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Applying Mindfulness Exercises to Improve Emotion Regulation and Flexibility In Pre-Adolescents

Somayeh Pour Mohammadi[1]
Fariborz Bagheri*[2]
NoorAli Farrokhi[3]

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Abstract

Emotions and pre-adolescents are not always best friends. Not yet fully developed prefrontal cortex makes pre-adolescents emotional experiences more intense than other age groups. Thus, since pre-adolescents need more intervention and training than other age groups to regulate their emotions, the aim of this study was to use Mindfulness to improve the emotions regulation and flexibility of pre-adolescents. The theoretical framework of the research has been developed using the approach of neurocognitive and developmental psychology. This study was conducted in a quasi-experimental design with pre-test and post-test with two experimental and control groups. The statistical population included all female students studying in the fifth grade of primary school in Tehran in the academic year 2017-2018. Among these, 24 were purposefully selected and randomly assigned to two groups (experimental 12 and control 12). The Mindfulness protocol was presented to the experimental group for 12 weeks. The variables were evaluated by the Iranian standardized version of the Shields and Cichetti emotion regulation checklist. Reliability of the test by Cronbach's alpha method for normal children is 0.74. Also, the validity of the test structure Confirmed by the implementation of confirmatory and exploratory factor analysis. The obtained data were analyzed by SPSS software using descriptive statistics and analysis of covariance.

The results showed that Mindfulness exercises in the post-test between the experimental group and the control group in the variables "Negative Emotion Regulation" ($F=14.84$, $p= 0.001$) and "Emotional Flexibility" ($F=15.32$, $P = 0.002$) was significant. In other words, applying mindfulness exercises has been able to improve the two components of negative emotion regulation and emotional flexibility in pre-adolescents.

Keywords: Mindfulness, Neurocognitive, Emotion Regulation, Emotional Flexibility, Pre-Adolescence.

1 . PhD Student, Department of Psychology, Science and Research Branch, Islamic Azad University, Tehran, Iran. Spourmohamadi@yahoo.com

2 .*Associate Professor, Department of Psychology, Science and Research Branch, Islamic Azad University, Tehran, Iran F.Bagheri@srbiau.ac.ir (Corresponding Author)

3 . Associate Professor, Department of Psychology, Allameh Tabatabaei University, Tehran, Iran Farrokhinoorali@yahoo.com

1. Introduction

From pre-adolescence to early adulthood, individuals start to face various external challenges such as stress in social interactions and school performance, learning to be independent, and attempting to successfully adapt to the social environment (Gross, 2015). Higher emotional reactivity and mood fluctuations in pre-adolescents increased their demand for emotion regulation (Macklem, 2015). Emotions are fundamentally related to behavior, and emotion regulation is a factor in controlling behavior in individuals and allows them to flexible react to what is happening around them (Pepping et al, 2016). Therefore, a student should be able to experience emotions without feeling confused with the help of emotion regulation. And learn to express his emotions in a way that is socially acceptable. It also responds with greater emotional flexibility to changing situations and stimuli that evoke emotions (Gross, 2015).

Emotion regulation acts as one of the strongest social modulators and has been considered as a basis for the relationship between the components of social and academic empowerment and success in schools (Loevaas et al., 2018). Thus, if emotion regulation works well, it enables students to change their behavior and the output of their behavior to conform to the values, goals, ideals, and criteria appropriate to the situation and society. Therefore, emotion regulation is a key to mental health and any maladaptation in emotion will cause great suffering (Baumeister et al., 2007). One of the most common methods used in various studies to emotion regulate is cognitive reappraisal. Cognitive reappraisal is a cognitive strategy that changes the trajectory of emotional responses by modulating and reformulating the meaning of emotional events and situation (Gross, 2015). This method has shown significance in many studies in adults, but in the reports of various studies on the use of this methodology to regulate emotions in children and adolescents, it has shown conflicting results. And even in some studies, no significance has been reported. Which can be referred to the following;

Dennis and Hajkak (2009), in their study with the help of electroencephalography and examination of brain waves in children aged 5 to 7 years, showed that the method of cognitive reappraisal in this age group did not show any significant difference in emotion regulation. This non-significance in

the results was also reported in study by Desico et al. (2012). Desico et al. (2014), Performed electroencephalographic evaluation on 26 children aged 7 to 9 years, and the results of their study showed that for this age group, too, cognitive reappraisal did not effect on emotion regulation. Also, the results of McRae et al.'s study in 2012 on pre-adolescents (10 to 12) years old showed that the method of cognitive reappraisal, in this age group, shows a significant difference only in the regulation of positive emotions, while in the regulation Negative emotions, there is a lack of significance. Recent studies include Liu et al.'s 2019 study, which also evaluated cognitive reappraisal methods to regulate the emotions of 46 children aged 8 to 12, and their research data showed only a significant difference to regulate positive emotions.

In explaining the results of the mentioned researches, it can be said; patterns that have examined the development of self-regulation in children such as; Cope (1989), Campus et al. (1994), Gross (2013), and Baumeister (2007), have acknowledged that the Emotion Regulation component is in the service of self-regulation and is a Growth-Related Concept (Vohs & Baumeister, 2011). Based on the data of these patterns, emotion regulation in children before the age of four is at the level of unregulated or unregulated, and regulation occurs only externally and through adults. After the age of four, in the age range between five to eight years, this external level of regulation leads to the inside and modulation of perception after experiencing the stimulus of emotion, and in addition to perceptual modulation, we will see the regulation of emotion at the level of expression and response. And this is while with increasing age and only in the age range of ten years, emotional experience becomes active, internal and mental, and it is in this age range that children find the ability to internally regulate their emotions (Zarandi et al., 2017).

Thus, there are developmental differences in the effectiveness of emotion regulation strategies. And since the reappraisal method to regulate emotions requires high-level executive processes such as working memory, inhibitory control and abstract thinking, so this method has not been effective for children and adolescents (Theurel & Gentaz, 2018). And for this reason, research has shown the non-significance of this method for these age group. On the other, neuroimaging studies have linked the process of emotion regulation to

processing in the frontal lobe areas of the brain, the same area of the brain that is involved in cognitive processes and executive functions.

Cognitive neuroscience research has shown that in the developmental stages, white matter in the brain increases linearly during development, whereas, a dramatic increase in gray matter occurs in the brain before puberty, and therefore Pre-adolescence (ages 9 to 12) is a key developmental period, during which time, due to the growth of the cerebral cortex, emotional experiences become internal and mental, And has found the ability to actively regulate by the child and, as mentioned, before this age, emotion regulation has been extra-organismic and passive (Deng et al., 2019).

Due to these changes in the structure of the brain, children in this age group (9 to 12 years) show more emotional reactions and mood swings. Therefore, in comparison between young children and adults, with children in pre-adolescence (9 to 12 years), in this period we see a higher prevalence of emotional problems (Deng et al., 2019).Thus, pre-adolescents need more intervention and training than other age groups to regulate their emotions (Kauhoven & Dorjee, 2017).

Therefore, using interventions and training that can improve emotion regulation in the years before adolescence, can provide more mental health for children during adolescence (Kauhoven & Dorjee, 2017).

1.1. Theoretical framework of emotion regulation based on neurocognition approach

Emotion regulation has a pivotal impact on developmental outcomes including social and emotional wellbeing and academic functioning (Macklem, 2015); pre-adolescence who exhibit ineffective emotion regulation skills are at increased risk of physical and mental health disorders as adults. Indeed, emotion-regulation abilities present during childhood predict adult health problems, substance dependence, socioeconomic position and the likelihood of committing a criminal offence in adulthood (Vohs & Baumeister, 2011). Higher levels of emotion-regulation are associated with enhanced well-being including better mental health, the ability to maintain effective social

relationships and global adaptive functioning in home and school life (Macklem, 2015).

Effective emotion-regulation hinges upon an optimal balance between **"bottom-up"** emotional reactivity (brain regions lower down the limbic areas) and **"top-down"** cognitive and attention control (brain regions higher up the prefrontal cortex; PFC) (Kauhoven & Dorjee, 2017).

Bottom-up regulation involves unconscious, non-volitional processes which are driven by the salient behaviorally relevant properties of stimuli (i.e. novel, unexpected or emotionally arousing). Bottom-up self-regulatory processes can be externally directed, i.e. the rapid detection and re-orientation of attention resources to salient stimuli within the environment or internally directed, i.e. the automatic orientation of attention away from a goal towards task irrelevant internal thoughts (mind wandering) (Kauhoven & Dorjee, 2017).

Top-down regulation involves the conscious, volitional goal oriented regulation of cognitions and emotions. Endogenous orienting is a top-down process which involves the orienting of attention towards goal relevant stimuli. Top-down executive attention abilities include conflict monitoring and resolution -- the detection of behavior which is incongruent to a goal, resulting modification of behavior to align it with a goal and inhibition of goal-irrelevant stimuli (Kauhoven & Dorjee, 2017).

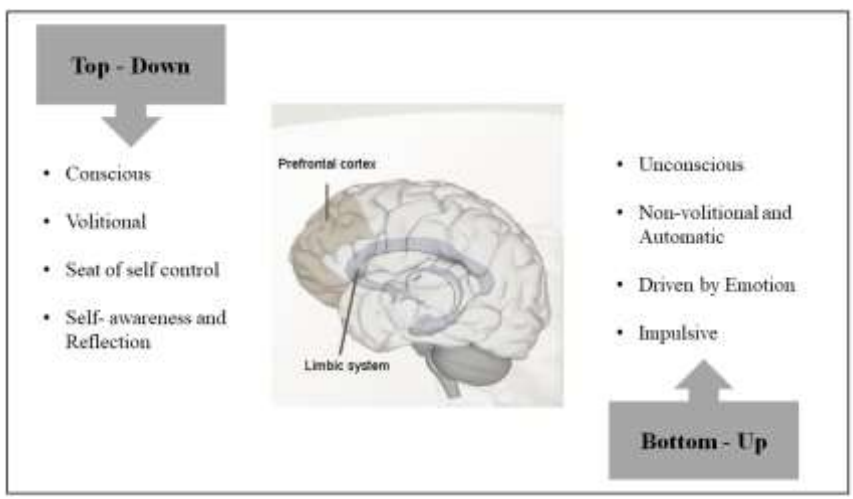

Figure 1. "Bottom-Up" emotional reactivity and "Top-Down" cognitive and attention control.
Image taken from the page the-human-brain-anatomy-functions-and-injury-main on the site of slidetodoc.

During pre-adolescence the brain networks underlying emotion-regulation undergo considerable maturation. Bottom-up regulatory processes develop earlier in childhood than top-down regulatory processes due to the protracted development of the PFC. During pre-adolescence considerable maturational brain changes occur including synaptic pruning of ineffective local neural connections and neuronal myelination of longer range neural connections. This enables the top-down regulatory regions of the PFC and the bottom-up sensory areas of the parietal cortex to become increasingly connected, facilitating the ability to employ methods of emotion-regulation (Kauhoven & Dorjee, 2017).

According to recent research results, one of the newest and most effective treatments for improving emotion regulation in children and pre-adolescence is mindfulness exercises, because these exercises, in particular, lead to the development of self-regulation ability and improve executive functions in children. . And since the rules of mindfulness in child-specific protocols, it is introduced to children in a simple and playful way, which is why research shows high effectiveness of this method for children and pre-adolescents (Albrecht, 2018).

1.2. Mindfulness and its association with Emotion regulation for pre-adolescents

Mindfulness has been conceptualized as the awareness that comes from paying attention to present moment experience with intention and non-judgmental manner, for the sake of cultivating self-awareness, wisdom, and self-compassion (Kabat-Zinn, 2003).

Five facets are often described and assessed as elements of trait mindfulness (i.e., **observing**, **non-judging of inner experience**, **acting with awareness**, **describing**, and **non-reactivity to inner experience**. Observing refers to noticing internal and external experience. Non-judging refers to regarding the inner experiences in a non-evaluative stance. Acting with

awareness refers to being aware of current activity or experience with continuing attention. Describing refers to labeling these experiences with words. Non-reactivity refers to letting feelings and thoughts come and go, without being caught in them or carried away by them (Zhang et al., 2019).

Research has shown that mindfulness exercises can improve emotional control and management and emotional flexibility by modulating and enhancing two attention processes in the brain.

1) Improving ascending attention processes (**bottom-up**) in the brain

2) Improving descending control and cognitive processes (**top-down**) in the brain

In ascending attention processes, Mindfulness, through a variety of exercises, improves awareness of emotional stimuli immediately after emotional arousal, and based on neuroscience research, increases awareness of the bodily senses by activating sensory cortex areas (the part of the brain that receives and processes sensory information from the whole body) , and the anterior cingulate cortex (the part of the brain involved in several complex cognitive functions, such as empathy, impulse control, emotions, and decision making) modulates the bottom-up brain reactivity (Deng et al., 2019).

In particular, a study has shown that even if participants engage in meditation exercises for only 12 weeks and only 12 minutes during the day, these large changes are well seen in the anterior cingulate cortex. And it is clear that more practice will bring more results (Newberg and Waldman, 2009).

Mindfulness also helps to shift attention from judgmental processes to encountering non-judgmental feelings and thoughts, thus reducing the habit of clinging to past memories and future fears. This is also effective in improving ascending attention processes in the brain and improves the management of Negative Emotions and Emotional Flexibility (Pepping et al., 2016).

In descending control and cognitive processes (top-down) in the brain, Mindfulness reduces distraction in the individual by enhancing moment-by-moment experiences and being in the present moment, thus increasing self-monitoring and directly helping to regulate and manage emotion (Deng et al., 2019).

Thus effective emotion regulation hinges upon an optimal balance between "bottom-up" emotional reactivity, and "top-down" cognitive and attention control. Therefore, Mindfulness training, as one of these effective interventions in emotion regulation, can help pre-adolescents who are at a sensitive age, and also support children who have experienced crises and are severely lacking in emotion regulation (Macklem, 2015).

2.Review of Literature

Initial evidence suggests that mindfulness training can improve well-being and nurture a wide range of effective emotion regulatory skills in children and youth with and without clinical disorders. Hill and Updegraff (2012), in their study of young people with average age of 19 years, showed that there is a strong positive correlation between mindfulness and emotion regulation. So that more Mindful youth have better emotion regulation (Hill & Updegraff, 2012). The results of a similar study in Iran on students with average age of 21 years showed that there is a correlation between mindfulness, emotion regulation and academic procrastination. So that more mindful youth, they have more emotion regulation and less academic procrastination (Ghasemi Jobneh et al., 2016).

The research results of Finkelstein-Fox, Park, and Riley (2018), have shown that mindfulness exercises can improve emotion regulation and resilience in young people with average age of 17 years. For this study, have been used mind-body exercises derived from yoga meditations. (Finkelstein-Fox, Park, & Riley, 2018). The results of another study on adolescents (14 to 16 years) with attention deficit/hyperactivity disorder showed that mindfulness is effective in reducing attention deficit/ hyperactivity and improving adaptation. In this study, researchers used general mindfulness exercises of Kabat-Zinn in 8 sessions (Zare et al., 2018). Another study have shown the direct effect of mindfulness on self - regulated learning, on high school students in Kerman. (Yousefi et al., 2019). A study in Qazvin examined the effectiveness of mindfulness on female high school students' adjustment and mental health and its results showed that mindfulness exercises have improved adaptation and

mental health in these students. This study, was used the mindfulness based on stress reduction exercises of Kabat-Zinn for 8 weeks (Babakhani, 2019).

In 2015, in a study on 99 pre-adolescents (9 to 12 years), The researchers have reported that mindfulness exercises improved cognitive control, reduced stress, and increased empathy and emotion control in this age group (Schwartz et al., 2015). Also Zhang et al. (2019), in their research on 154 children with an average age of 10 years showed a correlation between five aspects of mindfulness (observation, non-judgment, conscious action, description and non-reaction) by emotion regulation. In addition, in neurocognition research, the researchers examined the effect of mindfulness on electrocortical responses during emotional processing in children aged 9 to 12 years using event-relative potential. The results of their research as well showed the modulation of emotional responses in children in this age group (Deng et al., 2019)

As shown in the research mentioned above, mindfulness-based studies in the age groups between 6 and 21 years have been done in two forms of correlation and effectiveness. And in most effectiveness studies, for the pre-adolescent age group, either general mindfulness exercises of Kabat-Zinn or mind-body meditations derived from yoga exercises, or mindfulness-based stress reduction protocols of adults have been used. However, due to the differences in pre-adolescent brain structure, we need to use specific protocols for this age group.

Over the past decade, special protocols for children and adolescents have been reviewed and evaluated. These include the Inner Kids program (Flook et al., 2010; Kaiser-Greenland, 2010), Integrative contemplative pedagogy (Britton et al., 2014), Integrative Body-Mind Training (IBMT; Tang et al., 2012), Emotional Mindfulness Training (PINEP; Salicido Cibrian, 2014), Mindfulness-Based Cognitive Therapy for children, (MBCT-C; Semple et al., 2010), Mindful Schools, (MS; Black & Fernando, 2014), MindUP, (Schonert-Reichl et al., 2015), Still Quiet Place, (Snel, 2013).

Mindfulness programs for pre-adolescents vary in format, content and length, for instance, programs range from 30 to 60 minute daily sessions over 6 weeks to 90 minute sessions over 18 weeks.

Therefore, considering the differences in brain development in pre-adolescents compared to adults, the aim of the recent study was to evaluate the

effectiveness of specific exercises for this age group -a combination of four programs of Inner Kids program (Flook et al., 2010; Kaiser-Greenland, 2010), Emotional Mindfulness Training (PINEP; Salicido Cibrian, 2014), Mindfulness-Based Cognitive Therapy for children, (MBCT-C; Semple et al., 2010), & Still Quiet Place, (Snel, 2013)- on two components "emotion regulation" and "flexibility" and provide research evidence in this area.

3. Methodology

The method of the present study was quasi-experimental with pre-test and post-test design with a control group. Independent variables, Mindfulness exercises, and dependent variables were "Negative Emotion Management" and "Emotional Flexibility."

Conceptual definition:

Emotion Regulation: From the regulation of emotion as a category consisting of:

a) Awareness and understanding of emotions,
b) Acceptance of emotions and
c) The ability to control impulsive behaviors and behave in accordance with the desired goals in order to achieve individual goals and situational demands (Graz and Roemer, 2004).

Emotional Flexibility:

Emotional flexibility can be defined as the ability to respond in a context-appropriate emotional manner and recover from one's initial emotional responses when the context changes. Emotional flexibility has been associated with psychological health.

Mindfulness:

Mindfulness is conceptualized and defined as the non-judgmental and intentional awareness that comes from paying attention to current moment experience. The core theme of mindfulness is noticing of internal and external experience, being aware of current activity or experience with continuing attention, letting feelings and thoughts come and go without being carried away by them, and the non-evaluative stance (Kabat-Zinn, 2003).

Operational definition:

In this study, Emotion Regulation Checklist (ERC) of Shield and Cicchetti (1997), was used to measure the two variables of "Emotion Regulation" and "Emotional Flexibility".

Emotion Regulation Checklist (ERC): This checklist, was the normed by Esmailian et al., (2016), on 271 students (121 girls and 150 boys) aged 10 to 16 years old in Tehran in the 2014-2015 academic year Education. This checklist in the Iranian norm is a 20-item self-report scale, completed by children, which has both positive and negative items that measure emotional and regulation processes in children. The original version was designed by Shield and Cicchetti (1997). Each item contains a 4-point Likert scale rated from 1 (almost always) to 4 (never).

Reliability of the test in the study of Mahmoudi et al. (2016), was obtained by Cronbach's alpha method for children with learning disabilities 0.36 and for normal children 0.74, and by Guttmann halving method for children with learning disabilities 0.39 and for normal children 0.71.

Also, the reliability of the test in the research of Esmailian et al., (2016) was obtained using Cronbach's alpha coefficient for the components of negative emotion management and emotional flexibility, respectively 0.81 and 0.84.

Also, the validity of the test structure by Esmailian et al. (2016) was obtained from the implementation of confirmatory and exploratory factor analysis, although it showed more components than the main test (Esmailian et al., 2016).

SPSS software was used to analyze the data, and mean and standard deviation indices were used to describe the research variables and summarize the information. To evaluate the effectiveness of mindfulness training, analysis of covariance was used and the significance level for statistical tests was 0.05.

Mindfulness:

Mindfulness exercises protocol used in this study is a combination of two mindfulness training protocols for children and adolescents that have research support. Which include:

- Child and Adolescent Mindfulness Training Protocol, a combination of Inner Kids program (Flook et al., 2010; Kaiser-

Greenland, 2010), and Mindfulness-Based Cognitive Therapy for children, (MBCT-C; Semple et al., 2010). The effectiveness of this protocol has been shown in the research of Pour Mohammadi and Bagheri (Pour Mohammadi & Bagheri, 2015).

- The Children and Adolescents' Emotional Mindfulness Training Protocol (PINEP), owned by Ramos et al., Its effectiveness has been demonstrated in the thesis of Salicido cibrian (Salicido Cibrian, 2014), as well as research based on this protocol. (Salicido Cibrian et al., 2019), and program of Still Quiet Place, (Snel, 2013).

The content of the mindfulness training program used in this research is given in "Table 1".

Table 1. Twelve-week mindfulness protocol

Session Number	Topics	Exercised Used
Pretreatment	-Full interview with all members -Establishing a therapeutic relationship -Explain the rules and introduce the facilities used in treatment	
first	-Exploring the concept of autopilot and mindful function - -Mindful breathing training	-Breathing in two ways: teddy bear and gyration -Clouds and wind Game
second	- Mindful eating -Teach description instead of judgment	-Eat raisins -Seeds and Butterflies Game
third	-Teaching the three concepts of emotions, bodily senses and thoughts	-Using emotional cards -Short storytelling for mental imagery -Frog Attention Game
forth	-Training to maintain attention on one subject and then transfer attention to another subject with play -3 minute breathing training -Body scan exercise	-Bubble Meditation -Water glass exercise -Invisible Ball Game
Fifth	-Practice mindful listening -Play music and study the interaction of thoughts, emotions and body senses - mental imagery	-Cat and Cow Game (Mirroring)
Sixth	-Continue the practice of mindful listening -Using different tools to produce different sounds and create melodies by tools in groups -Talk about the different emotions we experience when we hear different sounds	-Jump Game -Button pause -First aid kit for difficult feelings
Seventh	- Mindful seeing -Mental imagery of a daily used tool (such as a comb or toothbrush) -Drawing based on the mental image of that tool - -Teaching the two concepts of judgment and describing and distinguishing between them	-See a device from different angles -Curious Mind Game
Eighth	-Continue the practice of mindful seeing -Pay more attention to the surroundings -Exploring the different emotions we experience when we see	-Kind Meditation- -Memory Game

	different topics -Introducing and showing images with visual perception errors	
Ninth	-Enhance the sense of touch through play -Pay more attention to the body senses	-Touch and guess Game -Sun and ice cream Game -Body pulling and breathing
Tenth	-Enhance the sense of smell through play -Paying attention to the thoughts that are formed by inhaling different odors in our minds. -Distinguish between thoughts and emotions -Describing what we feel inside us while inhaling odors	-Mountain condition and child condition -Spaghetti Game -Personal weather report
Eleventh	-Body awareness, while moving -Mindful walking	-Pendulum movement -Wish tree meditation
Twelfth	-Examining how to use mindfulness in everyday life	-Review all the exercises performed

The statistical population of the study consisted of all fifth grade female students in the 11th district of Tehran in the academic year 2017-2018.

Inclusion criteria included: written consent of students' parents to knowingly participate in this study, and receiving a lower score in the components of "negative emotion management" and "emotional flexibility" in the standardized version of Shields and Cichetti emotional regulation checklist, and exclusion criteria: Absence from more than two training sessions. Due to ethical issues, it was also explained to the parents that participation in the course would be voluntary and with the consent of the parents, and that the students' information would remain confidential.

Then, from the completed checklists, 24 people who received lower scores in the components of "negative emotion management" and "emotional flexibility" were considered as available samples. Of the 24 people selected as the available sample, 12 person were randomly assigned to the control group and another 12 person to the experimental group.

The reason for appointing 12 people in each group is also based on the opinion of Semple et al., (2010), who say; Since mindfulness training for children to adolescents, has a lot of physical exercises and a variety of executive instructions and requires direct training by the therapist, so in each group should be between 8 to 12 people and Also, training needs to be done with two therapists (Semple et al., 2010). Therefore, the experimental group received mindfulness exercises 12 sessions of one hour and a half, one session per week under the supervision of two trained therapists (researcher and a colleague), for 3 months, and the control group was placed on a waiting list.

4. Findings

The number of participants in this study was 24 female students with emotion dysregulation who were studying in the fifth grade of primary school. The mean age for the experimental group was 11 years with a standard deviation of 1.05 and for the control group the mean age was 10.83 years with a standard deviation of 1.34.

Table 2. Demographic characteristics of research participants

Variable			Experimental group	Control group
Number of participants			12 people	12 people
Gender			female	female
Nationality			Iranian	Iranian
Grade			Fifth (primary school)	Fifth (primary school)
Age	**Mean**		11	10.83
	Standard deviation		1.05	1.34
Position in the family	**single child**	Number	5	7
		Percentage	42%	58%
	Has siblings	Number	4	8
		Percentage	33%	67%

Descriptive information about pre-test and post-test scores along with the results of analysis of Covariance is given in "Table 4".

It is worth mentioning that the assumptions related to this test have been confirmed before performing the analysis of covariance.

Contains:

- ✓The normality of the distribution of scores was evaluated by Kolmogorov-Smirnov test and for both variables "negative emotion management" and "emotional flexibility", the significance level was higher than 0.05, so the hypothesis of normality was confirmed.
- ✓The similarity of variances between the experimental and control groups was also evaluated by Levin test and confirmed for both variables.
- ✓The homogeneity of the regression line slope was also investigated using group interaction test and pre-test and the results can be seen in Table 2.

Table 3. Interaction test to check the homogeneity of the regression line slope

Variable	Total Squares	Mean Square	F Value	Significance Level
Group & Pre-test				
Negative Emotion Management	6.56	6.56	0.169	0.389
Emotional Flexibility	7.16	7.16	0.180	0.674

The results of the table above show that the significance level of F-test in group contrast and control variable in both variables is higher than 0.05 and it means that there is no significant difference in the regression slope of pre-test and post-test variables between the two group.

Therefore, it is possible to use the analysis of covariance.

In addition, the homogeneity of the regression line in the two variables "Negative Emotion Management" and "Emotional Flexibility" is shown in "Figure 2" and "Figure 3", respectively.

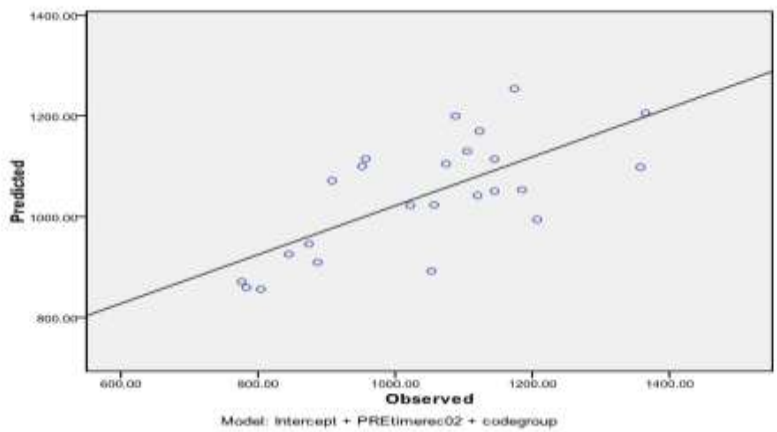

Figure 2. Homogeneity of the regression line slope in the variable "Negative Emotion Management" between the experimental and control groups

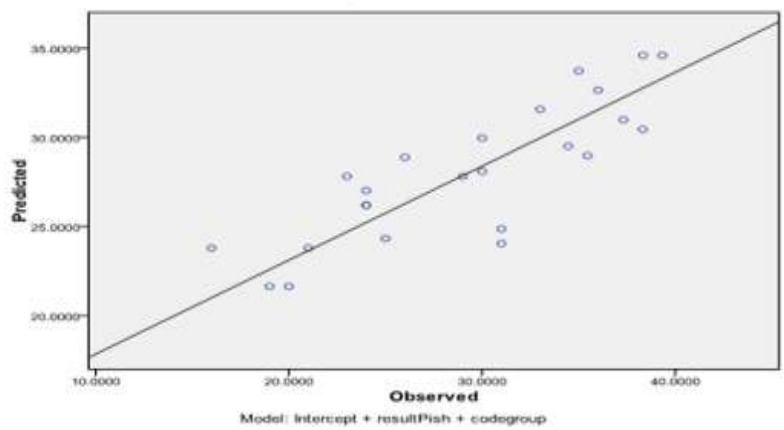

Figure 3. Homogeneity of the regression line slope in the variable "Emotional Flexibility" between the experimental and control groups

In the diagrams above, small circles represent the pre-test scores on the scales mentioned, and as can be seen in both the variables "Negative Emotion Management" and "Emotional Flexibility", the aggregation of these points closely Indicates the homogeneity of the regression line slope in the pre-test scores of the experimental and control groups.

Table 4. Mean and standard deviation of "Negative Emotion Management" and "Emotional Flexibility" variables in pre-test and post-test, with the results of analysis of Covariance

		Pre-test		Post-test		Post-test comparison		
Variable	**group**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**F value**	**P value**	**Eta squared**
Negative Emotion Management	Control	14.61	3.06	13.65	2.35	**14.84**	**0.001**	**0.46**
	Experimental	13.60	3.13	19.11	1.78			
Emotional Flexibility	Control	13.79	2.91	14.25	2.46	**15.32**	**0.002**	**0.61**
	Experimental	14.66	2.68	20.57	1.97			

In the present study, to evaluate and measure the component of "Emotion Regulation", two components of "negative emotion management" and "emotional flexibility" were measured by a checklist (ERC; Shield and Cicchetti, 1997). Therefore, the effectiveness of mindfulness exercises on the component of "Emotion Regulation" requires the effectiveness of mindfulness training on both components ("negative emotion management" and "emotional flexibility").

Based on the obtained results and according to the analysis of ANCOVA data, which can be seen in Table 4, the following items are extracted for the "Emotion Regulation" component:

In the component of "negative emotion management", an increase in the mean value can be seen in the experimental group between before and after the intervention. Also, with the help of analysis of Covariance, it was found that the reason for the difference between the post-test scores of the experimental and control groups, after adjusting the effect of the pre-test, was due to mindfulness exercises. And as the results show, the observed F value for the group variable by adjusting the pre-test effect is 14.84 and its significance level is $p = 0.001$, which is shows a significant difference between the post-test score in the two the experimental and control groups. And based on the reported Eta

squared, 46% of the changes on this component were due to mindfulness exercises.

Therefore the effectiveness of mindfulness on the component of "Negative Emotion Management" is confirmed with 95% confidence. This means that 12 sessions of mindfulness trainings have been able to improve the negative emotion management in pre-adolescents.

In the component of "emotional flexibility" as can be seen in "Table 4", an increase in the mean value can be seen in the experimental group between before and after the intervention. Also, with the help of analysis of Covariance, it was found that the reason for the difference between the post-test scores of the experimental and control groups, after adjusting the effect of the pre-test, was due to mindfulness exercises. And as the results show, the observed F value for the group variable by adjusting the pre-test effect is ۱۵.۳۲ and its significance level is p = 0.00۲, which is shows a significant difference between the post-test score in the two the experimental and control groups. And based on the reported Eta squared, ٦۱% of the changes on this component were due to mindfulness exercises.

Therefore the effectiveness of mindfulness on the component of "emotional flexibility" is confirmed with 95% confidence. These data show that 12 sessions of mindfulness training have also been able to increase "emotional flexibility" in pre-adolescents.

In total, it can be said that the applied of mindfulness exercises for 12 weeks and in 90-minute sessions, has been able to improve the Emotion Regulation pre-adolescent.

5. Conclusion

The aim of this study was to investigate the applied of mindfulness exercises to improve emotion regulation and emotional flexibility in pre-adolescents. The findings of the present study showed that mindfulness exercises have an effect on the studied variables, and significantly increased both components in students with emotional dysregulation, while these results were not observed in the control group. The results of this study are consistent with the results of previous researchers (Zhang et al., 2019; Deng et al., 2019; Guendelman et al., 2017; Kauhoven and Dorjee, 2017; and Esmailian et al.,

2015). The results of these studies show that the increase Mindfulness leads to reduced avoidance or excessive engagement with disturbing thoughts and emotions And therefore keeps the emotions in balance. In explaining the findings, the following factors can be mentioned:

Due to the limited capacity of attention, there is competition between the two mechanisms of the brain ("bottom-up" emotional reactivity and "top-down" cognitive and attention control) over the use of cognitive resources. And Mindfulness make interaction between these two mechanisms of attention to activate flexibility responses to arousal arises from negative stimuli (Kauhoven and Dorjee, 2017). In general, mindfulness exercises for children include games that teach self-regulatory aspects such as attention control and emotion regulation. In the protocol used in this research, Mindful breathing exercises lead attention to focus on a stimulus and use the breathing process as an anchor to stay in the present moment. Mindfulness programs often include exercises that increase awareness of thoughts, emotions, and body sensations. It also involves observing the changes of these three (thoughts, emotions, and body sensations) over time. There are exercises such as guided visualization that improve a kind attitude and create a sense of compassion for oneself and others. The wide and varied range of mindfulness exercises for this age group provides valuable assistance for supervisory and control abilities.

The mindfulness protocol used in this study helped students to turn their attention to less distressing aspects of the stimulus when confronted with negative emotion stimuli. And between the "bottom-up" emotional reactivity and "top-down" cognitive and attention control processes, and provide more space to "top-down" processes. Increased processing of "top-down" processes led to better monitoring and management of negative emotions, and therefore pre-adolescents behaved more flexibly during emotional experiences, and the expression of emotion in them became more flexible. Conclusions from studies on emotion dysregulation in a variety of disorders have shown that people use two defective strategies to regulate their emotions. These two strategies are: avoiding the current experience, and engaging too much with the experience. In both cases, the role of increasing attention focused on their inner arousals, reducing attention to the reality of the external environment, disrupting realism

and withdrawing from threatening situations can be seen. Excessive attention to the physical aspects evoked by negative stimuli leads to overestimation of the intensity of arousal and more intense emotional response (Zhang et al., 2019). In this case, people usually combine selected thoughts from the past, unrealistic expectations of the present, and fears about the future to form an image of them. This image does not reflect reality, and because of these images, cognitive misinterpretations are made, causing the child to experience emotional disturbances and irregularities, and Loses the ability of correct orient attention. Emotional disturbances and irregularities damage a person's capacity for degenerative attention and, consequently, prevent the proper management and control of negative emotions (Deng et al., 2019). In the mindfulness program, pre-adolescents can increase their attention abilities by learning different skills. Mindfulness exercises moderate the impact of negative stimuli on the environment by activating the management and control system.

As explained in the introduction, mindfulness has five facets; **observing**, **non-judging of inner experience**, **acting with awareness**, **describing**, and **non-reactivity to inner experience**. In the process of this research, each of these cases was reinforced by games extracted from special programs for children and pre-adolescents (Inner Kids program (Flook et al., 2010; Kaiser-Greenland, 2010), Mindfulness-Based Cognitive Therapy for children, (MBCT-C; Semple et al., 2010), Emotional Mindfulness Training Protocol (PINEP; Salicido Cibrian, 2014), and program of Still Quiet Place, (Snel, 2013)), and pre-adolescents acquired the necessary skills by learned a variety of exercises. Which are separately;

By learning the facet of **observing** (that is, paying attention to events and emotions without trying to eliminate them in a disgusting state or prolonging them in a happy state), pre-adolescents learn to allow themselves to do whatever it takes in the moment. Now it happens to experience consciously. Without leaving the situation or trying to end the emotional state. Generally, the ability to pay attention to events requires distance from events. Seeing an event is separate and different from that event itself. Observation skills are focused on disabling three automated topics: Automated cognitive processes -

Automated avoidance responses - Automated fear-based responses (Pour Mohammadi and Bagheri, 2015).

Learning the facet of **description**; by learning this skill, pre-adolescents acquired the ability to use verbal tags for behavioral and environmental events. They also learned not to equate their individual perceptions of their feelings and thoughts with the events they observed. That is, they learned not to think of their thoughts and feelings as real representations of environmental events. For example, having a feeling of fear does not necessarily mean that the situation is a threat to one's life. Confusing emotional responses with stimulus events is a common occurrence in many people, especially in pre-adolescents with emotional dysregulation. In such a way that the physical components of fear (I feel my abdominal muscles tighten, my throat shrinks) may be confused with environmental perceptions (I am taking an exam in the school). The result will be an inefficient mental bias (I will fail the exam) (Semple et al., 2010).

Another facet that pre-adolescents learn is the skill of **acting with awareness**. In this skill, pre-adolescents learn to be fully involved in activities in the present moment without isolating themselves from current events and interactions. Achieving this skill requires attention control, this ability teaches children not to be confused by past thoughts and future worries. They are taught to put everything aside and focus on the task at hand. In this skill, children learn to engage in activities consciously, this skill increases their ability to pay attention to management and control (Semple et al., 2010).

Learning to return attention to the stimulus, after recognizing that attention has shifted from the present moment to a distraction factor (this is the state of mind wandering and leaving the present moment), is another skill that children develop during the mindfulness program (Kauhoven and Dorjee, 2017). Because children have limitations in the areas of the brain involved in cognitive control, they are not always able to regulate their emotions using complex strategies of descending brain processes, such as cognitive reassessment.

Therefore, according to the findings of this study, it can be concluded that mindfulness exercises increase both the components of "Negative Emotion Management" and "Emotional Flexibility" in pre-adolescents. Because, unlike

cognitive reappraisal, mindfulness comes into play a role in the early stages of emotion production.

Regarding the efficiency of the protocol used in this research and its value can be said, it seems that the training package developed in the present study by integrating key elements of MBCT_C (Semple et al., 2010), with specific mindfulness training to improve the executive functions used In American schools (Inner Kids program; Kaiser-Greenland, 2010), and the dedicated emotion regulation mindfulness training protocol (PINEP; Salicido Cibrian, 2014), as well as enriching it with practical exercises appropriate to the age group of the present study (Still Quiet Place; Snel, 2013) , could be effective in improving the overall emotion regulation of pre-adolescents. The training in this protocol is designed to cover the general activities of pre-adolescent life and is not separate from their daily lives. Also, the protocol used in this study is performed in groups and with a specific time interval, because today, more than ever, therapists are asked to perform shorter sessions with a specific time limit. This is especially true for children who need faster, safer and more effective treatment.

Conflict of interest

The authors do not have any conflict of interest to declare, this includes any financial or personal relationships or any other relationships with other people or organizations.

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