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The Effects of Mind Subtraction Meditation on Depression, Social Anxiety, Aggression, and Salivary Cortisol Levels of Elementary School Children in South Korea[1]

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This study analyzed the effects of a school-based mind subtraction meditation program on depression, social anxiety, aggression, and salivary cortisol levels of 42 elementary school children in South Korea. The research design was a nonequivalent group comparison with pretest and post-test. The experimental group was given 8 weeks of the meditation program. The results showed social anxiety, aggression, and salivary cortisol levels were significantly lowered in the experimental group. This demonstrated that the school-based mind subtraction meditation program could be effective in improving psychosocial and behavioral aspects of mental health in elementary school children.

Background

With rapid changes in today's modern society, stress levels in elementary school students are increasing due to school performance pressures and competitions, peer relationship, and family issues. These risk factors are linked to anxiety, depression, suicidal ideations and attempts, and other mental health problems (Bae, Park, & Yang, 2012; Byrne & Mazanov, 2003; Lee, 2011a, 2011b, 2011c). Within the United States, there has been an increased attention on school-based promotion of students' social and emotional competence to improve poor academic motivation, school dropout, school bullying and aggression, and mental health problems

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(Schonert-Reichl et al., 2015). However, one-third of youth attending schools in the United States meet the criteria for at least one mental health disorder, with anxiety being the most common condition (Gibson, 2011). It has been also estimated that two thirds of youth with mental health problems are not getting the help they need (Varcarolis, 2013).

Globally, much research attention is being paid to stress levels of children in traumatic life events and experiences; such as war trauma in Palestinian children (Khamis, 2015), Somali refugees (Ellis et al., 2013), Rwandan genocide (Neugebauer et al., 2014), and Chilean earthquake (Garfin et al., 2014). According to the World Health Organization, mental health disorders are the most prevalent source of disability worldwide for youth aged 10–24 years who comprise 27% of the world's population; the disorders account for 45% of total morbidity and include major depression, substance abuse, schizophrenia, and bipolar disorder (Gibson, 2011). Mental disorders often continue into adulthood. Approximately 75% of 21 year-olds with mental disorders had previous mental health issues earlier in life (Varcarolis, 2013).

According to a recent South Korean health report (National Youth Policy Institute, 2014), children and youth with mental issues are on the rise. The report also indicated that many of these children are not able to receive appropriate care within the present health care system. Due to this, schools are exploring feasible strategies to satisfy such social, emotional, behavioral as well as academic demands of their students. As a part of these strategies, diverse meditation programs are being introduced in school settings abroad (Schonert-Reichl et al., 2015; Wisner, Jones, & Gwin, 2010). Frequently, many schools in South Korea tended to utilize counseling as a main part of intervention to alleviate stress levels and to enhance emotional stability of their students. As Ahn and Cheon (2010) stated, more South Korean educational systems are now using meditation as a possible stress intervention in diverse settings of schools and recent South Korean research studies on meditation seemed to demonstrate its positive effects. The effects of meditation were studied on school performance improvement, concentration/focus enhancement, emotional stability, psychological and social anxiety (Choi & Chun, 2010; Kim & Kim, 2007). Kang (2009) also reported that an increasing number of Korean schools are incorporating meditation programs to enhance personal development of students, not just merely as a stress intervention strategy.

Generally, meditation programs are shown to be effective in reducing negative emotions and can lead to maturity in youth through self-development (Kim, Yoo, Lee, & Son, 2013). Various meditation research studies on children and youth also have demonstrated effectiveness in academic performance as well as reductions in anxiety, improvements in independence and self-esteem (Barnes, Bauza, & Treiber, 2003; Beauchemin, Hutchins, & Patterson, 2008; Benson et al., 1994; Rosaen & Benn, 2006; So & Orme-Johnson, 2001; Wisner, 2008). School-based meditation programs especially were shown to be helpful in creating positive school ambience or environment (Wisner, 2008).

Various programs such as mindfulness based stress reduction (MBSR) were utilized in many meditation research studies in South Korea and other countries. For example, one study demonstrated a reduction in test taking anxiety for first to third graders through MBSR (Napoli, Krech, & Holley, 2005); and another (Zylowska et al., 2008) showed a reduction in depression and anxiety for youth with attention deficit hyperactivity disorder (ADHD). Biegel, Brown, Shapiro, and Schubert (2009) reported a reduction in anxiety, depression, compulsion, and perceived stress in youth being treated for mental symptoms on an out-patient basis. Astin (1997) and Bae and Chang (2006a, 2006b) also reported a reduction in both state anxiety and trait anxiety in medical students; and an increase in spiritual experience and self-esteem (Shapiro, Schwartz, & Bonner, 1998). Other research studies on meditation programs such as meditation-based perceived behavior program (Park & Kim, 2009), movement meditation program (Lim, 2003) and Anapanasati meditation (Park, 2003) also reported reductions in depression and anxiety in youth.

As demonstrated, meditation has received much attention as a possible strategy to alleviate stress levels and to enhance emotional stability of youth. In reality, many schools are incorporating meditation methods in their curricular programs to help prevent and heal psychological and emotional problems which impede learning (Fisher, 2006). This present study focuses on utilization of mind subtraction meditation which had been gaining attention worldwide, including South Korea (Lee, 2012). Because the mind subtraction meditation clearly defines the human mind with a method which is systematic and specific, its applicability in younger age groups is easier (Lee, 2009). The mind subtraction meditation is an assertive method of self-reflection to eliminate a false human mind (Woo, 2011). Previous studies in the mind subtraction meditation showed effective reductions in anxiety, depression, stress, and aggression in youth, college students, and educators (Jeong, 2005; Kim, 2010, 2012; Kim, Yoo, et al., 2013). But these studies had examined the effectiveness of the mind subtraction meditation only as camp programs during school breaks. There was a need to examine a school-based mind subtraction meditation practice as a curricular program, which is applied consistently during school semesters.

Therefore, this present study explored possible changes in psychosocial problems, such as depression, anxiety, aggression, and stress, in a school-based mind subtraction meditation program where the meditation practice was a part of school curriculum in South Korea. Specifically, this study was conducted to verify the effectiveness of the school-based meditation program on depression, social anxiety, aggression, and salivary cortisol levels, which is a measure of physiological stress level. Through the evaluation and verification, we hope to contribute to possible approaches for psychological and emotional enhancement

in elementary school students. The following questions were posed:

1) Is the meditation effective in depression reduction for elementary school students?
2) Is the meditation effective in social anxiety reduction for elementary school students?
3) Is the meditation effective in aggression reduction for elementary school students?
4) Is the meditation effective in stress reduction for elementary school students?

Literature Review

Research Studies on Youths Related to Mental Health

When examining related research studies exploring depression, anxiety, aggression and stress in youth, we found the following: first, when depression occurs in children, younger the age of the initial symptoms, more chronic are the conditions (Choi et al., 2012); and, in comparison to adults, depressed youth tend to be more emotionally labile with compulsive behaviors, which are continuously highly linked to suicides in youth (Bae, 2000; Goldney, Fisher, Wilson, & Cheok, 2002; Park, 2009).

Based on a 2012 survey, Korea Youth Counseling and Welfare Institute (2013) reported there had been a three-fold increase in youth counseling since 2008 due to depression and suicidal ideations; and counseling needs of youth with suicide attempts and self-mutilations increased six times. About 30% of youth experienced suicidal ideations with top two reasons being poor academic performance (42.7%) and family conflict (24.2%), according to Korea National Youth Policy Institute (2014). A recent 2014 survey by Korea Health Promotion Foundation also showed that over half of teenagers had suicidal thoughts; nearly one in three said they felt very depressed (Kang, 2014); and the number of youth suicides increased 57 percent since 2001 (Korea Herald, 2013).

Secondly, social anxiety is one of psychological symptoms that are most commonly experienced and it occurs in social situations or activities (Kim, Cho, & Lee, 2000). Some report 12 to 13 years of age as the typical age when social anxiety is noticed with elementary school years seen as an important period in development of social anxiety symptoms (Kwon, Park, & Kim, 2013; Oh & Yang, 2003). Social anxiety during childhood can lead to refusal to attend school, depression, related physical symptoms, and substance abuse. Also, some authors report development of social anxiety during this period of life can result in chronic anxiety which can affect these children for the rest of their lives (Kwon et al., 2013; Moon & Oh, 2002). These research results suggested high correlation between social anxiety in childhood with anxiety disorders of adulthood and thusly, propose the importance of early detection and appropriate treatments for social anxiety during childhood (Lee, 2011a, 2011b, 2011c).

Thirdly, aggression is defined as all types of behaviors with intend to hurt or harm another individual (Roh & Kim, 2013). It is known that children with higher levels of aggression have poorer level of social adaptation than children with lower levels of aggression; and there is a tendency of increasing problematic behaviors as the children get older (Hong & Rho, 1983; Kim, 2010). Further, not only the aggression in earlier years of development can persist and strengthen as the children get older, there is a possibility it can lead to problems due to social maladaptation, such as juvenile delinquency and criminal behaviors (Roh & Kim, 2013; Varcarolis, 2013).

Lastly, cortisol hormone levels were measured in this study, which has been shown to be a good measurement for stress levels in human beings (Kim, Jang, Kim, & Kim, 2012) and it has been well-studied in many populations, including children, as an important measurement of biologic reactivity to stress (Spratt et al., 2012). Cortisol is a steroid hormone, more specifically a glucocorticoid, which is released in response to stress and a low level of blood glucocorticoids. Its primary functions are to increase blood sugar through gluconeogenesis; suppress the immune system; and aid in fat, protein, and carbohydrate metabolism.

Any type of physical or mental stress can result in an elevation of cortisol. Serum cortisol levels increase in response to stress and it also affects immune and emotional state (Park, 2009). The cortisol levels can be measured through blood, urine, and saliva samples; salivary and serum levels of cortisol were shown to be positively correlated with statistical significance in adults (Shusaku, 2012). A meditation research study which specifically measured salivary cortisol levels in breast cancer patients found that MBSR approach was effective in lowering salivary cortisol levels (Kang & Oh, 2012).

In children, several studies indicate that salivary cortisol level is a simple and reliable method to measure stress levels in pediatric populations such as children with autism and children who are in foster care (Schupp, Simon, & Corbett, 2013; Van Andel, Jansen, Grietens, Knorth, & Van der Gaag, 2014). According to Gafni, Papanicolaou, and Nieman (2000), salivary cortisol measurement is a reliable and accurate way to screen for measuring hypercortisolism to detect Cushing's syndrome in children.

Mind Subtraction Meditation

Recently, there has been an increased attention on the mind subtraction meditation as a curricular program in schools not only in South Korea, but worldwide (Lee, 2012). According to the mind subtraction meditation principles, the human mind consists of a person's lived experiences and thoughts stored in his subconscious mind. These memories along with each accompanying emotions are recorded and stored similar to a videotape in one's mind, which influences the person's state of mind and behaviors (Woo, 2011). The mind subtraction meditation is a program through which one would eliminate the mind of 'self' and recover the original

mind, or the true self. When comparing cognitive therapy and the mind subtraction meditation, both methods are similar in that they change perceptions, attitudes of acceptance toward situations, and reduce negative emotions (Kim, 2012). Only difference would be that cognitive therapy approaches emphasize perception as a root of emotional responses and thusly, solve problems through changes in perceptions; whereas the meditation emphasizes direct elimination of emotions instilled within memories, thereby assisting in problem resolution and eradicating any chances of future development of dysfunctional thoughts or responses (An, 2006).

Method

Participants of the Research

About 60 participants are necessary to obtain statistically valid results for a power of 0.80 and a statistical significance level of 0.50; and 26 participants in each of the two groups, with a total sample size of 52 participants, will provide a power of F statistic of 0.80 at p value of 0.05 in two-group analysis of variance (Keppel, 1991). At the beginning of this research study, the total number of participants able to be recruited for this study consisted of 54 elementary students in a city of South Korea.

This elementary school was located in a large urban setting where there were many multiple dwelling apartments. The educational levels and economic status of parents were high with much attention paid to children's education and academic performance. Many students attended early or private enrichment programs in addition to regular school curriculums. Due to the high emphasis on education and accompanying academic pressures, many students of this school were stressed but were not supported or intervened through school-based programs.

The institutional review board of school of nursing, at a university in South Korea approved the study. The investigators explained to each participant the research study's purpose, procedures, confidentiality, voluntary participation, potential risks and benefits as well as the participants' rights to withdrawal from the research study without penalty. Only with their full consents, the research study was initiated with the students.

The participants of experimental group were 5th graders (mean age of 10 years) consisting of 26 students out of 27 total students in the class, who consented to the research study. The control group participants were from the same school but the classroom was physically located far from the experimental group's classroom. The control group consisted of 20 students out of available 27 students of 5th grade level (mean age of 10 years), who consented to study. Parental consents were obtained for all groups. At the start of meditation sessions, there were 26 for the experimental group and 20 for the control group; however, due to missing data, 3 of the experimental group and 1 of the control group were eliminated from the final data analysis. A total of 23 students in the experimental group consisted of 13 boys and 10 girls; and a total of 19 students in the control group consisted of 7 boys and 12 girls.

Research Design

This study used a nonequivalent group comparison with pretest and posttest design to examine the effects of a school-based meditation program on depression, social anxiety, aggression, and salivary cortisol levels of elementary school students. The experimental group was given the meditation program sessions by their instructor four times a week with 30 minutes per session, for a total of 8 weeks. The control group was given reading sessions with same frequencies as the experimental group: four times a week with 30 minutes per session, for a total of 8 weeks.

Evaluative Tools

Questionnaires for depression, social anxiety, and aggression as well as salivary cortisol levels for stress level testing were completed in this study.

Depression

Depression was measured using Children's Depression Inventory (CDI) developed by Kovacs (1981) which were translated into Korean by Han (1993). This measuring tool consisted of 27 items pertaining to 5 major factor areas related to negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. The CDI scale is self-rated and symptom-oriented with a rating from 0 to 2 for each statement; higher scores signify severity of depression. The research by Han (1993) indicated Cronbach's α as 0.81 and for this study Cronbach's α was 0.810 (pretest) and 0.898 (posttest).

Social Anxiety

To measure the elementary school students' social anxiety, Social Anxiety Scale for Children – Revised (SASC-R) developed by LaCreca and Stone (1993), which was translated into Korean version by Moon and Oh (2002), was used. It included a total of 18 items on a 5 point scale; higher scores indicate severity of social anxiety. Moon and Oh (2002) stated Cronbach's α as 0.87 and in this study it was 0.858 (pretest) and 0.937 (posttest).

Aggression

A Korean version (Park, 2007) of Aggression Questionnaire (BPAQ) developed by Buss and Perry (1992) was used to measure aggression levels of the students. This tool consisted of a total of 21 items (6 items related to physical aggression behavior; 5 items related to hostility, 6 items related to verbal aggression behavior, and 4 items related to anger) on a 5 point scale. Higher scores signified more levels of aggression. In the study by Park (2007), Cronbach's α as 0.91 and in this study it was 0.858 (pretest) and 0.888 (posttest).

Salivary Cortisol Testing

To evaluate the stress levels, physiological measurements of salivary cortisol were collected. Cortisol levels typically peak in the morning and are at lowest levels in the evening;

and cortisol is secreted from the adrenal cortices in response to stress (Clow, Thorn, Evans, & Hucklebridge, 2004; Schupp et al., 2013; Shin et al., 2011). A study on pre-school aged children with autism (Kidd et al., 2012) examined salivary cortisol levels upon awakening in the mornings, mid-afternoons at 2 PM, and also in the evenings right before bedtime. Another research study examined salivary cortisol levels of children during mid-afternoons at 4 PM, in addition to the morning and evening collections (Issaksson, Nilsson, & Lindblad, 2013). Typically, salivary cortisol levels are taken two to three times daily, as in the previously mentioned studies examining salivary cortisol levels in children. It was deemed difficult to control for accurate sample collections at home for this study and the investigators decided to collect samples at the same time during school hours for consistency.

To minimize the diurnal variations and fluctuations in cortisol secretions, the cortisol collection was accomplished during the afternoon hours of 2 to 4, when there is a steady concentration of cortisol (Takeda, Tsujita, Kaya, Takemura, & Oku, 2008). An hour before each cortisol collection, the participants were told not consume any stimulating food items. Also, 10 minutes before each collection, they rinsed their mouths with cold water. Within one minute intervals, the participants spat three times into clean specimen collection cups, with resulting approximate amount of 2 ml per cups. Immediately after collections, the cups were stored with a temperature of −20 °C and were transferred to a laboratory in a dry ice boxes. The laboratory used enzyme-linked immunosorbent assay (ELISA) to analyze the salivary cortisol. Increased levels of cortisol indicate an increase in physical stress level.

Meditation

The meditation program used in this research, the mind subtraction meditation, was given for a total of 8 weeks from October 28th to December 20th in 2013; it was given 4 times a week, with 30 minutes each session, during morning class hours. This program was taught by a certified instructor who completed a full 8 levels of the meditation program. The experimental group was instructed on first level of the program, which was appropriately modified to the age level in instructions and meditation sessions (Table 1). The program progression was as follows:

1) first of four sessions per week involved using the subtraction method with exercises to explain false vs. true mind (Table 2 for examples);
2) to further verify the contents of subtraction, the students were instructed to express about false mind within themselves through writings or drawings;
3) after each mind-subtraction activities, the students were given opportunities to present to their peers and also express their impressions through writings or drawings; and,
4) the meditation sessions were given in a group setting. For students who had a difficulty understanding instruction on the meditation, the instructor spent time with the individual students to practice the mind-subtraction by using more specific examples.

Data Collection

The data collection started after the researchers explained the purpose and method of data collection to the instructor. The pretest data were collected from the experimental and control groups on the first day of the program in the first week. The posttest data were collected from the groups on the same last day of the program. All data collections were accomplished in an equal manner consistently by the same researchers.

Data Analysis

SPSS software 21.0 was used for all data analysis. To analyze the effect of the meditation program, t-tests were used to compare the pretest and posttest scores in depression, social anxiety, aggression, and salivary cortisol levels. Through ANCOVA (analysis of covariance), the differences in intervention results were analyzed with controlling for pretest scores.

Results of the Research

Homogeneity Testing

Demographic data were used to analyze for homogeneity of the participants. Other than individual uniqueness and dependent variables (depression, aggression, and salivary cortisol), all other variables were homogeneous in groups (Table 3).

Research Hypotheses Testing

The following hypotheses were tested based on the research questions:

Hypothesis 1. The experimental group which received the school-based meditation program will have a decrease in depression scores in comparison to the control group.

The effect of the school-based meditation program on students' depression is shown in Table 4. Before the program, depression mean score for the experimental group was 5.91; for the control group it was 12.42. The experimental group's scores were low, which was statistically significant ($p < .001$). After the program, the experimental group was lower (4.52) than the control group (12.39) ($p < .001$). Analyzing by ANCOVA to control for the previous scores, the experimental group was still lower (7.34) than the control group (8.79), but it was not statistically significant ($p = .347$). These changes in scores may be analyzed as occurring due to pretest average score differences, not due to the meditation program. Therefore, the hypothesis 1 was rejected.

Hypothesis 2. The experimental group which received the school-based meditation program will have a decrease in social anxiety scores in comparison to the control group.

Table 5 shows analyzed results of social anxiety pretest and posttest. Mean pretest score for the experimental group

Table 1 Schedule of mind subtraction meditation program.

Weeks: Tues, Wed, Thurs, and Fridays (30 minutes each session)	Topic	Contents of meditation activity
1	Orientation; knowing the mind	-Orientation to the program (purpose and methods) -Knowing the false and true mind -Knowing the reasons for subtracting the mind -Knowing the method of subtraction and to practice
2	Throwing away of thoughts/ misperceptions about family	-Talk about events with family -Finding memories and writing about family -Subtracting thoughts/misperceptions about family -Verbalize feelings after the subtraction
3	Throwing away of thoughts/ misperceptions about school	-Talk about events in school (teachers and peers) -Finding memories and writing about school -Subtracting thoughts/misperceptions about school -Verbalize feelings after the subtraction
4	Throwing away of thoughts of inadequacy and dislikes	-Talk about memories of inadequacy and dislikes -Finding memories and writing about inadequacy and dislikes -Subtracting thoughts/misperceptions about inadequacy and dislikes -Verbalize feelings after the subtraction
5	Throwing away of thoughts of anxiety and worries	-Talk about memories of anxiety and worries -Finding memories and writing about anxiety and worries -Subtracting thoughts/misperceptions about anxiety and worries -Verbalize feelings after the subtraction
6	Throwing away of anger, irritation, and stress	-Talk about memories of anger, irritation, and stress -Finding memories and writing about anger, irritation, and stress -Subtracting thoughts/misperceptions about anger, irritation, and stress -Verbalize feelings after the subtraction
7	Throwing away of scary thoughts and fear	-Talk about memories of scary thoughts and fear -Finding memories and writing about scary thoughts and fear -Subtracting thoughts/misperceptions about scary thoughts and fear -Verbalize feelings after the subtraction
8	Throwing away of self (angry self, upset self, fighting self, stressed self, etc.)	-Talk about memories of self (what type of self exist?) -Finding memories and writing about self -Subtracting thoughts/misperceptions about self -Verbalize feelings after the subtraction

was 31.18; and for the control group it was 36.22, which showed no significance difference in social anxiety ($p = .119$). After the program, the social anxiety mean scores for the experimental group were lower (30.44) than the control group (46.29), which was statistically significant ($p = .001$). With ANCOVA to control for the previous pretest scores, the experimental group was lower (31.08) than the control group (44.20) ($p = .001$). This analysis demonstrated effectiveness of the school-based meditation program in reducing social anxiety, regardless of the pretest scoring on social anxiety. Therefore, the second hypothesis was accepted.

Hypothesis 3. The experimental group which received the school-based meditation program will have a decrease in aggression scores in comparison to the control group.

The analyzed effect on aggression (Table 6) demonstrates that pretest aggression mean scores for the experimental group was lower (36.36) than the control group (46.35), which was statistically significant ($p = .012$). After the program, the experimental group was significantly lower (30.74) than the control group (45.94) ($p < .001$). Through an analysis using ANCOVA to control for the previous pretest scores, the experimental group was still significantly lower (32.42) than the control group (44.12) ($p = .001$); demonstrating the effectiveness of the meditation program on reducing aggression, regardless of the pretest scores. Therefore, the hypothesis 3 was accepted.

Hypothesis 4. The experimental group, which received the school-based meditation program, will have a decrease in salivary cortisol levels in comparison to the control group.

The result of analysis on cortisol levels is listed on Table 7. Before the program, the experimental group's mean score was 0.052 and the control group was 0.080, which was statistically significant ($p = .024$). After the program, the experimental group mean score was significantly lower (0.046) than the control group (0.073) ($p < .001$). Using ANCOVA to control for the pretest scores, it was shown that the experimental group was still significantly lower (0.049) than the control group (0.070) ($p = .003$). Regardless of the

Table 2 Examples of instructional exercise.

Exercises	Instructor	Student responses
Exercise 1 objectives: 1. To assist the students' understanding of true vs. false mind 2. To realize what truly exist in the world and what are only remembered images/thoughts (false)	The instructor holds up and shows an apple to the students and asks, "What is it?"	The students answer: "It is an apple."
	"Is this a real apple? Can this be eaten?"	"Yes, it is a real apple and can be eaten."
	This instructor then hides the apple inside a desk drawer and asks, "Do you remember the apple? How it looked in color and shape? Can you bring it up in your mind?"	"Yes, it was a red, round apple."
	"Can this apple from your memory/thought be eaten and touched?"	"No, it is just an image of the apple, not a real apple. It cannot be eaten or touched."
	"So this apple in your mind is not real – does that mean this image of the apple in your mind is false and doesn't exist in the world?"	"Yes, it is false and it doesn't exist in the world."
	"Now think of another fruit, say banana – what color is it?"	"Banana is yellow in color."
	"Can you show me the banana in your mind?"	"No, the banana image in memory/thought cannot be shown to you, because it is not real and doesn't exist in the world."
	"The banana everyone in the classroom thought of - would it be the same exact banana?"	"No, probably not, because the banana image in mind won't be the exact same banana for everyone. It could be different sizes and color (bright yellow, greenish yellow, etc.)."
	The instructor says, "The banana in your mind is your own image/interpretation of the banana and it doesn't exist in the world. It cannot be shown to others and it cannot be eaten, either."	"Right."
Exercise 2 objectives: 1. To assist the students' understanding on throwing away remembered thoughts/ "pictures" of the mind 2. To practice throwing away thoughts/"pictures" of the mind	The instructor tells the students, "Now think about the apple you have seen just before. Imagine there is a big trash can in front of you. Does everyone have an image of a big trash can?"	"Yes."
	"Anything can be thrown into this trash can container. Please take your picture image of the apple, rip it up, crumple it and throw it into the trash."	The students imitate ripping and crumpling a picture paper of the apple and throw it into the imagined trash container.
	"Now raise your hands if you threw it away into the trash can. What happened when you threw it?"	"The apple disappeared."
	"Which apple disappeared, the real apple in the desk drawer or the false apple in your mind?"	"The false apple disappeared."
	The instructor takes out the apple from the drawer, "Here is the real apple. Just because you threw away the picture of apple in your mind, didn't mean the real apple was thrown away. Do you now understand how you can throw away thoughts of your mind?"	"Yes."

pretest scores, the program was shown to be effective in lowering cortisol levels in the elementary school students. Therefore, the hypothesis 4 was accepted.

Discussion

This study examined the effects of a school-based meditation program on depression, social anxiety, aggression, and a physiological stress measurement, salivary cortisol levels, in elementary school students. The results of this study enable the following discussions for improvements of mental health in elementary school students.

First, even though social anxiety mean scores were significantly reduced after the meditation program was given, depression mean scores did not show statistically significant reductions. This was also noted in other research studies related to meditation. For example, Lim (1996) showed that yoga was effective with social anxiety reduction but was not effective with depression. Another study on

Table 3 Homogeneity test between experimental and control groups.

Characteristics	Categories	Exp (n = 23)	Cont (n = 19)	x^2	p
		n (%)	n (%)		
Gender	Male	13 (56.5)	7 (36.8)	1.616	0.204
	Female	10 (43.5)	12 (63.2)		
Living arrangement	With Parents	23 (100)	19 (100)		
	With Mother	0	0		
	With Father	0	0		
	Alone	0	0		
Household economy	Very good	5 (21.7)	1 (5.3)	2.428	0.297
	Good	12 (52.2)	11 (57.9)		
	Moderate	6 (26.1)	7 (36.8)		
	Poor	0	0		
	Very poor	0	0		
Occupation of father	Professionals	8 (34.8)	3 (15.8)	2.000 †	0.403
	Manager/Office worker	13 (56.5)	14 (73.7)		
	Others	2 (8.7)	2 (10.5)		
Occupation of mother	Professionals	3 (13.0)	7 (36.8)	3.530 †	0.326
	Manager/office worker	5 (21.7)	4 (21.1)		
	Others	5 (21.7)	2 (10.5)		
	None	10 (43.5)	6 (31.6)		

Exp = experimental group; Cont = control group.
† Fisher's exact test.

health program with a focus on MBSR also resulted in statistically significant changes in stress responses and self-esteem of obese female middle school students; however, the health program did not show a significant change in bulimia and depression (Lee, 2007). Korean research studies on adults with MBSR approaches also reported a decrease in social anxiety, but were not able to reduce depression (Kim, Kim, Ahn, Seo, & Kim, 2013; Lee, Jun, Kim, & Gim, 2012). These results suggest that there may be factors other than anxiety that needs to be taken into account to improve depression.

Also, when considering the uniqueness of this present study, one cannot eliminate the possibility that the timing of the study may have played a role in emotional states of the participants. Before the pretest, the students had just returned from a school trip (with 2 overnight stays) and their mood and emotional state were relatively relaxed, with examination anxiety far removed from the students at this point. However, the posttest was given just before the final examinations and it can be speculated that due to the academic pressures, the students may have shown lowered mood. This may be a commonality in both the experimental and control groups, but given the likelihood that the students' emotional states are possibly influenced by factors such as curricular schedules, classroom climate, and instructor's directional guidance, future research studies will have to build in a control for possible variables influencing moods of the students. Also, this study only examined short term effects of the school-based meditation program on a small number of elementary students. Henceforth, it may be necessary in future studies to investigate long term effects in a larger sample of students and to consider and control for influential external variables, such as timing of the data collection.

Secondly, the results of this study showed that the meditation is helpful in improving mental health status of the elementary school students in terms of social anxiety, aggression, and cortisol levels. These results were similar to other previous mind subtraction meditation research studies. For example, Kim and Cha (2011) reported a reduction in depression and anxiety of elementary school students participating in meditation clubs which adapted the meditation method. Kim (2012) also reported an increase in self-esteem and a decrease in depression and anxiety in elementary school students who attended the meditation

Table 4 The effect of school-based mind subtraction meditation on depression.

Group	Pretest		Posttest		Adjusted mean	
	M (SD)	t	M (SD)	t	M (SE)	F
Experimental group	5.91 (3.46)	−4.201 p < .001	4.52 (4.79)	−4.075 p < .001	7.34 (.92)	.907 (.347)
Control group	12.42 (5.98)		12.39 (7.53)		8.79 (1.06)	
Total	8.86 (5.73)		7.98 (7.23)			

Table 5 The effect of school-based mind subtraction meditation on social anxiety.

Group	Pretest		Posttest		Adjusted mean	
	M (SD)	t	M (SD)	t	M (SE)	F
Experimental group	31.18 (8.84)	−1.597	30.44 (8.81)	−3.815 $p < .01$	31.08 (2.30)	13.014 $p < .01$
Control group	36.22 (11.14)		46.29 (15.38)		44.20 (2.71)	
Total	33.45 (10.13)		37.18 (14.28)			

camps; in another study, reductions in depression, anxiety, and stress as well as an increase in self-esteem were reported in college students who attended the meditation camp programs for college students (Kim, 2009).

Other reports have demonstrated positive effects of the mind subtraction meditation in adults with depression and anxiety. Due to scarcity of similar research studies to compare, we also reviewed meditation literature on adults, which examined depression and anxiety in relation to meditation practice. For example, a study examining teachers of elementary, middle, and high schools who were participants of 8 day training program based on the meditation, reported a decrease in depression and improvements in self-esteem (Lee & Kim, 2011). Similar study by Lee (2010) also reported reductions in anxiety and stress, and improvements in quality of life. The mind subtraction meditation is also shown to be effective in adult patients with depression and anxiety. Lee (2006) reported a reduction of anxiety in alcoholic patients; and Yun (2014) showed increases in life satisfaction and quality of life, as well as decreases in depression, anxiety, and perceived stress in breast cancer survivors. Very beneficial effects of depression, anxiety, and stress reductions were also shown in intensive mind subtraction meditation programs (with duration of one to 2 weeks) for adults with depression, anxiety, and other mental health diagnoses (Yun, Yoo, Choi, & Kim, 2012).

Thirdly, this study also demonstrated effectiveness of the mind subtraction meditation in aggression reduction in the elementary school students. This finding is similar to other research studies which also showed a reduction in aggression after attending the meditation program. Cho (2006) reported a decrease in aggression of middle school students who attended the meditation program. A mind subtraction meditation study of middle school students by Choi, Lee, and Cheon (2006) demonstrated a drop in anger scores; and another study (Lee, 2009) showed a reduction in aggression scores of middle school students after the meditation program. Kim, Yoo, et al. (2013) compared an experimental and a control groups through Draw A Person (Machoover, 1949), House-Tree-Person (Buck, 1966), and Kinetic Family Drawing Test (Burns & Kaufman, 1987) after a mind subtraction meditation camp program. The results showed a decrease in aggression and an increase in autonomy of the experimental group in the camp program. Research studies focused on other types of meditations also show effectiveness of aggression reduction in children and youth. Kang (2013) and Hwang (2013) reported reductions in aggression, anger, and hostility in elementary school students attending MBSR programs. Middle school students with conduct disorder also showed a reduction in aggression and were able to effectively self-control aggressive behaviors (Singh et al., 2007).

Lastly, an analysis of salivary cortisol showed that stress levels of the students were effectively reduced by the meditation program. The cortisol is known as a physiological indicator for psychological stress experienced. Diurnal variance of cortisol is very high (Clow et al., 2004; Shin et al., 2011); its secretion starts to increase in late night, with 30 minutes after morning awakening being the highest. Cortisol level measured 30 to 40 minutes after awakening is approximately 50 to 160% more than cortisol measured immediately after awakening. Measuring after 60–75 minutes of awakening would show a return to the previous cortisol level (right after awakening). It is suggested that for an accurate cortisol level comparison, collection of samples should be repeated around noon time during the day (Ahn, Lee, Choi, Kwon, & Chun, 2007; Lee et al., 2010; Van Cauter, Leproult, & Kupfer, 1996). In this study, considering the ease and feasibility of sample collections, 2 PM in the afternoon was selected as the time of collection. This mid-day time frame is when the cortisol level is thought to be more stabilized (Kidd et al., 2012). Upon the analysis, the pretest cortisol levels for the experimental group were lower than the control group. After using ANCOVA to control for

Table 6 The effect of school-based mind subtraction meditation on aggression.

Group	Pretest		Posttest		Adjusted mean	
	M (SD)	t	M (SD)	t	M (SE)	F
Experimental group	36.36 (7.78)	−2.719 $p < .05$	30.74 (8.17)	−4.515 $p < .001$	32.42 (2.00)	12.493 $p < .01$
Control group	46.35 (13.52)		45.94 (11.61)		44.12 (2.46)	
Total	40.72 (11.64)		36.97 (12.22)			

Table 7 The effect of school-based mind subtraction meditation on salivary cortisol levels.

Group	Pretest		Posttest		Adjusted Mean	
	M (SD)	t	M (SD)	t	M (SE)	F
Experimental group	.052 (.024)	−2.407 $p < .05$	.046 (.021)	−4.074 $p < .001$	.049 (.004)	9.869 $p < .01$
Control group	.080 (.046)		.073 (.021)		.070 (.005)	
Total	.064 (.038)		.058 (.025)			

the pretest scores, the posttest cortisol levels were still shown to be lower than the control group; which demonstrated effectiveness of the program in reducing the cortisol levels.

The previous research studies related to cortisol levels include: Diego et al. (2002) who reported reductions in cortisol levels and anxiety, and improvements in emotional states for aggressive children and youth receiving massages; and Shim, An, Yu, and Lee (2004) who used breathing techniques for professional young basketball players that resulted in significant decrease in depression, anger, fatigue, ACTH, and cortisol levels. Utilizing back massages on 52 youth with behavioral disorders showed reductions in depression and anxiety, with decreases in salivary cortisol levels (Field et al., 1992). Research studies by Witek-Janusek et al. (2008) and Kang and Oh (2012) also reported the effect of MBSR on breast cancer patients which showed a decrease in serum cortisol levels in the adults.

Even though various research studies were conducted to evaluate stress through salivary cortisol levels (Alpers, Abelson, Wilhelm, & Roth, 2003; Blood, Blood, Bennett, Simpson, & Susman, 1994; Bohnen, Nicolson, Sulon, & Jolles, 1991), not many studies have examined salivary cortisol to explore the effects of meditation methods in children or youth. Although the results had shown positive effects, most meditation-related research studies used questionnaires to survey stress reduction. By seeking to measure a physiological indicator of stress, this study contributed to a new approach in evaluating the effectiveness of a school-based meditation program in elementary school students.

The results of this study would be applicable to health care providers, practitioners, and nurses in any pediatric settings including schools, summer camps, and other learning systems. It is hoped that the meditation program could be optimally utilized for the psychosocial benefit of children to reduce stress, social anxiety, and aggression as it is shown in this study. In particular, we believe that school nurses could play a pivotal role in enhancing personal development and psychological wellbeing of their students, by fully engaging and instituting the meditation program in school systems. This would initially warrant the nurses' knowledge of their student needs (prevalence of student aggression, stress, and anxiety) and further, feasibility of the meditation program within their school system should be sought. The school nurses should have a good understanding of the system's organizational culture, and any underlying religious or philosophical values which may promote or hinder the program. In addition, the nurses should be able to maneuver through the system to have the meditation program offered and instituted on a regular basis. To accomplish this, ongoing data need to be provided to demonstrate the program's effectiveness and disseminations of the data analysis need to be continued consistently throughout the school systems for more meditation program offering and support.

Conclusion

This study demonstrated improvements in social anxiety, aggression, and stress in elementary school students receiving the school-based mind subtraction meditation program. By recognizing negative aspects of emotions (stress, social anxiety, and aggression) and eliminating them through reflection, the meditation program was effective in transforming negative mindset to positive. Because these positive effects of the meditation program were possible with a short duration of meditation sessions offered during the school year, this suggests practicality and usefulness of such program for application in a variety of diverse healthcare settings.

Limitations of this study and recommendations for future studies are discussed. First, the sample size was small and there were no randomization with the groups, which would impact generalization of the findings. In the future, it is suggested that a larger sample size and randomization of the groups should be considered for this type of study. Secondly, this study only examined pretest and posttest during 8 weeks and did not evaluate the changes on a more long term basis. A follow up assessment of long term duration would be suggested in the future studies. Thirdly, salivary cortisol levels were measured only once per pretest and posttest, and is a limitation. It is recommended that in the future, repeated testing and analysis should be considered for salivary cortisol levels. Finally, this study was conducted in South Korea where the meditation program was readily accepted into school systems to enhance students' social, psychological, and spiritual wellbeing. Elsewhere in the world, the implementation may be difficult or challenging to institute in school systems due to lack of awareness and knowledge about benefits of meditation, and others such as funding difficulties in offering school-based meditation programs, differences in organizational cultures, beliefs and values, and lack of administrative, staff, and parental supports.

In conclusion, this study demonstrates that the mind subtraction meditation program was adaptable and useful in

its scientific and systematic approaches for elementary school students in lowering social anxiety, aggression, and stress. In order to facilitate full adaptability of the meditation program, there is a need to foster training for the meditation instructors in schools (Cho, 2006). When further developed and utilized, these programs in school curricular settings can contribute to psychological stability as well as decreases in aggressive behaviors in children (Park, 2006). Furthermore, for the meditation program to be fully utilized as a strategy for humanistic education in schools, more education-related and government-related organizations will need to participate and be involved in providing support.

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