

# Validation of the French Version of the Child and Adolescent Mindfulness Measure (CAMM) Among Samples of French and Indigenous Youth

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**Abstract** Two independent studies were conducted to validate and assess the psychometric properties of the French-Canadian version of the Child and Adolescent Mindfulness Measure among samples of French and Indigenous youth. In study 1, 589 adolescents (60% girls) aged from 15 to 18 years from two urban high schools, and, in study 2, 311 (51% girls, 43% Indigenous) adolescents aged from 14 to 19 years from two rural high schools completed the Child and Adolescent Mindfulness Measure (CAMM) and other measures to assess its construct validity. An exploratory (study 1) and a confirmatory (study 2) factor analysis validated the single-factor solution. Results also indicate that the French-Canadian version of the CAMM had no floor or ceiling effects, as well as an adequate internal consistency and 2-week and 3-month test-retest reliability. The construct validity of the scale was supported by positive correlations with measures of self-esteem, resilience, and empowerment, and by negative correlations with psychological symptoms and family violence and difficulties. Child sexual abuse was also related to lower levels of mindfulness. Overall, results suggest that the CAMM may be a useful and appropriate tool to globally assess mindfulness among youth. Data also support the cross-cultural application of this scale among Indigenous adolescents.

**Keywords** Child and Adolescent Mindfulness Measure · Mindfulness · Self-acceptance · Reliability · Validity · Assessment · Adolescents · Psychological symptoms · Self-esteem · Resilience · Empowerment · Child abuse

Over the past two decades, considerable attention has been given to the construct of mindfulness. According to Kabat-Zinn (2003), mindfulness “refers to the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (p. 145). In several studies, mindfulness is defined as a skill or a disposition, which can manifest in different behaviors, and is associated with positive outcomes (see Brown et al. 2007 for a literature review). Although there are a growing number of measures to assess mindfulness among adults, few exist to capture mindfulness in adolescents, and even fewer are available in French. Psychometrically sound measures that are developmentally appropriate for adolescents are essential for theory development and clinical practice.

The two most commonly used measures for use with adolescents are the Child and Adolescent Mindfulness Measure (10 items; Greco et al. 2011) and the Mindful Attention Awareness Scale for Adolescents (MAAS-A; 15 items; Brown et al. 2011). The two scales are significantly correlated ( $r = .54$ ; de Bruin et al. 2011), but the Child and Adolescent Mindfulness Measure (CAMM) is particularly promising because it takes into account three aspects of mindfulness (observing, acting with awareness, and accepting without judgment). The CAMM is also entirely adapted to be used with children and adolescents, e.g., items were reviewed by experts in child clinical psychology and mindfulness, and were further assessed in a pilot study interviewing 35 children (10 to 17 years old) to ensure good comprehension of items. In

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comparison, only one item was removed from the MAAS and items were slightly adapted for adolescent respondents to develop the MAAS-A.

Developed by Greco et al. (2011), the CAMM is a 10-item measure that assesses mindfulness skills in children and adolescents using a 5-point scale (0 = *never true*; 4 = *always true*). The scale originally consisted of 25 items, which were generated by Greco and Baer and adapted for children and adolescents from the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al. 2004). This pool of 25 items measures three of the four dimensions of the KIMS, including *observing* (noticing internal phenomena such as thoughts, feelings, and bodily sensations), *acting with awareness* (present centered awareness and full engagement in one's current activity), and *accepting without judgment* (nonjudgmental awareness and openness to experiencing a full range of internal events). The fourth dimension, *describing* (the ability to put internal experiences into words), was not included in the CAMM, as it was suggested not being suitable for adolescents considering their developmental level (Greco et al. 2011).

Using an exploratory factor analysis with principal axis factoring and oblique rotation, the CAMM was shortened to 16 items, and then to a 10-item, single-factor solution, which covers three of the four aspects described above (Greco et al. 2011). This validation study of the CAMM has shown that the scale presents adequate internal consistency ( $\alpha = .80$ ), as well as convergent and divergent validity (Greco et al. 2011). The CAMM has been further validated in English in Australia (Kuby et al. 2015), as well as in other languages such as Catalan (Viñas et al. 2015), Dutch (de Bruin et al. 2014), Italian (Chiesi et al. 2017), and Portuguese (Cunha et al. 2013). Overall, these studies confirmed the unidimensional factor structure and the high internal consistency of the CAMM, as well as its construct validity.

Studies conducted with the CAMM have shown that high mindfulness is related to lower psychological symptoms (such as internalizing/externalizing symptoms, depression, anxiety), lower levels of perceived stress, and a low lifetime alcohol or marijuana use, as well as to positive outcomes including life satisfaction, positive affect, self-esteem, self-compassion, and resiliency among adolescents (e.g., Bluth and Blanton 2014; Cunha and Paiva 2012; Pepping et al. 2016; Robinson et al. 2014; Tan and Martin 2016; see Pallozzi et al. 2017 for a literature review). Our past analyses have also shown that being a victim of child sexual abuse is related to lower levels of mindfulness (Daigneault et al. 2016). Apart from these results, the CAMM has not been studied in relation to past trauma, although a recent study in adults found that cumulative traumatic experiences in childhood were related to lower levels of mindfulness (Bolduc et al. 2015).

One important quality of a measure is its responsiveness, which is the sensitivity of the scale to detect clinical changes over time (Terwee et al. 2007). Studies on the efficacy of

different adolescent mindfulness-based programs revealed pre-post improvement on mindfulness as measured with the CAMM, with small to moderate effects (e.g., Ames et al. 2014; Atkinson and Wade 2015; Bluth et al. 2016a, 2016b; Tan and Martin 2015; Van der Gucht et al. 2015). However, other effectiveness studies using the CAMM have failed to observe significant changes after such interventions, which might indicate a lack of effectiveness of the interventions (Lagor et al. 2013), or that in some circumstances, the CAMM may lack sensitivity to change (Johnson et al. 2016).

To our knowledge, there are no empirical reports of the psychometric properties of the French-Canadian version of the CAMM. A French validation seems important as the CAMM might be an efficient and accessible assessment tool that can adequately evaluate mindfulness skills (or disposition) for research and clinical purposes. In addition, it could help assess the effectiveness of mindfulness-based programs in French-speaking populations, which have become increasingly popular in the last couple of years (e.g., see Tan 2016; Zenner et al. 2014; Zoogman et al. 2015).

In sum, the objectives of the two current studies were to validate the CAMM for French-Canadian youth. Study 1 ( $n = 589$ ) used an exploratory factor analysis to assess the factorial structure of the French CAMM. It also assessed floor/ceiling effects, its internal consistency and construct validity with a large sample of urban youth, as well as testing its 2-week and 3-month test-retest reliability. In study 2 ( $n = 311$ ), a confirmatory factor analysis was conducted, and the floor/ceiling effects, internal consistency of scores, and construct validity were assessed with a rural ethnically diverse sample of youth from low socioeconomic settings. We also investigated gender differences in both studies. These two studies will be presented separately.

## Study 1

### Method

#### *Participants*

Study 1 received institutional review board (IRB) approval for initial and secondary data analyses. From the 794 eligible students recruited from two French urban high schools located in Canada, 767 completed questionnaires at T1, 694 at T2, and 693 at T3. At T1, students were aged from 15 to 18 years and mostly in grades 10 and 11. Among participants, 2.8% reported being Indigenous and 88.5% identified as French Canadians. While socioeconomic levels of families were not available to the investigators, participating schools were selected in middle- and high-class socioeconomic settings (MELS 2011).

## Procedure

After obtaining informed consent, participants completed self-reported questionnaires (less than 40 min) administered in the auditorium or cafeteria of each school (two to three classes at a time) during school hours, on three occasions. To ensure complete anonymity of their responses and to match their questionnaires at each follow-up (from T1 to T3), students generated a unique seven-character identification code (Yurek et al. 2008) by answering the same questions at each wave, such that they did not have to remember their code (e.g., the third letter of their mother's first name, last number of their main caregiver's phone number). After excluding missing data, invalid protocols, and failure to pair protocols over time, the total sample included 589 students (59.8% girls and 40.2% boys) at initial assessment (T1), 578 at 2-week (T2), and 487 at 3-month (T3) intervals, which represents a 74% participation rate over the three waves.

## Measures

**Child and Adolescent Mindfulness Measure** The CAMM (Greco et al. 2011) is composed of 10 items designed to assess self-acceptance/mindfulness in children and adolescents. For each statement, participants rate their level of agreement on a 5-point Likert scale ranging from 0 = *never true* to 4 = *always true*. The total score ranges from 0 to 40, with higher scores indicating greater self-acceptance and mindfulness. First, the original scale was independently translated into French. Second, this initial translation was submitted to two reviewers who discussed and revised the content of this translation. Subsequently, a professional translator whose mother tongue is English back translated the scale to verify the integrity of the French translation (Vallerand 1989). Discrepancies with the original English scale were noted and the French version was adapted accordingly until the back-translation was deemed equivalent to the original English version.

**Child and Youth Resilience Measure** Resilience features in children and youth were measured using the 27-item French version (Daigneault et al. 2013) of the Child and Youth Resilience Measure (CYRM) (Ungar et al. 2008). Answers are recorded on a 5-point Likert-type scale from 1 = *not at all* to 5 = *a lot*. Total scores range from 27 to 135, with higher scores indicating higher levels of resilience (individual, relational/familial, and community). The scale has demonstrated satisfactory psychometric qualities including high internal consistency and construct validity (Daigneault et al. 2013). Internal consistency of the total CYRM score in study 1 was .89.

**Rosenberg Self-Esteem Scale** The 10-item French version (Vallières and Vallerand 1990) of the Rosenberg Self-Esteem Scale (RSES) (Rosenberg 1965) was used to assess self-

esteem. Items are rated on a 4-point Likert scale with responses ranging from 1 = *strongly disagree* to 4 = *strongly agree*. The total self-esteem score varies from 10 to 40, with a higher score reflecting a higher level of self-esteem. The satisfactory psychometric qualities found in previous studies (Bagley et al. 1997; Bagley and Mallick 2001; Vallières and Vallerand 1990) were also found in the current sample (study 1:  $\alpha = .84$ ).

**Child Sexual Abuse** Adolescents' past experiences of sexual abuse were assessed with one item: "The next item represents a situation that might have happened to you with different people (family member, date, romantic partner, friend, neighbor, coach, acquaintance, stranger, etc.). Please, read the next item and indicate whether someone has behaved this way toward you (yes or no). Have you ever had a sexual relationship, were subjected to sexual behaviors or were forced to behave sexually with one of these people while you did not want to?" An affirmative answer to this item was scored as 1 (sexually abused in childhood) and a negative answer was scored as 0 (not sexually abused in childhood).

## Results

Using IBM Statistical Package for Social Sciences 24.0, the factorial structure of the CAMM was first investigated using data from the first measurement time with an exploratory factor analysis (EFA). EFA was chosen for the first study with the intention to compare the results to those obtained by Greco et al. (2011), using exactly the same method. A maximum likelihood principal axis factor analysis followed by an oblique rotation was then used to verify if the one-factor forced solution would fit the data using this French version of the CAMM. The Kaiser-Meyer-Olkin (KMO) indicator was .84 and the Bartlett test of sphericity was  $\chi^2_{(45)} = 1092.08, p < .001$ , which indicate an adequate sampling as well as the suitability of the data for the EFA. This single-factor solution explained 27.77% of the variance. The item loadings (see Table 1, study 1 section) ranged between .28 and .71.

The percentage of participants who had the lowest and highest possible scores on the total scale of the CAMM was assessed to determine possible floor or ceiling effects. When 15% or more of the respondents achieve the highest or lowest possible scores, it is considered as problematic (Terwee et al. 2007). Results indicate no floor or ceiling effect problems, as 1.2% of participants obtained the lowest (0) or highest (40) scores, which further attests its content validity (Terwee et al. 2007).

Internal consistency was evaluated using the Cronbach's (1951) alpha. The coefficients were good for each wave: T1 = .78; T2 = .83; T3 = .86. Test-retest intra-class correlation

**Table 1** Item content and factor loadings for the Child and Adolescent Mindfulness Measure (CAMM)

Item	Factor loading Study 1	Factor loading Study 2
1. Je m'en prends à moi-même quand je ne comprends pas mes sentiments. <i>I get upset with myself for having feelings that don't make sense.</i>	.54	.55
2. À l'école, je passe d'une classe à l'autre sans même m'en rendre compte. <i>At school, I walk from class to class without noticing what I'm doing.</i>	.28	.34
3. J'agis sans vraiment penser à ce que je fais. <i>I do things without thinking about what I'm doing.</i> <sup>a</sup>	.30	.53
4. Je m'occupe pour ne pas me laisser envahir par mes pensées ou par mes sentiments. <i>I keep myself busy so I don't notice my thoughts or feelings.</i>	.48	.60
5. Je me dis que je ne devrais pas me sentir comme je me sens. <i>I tell myself that I shouldn't feel the way I'm feeling.</i>	.57	.66
6. J'ai de la difficulté à me concentrer sur une seule chose à la fois. <i>It's hard for me to pay attention to only one thing at a time.</i>	.39	.56
7. Je pense plus facilement à ce qui est arrivé dans le passé qu'à ce qui arrive en ce moment. <i>I think about things that have happened in the past instead of thinking about things that are happening right now.</i>	.53	.65
8. Certaines de mes pensées m'énervent. <i>I get upset with myself for having certain thoughts.</i>	.71	.69
9. Je crois que certains de mes sentiments sont mauvais et que je ne devrais pas les avoir. <i>I think that some of my feelings are bad and that I shouldn't have them.</i>	.68	.77
10. Je m'empêche d'avoir des sentiments que je n'aime pas avoir. <i>I stop myself from having feelings that I don't like.</i>	.61	.66

<sup>a</sup> This item has been replaced for "I push away thoughts that I don't like" in the recent version of the CAMM (Greco et al. 2011)

coefficient at the 2-week interval was .72, and at 3-month intervals .58, revealing adequate stability of scores.

The CAMM correlated positively with resilience and with self-esteem, supporting its convergent validity (see Table 2, study 1 section) and concurring with the Tan and Martin (2016) study. The contrasted groups approach was used (i.e., comparing child sexual abuse victims to non-victims) as another way of measuring construct validity (DeVon et al. 2007). A one-way between subjects analysis of variance (ANOVA) revealed that participants who experienced childhood sexual abuse had lower levels of mindfulness than participants not reporting childhood sexual abuse,  $F(1, 553) = 21.83, p < .001, \eta^2 = .04$ . Results also indicated no differences in mean scores

of mindfulness among boys and girls ( $F(1, 553) = 2.36, p = .13$ ), or schools ( $F(1, 576) = 1.48, p = .22$ ).

## Discussion

This current study adds further evidence of the CAMM's suitability to assess mindfulness in youth.

The item loadings of the EFA appeared to be comparable to the mindfulness single-factor solution found in the original CAMM (between .42 and .66 in Greco et al. 2011), as well as in the validation studies in other languages (between .28 and .69 in Chiesi et al. 2017; between .22 and .72 in de Bruin et al. 2014; between .37 and .79 in Kuby et al. 2015; between .25 and .77 in Viñas et al. 2015). The internal consistency coefficients were similar to those found in previous validation studies (Cunha et al. 2013; de Bruin et al. 2014; Greco et al. 2011; Kuby et al. 2015; Viñas et al. 2015), and the test-retest stability estimates were higher than the ones obtained in previous studies using a 1-month interval (.46; Cunha et al. 2013) and 1-year interval (.47; Viñas et al. 2015).

Combined to previous studies assessing psychometric properties of the CAMM in various languages, our results also add to the convergent and divergent validity of the scale. The CAMM correlated positively with resilience and with self-esteem, concurring with the Tan and Martin (2016) study. Victims of child sexual abuse also reported lower levels of mindfulness compared to non-sexually abused adolescents. Although no previous studies have been conducted on the link

**Table 2** Correlations between CAMM with resilience, self-esteem, empowerment, trauma symptoms, and family problems

Measure	Study 1	Study 2
CYRM	.33***	.18**
RSES	.44***	.42***
CCES	–	.20**
TSCC	–	–.58***
FPI	–	–.25***

CYRM Child and Youth Resilience Measure, RSES Rosenberg Self-Esteem Scale, CCES Consumer-Constructed Empowerment Scale, TSCC Trauma Symptom Checklist for Children, FPI Family Problems Inventory

\*\* $p < .01$ , \*\*\* $p < .001$

between child sexual abuse and mindfulness, apart from our previous study using part of these data (Daigneault et al. 2016), it may be hypothesized that some of the consequences that may be related to child sexual abuse, such as emotional dysregulation or the overwhelmed available resources, are linked to a mindfulness deficit (Briere 2012; Follette et al. 2004). Results regarding gender are dissonant with other studies, indicating greater mindfulness in male youths when compared to their female counterparts (Cunha and Paiva 2012; de Bruin et al. 2014; Robinson et al. 2014), but similar to other studies that did not find gender differences (Chiesi et al. 2017; Greco et al. 2011; Kuby et al. 2015; Tan and Martin 2016; Viñas et al. 2015). Results of the Chiesi et al. (2017) study also revealed the measurement equivalence of the CAMM at the item level for both genders, suggesting that the scale is equally suitable and fair for boys and girls.

## Study 2

### Method

#### Participants

In this study, 311 adolescents (51.1% girls and 48.9% boys) aged from 14 to 19 years and in grades 9, 10, or 11 from two French-Canadian rural schools completed self-reported questionnaires. All students who were present on the assessment day and who consented to participate represent 92% of the targeted sample, which takes into account the absentees, missing data, and invalid protocols. More specifically, one school was located off reserve in a low socioeconomic setting (MELS 2011) and served both non-Indigenous and Indigenous students. Of these participants, 68 identified themselves as Indigenous, 177 as Caucasian, and 1 person did not answer this question. The second school was located on reserve in a low socioeconomic setting, approximately 50 km from the nearest city and served only Indigenous students ( $n = 65$ ).

#### Procedure

Data were collected either in the school library or in the classrooms, and questionnaires were completed in less than 40 min. All participants spoke and wrote French (schooling being provided in French in both schools). A research coordinator and research assistants were available to answer individual questions during data collection. The study received IRB approval for secondary data analysis from a study on trauma. It was also designed in accordance with Canadian principles of OCAP (Ownership, Control, Access and Possession) and the ethical guidelines of the Canadian Tri-Council Policy Statement for research involving Aboriginal peoples.

### Measures

The CYRM, RSES, CAMM, and child sexual abuse measures are described in study 1.

**Consumer-Constructed Empowerment Scale** The French translation and adaptation for an adolescent population (Daigneault et al. 1998) of the Consumer-Constructed Empowerment Scale (CCES) (Rogers et al. 1997; Sciarappa et al. 1994) was used to assess empowerment. This 23-item version comprises four of the original five subscales to which participants indicated their level of agreement on a 4-point Likert scale ranging from 1 = *strongly agree* to 4 = *strongly disagree*. The total score ranges from 23 to 92, with a higher score being indicative of a greater sense of empowerment. The original scale has demonstrated adequate internal consistency and construct validity (Rogers et al. 1997). The internal consistency of the adolescent adapted version in study 2 was .83.

**Psychological Symptoms** The French version (Wright and Sabourin 1996) of the Trauma Symptoms Checklist for Children (TSC-C; Briere 1996) was used to measure psychological symptoms (anxiety, depression, anger, post-traumatic stress, dissociation, and sexual concerns). The TSC-C comprises 54-item questionnaire and youth aged 8 to 17 score items on a 4-point Likert scale ranging from 0 = *never* to 3 = *almost always*. The factorial structure and internal consistency of the French language translation of the instrument were comparable to those of the original version (Jouvin et al. 2001). The total score, ranging from 0 to 162, was used in the present study. Higher scores indicate greater trauma symptoms (study 2:  $\alpha = .94$ ).

**Family Problems** Exposure to family problems was measured using 11 items of the Family Problems Inventory (family violence, parental separation or alcoholism, etc.; Thériault et al. 2003). Participants indicated whether or not they have experienced the events listed. The total score, ranging from 0 to 11 family problems, was computed and used in the present study (study 2:  $\alpha = .71$ ).

### Results

The extracted solution found in study 1 was examined via Confirmatory Factor Analysis (CFA; Amos 24.0), using maximum likelihood estimation method. The item loadings (see standardized coefficients in Table 1, study 2 section) ranged between .34 and .77. Fit indices also supported the data and were well-represented by a single-factor structure: root mean square error of approximation (RMSEA) = .06 (good fit), normed fit index (NFI) = .93 (good fit), and comparative fit index (CFI) = .96 (good fit). Results highlight the absence of floor or ceiling effects, as 2.3% of participants obtained the

lowest and highest total scores (Terwee et al. 2007). The internal consistency of the CAMM was .86.

Table 2 presents correlations between the CAMM and measures of related constructs (study 2 section). As expected, the CAMM correlated positively with resilience, self-esteem, and empowerment, and negatively with psychological symptoms (for those interested in the link between mindfulness and the different subscales of the TSC-C, see Daigneault et al. 2016). Results also revealed that child sexual abuse victims had lower levels of mindfulness than non-victims,  $F(1, 296) = 8.59$ ,  $p < .01$ ,  $\eta^2 = .03$ . In addition, lower levels of mindfulness were related to a higher number of family problems ( $r = -.25$ ,  $p < .001$ ). ANOVAs contrasting mindfulness scores according to gender indicated significant differences by sex, boys having slightly higher levels of mindfulness compared to girls,  $F(1, 300) = 4.36$ ,  $p = .05$ ,  $\eta^2 = .01$ . When controlling for Indigenous status, results indicated no differences between schools,  $F(1, 299) = .39$ ,  $p = .53$ . However, Indigenous adolescents presented slightly lower levels of mindfulness compared to non-Indigenous adolescents, while controlling for family problems, which were more frequent among Indigenous adolescents,  $F(1, 299) = 4.48$ ,  $p < .05$ ,  $\eta^2 = .02$ .

## Discussion

The CFA confirmed the one-factor structure of the CAMM. Moreover, the results regarding related constructs replicate those of other studies linking mindfulness with better functioning, such as higher self-esteem and resilience (Tan and Martin 2016), and lessened psychological symptoms (anxiety, depression, internalized/externalized symptoms) (Chiesi et al. 2017; Cunha and Paiva 2012; Greco et al. 2011; Kuby et al. 2015; Pepping et al. 2016; Tan and Martin 2016). Current results also suggest that adolescents exposed to a greater number of difficulties, including sexual abuse (as found in study 1) and various family problems such as family violence or abandonment, exhibit lower levels of mindfulness (see also Daigneault et al. 2016, for a thorough analysis of how mindfulness may act as a mediator and moderator). Such difficulties, or interpersonal traumas, may lead to persistent psychosocial distress or a number of avoidant behaviors to respond to overwhelming aversive internal experiences. Trauma-related experiential avoidance is conceptualized as the antithesis of mindful behavior (Briere 2012; Follette et al. 2015) and may paradoxically stimulate the frequency and saliency of the very trauma-related thoughts and feelings that the individual wishes to avoid (Briere 2015; Thompson et al. 2011).

Contrary to study 1, boys reported slightly higher levels of mindfulness compared to girls. Future studies are thus needed to better understand gender differences in relation to mindfulness and to consider possible factors that might interact with gender, such as family support. Concerning Indigenous status

of certain participants, our results may be interpreted in the light of previous studies that underscored higher rates of various traumatic events among Aboriginal populations compared with the general population (e.g., Bopp et al. 2003; Brennan 2011; Statistics Canada 2015). However, it is important to note that previous studies have shown that Aboriginal adolescents can be quite resilient despite considerable environmental stress and trauma history (e.g., LaFromboise et al. 2006; Zahradnik et al. 2010).

## General Discussion

The aim of these two studies was to validate the French-Canadian version of the CAMM. The factor structure, floor and ceiling effects, internal consistency, as well as construct validity, were examined in two independent samples of adolescents (studies 1 and 2), and the test-retest reliability was assessed at 2-week and 3-month intervals (study 1). Findings indicate that the one-factor solution found in previous studies held in two different samples, without significant gender differences in study 1 and with small gender differences in study 2 in favor of boys. Good internal consistency was also found in both studies, and the 2-week and 3-month test-retest reliability found in study 1 was adequate. The scale's content validity was further strengthened by the absence of floor or ceiling effects, which highlights its sensitivity to detect clinical changes over time, such as in mindfulness-based program effectiveness studies. In addition, the CAMM correlated with psychological functioning/symptoms in the expected direction. These findings are consistent with those found in previous validation studies of the CAMM in other languages (Chiesi et al. 2017; Cunha et al. 2013; de Bruin et al. 2014; Greco et al. 2011; Kuby et al. 2015; Viñas et al. 2015), as well as in other studies using the CAMM (Pepping et al. 2016; Tan and Martin 2016). The CAMM was also negatively correlated with traumas/family problems, adding to its divergent validity, which also mirrors the results of studies conducted in adult populations (Godbout et al. 2016).

However, results of the current study suggest that item 2 (*At school, I walk from class to class without noticing what I'm doing*) performed less well (standardized loadings in both studies were low), which was also observed in the Italian version (Chiesi et al. 2017). Chiesi et al. (2017) suggested that it might be related to the unfamiliar content of this item, as Italian students do not move from one class to another. However, this was not the case for students in the current studies. Also, the item 3 (*I do things without thinking about what I'm doing*) had a low standardized loading in study 1, but a higher one in study 2. Although this item does not appear in the recent version of the CAMM (it was in the first CAMM-10 items version, and figures in the CAMM-25 items), it may be less problematic than the one that replaced it (*I push away*

*thoughts that I don't like*), which had low standardized loadings in the Catalan (Viñas et al. 2015), Italian (Chiesi et al. 2017), and Portuguese (Cunha et al. 2013) versions. These items should be reviewed or excluded and the revised version of this scale should be further validated.

Strengths of the current studies include the use of two different and diverse samples (urban/rural, Caucasians and Indigenous adolescents, low to higher socioeconomic level schools). Although this is primarily due to the fact that no other child and adolescent mindfulness measures are available in French, it is important to note that a limitation of both studies is that we did not compare the CAMM to another mindfulness measure.

While the CAMM is based on a multidimensional conceptualization of mindfulness (observing, acting with awareness, and accepting without judgment), its factorial structure is unidimensional. Future studies should thus develop, validate, and assess the utility of multifactorial mindfulness scales. For example, researchers recently developed and validated a 25-item measure of mindfulness, comprising 8 factors: the Comprehensive Inventory of Mindfulness Experiences (Johnson et al. 2017). Of interest is the wording of the items of this scale, including both direct and reverse-scored items, which might reduce biases related to the use of a scale using only negatively scored items (Grossman 2011), such as the CAMM. Yet, in the context of large epidemiological studies, reliance on a short version offers an adequate and valid alternative. It would also be of interest to further validate the French version of the CAMM among children, as mindfulness may be developing differently from childhood to adolescence (de Bruin et al. 2014). Furthermore, it would be useful to validate the CAMM with other samples (e.g., clinical populations, with a cross-informant perspective).

Overall, results provide support for the psychometric properties of the French version of the CAMM in Caucasian and Indigenous adolescent populations, from rural and urban samples. The CAMM appears to be a psychometrically sound, developmentally and culturally relevant measure of mindfulness for adolescents.

## Data Availability Statement

Due to ethical constraints, data cannot be made openly accessible, but are available upon request from the corresponding author.

**Author Contributions** Jacinthe Dion: designed and executed the study 2, assisted with the EFA and CFA, conducted the other data analyses, and wrote the paper. Linda Paquette: conducted the EFA, assisted with the other data analyses and writing of the study. Isabelle Daigneault: designed and

executed the study 1 and collaborated with the writing of the study. Natacha Godbout: assisted with the data analyses and collaborated in the writing and editing of the manuscript. Martine Hébert: assisted with the data analyses and collaborated with the writing and editing of the manuscript.

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## Compliance with Ethical Standards

**Ethical Approval** All procedures performed in these studies involving human participants were in accordance with the ethical standards of the two institutional research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the studies.

**Conflict of Interest** The authors declare that they have no conflict of interest.

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