



Psychometric Properties of the Child and Adolescent Mindfulness Measure: A Psychological Measure of Mindfulness in Youth

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Abstract

Background: Although there are a number of acceptable means of measuring mindfulness for adults, this is not the case with the child and adolescent population. A requirement, therefore, is to establish and evaluate the child and adolescent mindfulness tools, such as the child and adolescent mindfulness measure (CAMM).

Objectives: The purpose of this study was to examine the validity and reliability of a Persian version of the CAMM.

Methods: This descriptive research involved a sample of 620 students aged 12 to 18 years in Kashan who were selected via cluster sampling in 2017. The participants completed the Persian CAMM, the eight-item Avoidance and Fusion Questionnaire for Youth (AFQ-Y8), the Mindfulness Attention Awareness Scale for Adolescents (MAAS-A), the Revised Children's Manifest Anxiety Scale, and the Children's Depression Inventory (CDI). The factor structure of the Persian CAMM was evaluated using exploratory and confirmatory factor analyses by separate samples. Test-retest reliability (with four-week interval and 50 participants), internal consistency, and convergent and divergent validities were also determined.

Results: The results of Confirmatory Factor Analysis (CFA) showed that the one-factor (original) model of the CAMM did not meet the goodness of fit indexes. The Exploratory Factor Analysis (EFA, $n = 300$) indicated that the Persian CAMM had a two-factor structure and the CFA verified the acceptable fit of the two-factor scale. The instrument also exhibited good reliability ($\alpha = 0.73$). The correlation between CAMM and anxiety, depression, and psychological inflexibility was negative, whereas its correlation with the MAAS-A was positive ($P < 0.001$).

Conclusions: Based on the results of this study, the Persian CAMM is an appropriate tool with acceptable psychometric properties for measuring adolescent mindfulness. Mindfulness can be considered an important protective construct in the mental health of children and adolescents.

Keywords: Adolescent, Child, Child and Adolescent Mindfulness Measure, Mindfulness, Psychometric Properties

1. Background

Mindfulness is an attention concentration approach originated from eastern meditation (1) and defined as the act of focusing on a particular goal in the present without judgment (2). Through mindfulness, people learn to perceive internal and external events freely and without judgment and they learn how to deal with a wide range of pleasant and unpleasant thoughts, emotions, and experiences (3, 4). In recent years, mindfulness-based interventions have shown beneficial results for clinical problems, including depression, anxiety, OCD, substance abuse, chronic pain, eating disorder, psychosis, and borderline personality disorder (1, 5-10). Such interventions have also been reported as efficient treatment options for adults in several

meta-analysis studies (11-14). These interventions are also effective for children and adolescents for whom stressors increase the risk of emotional, behavioral, and social problems and poor educational performance (15). Mindfulness-based interventions provide promising results in the management of children's stress through self-regulation and facilitation of social and emotional growth (15). Accordingly, recent efforts have reflected the increasing consideration of child and adolescent mindfulness in research (16-18). A number of these studies have indicated the effectiveness of mindfulness education for child anxiety (19, 20), emotional-social flexibility (19), conduct disorder, and aggressive behaviors (21). Despite the insights provided by these studies, research on the effectiveness of mindfulness-based treatments for children and adolescents is still in the

early stages. Thus, there is a need to develop tools that concretely identify the mindfulness skills of the younger population (22, 23).

Various tools have been designed for measuring mindfulness in adults, with some of the most commonly used instruments being the Kentucky Inventory of Mindfulness Skills (KMIS) (22), the Freiburg Mindfulness Inventory (FMI) (24), the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) (25), the Toronto Mindfulness Scale (TMS) (26), the Five-Facet Mindfulness Questionnaire (FFMQ) (21), the Mindfulness Attention Awareness Scale (MASS) (27), and the Southampton Mindfulness Questionnaire (SMQ) (28). By contrast, only two tools have been developed for measuring mindfulness in children and adolescents: the MAAS-A (27) and CAMM (29).

The CAMM was developed by Greco et al. (29) to measure mindfulness skills such as current awareness and non-judgmental and inevitable responses to thoughts and feelings in 10 to 17-year-old children and adolescents. The scale has been standardized in various countries around the world. In a study on the Portuguese version of the CAMM involving 410 adolescents with a mean age of 15.18 years, the results showed that the instrument is a univariate scale that presents desirable internal consistency ($\alpha = 0.80$, $CR = 0.85$) and retest reliability ($r = 0.46$). In another study, negative and positive correlations were found between the CAMM and the AFQ-Y and between the CAMM and the Social Comparison Scale (SCS), respectively (30). In research on the Spanish version of the CAMM involving children aged 11 to 16, the results indicated that the instrument is a univariate scale that is similar to the original version with regard to internal correlation ($\alpha = 0.80$). The CAMM scores were positively correlated with the Personal Wellbeing Index, the Early Adolescent Temperament Questionnaire-Revised, and the Multidimensional Self-concept Scale (31). Researchers have also investigated a Dutch version of the CAMM in a sample of 10 to 12-year-old children and 13 to 16-year-old adolescents (32); the factor analysis results confirmed the one- and two-factor models of the scale and its internal consistency ($\alpha = 0.71$ for children, $\alpha = 0.80$ for adolescents). The CAMM, likewise, showed to be positively correlated with the Subjective Happiness Scale, the Healthy Self-regulation Subscale, and the Pediatric Quality of Life Inventory Scale but negatively correlated with stress, self-blame, rumination, and catastrophizing (32). An investigation on the Australian version of the CAMM involving non-clinical adolescents (12 to 15 years) confirmed the one-factor model and good internal consistency of the scale ($\alpha = 0.84$). In other studies, CAMM scores were positively correlated with worry scores (Penn State Worry Questionnaire for Children) and negative affect but negatively correlated with positive affect (33). The findings on the Ital-

ian version confirmed the one-factor model of the scale and its negative correlation with the Difficulties in Emotion Regulation Scale, attention deficit problems, and depression; the scale was also positively correlated with the Life Satisfaction Scale (34). In another study on the Italian version, the analysis indicated that the scale is consisted of two factors, namely, "awareness" and "willingness", and of one high-order factor, namely, mindfulness skills. The scale showed acceptable internal consistency and convergent validity (35).

Considering the wide use of mindfulness interventions in recent years for children and adolescents and the effects of mindfulness on mental health, it was necessary for us to evaluate the effectiveness of the CAMM in the Iranian context. Correspondingly, it was hypothesized that the one-factor structure of the CAMM would be confirmed by confirmatory factor analysis (CFA) (aim 1), that CAMM items would be internally consistent as shown by Cronbach's $\alpha > 0.70$ and test-retest reliability (aim 2), and that the convergent and divergent validity of the CAMM would be shown by suitable correlations between the CAMM scores and relevant psychological measures such as MAAS-A, AFQ-Y8, RCMAS, and CDI (aim 3). Proving these hypotheses would provide further support for the use of the CAMM as a reliable and valid self-report test of mindfulness skills and a valid assessment tool in child and adolescent mindfulness-based programs.

2. Objectives

The purpose of this study was to examine the validity and reliability of a Persian version of the CAMM.

3. Methods

3.1. Participants

According to Comfrey and Lee (36), a sample size of 300 individuals for EFA and according to Myers et al.'s suggestion (37), a sample size of 200 individuals for CFA are good; thus, by accounting for the probability of drop-out, we considered a sample size of 620 students. The inclusion criteria for this study were as follows: (a) being not younger than 12 and not older than 18 years, (b) with any history of comorbid axis I and II psychiatric disorders, and (c) adequate Persian language skills. Participants were excluded if there was evidence of psychosis, cognitive dysfunction, and alcohol dependence. Participants were recruited from schools in Kashan city, Iran, (Table 1) that were selected via random cluster sampling in 2017 among 12 middle and high schools for boys (six schools) and girls (six schools). After the participants were assured of the confidentiality

of their participation, they were administered with the Persian CAMM. A total of 600 students fully completed the questionnaires.

The sample was randomly divided into two subsamples of 300 participants for separate analyses of EFA and CFA. The first subsample comprised 154 boys and 146 girls with a mean age of 15.18 years ($SD = 1.66$) and the second comprised 158 boys and 142 girls with a mean age of 14.97 years ($SD = 1.38$). The two subsamples were similar in age [$t(598) = 0.103$, ns, and sex, $\chi^2(1, N = 600) = 0.74$, ns]. To examine the retest reliability, 50 subjects were reevaluated after four weeks.

3.2. Procedure

To ensure the applicability of the CAMM in Iranian society, permission was obtained from the developers of the original tool through e-mail for the translation of the CAMM into the Persian language. The Persian version was then sent for review by a specialized group of clinical psychology professors. Next, the Persian CAMM was piloted in a small sample (five students) to examine the understanding of each item. At this stage, the final Persian version was presented to two translators who were familiar with English and psychological concepts for back-translation. The back-translated version was then compared with the original version to assess the degree of conceptual and semantic equivalence between the two versions. A satisfactory level of equivalence was found.

Next, the original model of the CAMM (single-factor model) was investigated by CFA. The results of CFA showed that the one-factor model of the CAMM did not meet the goodness of fit indexes. Then, EFA was carried out with 300 individuals. As EFA should be followed by CFA using a different and separate sample to evaluate the EFA-informed

model, finally, in a separate sample of 300 individuals, the CFA of the model was examined. Correlations between the CAMM scores and the scores of AFQ-Y8, CDI, RCMAS, and MAAS-A were calculated. After four weeks, 50 participants were randomly selected to obtain a second CAMM score for evaluating test-retest reliability. The required minimum level of significance in all statistical tests was $P < 0.05$.

3.3. Ethical Considerations

The research process and objectives of the study were explained to the enrolled students and their parents and written informed consent, considering the ethical issues, was obtained from them. Then, the study subjects responded to the scales. Also, the current study protocol was approved by the Ethics Committee of Kashan University of Medical Sciences (grant number: IR.KAUMS.REC.1396.27).

3.4. Instruments

3.4.1. Child and Adolescent Mindfulness Measure (CAMM)

This measurement developed by Greco et al. (29) is used to measure mindfulness skills with items that reflect acting with present-moment awareness (e.g., “at school, I walk from class to class without noticing what I’m doing”) with an attitude of acceptance and non-judgment (e.g., “I think that some of my feelings are bad and I shouldn’t have them”). This 10-item questionnaire was characterized by a single-factor structure obtained by means of exploratory and confirmatory factor analysis. The scale items are rated on a 5-point Likert scale (0 = false to 4 = always true). The lowest total score is zero and the highest total score is 40; the higher the score, the more the individual’s willingness for mindfulness. Cronbach’s alpha for this questionnaire was reported as $\alpha = 0.81$. Also, CAMM had a positive correlation with Youth Quality of Life-Revised (YQOL, $r = 0.25$) and Academic Competence Scale ($r = 0.25$; $P < 0.01$) but a negative correlation with Children’s Somatization Inventory-Short Form ($r = -0.40$), internalizing ($r = -0.51$) and externalizing ($r = -0.36$) symptoms (Symptoms and Functioning Scale, SFS) (29). The psychometric questionnaire features have been studied in various countries, including Spain, Portugal, Italy, the Netherlands, and Australia.

3.4.2. Mindfulness Attention Awareness Scale for Adolescents (MAAS-A)

This 14-item scale was constructed by Brown et al. (27) based on its adult version designed by Brown. This scale is a self-report questionnaire that measures mindfulness in adolescents. The items are rated on a 6-point Likert scale (1 = almost always to 6 = almost never). A high score on this scale indicates a higher degree of one’s mindfulness. The results of studies conducted by its authors showed the

Table 1. Sociodemographic Characteristics and Mean Child and Adolescent Mindfulness Measure (CAMM) Score of the Sample

Characteristics	N (%)	Mean (SD)
Sex		
Male	312 (52)	18.60 (6.99)
Female	288 (48)	18.67 (6.77)
Age		
12	44 (7.3)	18.57 (7.70)
13	52 (8.7)	20.88 (5.55)
14	101 (16.8)	17.95 (6.77)
15	150 (25.0)	19.09 (7.11)
16	153 (25.5)	17.43 (7.27)
17	71 (11.8)	20.07 (5.78)
18	29 (4.8)	17.45 (6.04)

good reliability and validity of this tool (27). In the Persian version of MASS-A, the results of the EFA at the age of 12 to 18 years suggested two factors for this scale labeled as “acting with attention and awareness” and “attention to the present moment”. The reliability of this scale was good ($\alpha = 0.81$, retest reliability = 0.86) and the correlation between mindfulness and anxiety was significant and negative ($r = -0.43$; $P < 0.01$) (38).

3.4.3. Avoidance and Fusion Questionnaire for Youth (AFQ-Y8)

The AFQ-Y8 (39) is an eight-item questionnaire for measuring psychological inflexibility in youth that measures two constructs: experiential avoidance and cognitive fusion. All questions are rated on a 5-point Likert scale (0 = always disagree to 4 = always agree). Higher scores show higher levels of psychological inflexibility. The internal consistency of AFQ-Y8 was satisfactory and its reported Cronbach's alpha coefficient was 0.83. The AFQ-Y8 was poorly correlated with the scales for constructs such as acceptance, mindfulness, suppression of thoughts, anxiety, depression, and life quality. The psychometric features of this tool have been confirmed in the United States, Spain, Sweden, and the Netherlands. In the Persian version of AFQ-8, the results of factor analysis at the age of 12 to 18 years showed the existence of one factor known as “psychological inflexibility” in this questionnaire. The CFA also confirmed a single-factor model for this scale. In addition, this questionnaire was convergent to the RCMAS ($r = 0.60$, $P < 0.001$) and the reported reliability of this scale was $\alpha = 0.71$ (40).

3.4.4. Revised Children's Manifest Anxiety Scale (RCMAS)

This scale was developed by Reynolds and Richmond in 1978 to assess and diagnose general anxiety symptoms in children and adolescents aged 6 to 19 years. The scale consists of 37 items, 28 of which assess the mental, psychic, and motor indices of anxiety and the remaining nine items form a false scale that evaluates the subject's non-honest answers. Subjects are asked to answer each of the items in the form of yes/no and each gets a “zero” or “one” score. Therefore, the ranges of the total scores were from zero to 28 for anxiety items and zero to nine for items related to the lie detector (41). In the study of samples from 6 to 19-years-old, the retest reliability coefficient showed that this scale had $r = 0.86$ at a one-week interval and $r = 0.77$ within a five-week period. Another study showed a positive correlation between RCMAS and State-Trait Anxiety Inventory ($r = 0.85$, $P < 0.001$) (42).

In the study by Taghavi and Alishahi, the Persian version of RCMAS had good retest reliability ($r = 0.67$, $P < 0.001$). Also, the discriminant validity analysis between the two groups of anxious patients and healthy individuals of

Iranian nationality showed that the RCMAS could significantly discriminate between the two groups ($P < 0.001$). Therefore, the scale had good discriminant validity. Also, the results of this study showed that all scale items had satisfactory correlations with the total scale score. Therefore, based on this study, the RCMAS had suitable psychometric appropriateness for use in Iran (43).

3.4.5. Children's Depression Inventory (CDI)

This inventory was developed by Kovacs (44) based on the Beck Depression Inventory to measure depression in children and adolescents aged 7 to 17 years. The CDI is a 27-item self-report instrument, in which each question consists of three sentences. It was designed to measure the symptoms of depression such as crying, suicidal thoughts, and the ability to focus on the school homework. The adolescents select one of the three statements reflecting his/her feelings, emotions, and behaviors in the past two weeks. The questions are rated from 0 to 2 and the minimum and maximum total scores are 0 and 54, respectively. Therefore, a higher score on this scale indicates a higher level of depression. The total CDI score showed the satisfactory internal consistency of a clinical sample ($\alpha = 0.86$) and the acceptable retest reliability (correlation after one month = 0.43). The discriminant validity of CDI was satisfactory and thus, this inventory could properly make a distinction between people with and without depression disorders (44). The reported retest reliability and internal consistency of the Persian version of CDI were 0.82 and 0.83, respectively. Also, the correlations between CDI and Children's Depression Scale and between CDI and the Beck Depression Inventory were 0.79 and 0.87, respectively, reflecting the convergent validity of this inventory (45).

3.5. Statistical Analysis

The statistical analysis was performed using SPSS V.19.0 and AMOS V. 22. Antecedent to analysis, the data were screened for missing data and normality. Normality was assessed using the values of skewness and kurtosis, with absolute skewness values above 3 and absolute kurtosis values above 10 as the indicators of non-normality (46). The EFA was conducted using the principal components analysis method by the first half of the sample ($n = 300$), which was randomly selected. The CFA was performed on the second half of the sample ($n = 300$), using the method for estimating maximum likelihood (ML) (47). To test the fit of the model, we used the following indices: χ^2/df index, CFI (comparative fit index), GFI (goodness of fit index), AGFI (adjusted goodness of fit index), and RMSEA (root mean square error of approximation). We calculated Cronbach's alpha coefficients to analyze the internal consistency. The Pearson correlation was used to determine convergent and

divergent validities and retest reliability. A two-tailed test with $\alpha < 0.05$ was applied for all statistical tests.

4. Results

Data screening indicated that 20 participants had a missing value on one of the CAMM items. Little's Missing Completely At Random (MCAR) test showed that all observations were MCAR and they were consequently removed from the dataset. The terminal sample consisted of $n = 600$ observations. The proportion of cases to model parameters was 600 to 10, which was excellent. The values of skewness and kurtosis showed that the data did not diverge from normal distribution on any of the measures.

4.1. Construct Validity

The results of CFA showed that the one-factor model of the CAMM did not meet the goodness of fit indexes (Table 3). Therefore, we extracted the factors of this questionnaire using EFA.

4.1.1. Exploratory Factor Analysis (EFA)

Based on this analysis, the numerical value of the Kaiser-Meyer-Olkin coefficient was 0.79 and the χ^2 index in the Bartlett test was 772.67 ($P < 0.001$), indicating the adequacy of the sample and the selected variables for the factor analysis.

Using a factor analysis with Varimax rotation with Kaiser normalization (extraction criterion > 1 and scree test) and based on eigenvalue and scree plot, two factors were extracted for this scale. The highest load factor was 0.83 for items 5 and 9 and the lowest factor load was 0.59 for item 1. Based on the contents of factor items, factors were named as "present moment awareness" and "avoidance of thoughts and feelings" (Table 2).

4.1.2. Confirmatory Factor Analysis (CFA)

In this study, χ^2 , χ^2/df , GFI, AGFI, CFI, and RMSEA indices were used to examine the fitting of the hypothesized models. It is said that if χ^2/df is smaller than 2, it is desirable and if it is smaller than 5, it is acceptable with connivance (48). Also, GFI, AGFI, TLI, and CFI > 0.9 correspond to the goodness of fit of the model (49-51). In the case of RMSEA, a value of less than 0.05 indicates a good fit, between 0.05 and 0.08 represents a relatively good fit, and greater than 0.1 indicates a poor fit of the model (46).

Table 3 shows the goodness of fit indices for the three models. In the models, all 10 items were considered. Of the three models, the two-factor model (RMSEA = 0.05) had a better fit than the second-order model (RMSEA = 0.08) and the one-factor model (RMSEA = 0.07; Figure 1).

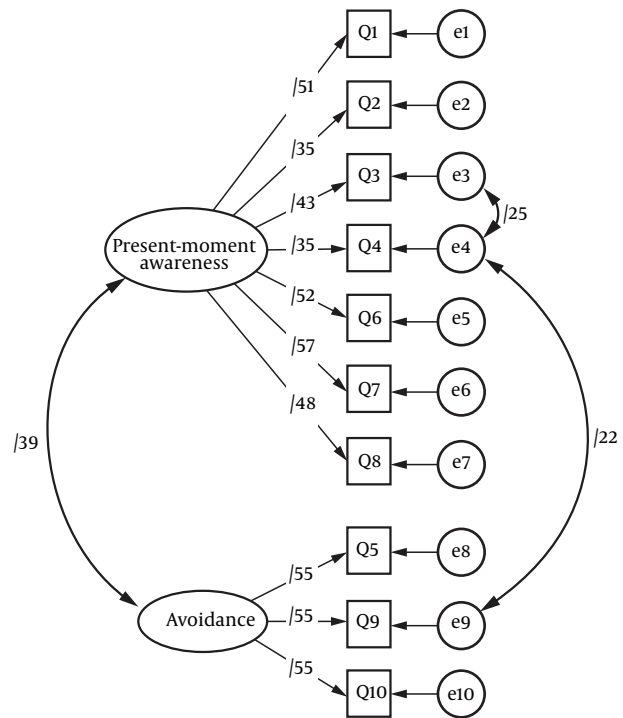


Figure 1. The two-factor model of Child and Adolescent Mindfulness Measure (CAMM)

4.2. Reliability

The Cronbach's alpha coefficient (desirable if above 0.70), the mean inter-item correlation (MIIC; considered good if ranged between 0.15 and 0.50), the corrected item-total correlation range (CITCR; desirable if above 0.20) (52, 53), and a test-retest after a four-week interval were used to assess the reliability of this scale. The Cronbach's alpha coefficient depends on the number of items on a scale, and when the number of items is less than 10, the Cronbach's alpha can be smaller (54). As a result, it is proposed to use MIIC and CITCR instead of Cronbach's alpha.

The test-retest reliability with a four-week interval was 0.81 for the total scale and 0.75 and 0.71 for the "present moment awareness" and "avoidance of thoughts and feelings" factors, respectively ($P < 0.01$). According to Table 4, the total scale and the "present moment awareness" factor showed acceptability internal consistency based on the alpha coefficient (above 0.70), MIIC (ranged between 0.15 and 0.50), and CITCR (above 0.20). The factor "avoidance of thoughts and feelings" revealed low Cronbach's alpha (below 0.70); however, it showed a good MIIC (ranged between 0.1 and 0.5) and CITCR (above 0.2).

Table 2. Item Factor Load of Child and Adolescent Mindfulness Measure (CAMM) in the Current Study, Correlations Between the CAMM Items, and Descriptive Analysis

CAMM items	EFA Result		CAMM Items										Descriptive Analysis			
	Factor 1	Factor 2	2	3	4	5	6	7	8	9	10	Minimum	Maximum	Skewness	Kurtosis	
1	0.59	0.17	0.24 ^a	0.24 ^a	0.30 ^a	0.07	0.28 ^a	0.37 ^a	0.20 ^a	0.21 ^a	0.18 ^a	0	4	0.050	-1	
2	0.71	-0.14	-	0.32 ^a	0.26 ^a	-0.08	0.31 ^a	0.24 ^a	0.24 ^a	0.04	-0.03	0	4	0.752	-0.71	
3	0.63	0.27	-	-	0.43 ^a	0.15 ^a	0.30 ^a	0.26 ^a	0.22 ^a	0.21 ^a	0.21 ^a	0	4	0.228	-1.0	
4	0.65	0.39	-	-	-	0.11 ^a	0.25 ^a	0.30 ^a	0.25 ^a	0.33 ^a	0.20 ^a	0	4	0.161	-1.0	
5	-0.02	0.83	-	-	-	-	0.08	0.01	-0.01	0.42 ^a	0.32 ^a	0	4	-0.523	-0.81	
6	0.68	0.12	-	-	-	-	-	0.40 ^a	0.29 ^a	0.12 ^a	0.11 ^a	0	4	0.037	-1.1	
7	0.72	0.08	-	-	-	-	-	-	0.35 ^a	0.15 ^a	0.18 ^a	0	4	0.111	-1.0	
8	0.61	-0.05	-	-	-	-	-	-	-	0.12 ^a	0.09	0	4	0.114	-0.97	
9	0.13	0.82	-	-	-	-	-	-	-	-	0.33 ^a	0	4	-0.278	-0.91	
10	0.12	0.63	-	-	-	-	-	-	-	-	-	0	4	-0.139	-0.98	
Eigen values	3.11	2.08														
Factor variance, %	31.09	20.86														
Total variance, %		51.96														

^aP < 0.001.

Table 3. The Results of Confirmatory Factor Analysis of Various Child and Adolescent Mindfulness Measure (CAMM) Models

Model	Goodness of Fit Indices						
	χ^2	df	χ^2/df	GFI	AGFI	CFI	RMSEA (90% CI)
One-factor	83.36	32	2/60	0.92	0.90	0.84	0.07 (0.05 - 0.09)
Two-factor with second-order factor	137.24	34	4/03	0.94	0.90	0.85	0.08 (0.06 - 0.10)
Two-factor	62.45	32	1.95	0.96	0.93	0.91	0.05 (0.03 - 0.07)

Table 4. Cronbach's Alpha, Mean Inter-Item Correlation (MIIC), and Corrected Item-Total Correlation (CITCR) for Child and Adolescent Mindfulness Measure (CAMM) and its Factors (N = 600)

	Items	Alpha	MIIC	CITCR
CAMM total	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	0.73	0.21	0.31 - 0.50
Factor 1	1, 2, 3, 4, 6, 7, 8	0.74	0.29	0.40 - 0.51
Factor 2	5, 9, 10	0.62	0.35	0.38 - 0.46

4.3. Convergent and Divergent Validity

The results showed that CAMM was negatively correlated with RCMAS ($r = -0.54, P < 0.001$), CDI ($r = -0.50, P < 0.001$) and AFQ-Y8 ($r = -0.33, P < 0.001$), which indicated the divergent validity of CAMM. It was also positively correlated with MAAS-A scores ($r = 0.71, P < 0.001$), which indicated the convergent validity of the total scale and sub-scales of Persian CAMM (Table 5).

5. Discussion

Given the increasing interest of researchers and psychologists in measuring mindfulness in children and adolescents and the lack of valid and reliable tools for measuring it in Iran, this study examined the psychometric properties of the Persian version of the CAMM and the relationship between mindfulness and anxiety, depression, and psychological inflexibility in adolescents. To assess the

psychometric adequacy of the scale, we determined its factor structure, internal consistency, and retest reliability. The EFA revealed the existence of two factors in the scale, namely, "present moment awareness" and "avoidance of thoughts and feelings". The CFA verified the suitability of the two-factor model of the scale (RMSEA = 0.05) and indicated that it was more favorable than the original and Italian versions (RMSEA = 0.07 and 0.06, respectively). The Netherland and Portuguese versions of the CAMM (30, 32) have two factors that are similar to those in the Persian version.

Regarding reliability, the results indicated the appropriate reliability of the scale, as evidenced by its Cronbach's α value of 0.73. In comparison, the Cronbach's α values of the Australian, Dutch, Portuguese, Spanish, and Italian versions of the CAMM were 0.84, 0.80, 0.79, 0.87, and 0.79, respectively. The total score of the CAMM pointed to its significant negative correlation with the RC-

Table 5. Correlation of Child and Adolescent Mindfulness Measure (CAMM) Subscales with Measures of Validity (N = 600)

Variables	Present Moment Awareness	Avoidance	RCMAS	CDI	AFQ-Y8	MAAS-A
RCMAS	-0.43 ^a	-0.44 ^a	-	-	-	-
CDI	-0.25 ^a	-0.48 ^a	0.27 ^a	-	-	-
AFQ-Y8	-0.41 ^a	-0.27 ^a	0.43 ^a	0.35 ^a	-	-
MAAS-A	0.48 ^a	0.62 ^a	-0.31 ^a	-0.30 ^a	-0.23 ^a	-

Abbreviations: AFQ-Y8, avoidance and fusion questionnaire for youth; CAMM, child and adolescent mindfulness measure; CDI, children's depression inventory; MAAS-A, mindfulness attention awareness scale for adolescents; RCMAS, revised children's manifest anxiety scale.

^aP < 0.001.

MAS ($r = -0.54$) and CDI ($r = -0.50$), indicating that individuals with strong mindfulness experience less anxiety and depression. Similarly, Roemer et al. (55) found a negative correlation between mindfulness and anxiety. Because defective attention is the main symptom of anxiety and depression, mindfulness exercises can effectively improve attention and reduce psychological symptoms in adolescents (56). Previous studies also demonstrated the effectiveness of mindfulness-based interventions in reducing adolescent anxiety (57, 58). The correlation between the Portuguese version of the CAMM and the RCMAS is similar to the correlation between RCMAS and the Persian version of the CAMM ($r = -0.55$ for the Portuguese version and $r = -0.54$ for Persian version). Various studies asserted that mindfulness can be expected to predict anxiety (11).

In a similar vein, the observed association between mindfulness and depression in the current work is consistent with the results of other studies (30, 34). We found that weak mindfulness is related to greater depression. Also, we found a negative correlation between CAMM and AFQ-8. Different studies also showed a negative relationship between mindfulness and psychological inflexibility (24, 30, 32). The original ($r = -0.60$), Portuguese ($r = -0.56$), and Italian ($r = -0.70$) versions of the CAMM showed a negative correlation with the AFQ-Y. The constructs of mindfulness and psychological inflexibility indicate how a person responds to internal and external conditions and they are strongly correlated with diverse forms of psychopathology and behavioral health (3, 6). As previously stated, mindfulness helps people perceive internal and external events freely and without distortion (3), thereby increasing psychological flexibility. Consistent with previous studies, the present research showed that the Persian CAMM was negatively correlated with psychological inflexibility (AFQ-Y8). This finding indicates that the scale has acceptable divergent validity. As predicted, the scale was positively correlated with the MAAS-A, demonstrating that both scales measure the same structure (i.e., mindfulness) and that the CAMM exhibits suitable convergent validity.

Similar to any other study, the current research is en-

cumbered by a number of limitations. The participants were selected from schools belonging to only one geographical area (Kashan city). Although the sample size was large, sample selection from a single city restricts the generalizability of the results to adolescent populations from different societies with varying socioeconomic status. Various cities in Iran do not differ much in terms of these attributes, but we recommend the examination of the scale in other cities for a more comprehensive analysis. Another limitation was the administration of the CAMM to non-clinical samples. We suggest that future research probe into the validity and reliability of the scale in more widespread adolescent samples with psychiatric symptoms or disorders. Researchers should also use more questionnaires for comparison.

5.1. Conclusions

The findings indicated that the CAMM has good psychometric properties for the measurement of mindfulness in Iranian adolescents and children. The analysis showed that the instrument is best represented by a two-factor structure. The CAMM can also be used to predict the level of anxiety and depression and evaluate the efficiency of mindfulness-based interventions.

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Footnotes

Authors' Contribution: Hamid Mohsenabadi, Mohammad Javad Shabani, and Zahra Zanjani studied the concept and designed analyzed and interpreted of the data, and drafted the manuscript. Hamid Mohsenabadi, Mohammad Javad Shabani, and Fatemeh Assarian gathered the data. Hamid Mohsenabadi, Mohammad Javad Shabani,

Zahra Zanjani, and Fatemeh Assarian revised critically the manuscript for important intellectual content.

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Patient Consent: The research process and objectives of the study were explained to the enrolled students and their parents and written informed consent, considering the ethical issues, was obtained from them. Then, the study subjects responded to the scales.

References

- Baer RA. Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clin Psychol Sci Pract*. 2003;10(2):125-43. doi: [10.1093/clipsy.bpg015](https://doi.org/10.1093/clipsy.bpg015).
- Kabat-Zinn J. Mindfulness-based interventions in context: Past, present, and future. *Clin Psychol Sci Pract*. 2003;10(2):144-56. doi: [10.1093/clipsy.bpg016](https://doi.org/10.1093/clipsy.bpg016).
- Brown KW, Ryan RM, Creswell JD. Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychol Inq*. 2007;18(4):211-37. doi: [10.1080/10478400701598298](https://doi.org/10.1080/10478400701598298).
- Pepping CA, Davis PJ, O'Donovan A. Mindfulness for cultivating self-esteem. *Mindfulness and buddhist-derived approaches in mental health and addiction*. Springer; 2016. p. 259-75. doi: [10.1007/978-3-319-22255-4_13](https://doi.org/10.1007/978-3-319-22255-4_13).
- Teasdale JD, Segal ZV, Williams JM, Ridgeway VA, Soulsby JM, Lau MA. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *J Consult Clin Psychol*. 2000;68(4):615-23. doi: [10.1037/0022-006x.68.4.615](https://doi.org/10.1037/0022-006x.68.4.615). [PubMed: 10965637].
- Hayes SC, Luoma JB, Bond FW, Masuda A, Lillis J. Acceptance and commitment therapy: Model, processes and outcomes. *Behav Res Ther*. 2006;44(1):1-25. doi: [10.1016/j.brat.2005.06.006](https://doi.org/10.1016/j.brat.2005.06.006). [PubMed: 16300724].
- Wharton E, Kanas N. Mindfulness-based stress reduction for the treatment of anxiety disorders. *Int J Group Psychother*. 2019;69(3):362-72. doi: [10.1080/00207284.2019.1599289](https://doi.org/10.1080/00207284.2019.1599289).
- Shabani MJ, Mohsenabadi H, Omid A, Lee EB, Twohig MP, Ahmadvand A, et al. An Iranian study of group acceptance and commitment therapy versus group cognitive behavioral therapy for adolescents with obsessive-compulsive disorder on an optimal dose of selective serotonin reuptake inhibitors. *J Obses Compul Relat Disord*. 2019;22:100440. doi: [10.1016/j.jocrd.2019.04.003](https://doi.org/10.1016/j.jocrd.2019.04.003).
- Majeed MH, Ali AA, Sudak DM. Mindfulness-based interventions for chronic pain: Evidence and applications. *Asian J Psychiatry*. 2018;32:79-83. doi: [10.1016/j.ajp.2017.11.025](https://doi.org/10.1016/j.ajp.2017.11.025). [PubMed: 29220782].
- Linehan MM, Korslund KE, Harned MS, Gallop RJ, Lungu A, Neacsu AD, et al. Dialectical behavior therapy for high suicide risk in individuals with borderline personality disorder: A randomized clinical trial and component analysis. *JAMA Psychiatry*. 2015;72(5):475-82. doi: [10.1001/jamapsychiatry.2014.3039](https://doi.org/10.1001/jamapsychiatry.2014.3039). [PubMed: 25806661].
- Keng SL, Smoski MJ, Robins CJ. Effects of mindfulness on psychological health: A review of empirical studies. *Clin Psychol Rev*. 2011;31(6):1041-56. doi: [10.1016/j.cpr.2011.04.006](https://doi.org/10.1016/j.cpr.2011.04.006). [PubMed: 21802619]. [PubMed Central: PMC3679190].
- Hofmann SG, Sawyer AT, Witt AA, Oh D. The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *J Consult Clin Psychol*. 2010;78(2):169-83. doi: [10.1037/a0018555](https://doi.org/10.1037/a0018555). [PubMed: 20350028]. [PubMed Central: PMC2848393].
- Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits. A meta-analysis. *J Psychosom Res*. 2004;57(1):35-43. doi: [10.1016/S0022-3999\(03\)00573-7](https://doi.org/10.1016/S0022-3999(03)00573-7). [PubMed: 15256293].
- Segal ZV, Williams M, Teasdale JD. *Mindfulness-based cognitive therapy for depression*. Guilford Publications; 2018.
- Mendelson T, Greenberg MT, Dariotis JK, Gould LF, Rhoades BL, Leaf PJ. Feasibility and preliminary outcomes of a school-based mindfulness intervention for urban youth. *J Abnorm Child Psychol*. 2010;38(7):985-94. doi: [10.1007/s10802-010-9418-x](https://doi.org/10.1007/s10802-010-9418-x). [PubMed: 20440550].
- Harnett PH, Dawe S. The contribution of mindfulness-based therapies for children and families and proposed conceptual integration. *Child Adolesc Ment Health*. 2012;17(4):195-208. doi: [10.1111/j.1475-3588.2011.00643.x](https://doi.org/10.1111/j.1475-3588.2011.00643.x).
- Greco LA, Hayes SC. *Acceptance and mindfulness treatments for children and adolescents: A practitioner's guide*. New Harbinger Publications; 2008.
- Burke CA. Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. *J Child Fam Stud*. 2010;19(2):133-44. doi: [10.1007/s10826-009-9282-x](https://doi.org/10.1007/s10826-009-9282-x).
- Semple RJ, Lee J, Rosa D, Miller LF. A randomized trial of mindfulness-based cognitive therapy for children: Promoting mindful attention to enhance social-emotional resiliency in children. *J Child Fam Stud*. 2010;19(2):218-29. doi: [10.1007/s10826-009-9301-y](https://doi.org/10.1007/s10826-009-9301-y).
- Borquist-Conlon DS, Maynard BR, Brendel KE, Farina ASJ. Mindfulness-based interventions for youth with anxiety: A systematic review and meta-analysis. *Res Soc Work Pract*. 2019;29(2):195-205. doi: [10.1177/1049731516684961](https://doi.org/10.1177/1049731516684961).
- Singh NN, Lancioni GE, Singh Joy SD, Winton ASW, Sabaawi M, Wahler RG, et al. Adolescents with conduct disorder can be mindful of their aggressive behavior. *J Emot Behav Disord*. 2007;15(1):56-63. doi: [10.1177/10634266070150010601](https://doi.org/10.1177/10634266070150010601).
- Bishop SR, Lau MA, Shapiro S, Carlson L, Anderson ND, Carmody J, et al. Mindfulness: A proposed operational definition. *Clin Psychol Sci Pract*. 2004;11(3):230-41. doi: [10.1093/clipsy.bph077](https://doi.org/10.1093/clipsy.bph077).
- Baer RA, Smith GT, Hopkins J, Krietemeyer J, Toney L. Using self-report assessment methods to explore facets of mindfulness. *Assessment*. 2006;13(1):27-45. doi: [10.1177/107319105283504](https://doi.org/10.1177/107319105283504). [PubMed: 16443717].
- Baer RA, Smith GT, Allen KB. Assessment of mindfulness by self-report: the Kentucky inventory of mindfulness skills. *Assessment*. 2004;11(3):191-206. doi: [10.1177/107319104268029](https://doi.org/10.1177/107319104268029). [PubMed: 15358875].
- Feldman G, Hayes A, Kumar S, Greeson J, Laurenceau JP. Mindfulness and emotion regulation: The development and initial validation of the cognitive and affective mindfulness scale-revised (CAMS-R). *J Psychopathol Behav Assess*. 2007;29(3):177-90. doi: [10.1007/s10862-006-9035-8](https://doi.org/10.1007/s10862-006-9035-8).
- Lau MA, Bishop SR, Segal ZV, Buis T, Anderson ND, Carlson L, et al. The Toronto Mindfulness Scale: Development and validation. *J Clin Psychol*. 2006;62(12):1445-67. doi: [10.1002/jclp.20326](https://doi.org/10.1002/jclp.20326). [PubMed: 17019673].
- Brown KW, West AM, Loverich TM, Biegel GM. Assessing adolescent mindfulness: Validation of an adapted Mindful Attention Awareness Scale in adolescent normative and psychiatric populations. *Psychol Assess*. 2011;23(4):1023-33. doi: [10.1037/a0021338](https://doi.org/10.1037/a0021338). [PubMed: 21319908].
- Chadwick P, Hember M, Symes J, Peters E, Kuipers E, Dagnan D. Responding mindfully to unpleasant thoughts and images: Reliability and validity of the Southampton mindfulness questionnaire (SMQ). *Br J Clin Psychol*. 2008;47(Pt 4):451-5. doi: [10.1348/014466508X314891](https://doi.org/10.1348/014466508X314891). [PubMed: 18573227].

29. Greco LA, Baer RA, Smith GT. Assessing mindfulness in children and adolescents: Development and validation of the Child and Adolescent Mindfulness Measure (CAMM). *Psychol Assess*. 2011;**23**(3):606-14. doi: [10.1037/a0022819](https://doi.org/10.1037/a0022819). [PubMed: [21480722](https://pubmed.ncbi.nlm.nih.gov/21480722/)].
30. Cunha M, Galhardo A, Pinto-Gouveia J. [Child and adolescent mindfulness measure (CAMM): Study of the psychometric properties of the Portuguese version]. *Psychol Reflect Critic*. 2013;**26**(3):459-68. Portuguese. doi: [10.1590/s0102-79722013000300005](https://doi.org/10.1590/s0102-79722013000300005).
31. Vinas F, Malo S, Gonzalez M, Navarro D, Casas F. Assessing mindfulness on a sample of Catalan-speaking Spanish adolescents: Validation of the Catalan version of the child and adolescent mindfulness measure. *Span J Psychol*. 2015;**18**. E46. doi: [10.1017/sjp.2015.48](https://doi.org/10.1017/sjp.2015.48). [PubMed: [26096259](https://pubmed.ncbi.nlm.nih.gov/26096259/)].
32. de Bruin EI, Zijlstra BJH, Bögels SM. The meaning of mindfulness in children and adolescents: Further validation of the child and adolescent mindfulness measure (CAMM) in two independent samples from The Netherlands. *Mindfulness*. 2014;**5**(4):422-30. doi: [10.1007/s12671-013-0196-8](https://doi.org/10.1007/s12671-013-0196-8).
33. Kuby AK, McLean N, Allen KB. Validation of the child and adolescent mindfulness measure (CAMM) with non-clinical adolescents. *Mindfulness*. 2015;**6**(6):1448-55. doi: [10.1007/s12671-015-0418-3](https://doi.org/10.1007/s12671-015-0418-3).
34. Chiesi F, Dellagiulia A, Lionetti F, Bianchi G, Primi C. Using item response theory to explore the psychometric properties of the Italian version of the child and adolescent mindfulness measure (CAMM). *Mindfulness*. 2017;**8**(2):351-60. doi: [10.1007/s12671-016-0604-y](https://doi.org/10.1007/s12671-016-0604-y).
35. Ristallo A, Schweiger M, Oppo A, Pergolizzi F, Presti G, Moderato P. [Measuring mindfulness in developmental age: Psychometric properties and factorial structure of the Italian version of the Child and Adolescent Mindfulness Measure (I-CAMM)]. *Cognit Behav Psychother*. 2017;**22**(3):297-315. Italian. doi: [10.1037/t61201-000](https://doi.org/10.1037/t61201-000).
36. Comrey AL, Lee HB. *A first course in factor analysis*. Psychology Press; 2013.
37. Myers ND, Ahn S, Jin Y. Sample size and power estimates for a confirmatory factor analytic model in exercise and sport: A Monte Carlo approach. *Res Q Exerc Sport*. 2011;**82**(3):412-23. doi: [10.1080/02701367.2011.10599773](https://doi.org/10.1080/02701367.2011.10599773). [PubMed: [21957699](https://pubmed.ncbi.nlm.nih.gov/21957699/)].
38. Mohsenabadi H, Shabani MJ, Zanjani Z. Factor structure and reliability of the mindfulness attention awareness scale for adolescents and the relationship between mindfulness and anxiety in adolescents. *Iran J Psychiatr Behav Sci*. 2018;**13**(1). e64097. doi: [10.5812/ijpbs.64097](https://doi.org/10.5812/ijpbs.64097).
39. Greco LA, Lambert W, Baer RA. Psychological inflexibility in childhood and adolescence: Development and evaluation of the Avoidance and Fusion Questionnaire for Youth. *Psychol Assess*. 2008;**20**(2):93-102. doi: [10.1037/1040-3590.20.2.93](https://doi.org/10.1037/1040-3590.20.2.93). [PubMed: [18557686](https://pubmed.ncbi.nlm.nih.gov/18557686/)].
40. Shabani MJ, Mohsenabadi H, Zanjani Z. [Psychometric properties of the Persian version of the Avoidance and Fusion Questionnaire for Youth]. *J Mazandaran Univ Med Sci*. 2018;**28**(164):91-101. Persian.
41. Reynolds CR, Richmond BO. What I think and feel: A revised measure of children's manifest anxiety. *J Abnorm Child Psychol*. 1978;**6**(2):271-80. doi: [10.1007/bf00919131](https://doi.org/10.1007/bf00919131). [PubMed: [670592](https://pubmed.ncbi.nlm.nih.gov/670592/)].
42. Reynolds CR. Concurrent validity of "What I think and feel:" The Revised Children's Manifest Anxiety Scale. *J Consult Clin Psychol*. 1980;**48**(6):774-5. doi: [10.1037//0022-006x.48.6.774](https://doi.org/10.1037//0022-006x.48.6.774). [PubMed: [7440835](https://pubmed.ncbi.nlm.nih.gov/7440835/)].
43. Taghavi M, Alishahi M. [Study of validity and reliability of manifest anxiety scale for children]. *J Psychol*. 2003;**4**(7):342-57. Persian.
44. Kovacs M. The children's depression, inventory (CDI). *Psychopharmacol Bull*. 1985;**21**(4):995-8. [PubMed: [4089116](https://pubmed.ncbi.nlm.nih.gov/4089116/)].
45. Dehshiri G, Najafi M, Shikhi M, Habibi Askarabd M. [Investigating primary psychometric properties of children's depression inventory (CDI)]. *J Fam Res*. 2009;**5**(2):159-77. Persian.
46. Kline TJB. *Psychological testing: A practical approach to design and evaluation*. Sage; 2005. doi: [10.4135/9781483385693](https://doi.org/10.4135/9781483385693).
47. Yong AG, Pearce S. A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutor Quant Meth Psychol*. 2013;**9**(2):79-94. doi: [10.20982/tqmp.09.2.p079](https://doi.org/10.20982/tqmp.09.2.p079).
48. West SG, Taylor AB, Wu W. Model fit and model selection in structural equation modeling. *Handbook of structural equation modeling*. 2012. p. 209-31.
49. Brown TA. *Confirmatory factor analysis for applied research*. New York, NY: Guilford; 2006.
50. Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, editors. *Testing structural equation models*. Newbury Park, CA: Sage; 1993. p. 136-62.
51. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equation Model*. 1999;**6**(1):1-55. doi: [10.1080/10705199909540118](https://doi.org/10.1080/10705199909540118).
52. Streiner DL, Norman GR, Cairney J. *Health measurement scales: A practical guide to their development and use*. USA: Oxford University Press; 2015. doi: [10.1093/med/9780199685219.001.0001](https://doi.org/10.1093/med/9780199685219.001.0001).
53. Clark LA, Watson D. Constructing validity: Basic issues in objective scale development. *Psychol Assess*. 1995;**7**(3):309-19. doi: [10.1037/1040-3590.7.3.309](https://doi.org/10.1037/1040-3590.7.3.309).
54. Nunnally J. *Psychometric methods*. New York: McGraw-Hill; 1978.
55. Roemer L, Williston SK, Rollins LG. Mindfulness and emotion regulation. *Curr Opin Psychol*. 2015;**3**:52-7. doi: [10.1016/j.copsyc.2015.02.006](https://doi.org/10.1016/j.copsyc.2015.02.006).
56. Semple RJ, Reid EFG, Miller L. Treating anxiety with mindfulness: An open trial of mindfulness training for anxious children. *J Cognit Psychother*. 2005;**19**(4):379-92. doi: [10.1891/jcop.2005.19.4.379](https://doi.org/10.1891/jcop.2005.19.4.379).
57. Lagor AF, Williams DJ, Lerner JB, McClure KS. Lessons learned from a mindfulness-based intervention with chronically ill youth. *Clin Pract Pediatr Psychol*. 2013;**1**(2):146-58. doi: [10.1037/cpp0000015](https://doi.org/10.1037/cpp0000015).
58. Noggle JJ, Steiner NJ, Minami T, Khalsa SB. Benefits of yoga for psychosocial well-being in a US high school curriculum: A preliminary randomized controlled trial. *J Dev Behav Pediatr*. 2012;**33**(3):193-201. doi: [10.1097/DBP.0b013e31824afd4c](https://doi.org/10.1097/DBP.0b013e31824afd4c). [PubMed: [22343481](https://pubmed.ncbi.nlm.nih.gov/22343481/)].