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The Effectiveness of a School-Based Mindfulness Training as a Program to Prevent Stress in Elementary School Children

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Abstract Studies on the effects of mindfulness interventions on mental health and behavioral problems in children show promising results, but are primarily conducted with selected samples of children. The few studies investigating school-based interventions used self-selected samples, provided training outside of the classroom, and did not report longer-term effects. The immediate and longer-term effects of a class-based mindfulness intervention for elementary school children were investigated as a primary prevention program (MindfulKids) to reduce stress and stress-related mental health and behavioral problems. Children (8–12 years) from three elementary schools participated. Classes were randomized to an immediate-intervention group ($N=95$) or a waitlist-control group ($N=104$), which received the intervention after a waitlist period. Twelve 30-min sessions were delivered in 6 weeks. At baseline, pretest, posttest, and follow-up, variables indicative of stress and mental well-being were assessed with children, variables indicative of mental health problems were assessed with parents, and teachers reported on class climate. Multilevel analysis revealed that there were no significant changes from baseline to pretest. Some primary prevention effects on stress and well-being were found directly after training and some became more apparent at follow-up. Effects on mental health problems also became apparent at follow-up. MindfulKids seems to have a primary preventive effect on

stress, well-being, and behavior in schoolchildren, as reported by children and parents. Exploratory analysis revealed that children who ruminate more are affected differently by the intervention than children who ruminate less. It is concluded that mindfulness training can be incorporated in elementary schools at the class level, letting all children benefit from the intervention.

Keywords Mindfulness · Attention training · Elementary school · Children · Stress

Introduction

Psychosocial stress is an important risk factor for internalizing (e.g., anxiety, depression) and externalizing (e.g., behavioral) problems in childhood and adolescence (Grant et al. 2006; McMahon et al. 2003; Takeuchi et al. 1991), and chronic or (cumulative) daily stressors play a greater role in psychological and behavioral problems than major life events (Compas 1987). How children cope with stressors, however, is an important mediator and moderator of the impact of stress on current and future mental health (Goodman et al. 1995; Grant et al. 2006). Therefore, teaching children effective ways to cope with daily stressors may help to prevent internalizing and externalizing problems in childhood and adolescence. Moreover, childhood may be a crucial period for such prevention programs, since the association between stressors and anxiety is stronger for children than for adolescents (Twenge 2000). This article investigates the effectiveness of a school-based mindfulness training to prevent and decrease stress and related mental health and behavioral problems in children.

In the last two decades, there is an increased interest in mindfulness-based interventions to promote mental health and well-being in adult populations. Mindfulness is a form of attention training using meditation techniques, in which

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participants learn to pay attention in a specific way: “...on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn 2003, p. 145). Mindfulness-based stress reduction (MBSR) is a group intervention in which participants are trained in mindfulness meditation to alleviate stress, pain, and illness (Kabat-Zinn 1990). In Mindfulness-based cognitive therapy (MBCT), developed for depressed patients (Segal et al. 2002), meditation enables patients to decenter from their negative thoughts and interrupt the cycle of negative, repetitive thoughts before they escalate into a depressive episode. Several meta-analyses support the effectiveness of MBSR and MBCT for various emotional problems, including anxiety and depression in adults (e.g., Bear 2003; Grossman et al. 2004).

More recently, the application of mindfulness with children and adolescents has increased, both in clinical and nonclinical populations. A review of the emerging body of research on mindfulness-based interventions with children and adolescents revealed that such interventions reduce anxiety symptoms, as well as attention and behavioral problems (Burke 2009). Most of these studies, however, were conducted with relatively small ($N < 100$) and select samples of children, in which selection was based on clinical symptoms or clinical referral (Bögels et al. 2008; Semple et al. 2005; Singh et al. 2010; van der Oord et al. 2012; van de Weijer-Bergsma et al. 2011) or self-referral (Saltzman et al. 2008). While studying the possible benefits of mindfulness in children with clinical problems, such as ADHD, autism, or anxiety, is of great value to clinical practice, it does not answer the question whether mindfulness would be beneficial for community children in schools to cope with daily stress.

Only few studies investigated elementary school-based mindfulness interventions in nonselected or nonclinical populations (Flook et al. 2010; Mendelson et al. 2010; Napoli et al. 2005). Napoli et al. (2005), for example, investigated a mindfulness program (12 sessions of 45 min over 24 weeks) in the first, second, and third grade classes of two elementary schools, using a pre–post design. Approximately 76 % of parents invited to enroll their child gave consent for participation. Napoli et al. (2005) found an increase in selective attention and a decrease in self-reported test anxiety and teacher-reported behavioral problems in the intervention group ($N=97$) when compared to a control group of children ($N=97$). Flook et al. (2010) studied the effects of a mindfulness program (16 sessions of 30 min over 8 weeks) in the second and third grade classes of an on-campus university elementary school with a sample diverse in ethnic background, using a pre–post design. Approximately 58 % of parents invited to enroll their child gave consent for participation. Parents and teachers reported reduced behavioral problems in the intervention group ($N=32$), compared to a control group ($N=32$). Mendelson et al. (2010) investigated the effects of a mindfulness program (48 sessions of 45 min over

12 weeks) in fourth and fifth grade classes of a public elementary school with a sample of children with a predominantly African-American background (83.5 %). A pre–post design was used. The percentage of parents consenting in participation was unreported. The intervention was provided in a space conducive for physical activity. Children in the intervention group ($N=51$) reported reduced rumination, intrusive thoughts, and emotional arousal as responses to stress, compared to children in a control group ($N=46$).

Although the results from these school-based studies are promising, there are some limitations. First, participants were recruited on an invitational basis, inviting parents to sign up their child for the interventions, which possibly resulted in a selective population of children whose parents were interested in their child receiving the intervention, making it difficult to generalize findings to the general population. Secondly, the interventions were provided within the school, but mostly outside the regular classroom, making it a selective intervention rather than a part of the curriculum and the class process. Third, none of the studies investigated longer-term effects, and therefore, it remains unclear whether the possible benefits achieved from mindfulness remain. Therefore, the aim of the present study is to investigate the effectiveness of an elementary school-based mindfulness intervention incorporated at class level, letting all children benefit from the intervention. In addition, training was provided in the regular classroom to increase generalization of the practices. The immediate and longer-term effects of the program on stress, mental well-being, and mental health are explored, using children, parents, and teachers as informants.

Methods

Participants, Procedure, and Design

Participants ($N=208$) were children, aged 8 to 12 years, from three public elementary schools in Amsterdam, the Netherlands. Since ethnic diversity varies between schools, a representative sample of schools in the Netherlands was selected based on the student body children’s ethnic background, with 10, 30, and 81 % of the students coming from immigrant families, respectively. Schools were contacted by the trainers. Eight classes (third, fourth, and fifth grade) participated, based on whether teachers were interested in participation.

An experimental design with waitlist control was used. Classes were matched on school and grade when two parallel grades participated within one school, which was the case for six of the classes. In addition, the two remaining classes were also matched. Classes were then randomly assigned to an immediate-intervention group (four classes) or a waitlist-control group (four classes) (see Table 1).

Table 1 Matching of classes and random assignment to condition

Class	Condition	Matched class	Condition
School A, grade 4A	WL	School A, grade 4B	II
School A, grade 5A	WL	School A, grade 5B	II
School B, grade 3A	WL	School B, grade 3B	II
School B, grade 5	WL	School C, grade 4	II

WL waitlist, II immediate intervention

Assessment for both groups started at the same time, with the immediate-intervention group completing three assessments (time 1=pretest, time 2=posttest, and time 3=follow-up), and the waitlist-control group completing four assessments (time 1=baseline, time 2=pretest, time 3=posttest, and time 4=follow-up). The immediate-intervention group received the intervention between time 1 and 2, the waitlist-control group between time 2 and 3. Assessments took place 7 weeks before (baseline), 1 week before (pretest), and 1 week after (posttest) the intervention and 7 weeks after posttest (follow-up). Children and teachers filled in pencil-and-paper questionnaires in the classroom. Parents filled in questionnaires using an online survey tool or received pencil-and-paper questionnaires when they had no Internet access available. Parents were informed by letter about the study and a passive informed consent procedure was used. Parents were asked to inform the teacher of their child when they did *not* want their child to participate in the research and/or the training. The study was approved by the local ethics committee of the University of Amsterdam.

Of the 208 children, 1 child moved, 2 children transferred to a different school, and 6 children did not receive parental permission to participate. This resulted in a total N of 199 children (110 girls, 55 %, mean age=9.92, SD=0.923), with $N=95$ children in the immediate-intervention condition and $N=104$ children in the waitlist-control condition. One hundred thirty-three children (66.8 %) completed all sessions, 57 children (28.6 %) missed 1 session, 5 children (2.5 %) missed 2 sessions, and 3 children (1.5 %) missed 3 sessions (overall attendance rate=95.8 %). A total of 120 parents (70.8 % mothers) participated in the study at some time, with $N=92$ respondents at time 1, $N=89$ at time 2, $N=70$ at time 3, and $N=35$ at time 4. Children of parents with eligible data did not differ from children without eligible data on age, gender, or any of the children's variables (e.g., rumination) at pretest. Due to shared jobs, 15 teachers participated at some point. Teachers who taught the eight classes most frequently (3 to 5 days/week) had the highest response rate ($N=8$).

Indicators of child-perceived stress were assessed using child-reported measures of rumination and sense of coherence. Mental well-being was assessed using child-reported measures of emotional awareness and happiness. Mental health problems of children were assessed with parent-reported measures of child problem behaviors, of child

anxiety symptoms, and of child sleeping problems. Teachers reported on social class climate.

Intervention

General Aspects

The MindfulKids training used in the study is a curriculum developed by two of the authors (GL and RB). The program is modeled after the MBSR and MBCT training for adults and inspired by the MindfulSchools program (Biegel and Brown 2010). In the intervention, the trainer visits each class for 12 sessions of 30 min during 6 weeks (two sessions per week). During sessions, children participate in secular and age-appropriate meditation practices focusing on nonjudging awareness of sounds, bodily sensations, the breath, thoughts, and emotions (Table 2 presents a short overview of the curriculum). The classroom teacher is present during sessions and is asked to perform 5-min exercises—presented in verbatim—with the class on the remaining school days. Children receive a flyer after every session with further illustration of session themes and suggestions for optional practice at home. The intervention was provided by GL, who is an experienced mindfulness trainer for adult groups with a background as yoga teacher, schoolteacher, and family counselor.

Assessment Procedure

Measures

Child Report The Dutch 10-item *Non-Productive Thoughts Questionnaire for Children* (NPDK) assesses ruminative and repetitive thoughts (Jellesma et al. 2005). Items are scored on a Likert-type scale (0=not true, 1=sometimes true, 3=often true). Higher scores reflect more ruminative thoughts. The questionnaire has good internal consistency ($\alpha=0.84$) and correlates with related constructs, such as circular thinking, anxiety, and depression. The internal consistency in the current study was $\alpha=0.75$.

The Dutch 30-item *Emotion Awareness Questionnaire* revised (EAQ-30) assesses six aspects of children's emotional functioning: differentiating emotions, verbal sharing of emotions, not hiding emotions, bodily awareness, attending to others' emotions, and analyses of emotions (Rieffe et al. 2008). The items are scored on a Likert-type scale (0=not true, 1=sometimes true, 2=often true). The 19 items with a negative wording were rescored. Higher scores on most scales, except for bodily awareness, reflect better emotion awareness. The EAQ correlates with related constructs, such as moods and emotional efficiency (Rieffe et al. 2008). The internal consistency of the subscales varied between $\alpha=0.62$ (verbal sharing) and $\alpha=0.76$ (bodily awareness) and was roughly similar in this study ($\alpha=0.61$ to 0.78).

Table 2 Overview of the session themes, main exercise, and mindfulness aspect that is being trained and verbatim for the teacher

Session	Theme	Exercise	Mindfulness aspect	Verbatim for the teacher
1.	Silent body	The mindful body	Bodily awareness, being nonreactive	Exercise on being silent and the experiences that may bring
2.	Listening to silence	Bell meditation Sound meditation	Orienting attention, observing sounds and silence, being nonreactive, curious attitude	Exercise with listening to sounds and silence
3.	Attentive listening	Sound meditation with rainstick (i.e., long, hollow tube filled with small beans that fall when the tube is turned, making a sound reminiscent of rain falling) Awareness of breath	Observing bodily awareness and sounds, orienting, sustaining and switching attention (back to your body)	Exercise with listening and returning to your body
4.	Friendly breath	Awareness of breath	Bodily awareness, awareness of breath	Exercise in friendly awareness of the breath
5.	Breath as an anchor	Mindful breath	Calm, nonjudgmental awareness, eating mindfully	Exercise with the breath as an anchor
6.	Friendly wish	Raisin exercise Heartfulness exercise	Empathy, awareness of emotions and bodily sensations	Exercise with sending a friendly wish to yourself
7.	Catch the first thought	Thought meditation	Awareness of thoughts, bodily awareness, being nonreactive, nonjudgmental awareness	Exercise with thoughts coming and going
8.	Breathing space	Breathing space (on stressful moments)	Nonjudgmental awareness, being nonreactive	Exercise with breathing space when feeling tension
9.	Journey through your body	Body scan	Being nonreactive, bodily awareness, orienting, sustaining and switching attention	Body scan
10.	Friendly attention	Heartful wish to another person (e.g., classmate)	Empathy, awareness of emotions and bodily sensations	Body scan (sequel)
11.	Thoughts and emotions	Recognition and feeling of emotions	Being nonreactive, nonjudgmental awareness, bodily awareness	Exercise with sending a friendly wish to yourself and a classmate
12.	Mindfulness for you	When and where can you use mindfulness	Consolidation of all aspects learned by the children	Exercise with sending a friendly wish to a classmate

The Dutch 13-item *Sense of Coherence Questionnaire for Children* (SOC-K) assesses the extent to which children feel that their life and the environment they encounter is comprehensible, manageable, and meaningful (Jellesma et al. 2006). Items are scored on a Likert-type scale (1=very often, 2=often, 3=sometimes, 4=seldom, 5=never). Example items are: “How often do you have the feeling that you are being treated unfairly?” and “How often do you have the feeling that the things you do everyday are not really important?”. Two of the 13 items were positively formulated, for which a different five-point scale was used (1=like it a lot to 5=do not like it at all; scores were recoded). Higher scores indicate a higher sense of coherence. The questionnaire has good test–retest reliability over a 6-month period ($r=0.46$) and good internal consistency ($\alpha=0.76$), which was $\alpha=0.78$ in this study. The validity of the scale was supported by negative relationships with constructs, such as symptoms of depression, fear of negative evaluation, and social avoidance (Jellesma et al. 2006).

Two items of the four-item *Subjective Happiness Scale* (SHS) were applied, slightly adapted, and translated to Dutch, taking into account the ages of children in the study (Lyubomirsky and Lepper 1999). Higher scores reflect more feelings of happiness. The internal consistency in this study was $\alpha=0.81$.

Parent Report About Their Child The parent version of the Dutch *Screen for Child Anxiety Related Emotional Disorders* (SCARED-71) assesses children’s anxiety symptoms and has good discriminant validity (Bodden et al. 2009). We used five out of nine scales: panic disorder, generalized anxiety disorder, social phobia, separation anxiety disorder, and obsessive–compulsive disorder. Parents indicate how frequently their child experiences each anxiety symptom on a Likert-type scale (0=never, 1=sometimes, 2=often). Higher scores reflect more symptoms of anxiety. Internal consistency for the total score in this study was $\alpha=0.89$.

A Dutch translation of the 30-item *Social Competence and Behavior Evaluation* (SCBE-30) assesses children’s behavioral functioning in three domains: anger/aggression, social competence, and anxiety/withdrawal (LaFreniere and Dumas 1996) and was developed for children of 3 to 6 years of age. Items are rated on a Likert-type scale (1=never to 6=always). Higher scores on anger/aggression and anxiety/withdrawal reflect more problem behaviors, whereas higher scores on social competence reflect more socially competent behaviors. All scales show good internal consistency, ranging from $\alpha=0.73$ to 0.82, which was found to be similar in this study ($\alpha=0.78$ to 0.82). Construct validity was supported by its relationship with observed behavioral patterns during mother–child interactions (Kotler and McMahon 2002).

Four out of six scales of a Dutch translation of the *Sleep Disturbance Scale for Children* (SDSC) were used to assess children’s sleep difficulties (Bruni et al. 1996): disorders of

initiating and maintaining sleep, disorders of arousal nightmares, sleep–wake transition disorders, and disorders of excessive somnolence. Items were scored on a Likert-type scale (1=never to 5=always), except for two items on sleep duration (9–11, 8–9, 7–8, 5–7, and <5 h) and on how long it takes to fall asleep (<15, 15–30, 30–45, 45–60, >60 min, and I do not know). Higher scores reflect more sleeping difficulties. The questionnaire has good internal consistency ($\alpha=0.71$ in sleep disorder subjects, $\alpha=0.79$ in control subjects), adequate test–retest reliability ($r=0.71$), and good discriminant validity (Bruni et al. 1996). In this study, the internal consistency was $\alpha=0.85$.

Teacher Report About Class Climate A Dutch translation and adaptation (Verhoeven et al. 2007) of three subscales of the *School as a Caring Community Profile II* (Lickona and Davidson 2003) was used to assess the social climate in the classroom: perceptions of student respect, perceptions of student friendship and belonging, and perceptions of students shaping of environment. Higher scores reflect a better social climate in the classroom.

Expectations

From baseline to pretest, no changes in any of the measures are expected. After training, we expect a reduction in children’s ruminative thoughts, an increase in sense of coherence and feelings of happiness, and an increase in the following aspects of emotion awareness: differentiating emotions, verbal sharing, not hiding emotions, and attending to others’ emotions. Although higher scores on bodily awareness and lower scores on analysis of emotions are regarded as indicative of lower emotion awareness (Rieffe et al. 2008), we expect bodily awareness to increase and analysis of emotions to reduce after intervention, since mindfulness focuses on becoming aware of bodily sensations and returning to the breath, instead of analyzing emotions. We also expect reductions in children’s symptoms of anxiety, sleep difficulties, anger/aggression, and anxiety/withdrawn behaviors and an increase in social competent behaviors. Finally, an increase in teacher-reported social climate is expected. Since rumination is a potentially important predictor or risk factor for mental health problems, such as depression and anxiety (Muris et al. 2005), we also explored whether children with higher or lower levels of rumination at pretest are affected by the intervention differently.

Statistical Analysis

The effectiveness of the school-based mindfulness intervention was tested through multilevel regression analysis (aka linear mixed model analysis), in which the repeated measurements were considered as nested within subjects. Subjects were associated with eight classrooms from three schools, but these

numbers are too small to distinguish another level in the multilevel analysis, and classroom was entered as a fixed variable instead to account for class differences. Multilevel regression analysis enables utilization of all available data, including observations from subjects with partially missing data (incidentally or by design). The analysis was conducted in three steps.

Firstly, for each outcome variable, we fitted a model with main and interaction effects of measurement occasion and classroom. A significant interaction effect of measurement occasion and classroom might indicate that the intervention affected classes from the waitlist-control condition and classes from the immediate-intervention condition differently. However, none of the global tests of interaction effects turned out significant. Secondly, we fitted models with binary indicator variables for baseline, posttest, and follow-up measurements, using the pretest measurement as reference and including classroom, sex, and age as control variables. Thirdly, we explored possible interaction effects of control variables with measurement occasions to test whether the intervention effects varied with sex and age.

All outcome variables were standardized to zero mean and unit variance, so that the regression coefficients can be interpreted as effect sizes d for binary indicator predictors and effect sizes r for standardized continuous predictors. The number of teachers was too small to conduct significance tests. Therefore, we decided to report only the descriptives for teacher-reported measures.

Results

Preliminary Analysis

Descriptives for outcome measures at baseline, pretest, posttest, and follow-up test are presented in Table 3. Independent-sample t tests showed that children in the waitlist-control group and the immediate-intervention group did not differ in age, gender, or any of the outcome variables at pretest.

The data were screened for the presence of outliers and missing values. As a rule of thumb, no more than 10 % of the missing items on a scale were allowed to be included in the analysis. With <10 % missing, the missing value was replaced by the mean item score of that individual on that particular scale. With more than 10 % missing, the data were excluded from analysis. Inspection of the distributions of outcome variables revealed that disorders of arousal nightmares were never to seldom present in this sample, and this variable was excluded.

Intervention Effects

The first series of models showed significant effects of measurement occasion and classroom but no significant

interaction effects, indicating that the intervention affected classes from the waitlist-control condition and classes from the immediate-intervention condition in the same way. We, therefore, removed the interaction effects from the second series of models, in which we reparameterized the measurement occasions in such a way that the baseline parameter is associated with a test of the difference between baseline and pretest, the posttest parameter is associated with a test of the difference between pretest and posttest, and the follow-up parameter is associated with a test of the difference between pretest and follow-up. Classroom, sex, and age were included as control variables. Table 4 gives parameter estimates for the baseline, posttest, and follow-up deviations from pretest, as well as the effects of the sex and age.

From Table 4, it appears that differences between baseline and pretest are small and not significant for any of the child-reported or parent-reported variables. From pretest to posttest, child-reported verbal sharing of emotions and bodily awareness of emotions increased significantly, although the effect sizes are small. We also see small effects on not hiding emotions, on sense of coherence, and on parent-reported anxiety symptoms, but these effects are not significant at the 5 % level.

From pretest to follow-up, child-reported differentiating emotions, verbal sharing of emotions, bodily awareness, not hiding emotions, and sense of coherence increased significantly. In addition, a significant decrease in rumination and analyzing emotions was found. Parent-reported anxiety symptoms and angry/aggressive behaviors decreased significantly. However, all effect sizes are small, and subsequent likelihood ratio tests show that the differences between pretest and posttest or follow-up are generally not significantly larger than differences between baseline and pretest, with the exception of the pretest–posttest difference that is significantly larger than the baseline–pretest difference for bodily awareness ($\chi^2=4.173$, $df=1$, $p=0.041$) and the pretest–follow-up difference that is significantly larger than the baseline–pretest difference for anxiety symptoms ($\chi^2=4.047$, $df=1$, $p=0.044$).

We explored whether the intervention affected girls and boys differently or whether the intervention effects were moderated by children's age, but we found no significant or interpretable results.

Additional exploratory analyses revealed that children who ruminated at medium or low levels showed a larger increase in bodily awareness due to the intervention than children who ruminate more and showed higher bodily awareness already at pretest. Similar results were found for attending to others' emotions. Children with medium or low levels of rumination showed a larger increase in attending to others' emotions due to the intervention than children who ruminated more and attended to others emotions more initially. With regard to analyzing emotions, children with medium or high levels of rumination showed a larger decline in analyzing emotion due

Table 3 Means (*M*) and standard deviations (*SD*) for outcome variables

	Baseline		Pretest		Posttest		Follow-up test	
	102–104		188–195		185–189		174–192	
	47		103		78		61	
	6		12		9		9	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Child report								
Differentiating emotions	16.99	3.04	17.16	3.23	17.30	3.22	17.79	3.12
Verbal sharing of emotions	7.89	2.22	8.18	2.16	8.54	2.15	8.72	2.21
Bodily awareness	10.51	2.75	10.42	2.79	10.90	2.39	10.85	2.62
Not hiding emotions	7.99	1.96	8.24	2.11	8.46	1.92	8.66	2.09
Attending to others' emotions	12.06	2.10	12.26	2.15	12.12	2.49	12.46	2.23
Analysis of emotions	9.95	2.37	10.04	2.40	9.85	2.80	9.46	2.69
Rumination	18.26	4.09	18.01	4.13	17.88	4.37	17.28	4.51
Sense of coherence	47.01	6.94	47.17	7.09	47.74	7.51	48.76	7.47
Happiness	7.18	1.41	7.22	1.63	7.21	1.54	7.35	1.54
Parent report								
Anxiety symptoms	64.91	8.84	65.38	9.59	63.59	9.01	61.89	7.96
Anger/aggression	15.40	3.35	14.84	2.93	14.49	2.91	14.16	2.52
Social competence	30.15	3.58	30.39	3.93	30.67	4.07	30.11	3.74
Anxiety/withdrawal	15.45	3.32	15.18	3.42	15.08	3.31	14.88	3.07
Disorders of initiating and maintaining sleep	11.40	4.34	11.63	3.48	10.94	3.55	10.97	3.19
Sleep–wake transition disorders	8.61	2.09	8.41	2.50	8.12	2.22	8.39	2.34
Disorders of excessive somnolence	6.59	1.61	6.68	2.09	6.61	2.34	6.57	2.36
Teacher report								
Student respect	3.28	0.39	3.31	0.58	3.73	0.16	3.43	0.47
Student friendship and belonging	3.50	0.32	3.57	0.44	3.84	0.24	3.81	0.38
Student shaping of environment	3.29	0.34	3.15	0.62	3.48	0.45	3.38	0.56

to the intervention than children with low levels of rumination. Children who ruminate less showed higher levels of anger and aggression initially and a larger decrease as a result of the intervention. Rumination did not moderate the effects of the intervention on any of the other child-reported or parent-reported measures.

Descriptives from Teacher Report

Although significance tests are not possible, inspection of the means in Table 3 reveals large increases in student respect, student friendship and belonging, and student shaping of the environment as perceived by teachers.

Discussion

This study investigated the effects of a 6-week school-based mindfulness training on stress and mental health in

unselected elementary school children, using an experimental waitlist controlled design. The main results can be summarized as follows:

First, although only a few primary prevention effects of the training on stress and mental well-being were found directly after training, more effects were reported by both children and their parents at follow-up.

Second, exploratory analysis revealed that children who ruminated more are affected by the intervention differently than children who ruminated less. Children who ruminated more already had high levels of bodily awareness and attention to others' emotions initially, but analyzed their emotions less as a result of the intervention. Children who ruminated less showed an increase in bodily awareness and attention to others' emotions as well as a decline in anger and aggression due to the intervention.

The finding that primary prevention effects became more visible at follow-up suggests that the training has a prolonged effect. A possible explanation for this prolonged

Table 4 Significance tests of the effects of mindfulness interventions on mental health and behavioral problems in 8- to 12-year-old children

	Baseline (vs pretest)			Posttest (vs pretest)			Follow-up (vs pretest)			Sex (girl vs boy)			Age (standardized)		
	<i>b</i>	SE	<i>p</i>	<i>b</i>	SE	<i>p</i>	<i>b</i>	SE	<i>p</i>	<i>b</i>	SE	<i>p</i>	<i>b</i>	SE	<i>p</i>
Child report															
Differentiating emotions	-0.154	0.083	0.065	0.063	0.061	0.298	0.193	0.068	0.005	0.034	0.120	0.777	-0.027	0.103	0.797
Verbal sharing of emotions	-0.155	0.085	0.067	0.171	0.064	0.008	0.222	0.069	0.001	0.185	0.117	0.113	0.056	0.101	0.578
Bodily awareness	0.054	0.081	0.506	0.186	0.061	0.003	0.162	0.068	0.018	0.518	0.114	0.000	-0.140	0.098	0.155
Not hiding emotions	-0.124	0.088	0.158	0.128	0.067	0.056	0.202	0.075	0.007	0.341	0.116	0.004	0.162	0.099	0.105
Analysis of emotions	0.067	0.089	0.454	-0.083	0.073	0.256	-0.220	0.076	0.004	0.081	0.110	0.460	-0.076	0.094	0.424
Attending to others' emotions	-0.085	0.076	0.268	-0.038	0.053	0.476	0.064	0.061	0.299	0.508	0.114	0.000	-0.017	0.098	0.861
Rumination	0.111	0.083	0.183	-0.053	0.055	0.339	-0.165	0.061	0.007	0.095	0.110	0.392	-0.026	0.096	0.789
Sense of coherence	-0.104	0.074	0.161	0.085	0.051	0.095	0.216	0.058	0.000	0.232	0.122	0.058	0.135	0.105	0.201
Happiness	0.049	0.095	0.605	0.034	0.065	0.601	0.094	0.064	0.144	0.104	0.119	0.385	0.097	0.104	0.349
Parent report															
Anxiety symptoms	0.007	0.115	0.952	-0.163	0.098	0.100	-0.369	0.089	0.000	0.137	0.171	0.426	0.385	0.159	0.018
Anger/aggression	0.147	0.115	0.207	-0.104	0.107	0.333	-0.301	0.093	0.002	-0.287	0.164	0.084	0.031	0.152	0.838
Social competence	-0.045	0.123	0.712	0.119	0.105	0.259	-0.034	0.101	0.740	0.271	0.164	0.101	0.396	0.154	0.012
Anxiety/withdrawal	-0.013	0.110	0.909	-0.019	0.100	0.846	-0.078	0.087	0.374	-0.218	0.173	0.211	0.259	0.161	0.113
Disorders of initiating and maintaining sleep	0.145	0.113	0.203	-0.161	0.107	0.136	-0.089	0.098	0.369	-0.090	0.163	0.580	0.124	0.150	0.413
Sleep-wake transition disorders	0.052	0.108	0.634	-0.053	0.108	0.627	0.126	0.108	0.248	-0.160	0.177	0.369	-0.021	0.166	0.900
Disorders of excessive somnolence	0.095	0.134	0.482	0.012	0.121	0.920	0.054	0.093	0.562	0.229	0.159	0.154	0.161	0.148	0.281

As outcome variables have been standardized, regression coefficients for binary indicator variables can be interpreted as effect sizes *d*, with 0.2, 0.5, and 0.8, indicating small, medium, and large effects, respectively, and regression coefficients for standardized predictors can be interpreted as effect sizes *r*, with 0.1, 0.3, and 0.5 indicating small, medium, and large effects, respectively. To save space, the table does not include estimates of intercepts and classroom effects

b regression coefficient, *SE* standard error, *p* probability associated with significance test

effect may be that children continue to integrate mindfulness into their lives, strengthening their skills over time.

Although effect sizes were small, the results are valuable, considering that participants in primary prevention programs are mostly functioning in the normal range (Durlak and Wells 1997). Several meta-analysis show that effects of primary (or universal) prevention programs targeting depression, anxiety, or behavioral problems in children and adolescents are often nonsignificant and that, when effects are found, effect sizes are mostly small (Horowitz and Gardner 2006; Merry et al. 2009; Stice et al. 2009; Wilson and Lipsey 2007), although primary prevention programs targeting anxiety specifically may show larger effects (Neil and Christensen 2009).

Effects of the intervention on class climate as reported by teachers seem large. However, the number of teachers was too small to conduct significance test. Future studies should include a larger number of teachers be able to draw conclusions on the effects of the intervention on class climate.

Although the effects of the training on emotion awareness aspects were in the expected direction, two aspects of emotion awareness need further consideration. First, the authors of the EAQ have found evidence that more bodily awareness of emotions might be indicative of less emotion awareness (Rieffe et al. 2008) and argue that it is probably more adequate to focus on the elements in the situation that caused the emotion (differentiating emotions) than on the physical signals (bodily awareness) in order to deal with a situation adaptively. However, in mindfulness, it is assumed that bodily awareness of emotion-related physical signals may help recognize emotional states before one is able to identify what evoked the emotion. However, for adaptive coping, it is important not to be caught up in that emotion and to observe it with a certain amount of distance, so called “decentering” (Segal et al. 2002). This is what is learned in mindfulness training; being aware of whatever physical sensations, emotions, or thoughts that exist at the present moment, without being absorbed by them. Second, although analyzing emotions is considered to indicate more emotion awareness (Rieffe et al. 2008), from a mindfulness perspective, analyzing emotions may result in ruminative worry. However, after the training, children were more aware of their bodily sensations and especially children who tended to ruminate at the start of the study analyzed their emotions less.

The present study showed that it is feasible to incorporate a low-intensity (6 h) mindfulness training in the classroom setting, letting all children benefit from the intervention. Effects became more pronounced at follow-up, when formal training had ended. Although teachers supported the program in their classroom, they reported difficulties incorporating mindfulness in the classroom after the training by the experienced mindfulness trainer had ended. Perhaps more guidance of classroom teachers or an in-school mindfulness trainer could enhance the incorporation of mindfulness in

the school climate. Mindfulness trainers must have extensive personal experience of mindfulness practice and an embodiment of the foundations of mindfulness (Kabat-Zinn 2003). Teachers and students may benefit from the incorporation of mindfulness in the educational setting, since mindfulness training may help teachers cope with their own stress and, as a result, may influence their interaction with their pupils (Gold et al. 2010).

Strong points of this study are the randomized trial with a large sample, low attrition rate, follow-up measurement, multilevel analysis allowing for utilizing all available data, including observations from children with incomplete data, use of multiple outcome measures and multiple informants, and the heterogeneity of the sample, with schools included with students from different ethnic backgrounds. Limitations and directions for future research are given in the succeeding paragraphs.

First, since the waitlist-control group also received training, it is not possible to say whether children in the intervention group indeed develop psychopathology less frequently in the longer run. In addition, since changes found between pretest and posttest or follow-up were not always significantly larger than changes between baseline and pretest, we cannot exclude the possibility that change is due to maturation instead of the intervention. In future research, a control group that receives no training at all and a control group that receives a different kind of training should be incorporated. Second, only a small number of classes participated, making generalization of results to the general school population difficult. In addition, although children of parents who participated in the research did not differ on gender, age, and outcome variables from children of parents who did not participate in the research, it is possible that they differ on other important variables unknown to us. Although we tried to prevent selection bias by including whole classrooms, the inclusion of teachers who were interested in participation most likely also resulted in a selection bias, although on a different level. Therefore, caution with regard to generalization of the results is still warranted. Future studies should include larger samples and make a special effort into including whole schools in the training—with all teachers participating—and all parents as informants. Third, because we wanted to explore which aspects of child functioning are targeted with mindfulness training, we included a fairly large number of variables. Since this may increase the risk of a type I error (i.e., false-positive finding), replication of the results is necessary using fewer, specifically chosen variables. Fourth, since follow-up measurement indicates that some effects emerge later, it will be interesting to include longer-term follow-up measurements. Fifth, interventions were given by a single mindfulness trainer. Results should be replicated using a larger group of trainers, preferable from the school context,

in order to facilitate implementation. A training program for elementary school professionals has been implemented in the Netherlands. Finally, effects may be enlarged by involving parents in mindfulness practice, so that mindfulness becomes part of the family climate, and by follow-up training in subsequent school years. This provides children with the possibility to expand their mindfulness skills or to benefit from mindfulness training in different phases of their individual development.

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