group (Figure 3). Children in the FBMI group showed a non-significant increase in morning cortisol over time compared to a non-significant decrease in the control group (Figure 4). The FBMI effects on evening and mean cortisol were small and non-significant (d = 0.07 – 0.08, p = 0.75 - 0.78).

[Figures 3 & 4 about here]

4 Discussion

The present study is the first RCT that evaluated the physiological effects of FBMI among families under economic disadvantage context and examined whether MBI could improve the objective biomarkers in parents and children from EDF. Most of the within-group changes in the two groups were not statistically significant. This could be attributed to the small group size and associated lower statistical power. Between-group comparisons revealed significant treatment effects in improving the morning cortisol and diurnal cortisol slope for the children and evening cortisol for the parents. However, no significant intervention effects were found for mean cortisol in both samples. These results provide partial support to the research hypotheses on the effectiveness of FBMI in the cortisol measures. The present study found potential heterogeneous effects of the FBMI over the two samples. In the child sample, the steeper diurnal slopes likely denote improved modulation of stress reactivity. It could be noted that parents reported higher evening cortisol than their children at baseline (t = 2.34, p = 0.023, d = 0.33). The higher basal cortisol level in the evening implies that parents could have a larger room for improvement in this aspect.

The present physiological effects for the FBMI have clinical implications that suggest favorable modulation of HPA axis activities. A lower evening cortisol denotes a better nocturnal stress response and has been linked with fewer sleep disturbances in patients with metastatic breast cancer and hepatitis C (Koopman et al., 2002; Raison et al., 2010). Given the close relationship between circadian cortisol rhythm and sleep modulation (Wright Jr et al., 2015), future studies could evaluate the FBMI effects on improving sleep disturbance and the potential reciprocal effects between sleep and cortisol.

Several limitations should be noted for this study. First, the present study only examined the effects of a brief FBMI intervention. The participants were randomized into FBMI and control groups within each recruitment site and neither the participants nor group facilitators were blinded to the results of group assignment. The use of active control group could theoretically reduce the contamination between the two groups. Our design allowed us to compare those completed the FBMI and those on waitlist only. Since only half of the participants in the intervention group were selected to contribute their cortisol samples and all participants provided their homework compliance anonymously, the effects of homework dosage was not available. Future studies on dose-response relationship are needed to evaluate whether FBMI with greater intensity and dosage can provide more benefits to the neuroendocrine functioning of the families. Second, the present study did not include follow-up assessments of salivary cortisol. The present pre-post study design did not permit us to examine the long-term physiological effects of FBMI. Future studies with longer follow-up periods are needed. As the child and parent received MBI at the same period, we do not know whether the intervention directly influenced the parents, which in return influenced the children, or vice versa.

Third, the diurnal cortisol pattern at each assessment was measured on a single day which did not account for potential day-to-day fluctuations. The present study did not assess the cortisol awakening response and the associated intervention effect. Future studies should include repeated measures after awakening and obtain multiple days of saliva samples to improve the reliability of the cortisol measures. Fourth, the study hypotheses are not specific to one measure of cortisol. The combination of small sample size, multiple measures, and lack of corrections for multiple analyses raises concerns about the statistical power and family-wise error rate of the study. The present results should be interpreted cautiously until they are replicated in larger-scale studies. Fifth, though around two-third of the participants reported a delay of at most 15 mins between wake-up and collection of first sample, this time delay could possibly confound the morning cortisol level given the cortisol awakening response. Some variation may have occurred because sampling time in children was not collected since they followed the sampling timeframe of their parents. The present study relied on subjective monitoring of the sampling time and objective measures such as actigraphy and electronic monitors should be employed in future studies to improve the precision of the sampling timeframe.

Given the crucial role of the HPA axis in regulating the metabolic system and central nervous system, future studies could incorporate other biomarkers on inflammation (Silverman & Sternberg, 2012) and immune functions (Leonard, 2005) for a comprehensive evaluation of the physiological effects of the FBMI. Future research should attempt to elucidate the underlying mechanisms of the FBMI in producing physiological effects. This could be done by examining the linkages or interaction among diurnal cortisol pattern and other biomarkers (C-reactive protein and interleukins) and psychosocial constructs such as subjective perceived stress (Ho, Fong, & Yip, 2018), social support (Ho et al., 2013), and lifestyle factors (Ho et al., 2016) using mediation and moderated analyses.

Finally, this study adds knowledge to the potential benefits of MBI to EDFs. In view of strong adverse impact of poverty on development in early childhood, and the physical and psychosocial health of individuals over their course of life, current policy and preventive strategies are still inadequate (Dishion & Stormshak, 2007; Marmot et al., 2012). Most measures that aim to alleviate difficulties of EDFs mainly fall under the umbrella of income transfer or resource redistribution policies, without addressing the far-reaching effects of physiological stress arising from economic disadvantage that cannot be treated with fiscal resources alone. Our study attempts to shed light on how family stress can be combated with the use of MBI and effective preventive intervention can be developed to promote better family well-being and functioning.

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Table 1. Mindfulness training for parents

Session	Theme	Goal
1	Stress of being a parent	· Establish motivation to learn mindfulness for promotion of family health · Introduce mindfulness training · Introduce body scan · Introduce stretching
2	Automatic reactions	· Notice physiological, emotional and cognitive reaction in stressful moments of parenting · Use of mindful breathing and nonjudgmental attitude in managing the reaction in parenting
3	Respond to children mindfully	· introduce mindfulness to breath and body · Further notice reactive patterns in parenting · Introduce three minute breathing as coping · Practice deep listening in mindfulness
4	Quality parenting	· Joint session: practice with children, progress review · Introduce mindfulness to sounds and thoughts · mindful living for ADHD children and family caregivers
5	Facing difficulties with kindness	· Exploring difficulties with mindfulness practice · Introduce lovingkindness practice for self-care, and care of others
6	Self-care of parents	· Joint session: practice with children, progress review · Care plan of children and self · Consolidate learning

Table 2. Child program of family-based mindfulness intervention

Session	Theme	Goal
1	A for attention	- Establish motivation of be attentive and mindful - Use breathing as a beginning of exploration of attention
2	Exploring our body	- Introduce mindful movement exercises - Expand awareness of body sensation
3	Tasting, Smelling, Hearing, Seeing and Feeling	- Introduce the use of multiple senses in understanding our inner and outside world
4	Feel our feelings	- Learn to be aware and to describe feelings
5	Accepting feelings	- Acknowledge feelings of self and others - Experience the importance of accepting feelings
6	Conscious movement	- Bring attention and awareness to self and others
7	The power of awareness and thoughts	- Experience the application of mindful attention and thoughts in daily life
8	Being nice is good	- Consolidate learning - Practice of lovingkindness

Table 3. Baseline comparison of demographic characteristics and cortisol profile across groups

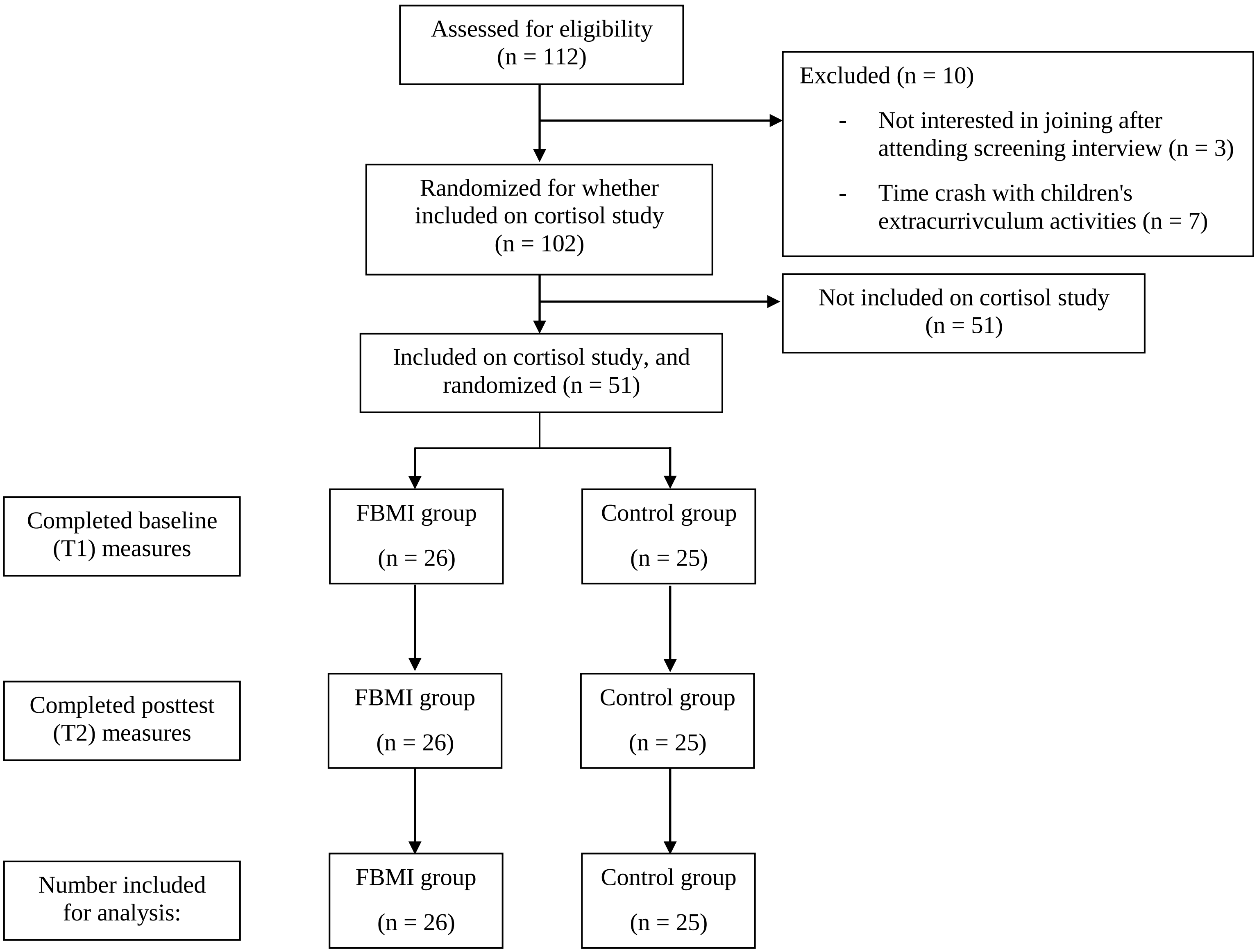
	child sample				parent sample			
	Intervention (n = 26)	Control (n = 25)			Intervention (n = 26)	Control (n = 25)		
Variables	Mean (SD)	Mean (SD)	χ^2/t	p	Mean (SD)	Mean (SD)	χ^2/t	p
Female	11 (42.3%)	9 (36.0%)	0.21	0.65	24 (92.3%)	25 (100%)	2.00	0.16
Age	6.60 (0.86)	6.52 (0.81)	0.33	0.75	39.2 (4.10)	38.3 (6.71)	0.55	0.58
Cortisol (ln nmol/L)								
Sample 1	1.75 (0.59)	1.85 (0.60)	-0.65	0.52	1.90 (0.53)	1.91 (0.48)	-0.06	0.95
Sample 2	1.22 (0.51)	1.20 (0.37)	0.11	0.91	1.57 (0.46)	1.38 (0.38)	1.55	0.13
Sample 3	1.31 (0.53)	1.28 (0.46)	0.23	0.82	1.21 (0.59)	1.19 (0.42)	0.10	0.92
Sample 4	0.83 (0.36)	0.86 (0.36)	-0.33	0.74	1.09 (0.41)	0.95 (0.39)	1.31	0.20
Mean cortisol	1.28 (0.35)	1.30 (0.29)	-0.15	0.88	1.45 (0.33)	1.36 (0.27)	0.96	0.34
Diurnal slope (ln nmol/L/hr)	-.053 (.049)	-.060 (.044)	0.57	0.57	-.059 (.042)	-.065 (.051)	0.49	0.63
	Baseline				Post-intervention			
	Intervention	Control	t	p	Intervention	Control	t	p
Wake-up time (h)	7.15 (1.17)	7.23 (0.92)	-0.27	0.79	7.21 (0.99)	7.16 (0.75)	0.19	0.85
Sample 1 Time	7.37 (1.13)	7.47 (0.84)	-0.36	0.72	7.46 (0.94)	7.43 (0.71)	0.10	0.93
Sample 2 Time	12.20 (0.54)	12.29 (0.80)	-0.48	0.64	12.08 (0.64)	12.24 (0.57)	-0.95	0.35
Sample 3 Time	17.69 (0.87)	17.84 (1.02)	-0.56	0.58	17.87 (1.18)	17.73 (1.13)	0.44	0.66
Sample 4 Time	21.44 (0.64)	21.42 (0.60)	0.16	0.87	21.33 (0.69)	21.56 (0.66)	-1.21	0.23

Table 4. Effects of family-based mindfulness intervention on cortisol outcomes (in ln nmol/L) in child and parent samples

	Intervention group (n = 26)		Control group (n = 25)		Latent difference score			
	T1	T2	T1	T2	Treatment effect			
Variables	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	*B*	*SE*	*p*	*d*
Child sample								
Morning cortisol	1.75 (0.59)	1.89 (0.56)	1.85 (0.60)	1.63 (0.71)	0.33	0.15	0.03*	0.50
Evening cortisol	0.83 (0.36)	0.90 (0.30)	0.86 (0.36)	0.94 (0.40)	-0.03	0.10	0.75	0.08
Mean cortisol	1.28 (0.35)	1.30 (0.24)	1.30 (0.29)	1.29 (0.35)	-0.02	0.07	0.78	0.07
Cortisol slope (ln nmol/L/hr)	-.053 (.049)	-.062 (.051)	-.060 (.044)	-.042 (.045)	-0.023	0.011	0.04*	0.50
Parent sample								
Morning cortisol	1.90 (0.53)	1.75 (0.68)	1.91 (0.48)	1.91 (0.82)	-0.17	0.20	0.40	0.23
Evening cortisol	1.09 (0.41)	1.00 (0.41)	0.95 (0.39)	1.09 (0.38)	-0.18	0.09	0.04*	0.50
Mean cortisol	1.45 (0.33)	1.35 (0.28)	1.36 (0.27)	1.35 (0.36)	-0.03	0.08	0.69	0.10
Cortisol slope	-.059 (.042)	-.053 (.047)	-.065 (.051)	-.057 (.047)	0.001	0.011	0.90	0.03

d = standardized between-group mean difference; * $p < 0.05$

Figure **1.** CONSORT flowchart of the present study.



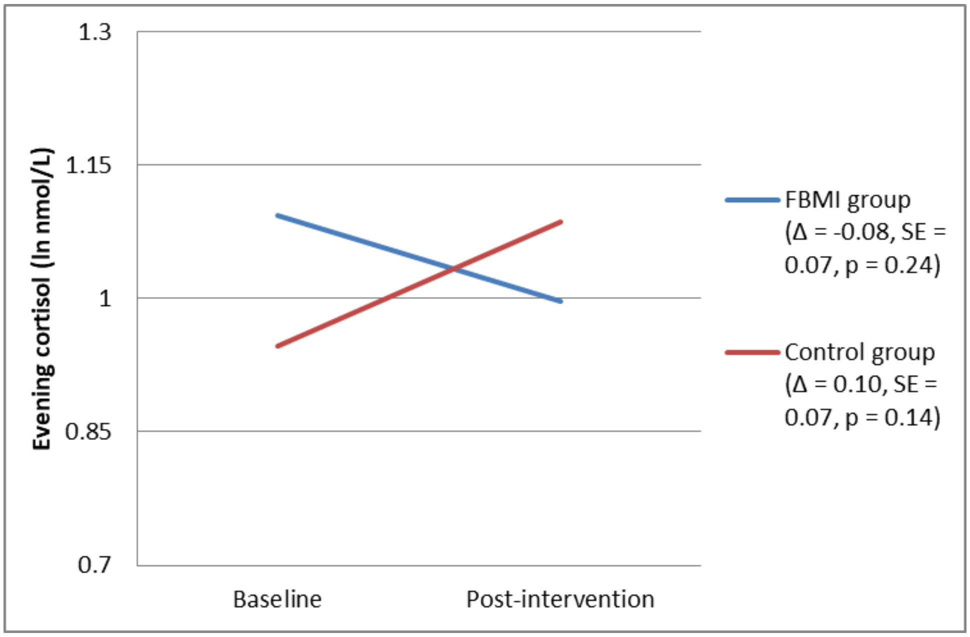


Figure 2. Evening cortisol levels for the parent sample in the two groups before and after the intervention

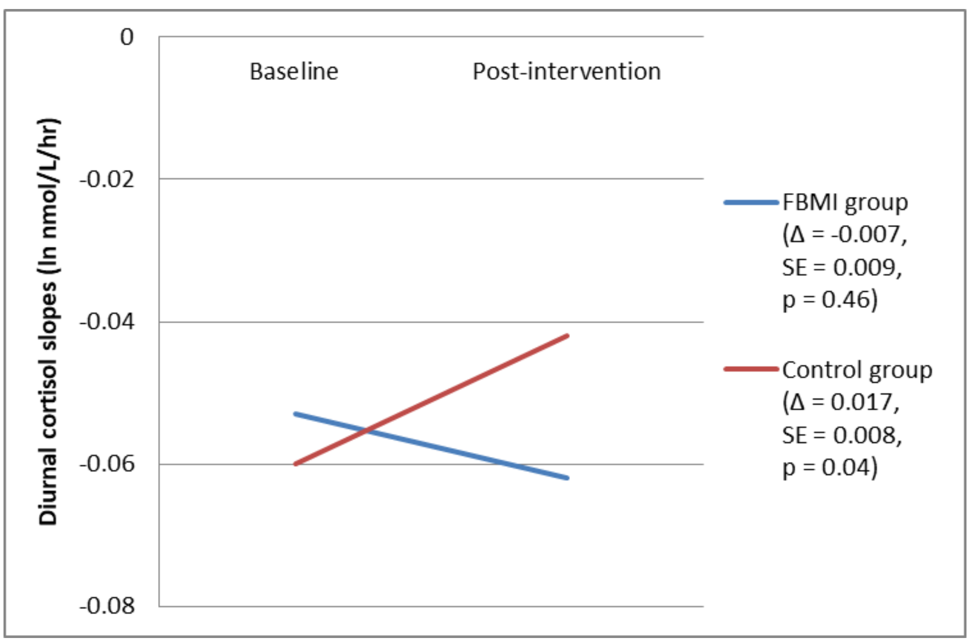


Figure 3. Diurnal cortisol slopes for the child sample in the two groups before and after the intervention

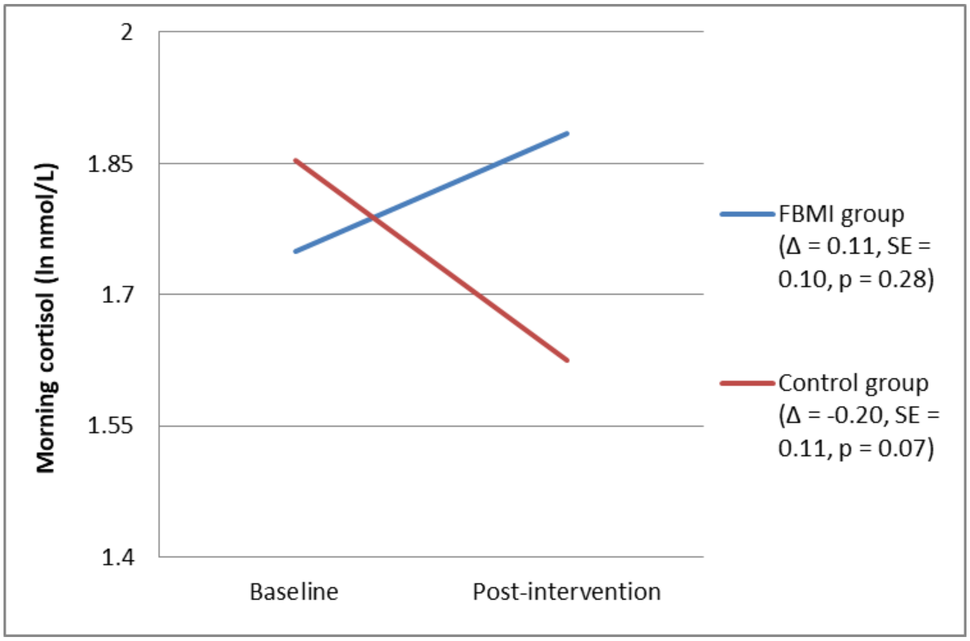


Figure 4. Morning cortisol levels for the child sample in the two groups before and after the intervention