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Original article

A French validation of the Child and Adolescent Mindfulness Measure (CAMM)

Validation francophone du questionnaire de pleine conscience pour enfants et adolescents (CAMM)

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ABSTRACT

Introduction. – A large number of studies have been devoted to the development of mindfulness questionnaires, a potential central mechanism in therapy. Although these questionnaires are well validated for adults, their accessibility to young populations are still in its infancy.

Objective. – This study aims to validate a French version of the Child and Adolescent Mindfulness Measure (CAMM) to foster the use of mindfulness questionnaires in clinical studies on children and adolescents, and to fix limitations of a previous French-Canadian version.

Method. – A total of 545 youth aged from 10 to 17 were recruited in a Belgian and a French school in order to test the validity and reliability of the CAMM.

Results. – The results indicate a one-factor structure and suggest a good internal consistency. As expected, the CAMM was positively correlated to another mindfulness questionnaire and negatively correlated to depressive symptomatology and psychological inflexibility.

Conclusion. – Overall, the French version of the CAMM presents good psychometric qualities and seems to remain faithful to its original scale. This measure could help to assess mindfulness in young French speakers.

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R É S U M É

Introduction. – Un grand nombre d'études ont été consacrées à l'élaboration de questionnaires de pleine conscience. En effet, celle-ci pourrait se révéler être un mécanisme psychologique central en contexte thérapeutique. Bien que de nombreux questionnaires aient été validés pour les adultes, peu d'entre eux ont été rendus accessibles aux jeunes populations.

Objectif. – Cette étude a pour objectif de valider une version française du questionnaire de pleine conscience pour enfants et adolescents (CAMM) afin de le rendre accessible aux populations cliniques plus jeunes et répondre aux limites de la version francophone canadienne.

Méthode. – Un total de 545 adolescents, âgés de 10 à 17 ans, ont été recrutés dans une école belge et une école française afin de tester la validité et la fidélité de la version francophone du CAMM.

Résultats. – Les résultats confirment la structure unidimensionnelle du questionnaire et suggèrent une bonne cohérence interne. Comme cela était attendu, la version française du CAMM est positivement corrélée à un autre questionnaire de pleine conscience et négativement corrélée à la symptomatologie dépressive et la rigidité psychologique.

Conclusion. – La version francophone du CAMM présente de bonnes qualités psychométriques et reste fidèle à son échelle d'origine. Elle pourrait donc se révéler utile pour mesurer le niveau de pleine conscience des jeunes francophones.

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1. Introduction

This last decade, mindfulness-based interventions (MBIs) have progressively gained an important place within psychological treatments. Based on breathing exercises, attentional training and body awareness, MBIs focus on the capacity to maintain attention on the present-moment experience, suspending automatic judgement (Brown & Ryan, 2003). One of MBIs' objectives is to decrease experiential avoidance and thoughts suppression (Hofmann & Asmundson, 2008). A large body of evidence has demonstrated the benefits of mindfulness in clinical and non-clinical setting for adults (Grossman, Niemann, Schmidt, & Walach, 2004; Khoury, Sharma, Rush, & Fournier, 2015; Sedlmeier et al., 2012). Scaffolding on these encouraging results, MBIs in younger populations are currently receiving increasing attention. For example, meta-analyses conducted among children and adolescents have shown an impact of MBIs on psychological symptoms, such as stress and anxiety, and cognitive performance (Kallapiran, Koo, Kirubakaran, & Hancock, 2015; Zenner, Herrnleben-Kurz, & Walach, 2014; Zoogman, Goldberg, Hoyt, & Miller, 2015). However, the need of well-validated tools to assess mindfulness in young population is a real concern. Few questionnaires assessing mindfulness skills have been adapted to children and adolescents, particularly in French-speaking populations. Based on these observations, the current study aims to validate a widely used questionnaire of mindfulness for youth: the Child and Adolescent Mindfulness Measure (CAMM; Greco, Baer, & Smith, 2011).

In the adult population, a set of mindfulness questionnaires have been validated as the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) or the Kentucky inventory of mindfulness skills (KIMS; Baer, Smith, & Allen, 2004). In young populations, seven self-report measures of trait mindfulness can be identified, of which four were supported by a validation article (Goodman, Madni, & Semple, 2017): the Child and Adolescent Mindfulness Measure (Greco et al., 2011), the Mindful Attention Awareness Scale for adolescent (Brown, West, Loverich, & Biegel, 2011), the Mindful Attention Awareness Scale for children (the MAAS-C; Lawlor, Schonert-Reichl, Gadermann, & Zumbo, 2014) and the Comprehensive Inventory of Mindfulness Experiences for adolescents (CHIME-A; Johnson, Burke, Brinkman, & Wade, 2016). Among them, the CAMM (Greco et al., 2011) seems particularly promising. The robustness of its psychometric qualities has been ensured by a large data collection in several studies (de Bruin, Zijlstra, & Bögels, 2014; Greco et al., 2011), that is not the case for some other more recent mindfulness questionnaires such as the MAAS-C or the CHIME-A. In addition, the 10-item form of the CAMM allows a fast completion and can be completed by children as well as adolescents (10 to 17 years old) contrary to some other questionnaires such as the MAAS-A that has been validated from 14 years old. Greco et al. (2011) developed the CAMM for the evaluation of an overall mindfulness dimension (named "present-moment awareness and nonjudgmental, nonavoidant responses to thoughts and feelings"). This questionnaire is composed of reverse coded items on a 5-point likert scale (0 = never true to 4 = always true). To design the CAMM, the authors performed an exploratory factor analysis (EFA) on two dimensions of the KIMS and restrained to 10 items the initial 25 items by choosing the unidimensional solution suggested by analyses. Confirmatory factor analysis (CFA) confirmed this final one-factor model. The CAMM has several advantages such as a short testing time (only 10 items) and good psychometric qualities. Indeed, on the seven studies that explored its psychometric qualities (Chiesi, Dellagiulia, Lionetti, Bianchi, & Primi, 2017; Cunha, Galhardo, & Pinto-Gouveia, 2013; de Bruin et al., 2014; Dion, Paquette, Daigneault, Godbout, & Hébert, 2017; Greco et al., 2011; Kuby, McLean, & Allen, 2015; Viñas, Malo, González, Navarro, &

Casas, 2015) all of them reported the validity of the single-factor structure (although some items sometimes did not fit to the model) as well as numerous expected correlations for convergent validity, which was mainly axed on child internalizing and externalizing symptoms, attention, rumination/worry, psychological inflexibility, quality of life and well-being. Six studies reported a satisfactory internal consistency ($\alpha > .70$). Also, one study reported an adequate test-retest reliability with a Pearson correlation of .72 at 2-week interval and .58 at 3-month interval (Dion et al., 2017) but two other studies reported a poor and mediocre reliability with Pearson correlations equal to .46 at one-month interval (Cunha et al., 2013) and .47 at one-year interval (Viñas et al., 2015). In addition, none of these seven studies investigated the divergent validity (non-related constructs) or the content validity (correlation with another mindfulness questionnaire). In the large review of mindfulness questionnaires for adolescents conducted by Pallozzi, Wertheim, Paxton, & Ong (2016), the CAMM and the MASS were considered as the most suitable questionnaires to measure mindfulness in adolescent population. The CAMM was used in sixteen studies since its publication by Greco et al. in 2011 (Pallozzi et al., 2016). The authors have pointed out its good reading level but have also noted its high proportion of abstract items. The CAMM was validated in Dutch (de Bruin et al., 2014), in Catalan (Viñas et al., 2015), in Italian (Chiesi et al., 2017), in Portuguese (Cunha et al., 2013) and more recently in French (Dion et al., 2017). This French validation was conducted among a Canadian population. The Canadian study was conducted at the same time as our data collection, which also aimed to validate the CAMM in French. The alternative French version of the CAMM that we propose presents some differences. We identified four main points that legitimate the use of this alternative French version. Firstly, the validation of Dion et al. (2017) was only conducted in a Canadian sample that limits its scope for European French speakers. Secondly, the French-Canadian version was only dedicated to adolescents (from the age of 14 years) whereas the initial version of the CAMM was validated from the age of 10 years with a mean age about 12 years (Greco et al., 2011). A validation of a French version of the CAMM among children aged between 10 and 14 could be a significant advantage considering that this questionnaire was initially created for this younger population. Thirdly, the resilience and self-esteem questionnaires used for the convergent validity of the French-Canadian CAMM appear to be far removed from mindfulness measures. Similarly, sexual abuse, chosen for the divergent validity, arises the same problem: the authors mention that no previous studies have been conducted on the link between mindfulness and sexual abuse except this validation study. Other measures can be considered as more relevant for assessing the convergent validity of the CAMM according to their proximity to the mindfulness construct. For example, psychological flexibility (i.e., individuals' capacity to shift perspective and adapt to fluctuating situational demands) and ruminative thinking (i.e., repetitive thoughts about the causes, meanings, and consequences of depressive mood) are central processes in mindfulness-based interventions (Heeren & Philippot, 2011; Tan & Martin, 2012). Strong correlation should thus be expected between these constructs and a measure of mindfulness. Fourthly, the article did not set standardized norms for girls and boys, which, however, are useful in clinical settings. In addition to these limitations, the French-Canadian CAMM is a slightly different version from the CAMM validated by Greco et al. (2011). The item "I push away thoughts that I don't like" was replaced by "I do things without thinking about what I'm doing", and the order of some items have changed (e.g. the item three was moved to fourth place and the item four was moved to fifth place). These changes may have improved the quality of the questionnaire, but they may also have led to poorer psychometric properties. For these reasons, this article presents a validation of an alternative French

version of the CAMM. The aims were (1) to ensure the psychometric validity and the one-factor structure of the questionnaire in European French speakers, (2) to extend the age range to children (while it was limited to adolescents in the French-Canadian validation), (3) to explore the associations between the CAMM and related constructs such as mindfulness and psychological inflexibility that were not included in the French-Canadian validation and (4) to provide means and standard deviations in order to offer norms for the children and adolescent populations.

2. Method

2.1. Participants

This study was conducted in a Belgian school ($n=251$) and a French school ($n=294$). The data of the children who did not have French as first language, who were more than 17 years or less than 10 years, who did not complete at least 95% of the questionnaires were not included. The overall sample consisted of 545 youth aged from 10 to 17 with a mean age of 13.28 ($SD=1.92$; 51.6% boys). No difference between the two samples was observed for gender [$\chi^2(1, n=545)=.17, p=.67$] but the analyses revealed that the French sample was slightly younger than the Belgian one [respectively, $M=12.83, SD=1.28$; $M=13.80, SD=2.37$; $t(543)=6.02, p<.001$]. Another study for the test-retest procedure was conducted with another sample in the same Belgian school ($n=62$) among children aged 13 from 17 years old ($M=14.92, SD=1.01$; 64.5% girls).

2.2. Procedure and measures

A battery of questionnaires was completed during one-hour classes (between 20 and 30 children) with the presence of a psychologist who answered questions. These questionnaires were included in a larger study of validation of French questionnaires. All questionnaires were administered in the French school in this order: the Kiddie-Cambridge-Exeter Repetitive Thought Scale (Kiddie-CERTS; Franckx, Roux, Lahaye, Deplus, & Philippot, in prep), the Children and Adolescents Mindfulness Measure (Greco et al., 2011), the Five Facets Mindfulness Questionnaire for Adolescents (FFMQ-A; Franckx, Lahaye, Deplus, & Philippot, in prep), the Avoidance and Fusion Questionnaire for Youth (AFQ-Y; Roux, Franckx, Lahaye, Deplus, & Philippot, in prep), the Multiscore depression inventory for children (MDI-C; Berndt & Kaiser, 1999) and the Children's Social Desirability (CSD; Baxter et al., 2004). Only three of them were administered in the Belgian school (the CAMM, the AFQ-Y and the MDI-C). Written informed consent was provided by the parents and the adolescents to participate in the study. In order to validate the French version of the CAMM, we followed the steps proposed by Vallerand (1989). A first French version of the CAMM was obtained by translating English items into French. Then, the scale was back translated by other reviewers French and English bilingual psychologists. All the translators met together to decide on the best translation considering the few differences between the two versions by prioritizing the meaning of the items. Firstly, we explored the factor structure of the CAMM. Secondly, the convergent validity was also checked by examining correlations with a psychological inflexibility questionnaire (AFQ-Y), a depression questionnaire (MDI-C) and a repetitive thinking questionnaire (Kiddie-CERTS) whereas the divergent validity was assessed by a questionnaire of social desirability (CSD). The concurrent validity was assessed by another mindfulness questionnaire (FFMQ-A). Concerning the reliability of the questionnaire, Cronbach's alpha was investigated and a test-retest with at a three-week interval was performed. Finally, questionnaire norms for girls and boys per group of age have been established.

2.2.1. Mindfulness

Mindfulness was assessed using the CAMM described earlier (Greco et al., 2011). In addition, we also administered the Five Facets Mindfulness Questionnaire developed by Baer et al. (2006). The FFMQ is a mindfulness 39-item questionnaire translated in French by Heeren, Douilliez, Peschard, Debrauwere, and Philippot (2011). The FFMQ contains items rated on a five-point scale ranging from 1 (never or very rarely true) to 5 (very often or always true) with five dimensions (Observing, Describing, Acting with awareness, Nonjudgement of inner experience and Nonreactivity to inner experience). The version used in this study was the FFMQ-A, an adaptation of the French FFMQ for adolescents (Roux, Franckx, Lahaye, Deplus, & Philippot, in prep). It consists of 20 items and four dimensions (five items per dimension, the Observation dimension has been removed due to poor fitting). The overall Cronbach's alpha was good for this study ($\alpha=.78$).

2.2.2. Experiential avoidance: Avoidance and Fusion Questionnaire for Youth

Based on Acceptance and Commitment Therapy concepts, the AFQ-Y is a self-report questionnaire designed to measure psychological inflexibility, cognitive fusion and experiential avoidance in children (Greco, Lambert, & Baer, 2008). This 17-item questionnaire is composed of one dimension with items ranged from 0 (not at all true) to 4 (very true) on a 5-point Likert scale. The French version used in this study was a part of the validation study (Roux, Franckx, Lahaye, Deplus, & Philippot, submitted). A good internal consistency was observed ($\alpha=.84$) in this sample.

2.2.3. Depressive symptoms: Multiscore depression inventory for children

The intensity of depression-related symptomatology was assessed by the French version Berndt & Kaiser (1999) of the MDI-C (Berndt & Kaiser, 1996), itself adapted from the adult form: Multiscore Depression Inventory (MDI; Berndt, 1986). Designed for children and young people aged 8 to 17, this self-report questionnaire contains 79 items assigned to eight scales: Anxiety (somatic and cognitive aspects of anxiety), Self-esteem (children's perceptions and assessments of themselves), Sad mood (the individual's current emotional state), Instrumental Helplessness (the child's perception of his or her own ability in order to receive ordinary benefits), Social Introversion (the tendency to withdraw from social situations or social contact), Low Energy (cognitive intensity and somatic vigor), Pessimism (the child outlook and the extent to which he feels discouraged), and Defiance (behavior problems and irritability). The child answers by surrounding "V" (true) or "F" (false) for each item. A high score represents a higher intensity of depressive symptomatology. In our sample, the Cronbach's alpha for the global score was .92.

2.2.4. Repetitive thinking: Kiddie-Cambridge-Exeter Repetitive Thought Scale

The Kiddie-CERTS is a 16-item questionnaire that measures two dimensions: constructive repetitive thinking (concrete and experiential) and unconstructive repetitive thinking (abstract and analytical). Originally developed by Barnard, Watkins, Mackintosh, and Nimmo-Smith (2007), the Cambridge-Exeter Repetitive Thought Scale was shortened and translated into French (Mini-CERTS, Douilliez et al., 2014) before to be adapted to youth (Kiddie-CERTS, Franckx, Roux, Lahaye, Deplus, & Philippot, in prep). In this study, a minimally acceptable internal consistency was observed for constructive repetitive thinking ($\alpha=.67$) and unconstructive repetitive thinking ($\alpha=.65$).

2.2.5. Children's Social Desirability

A questionnaire of social desirability (the CSD, [Baxter et al., 2004](#)) was added to the battery of questionnaires. By using True/False answers, the 14 items of the CSD assessed the tendency to respond in a socially desirable way. In this study, the Cronbach's alpha was good ($\alpha = .75$).

2.3. Data analysis

In order to ensure the one-factor structure of the questionnaire, a Confirmatory Factor Analysis (CFA) was conducted by using mindfulness as latent variable and the ten items as construct variables. Considering the nonnormality of the data and the used of ordinal variables (items with five categories), the diagonally weighted least squares method (DWLS) was preferred to the maximum likelihood standard method (ML). Indeed, recent research argues in favor of DWLS compared to ML when data are moderately asymmetric with a gain in accuracy on factor loading and interfactor correlation estimates ([Li, 2016](#); [Míndrilá, 2010](#)). To perform these analyses, the R software was used by applying the package lavaan specifically adapted to test structural equation modeling ([Rosseel, 2012](#)). The convergent and divergent validity were tested by investigating Pearson correlations (according to [Cohen's standards, 1992](#)) between the AFQ-Y, the Kiddie-CERTS, the MDI-C, the CSD and the French version of the CAMM. The correlations with two dimensions of the MDI-C (i.e., Anxiety and Sad Mood dimensions) were also presented in order to distinguish the global depressive symptomatology with the pure depressive and anxious symptoms. Finally, the concurrent validity was observed by testing the correlation between the CAMM and the FFMQ-A. Differences between the correlations of these two questionnaires and the other constructs were also analyzed.

3. Results

3.1. Questionnaires by samples

The scores of both samples are presented in [Table 1](#). Overall, the scores obtained in the two samples on the CAMM, the AFQ-Y, the CSD and the MDI-C were similar to those reported by previous validation studies ([Baxter et al., 2004](#); [Berndt & Kaiser, 1999](#); [Greco et al., 2011, 2008](#)). No differences were found expect for the CAMM [$t(543) = 4.6, p < .001$], indicating a higher mean for the Belgian sample ($M = 25.92, SD = 7.27$) than for the French sample ($M = 23.03, SD = 7.30$). However, this difference could be explained by the age difference previously found between the two samples. Indeed, when the age was taken into account in the model, the interaction Age*Sample was not significant [$F(6, 530) = 1.66, p = .13$]. For this reason, we decided to conduct the analyses on the two samples together.

3.2. Factor structure

Factor loadings of the CFA were depicted in [Table 2](#). The model presents good fit indices: root mean square error of approximation (RMSEA) = .052, Comparative Fit Index (CFI) = .97, Standardized Root Mean Squared Residual (SRMR) = .056. Although the Chi-Square was significant, $\chi^2(35, n = 545) = 87.02, p < .001$, this test assumes multivariate normality and, because of its sensitivity to sample size, leads to a systematic rejection of models with large samples ([Hooper, Coughlan, & Mullen, 2008](#)). Only one item seems poorly adjusted with a low factor loading of .29 (item 2). As it remained significant, we did not exclude this item. Overall, the analyses supported the one-factor structure of this French version of the CAMM.

3.3. Internal consistency and test-retest reliability

The Cronbach's alpha of the CAMM was .77, indicating a correct internal consistency. Concerning the temporal stability, a test-retest has been performed three weeks apart in the same Belgian school with another sample ($n = 62$). A good reliability was reported with a high coefficient of correlation between the Time 1 and the Time 2, $r(62) = .76, p < .001$. This result supports the stability of the CAMM across time. In the same way, the questionnaire sensitivity was attested by the large range of the scores (Min = .3, Max = 4), the skewness ($\gamma_1 = -.17$) and kurtosis ($\gamma_2 = -.41$) indices which were close to 0.

3.4. Concurrent, convergent and divergent validity

The [Table 3](#) presents the correlations between the CAMM and the other questionnaires. The concurrent validity is measured by comparing the score of an instrument with another questionnaire that measures the same concept. The FFMQ-A was chosen for this purpose. A significant and large correlation has been found between the FFMQ-A and the CAMM, $r(294) = .56, p < .001$, which suggests that the CAMM assesses mindfulness concept. Correlations between these two questionnaires and the other constructs indicated the existence of different effect sizes. The FFMQ-A was more related to social desirability, less to depressive symptoms and concrete repetitive thinking.

The convergent validity was assessed by three questionnaires: the AFQ-Y, the MDI-C and the Kiddie-CERTS. It was expected to find a negative significant correlation between the CAMM and the AFQ-Y, the MDI-C and the unconstructive repetitive thinking subscale of the Kiddie-CERTS while a positive correlation between the CAMM and the constructive repetitive thinking subscale of the Kiddie-CERTS was expected. Results showed that the CAMM was negatively correlated with the AFQ-Y, the MDI-C and the unconstructive repetitive thinking subscale of the Kiddie-CERTS while no correlation was observed with the constructive repetitive thinking subscale of the Kiddie-CERTS. The existence of a positive, but small, correlation between the CAMM and the CSD, $r(294) = .21, p < .001$, may highlight a low tendency of children to respond in a socially desirable way, as well as a slight association between psychological inflexibility and social desirability.

3.5. Descriptive statistics and norms

A two-way between subjects analysis of variance (ANOVA) has been performed to explore the influence of age and sex on the CAMM. Mindfulness scores are stable across age (from 10 to 17 years old), $F(7, 537) = .90, p = .50$, but seem to be affected by gender, $F(1, 543) = 25.49, p < .001$. This main effect of gender indicates that boys have higher scores than girls. The interaction Age*Gender was also significant, $F(7, 529) = 25.49, p < .001$. Thus, boys tend to increase their score across time (notably at the end of the adolescence) whereas the opposite effect can be observed in girls. In order to have a sufficient number of participants ($n > 50$ per category) to establish the CAMM means by age and sex, we computed the norms in three groups of age that represent early, middle and late adolescence. The norms are presented in [Table 4](#).

4. Discussion

With the growing use of MBIs in youth, an urgent need for validated questionnaires arises to ensure the reliability of measurements. The aim of this study was to explore the psychometric qualities of a French version of the CAMM in a French European population of children and adolescents.

Table 1
Mean (standard deviation) and statistical differences by samples.

	CAMM	FFMQ-A	MDI-C	Kiddie-CRT	Kiddie ART	CSD	AFQ-Y
French sample	23.03 (7.30)	63.16 (11.38)	53.52 (10.32)	21.36 (4.47)	16.86 (4.42)	6.28 (3.23)	23.65 (10.34)
Belgian sample	25.92 (7.27)		53.69 (9.02)				24.86 (10.89)
t-test (n = 545)	4.6***		.20				1.14

CAMM: Children and Adolescents Mindfulness Measure; FFMQ-A: Five Facets Mindfulness Questionnaire for Adolescents; MDI-C: Multiscore depression inventory for children; Kiddie-CRT: Cambridge-Exeter Repetitive Thought Scale for children-constructive repetitive thinking; Kiddie-ART: Cambridge-Exeter Repetitive Thought Scale for children-unconstructive repetitive thinking; CSD: Children's Social Desirability; AFQ-Y: Avoidance and Fusion Questionnaire for Youth.

*** $p < .001$.

Table 2
French items of the CAMM and their standardized factors loadings.

English item	French item	Factor loading
CAMM.1 I get upset with myself for having feelings that don't make sense	« Je suis contrarié(e), irrité(e), fâché(e) d'avoir des émotions qui n'ont aucun sens. »	.64
CAMM.2 At school, I walk from class to class without noticing what I'm doing	« À l'école, je vais de classe en classe sans faire attention à ce que je fais. »	.29
CAMM.3 I keep myself busy so I don't notice my thoughts or feelings	« Je m'occupe pour ne pas remarquer ce que je pense et ce que je ressens. »	.71
CAMM.4 I tell myself that I shouldn't feel the way I'm feeling.	« Je me dis que je ne devrais pas me sentir comme je me sens. »	.89
CAMM.5 I push away thoughts that I don't like	« Je repousse les pensées que je n'aime pas. »	.37
CAMM.6 It's hard for me to pay attention to only one thing at a time	« C'est difficile pour moi de faire attention à une seule chose à la fois. »	.48
CAMM.7 I think about things that happened in the past instead of thinking about things that are happening right now	« Je pense aux choses qui sont arrivées dans le passé au lieu de penser aux choses qui arrivent juste maintenant. »	.65
CAMM.8 I get upset with myself for having certain thoughts	« Je suis contrarié(e) d'avoir certaines pensées. »	.92
CAMM.9 I think that some of my feelings are bad and that I shouldn't have them	« Je crois que certaines de mes émotions sont mauvaises et que je ne devrais pas les avoir »	.88
CAMM.10 I stop myself from having feelings that I don't like	« J'essaie d'arrêter d'avoir des émotions que je n'aime pas »	.69

Table 3
Correlations between the CAMM and mindfulness, depression, rumination, social desirability and cognitive fusion.

	FFMQ-A ^b	Anxiety ^a	Depressive mood ^a	MDI-Ca	Kiddie-CRT ^b	Kiddie ART ^b	CSD ^b	AFQ-Y ^a
CAMM	.56***	-.48***	-.34***	-.47***	.06	-.68***	.21***	-.64***
FFMQ-A ^b		-.37***	-.29***	-.66***	.49***	-.54***	.39***	-.51***

CAMM: Children and Adolescents Mindfulness Measure; FFMQ-A: Five Facets Mindfulness Questionnaire for Adolescents; MDI-C: Multiscore depression inventory for children; Kiddie-CRT: Cambridge-Exeter Repetitive Thought Scale for children-constructive repetitive thinking; Kiddie-ART: Cambridge-Exeter Repetitive Thought Scale for children-unconstructive repetitive thinking; CSD: Children's Social Desirability; AFQ-Y: Avoidance and Fusion Questionnaire for Youth.

^a $n = 545$.

^b $n = 294$.

*** $p < .001$.

Analyses confirmed the one-factor structure of this French version of the CAMM with a good fit of the data to the model. Fit indices are close to those obtained by Greco et al. (2011). The internal consistency found in this study was also correct ($\alpha = .77$) and the reliability of the questionnaire was supported by the test-retest analysis. In the same way, the means and standard deviations appear to be stable between the ages of 10 and 17 suggesting that the CAMM preserves its discriminatory capacity over time. Its sensitivity was also confirmed by the large range of the scores, the skewness and kurtosis indices. Males scored slightly higher than females, which can be at first surprising given that the capacity to be aware of internal experience is often attributed to women. This observation may be due to a difference in the use of coping strategies that are essentially based on rumination and resignation in female children (Hampel & Petermann, 2005). The difference of mindfulness scores between girls and boys was also found by Cunha and Paiva (2012). Their results tended to show that adolescent girls were more likely to develop internalized symptomatology,

Table 4
Means and standard deviations of the CAMM scores by age and sex.

	10–12 years	13–15 years	16–17 years
Boys	25.5 (7.2)	25.9 (6.8)	27.9 (7)
Girls	23.6 (7)	23.7 (7.5)	20.6 (7.1)

such as anxiety, than adolescent boys. In addition, this symptomatology was correlated with the CAMM score. As expected, the correlation coefficients between the CAMM and similar constructs were significant and very close to those obtained by the other validation studies. The CAMM was negatively associated with global depressive symptomatology ($r = -.47$; $r = -.50$ for internalizing symptomatology in Greco et al., 2011), sad mood ($r = -.34$; $r = .28$ for happiness in de Bruin et al., 2014), anxiety ($r = -.48$; $r = -.56$ for stress in de Bruin et al., 2014), repetitive thinking (abstract and analytical, $r = -.68$; $r = -.50$ for worry in Kuby et al., 2015), and psychological inflexibility ($r = -.64$; $r = -.60$ in Greco

et al., 2011) with a medium to large effect size. The CAMM was also positively correlated to another mindfulness questionnaire (the FFMQ-A) with a large effect size. This result indicates that the CAMM tends to assess the same construct than the FFMQ-A. Yet, the correlation pattern differences observed between these two questionnaires suggest a slight difference in sensitivity regarding the outcomes. With reverse items, the CAMM could capture a deficit of mindfulness (more associated to anxiety and abstract repetitive thoughts than the FFMQ-A) while the FFMQ-A could capture the concept of resilience (more associated to depressive symptomatology and concrete repetitive thoughts than the CAMM). No significant correlation was found between the repetitive thinking (concrete and experiential) subscale of the Kiddie-CERTS and the French version of the CAMM. That may indicate that, for youth, the mindfulness Trait protects from negative repetitive thinking but do not imply concrete repetitive thinking. This result is surprising considering the significant correlation of the global score of the FFMQ-A with the concrete repetitive thinking subscale. Although some biases may also emerge from the low but significant correlation between social desirability and the CAMM, it remains less vulnerable to social desirability than the FFMQ-A considering the correlation coefficients and, thus, may present more reliable scores. The descriptive norms found in this study are in line with those encountered in the articles of validation in other languages (de Bruin et al., 2014; Greco et al., 2008; Viñas et al., 2015).

The present validation answers to the several limitations encountered in the validation of the French-Canadian version of the CAMM (Dion et al., 2017). First, this study added standardized norms (means and standard deviations by age and gender) that were not exposed in the Canadian version. Secondly, the current study explored the association between the CAMM and other questionnaires more related to mindfulness (such as the cognitive fusion or repetitive thinking) than the measures proposed by Dion et al. (2017). The correlations demonstrated the clinical interest to use this questionnaire as a complementary tool to understand psychopathological functioning of children and adolescents. Thirdly, data from the age of 10 were provided extending the validation of four years compared to the original Canadian version, which was validated from 14. This extension had no impact on the psychometric properties of the CAMM and gives children access to it. Both Canadian version and French version obtained similar results regarding factor structure and factor loading. Nevertheless, the French version fixed several limitations observed in the Canadian version (and mentioned above), which justifies its use in French-speakers.

Some limitations concerning this validation must be mentioned. The lack of a clinical population and youth who practice meditation

does not permit to apprehend cut-offs or sensitivity to interventions. Another limitation is related to the use of questionnaires that are currently in validation. Still, it is important to note that no questionnaire, which assess repetitive thinking, cognitive fusion or mindfulness, have been validated in French for young people. Finally, future studies could reveal that the Canadian version might be suitable for younger populations, highly correlated with close constructs of mindfulness and appropriate for French and Belgian people. This could question the added value of our French version.

This study reports a French validation of the CAMM and answers to the necessity to have reliable tools to assess mindfulness. Future studies should take into consideration the use of this French version of the CAMM to measure the efficacy of MBIs, to depict the role of mindfulness as psychological mechanism or, more broadly, to investigate the features of mindfulness among children and adolescents. In the same vein, the use of experimental tasks to assess mindfulness for younger people or for alternative kind of measures should be addressed (Baer, 2016). For example, Grossman (2008) postulates that novices can be not aware of their “non-awareness” and are more likely to score higher than mindfulness practitioners. If the field of mindfulness assessment requires continuous investigation, this validation study brings some advancement by making accessible to French populations a widely used questionnaire of mindfulness.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Child and Adolescent Mindfulness Measure (English version).

We want to know more about what you think, how you feel, and what you do. Read each sentence. Then, circle the number that tells how often each sentence is true for you.

		Never True	Rarely True	Sometimes True	Often True	Always True
1	I get upset with myself for having feelings that don't make sense	0	1	2	3	4
2	At school, I walk from class to class without noticing what I'm doing	0	1	2	3	4
3	I keep myself busy so I don't notice my thoughts or feelings	0	1	2	3	4
4	I tell myself that I shouldn't feel the way I'm feeling	0	1	2	3	4
5	I push away thoughts that I don't like	0	1	2	3	4
6	It's hard for me to pay attention to only one thing at a time	0	1	2	3	4
7	I think about things that happened in the past instead of thinking about things that are happening right now	0	1	2	3	4
8	I get upset with myself for having certain thoughts	0	1	2	3	4
9	I think that some of my feelings are bad and that I shouldn't have them	0	1	2	3	4
10	I stop myself from having feelings that I don't like	0	1	2	3	4

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.erap.2019.06.001>.

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