

**Cognitive Fusion Questionnaire: exploring measurement invariance across three groups
of Brazilian women and the role of cognitive fusion as a mediator in the relationship
between rumination and depression**

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Funding Sources: The major project mentioned in the method section has been funded by CNPq (National Counsel of Technological and Scientific Development/Brazil) and by FAPERGS (Foundation for Research of the State of Rio Grande do Sul/Brazil); Research by the author Paola Lucena-Santos is supported by a PhD. Grant sponsored by CAPES (Coordination for the Improvement of Higher Education Personnel/Brazil). None of the sponsors have participated in the design, collection, analysis, interpretation of data, writing the report, or in the decision to submit the article for publication.

Conflict of Interest: Authors declare no conflicts of interest.

Abstract

This study aimed to test the measurement invariance of the Brazilian version of the Cognitive Fusion Questionnaire (CFQ), to investigate its internal consistency, concurrent validity and to explore the role of cognitive fusion as a mediator of the effect of rumination on depression symptoms in women. The CFQ showed good model fit and its one-factor structure was confirmed. Strong measurement invariance was obtained (using three samples of women: general population, college students and a medical sample of women with overweight or obesity). The scale showed good internal consistency, CFQ's scores were positively associated with symptoms of depression, anxiety, stress, psychological inflexibility and rumination, and negatively associated with mindfulness and decentering. Also, cognitive fusion emerged as mediator of the effect of rumination on depression symptoms in a medical sample of women. In conclusion, this study provides data confirming the robust psychometric properties of the Brazilian version of the CFQ, allowing reliable comparative studies between these three different populations of women.

Keywords: Cognitive fusion; CFQ; Measurement Invariance; Psychometric properties; Brazilian version

Cognitive Fusion Questionnaire: exploring measurement invariance across three groups of Brazilian women and the role of cognitive fusion as a mediator in the relationship between rumination and depression

In the last two decades, several models of psychotherapy have emerged, giving rise to the so called “third generation” of behavioural therapy (Hayes, Strosahl, Bunting, Twohig, & Wilson, 2004). These new approaches highlight the importance of the context in which thoughts and feelings occur in the development and maintenance of psychopathology, and the role of acceptance and mindfulness in its treatment (Fletcher, & Hayes, 2005; Herbert, & Forman, 2013; Rector, 2013). Acceptance and mindfulness-based approaches focus on altering the relationship a person has with his or her internal experiences, as opposed to changing the form or content of cognitive events (Hayes, Follette, & Linehan, 2004).

Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2012) is one of these psychotherapies. It is a form of contextual-behavioral therapy (Forman & Herbert, 2009) that has developed in parallel to a behavior analytic account of language and human cognition called Relational Frame Theory (RFT; Barnes-Holmes, Barnes-Holmes, McHugh, & Hayes, 2004). According to ACT, our capacity to arbitrarily associate stimuli also leads to the ubiquity of human suffering: the stimulus functions of aversive events (external or internal) can be brought to bear on an individual without those actual stimuli being present. In fact, via derived relating, a human being can be influenced by the stimulus properties of events that *no human being* has ever actually encountered, let alone that specific person has encountered. The ability of derived (as opposed to directly experienced) contingencies to influence behavior and emotion is suggested as why it is hard to fully, effectively and permanently restructure cognitive networks (Hayes, Levin, Plumb-Villardaga, Villatte & Pistorello, 2013).

One of the core processes that ACT states to be central in understanding psychopathology is *cognitive fusion* (Hayes et al., 2004; Hayes et al., 2012), and it is conceptualized as the inappropriate and excessive regulation of behavior by verbal processes such as derived relational responding (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Orsilo, Roemer, & Holowka, 2005; Pierson, Gifford, Smith, Bunting, & Hayes, 2004). In other words, cognitive fusion refers to an excessive attachment to the content of thoughts, verbal rules and beliefs as well as an entanglement with emotions, sensations, and other private events, rather than noticing the ongoing process of these experiences (Luoma & Hayes, 2003). As a consequence of this entanglement with internal experiences, one tends to react to thoughts about an event as if those thoughts were the event itself (Blackledge & Hayes, 2001; Eifert & Forsyth, 2005). This is particularly evident with evaluative and self-descriptive thoughts (Bond et al., 2011), frequently leading to the disregarding of others sources of information and behavioral regulation (Luoma, Hayes, & Walser, 2007).

It is important to highlight that there are similar constructs such as decentering, metacognition and mindfulness that might overlap with cognitive fusion, even though they are theoretically distinct. Specifically, while the main focus of defusion is to increase the behavior repertoire, decentering is merely the ability to interrupt cognitive patterns by taking a detached view of one's internal experiences (Fresco et al., 2007; Gillanders et al., 2014). Furthermore, mindfulness has been described as a means through which decentering is achieved rather than a way of promoting values-based action (Segal, Williams, & Teasdale, 2002). Finally, metacognition is often referred to as the process of "thinking about thinking" (Wells, 2008), and it doesn't necessarily imply taking the step back from cognitive events and also doesn't promote actions congruent with personal values.

Empirical studies have been published showing the association between cognitive fusion and psychopathological symptoms, such as anxiety (Herzberg et al., 2012), depression

and shame traumatic memories (Gillanders et al., 2014; Dinis, Carvalho, Pinto-Gouveia & Estanqueiro, 2015), work stress, burnout, lowered quality of life and low life satisfaction (Gillanders et al., 2014), eating-related symptoms (Trindade, & Ferreira, 2014), guilt and rumination (Romero-Moreno et al., 2014). In fact rumination, which has been described as a specific self-focused attention process that involves both the repetitive thinking on personal negative feelings and a self-reflection on the events that have led to these feelings (Lyubomirsky & Nolen-Hoeksema, 1993; Nolen-Hoeksema & Morrow, 1991), is correlated with cognitive fusion (Gillanders et al., 2014), even though both processes are theoretically different. Also, rumination is a well established predictor of depression symptoms (Nolen-Hoeksema, 2004; Watkins, 2008).

Nevertheless, not all people who present high scores of rumination will necessarily show depressive symptomatology, which might suggest the existence of other psychological processes operating this relationship. Theoretical models have described cognitive fusion as an important psychological process involved in the maintenance of depression psychopathology. In fact, the deleterious effect of cognitive fusion results from the entanglement itself with the process of thinking and the inability to get an observing stance to the thought process (Zettle, 2007). Moreover, given the language-based nature of these two processes (i.e. rumination and cognitive fusion), it is possible to hypothesize that cognitive fusion, by maintaining the entanglement with the internal process of thinking, might contribute for the ongoing negative effect of ruminative responses on depression. To our knowledge, this mechanism has never been explored.

In fact, recent empirical studies have stressed the impact of cognitive fusion in adult females (Ferreira, Palmeira, & Trindade, 2014; Trindade, & Ferreira, 2014) including in women experiencing weight-related difficulties and disordered eating (Duarte, Pinto-Gouveia, & Ferreira, 2015). Additionally, it seems that women tend to experience more frequently

patterns of repetitive thinking and more depression symptoms than men (Hankin et al., 1998; Simonson, Mezulis, & Davis, 2011; Dinis et al., 2015, Romero-Moreno et al., 2014). Also, some studies have suggested that women have more cognitive fusion than men (Dinis et al., 2015) and that clinical depressive symptoms are positively associated with cognitive fusion only in female caregivers (Romero-Moreno et al., 2014). Finally, empirical findings also suggest that obesity is highly associated with depression, being considered a risk factor for developing depression symptoms (Luppino et al., 2010). Hence, it seems to be rather important to explore the relationship between the aforementioned psychological mechanism in women, particularly those who struggle with weight and eating-related difficulties.

Historically, studies have operationalised cognitive fusion using measures such as “believability of thoughts” as an approximated construct to assess cognitive fusion, using the Believability of Anxiety Feelings and Thoughts Scale (BAFT; Herzberg et al., 2012). This is a relatively narrow conceptualization of cognitive fusion given that it is circumscribed to anxiety. Cognitive fusion has also been operationalised as “believability of thoughts” in studies by Zettle and colleagues (Zettle, Rains, & Hayes, 2011). Other studies have used The Avoidance and Fusion Questionnaire for Youth as a measure of cognitive fusion (AFQ-Y; Greco, Lambert, & Baer, 2008; Fergus et al., 2012). This instrument does contain fusion items, though also assesses other ACT processes (e.g. experiential avoidance). The Drexel Defusion Scale (DDS; Forman et al., 2012) is a measure of cognitive defusion that has an instruction set that may actually prime defused responding. In addition it relies on responses to vignettes rather than actually sampling fused or defused responding (Gillanders et al., 2014).

The lack of a well-suited instrument specifically created to measure cognitive fusion and to provide a general score of fusion, led to the development of the Cognitive Fusion Questionnaire (CFQ; Gillanders et al., 2014). The CFQ has several advantages when

compared to proxy measures of cognitive fusion: a) it was specifically developed to measure cognitive fusion as a process; b) it is not population- nor content-specific; c) not time-consuming, giving it is composed by 7-items; d) it doesn't require familiarization with the construct.

The CFQ started from a pool of 42 items and were progressively improved by reducing it into 28, 13 and 7-items final version (Gillanders et al., 2014). Additionally, the original study conducted a series of Confirmatory Factor Analyses and showed a unifactorial structure with good model fit across different samples.

Currently the CFQ is only translated into few languages. For example, the Italian version of the CFQ-13 (Dell'Orco, Prevedini, Oppo, Presti, & Moderato, 2012), has good internal consistency ($\alpha = .84$) and test-retest reliability ($\rho = -0.75$; $p < 0.001$), although it didn't confirm the obtained factor structure and it only validated the 13-items version. There are also preliminary results from a Dutch version of the CFQ-13, with good internal consistency ($\alpha > .80$). However, this was not a validation of CFQ's final version and no information was given regarding factor analysis (Batink, & De Mey, 2011).

There is a Spanish validation of the CFQ-7 (Romero-Moreno et al., 2014), that presented better results than the 13-items version regarding the internal consistency ($\alpha = .87$). Also the factor structure was confirmed with good model fit indices. Furthermore, the psychometric study of the French version was also performed with the final 7-items scale and found good internal consistencies (ranging from .73 to .92 considering different samples). The French study confirmed the CFQ's one-factor structure with good model fit indices (Dionne, Balbinotti, Gillanders, Gagnon, & Monestès, 2014).

It is crucial to bear in mind that self-report measures can be extremely useful resources and key-components for the psychological science and practice, if their scores are previously validated in the specific context where they are being applied (Urbina, 2014).

Moreover, despite the growing interest among Brazilian researchers and clinicians in ACT processes, there is not a Brazilian Portuguese version of CFQ – which can be a potential obstacle for the dissemination and scientific advance of the ACT literature and resources in a country with 200 million inhabitants.

Adittonally, apart from the original CFQ paper (Gillanders et al., 2014), there is still a lack of studies exploring the CFQ's measurement invariance across different samples. Analysis of measurement invariance across different groups of interest is an important statistical procedure that will test if the scale is measuring the same construct, in the same way, when responded by qualitatively distinct samples. Thus, in order to compare and to analyse scores from the same measure between different sets of individuals, one must first assume the considered values are numerically on the same measurement scale for all samples (Widaman, & Reise, 1997). In fact, stastically speaking, any group comparisons made through a given scale for which measurement invariance cannot be demonstrated does not yield meaningful or acceptable results and interpretations (Chen, Souza, & West, 2005).

In line with this, the current study has five aims: a) to translate and validate the CFQ to Brazilian-Portuguese; b) to confirm the CFQ's unifactorial structure; c) to explore the existence of measurement invariance across three qualitatively different samples; d) to analyze the internal consistency and concurrent validity of the CFQ; e) to explore the role of cognitive fusion as a mediator of the effect of rumination on depression symptoms in a medical sample.

Methods

Design and ethics

This is a cross-sectional study with a between-groups design, through which the CFQ's psychometric properties and validation study were conducted. The samples were recruited as part of a major study on psychological flexibility and emotional-related

difficulties in eating behaviours of adult women (Grant's references: CAPES: BEX Process number 0514/12-8, FAPERGS: 2263-2551/14-4SIAFEM and CNPq 408697/2013-0). The project was submitted and approved by the Scientific Committee of a Rio Grande do Sul University, under the official letter nº 014/2013. Additionally, it was approved by the Research Committee of the same institution under the report nº 386.978. All participants signed a consent form before participating in the study and were provided clarification regarding the goals of the research, as well as its voluntary and confidential nature.

Translation and adaptation steps

Firstly, two independent translators, both fluent in English and native in Brazilian Portuguese, did a translation to Brazilian Portuguese and a back-translation to English. Then, a committee of three juries who had lived in different Brazilian states – in order to ensure that the Brazilian version would be understood by people with different cultural backgrounds – was composed, in order to decide which translation of each item should compose the CFQ's preliminary version. These experts in the construct assessed by the CFQ were also fluent in English and Portuguese, and had experience in translations and transcultural adaptations of psychological measures. They provided an assessment on a 5-point Likert scale for each translated item according to: a) clarity of language, b) practical pertinence for the target culture and c) theoretical relevance (Cassep-Borges, Balbinotti, & Teodoro, 2010).

Afterwards, the Content Validity Coefficient (CVC; this coefficient vary from 0 to 1, the higher the value, the stronger the validity of item's content) was calculated according to Hernández-Nieto (2002), i.e., all 7 items presented $CVC \geq .8$, which indicates a good content validity. Finally, a pilot study was conducted in a sample of 26 Brazilian adults (being 73.1% female, $n= 19$), with a mean of 13.63 ($SD= 2.62$) years of education and a mean age of 21.92 ($SD= 13.89$; Min. = 18; Max. = 58). Regarding marital status, 65.4% ($n=17$) were single, 30.8% ($n= 8$) were married/cohabiting and 3.8% ($n= 1$) were divorced. Thus, since

participants did not report any difficulty in understanding the items, the CFQ's final version was originated and the official data collection was initiated.

Sample size

When conducting Structures Equation Modeling (SEM), and specifically factor analysis, it is advised that each sample should be at least 10 times the size of the number of items in the scale (Hair, Anderson, Tatham, & Black, 2005). It is also suggested to be considered a ratio of 10 to 15 observations to each manifest variable in the model is necessary for conducting SEM (Marôco, 2010). Taking these suggestions into consideration, and since the CFQ has 7 items, each sample used in the factorial analysis should be at least ≥ 70 .

Regarding our hypothetized mediational model, we used the Soper's Sample Size Calculator for SEM (Soper, 2017), in order to calculate the minimum sample size required to detect effect. Thus, considering a minimum anticipated effect size of .4, probability level of 5% and statistical power $\geq .8$, it is necessary at least 44 participants.

Recruitment and Sampling

Data was collected during 2014 in three independent samples: a) college female student sample composed of students attending the fifth year of the Psychology Course in a private university from Rio Grande do Sul; b) general population sample, composed of individuals who were approached to participate in the study in three citizen's bureau and in Porto Alegre Bus Station; c) medical sample, composed of women with overweight or obesity currently being enrolled in endocrinology and obesity consultations of a public hospital in Porto Alegre. BMI data for the medical sample was obtained from the medical information sheet provided by the clinical practitioners.

For all three samples, the inclusion criteria were: a) female gender; b) age between 18 and 60; c) ≥ 5 years of education (in order to diminish difficulties in understanding the items from the questionnaires). Specifically for the medical sample, participants had also to meet

the following inclusion criteria: a) presenting a Body Mass Index (BMI) ≥ 25 (kg/m² – Finucane et al., 2011); and b) currently receiving a treatment for weight loss.

At Porto Alegre's Bus Station, participants were invited to collaborate in the study by a member of the research team during the time they were waiting for their buses (only if they had at least 40 minutes to wait until their transport would arrive). This criterion was adopted as the average time to complete the research protocol was around 25 minutes. At the citizen's bureaus, only individuals that were waiting to be called and had at least 20 people ahead in the waiting room were invited to participate in the study. Finally, participants from the medical sample completed the protocol while waiting to be called for their consultations in a public hospital (generally the average time to be called was of 45 minutes). All participants responded to the protocol while comfortably seated and while using a clipboard provided by the researcher. Potential participants who did not meet inclusion criteria did not participate in the study and were provided a rationale for that.

Participants

The current study is inscribed in a major research project designed to explore the impact of different psychological processes in women struggling with weight-related and eating difficulties. The statistical analyses were performed in the following independent samples:

The factor analyses were conducted in Sample 1, which was composed of $N = 677$ ($n = 301$ from the general population; $n = 171$ college students; and $n = 205$ women with overweight or obesity currently in treatment for weight loss – medical sample). See Table 1 for a description of sociodemographic characteristics.

----- Insert Table 1 here -----

Two additional independent samples (Sample 2 and Sample 3) were used in order to perform concurrent validity analyses::

Sample 2 was composed of 324 participants ($n= 106$ from general population; $n= 116$ college students; $n= 102$ participants from medical sample) who responded to the CFQ, RRS-10 and DASS-21. The mean age of the total sample was 34.61 years ($SD= 12.09$), with a mean of 12.25 ($SD= 3.55$) years of education and a BMI average of 28.77 ($SD= 8.59$). Regarding marital status, 47.8% ($n= 155$) were single, 42.3% ($n= 137$) were married/cohabiting, 6.7% ($n= 22$) divorced and 3.2% ($n= 10$) were widowed. Additionally, the majority of participants were employed (63.3%, $n= 205$), followed by unemployed (33.6%, $n= 109$) and retired (3.1%, $n= 10$).

It is important to note that concurrent validity analyses were performed only after having the factor analyses results. Since factor analyses results showed strong measurement invariance (see Results section), we have subsequently conducted the concurrent validity analyses using the total Sample 2.

Sample 3 was composed of 198 women from general population (who responded to the CFQ, MAAS, AAQ-II and EQ), with an average of 13.68 ($SD= 3.38$) years of education, a mean of 31.13 ($SD= 9.96$) of age and 23.78 ($SD= 4.09$) of BMI. In terms of marital status, the majority of participants were single (64.6%, $n= 128$) followed by married/cohabiting (31.8%, $n= 63$) and divorced (3.5%, $n= 7$). In regard to occupational status, 69.2% ($n= 137$) were employed, 29.8% ($n= 59$) unemployed and 1% ($n= 2$) retired.

Finally, we have conducted the mediational analysis in a subset of Sample 2. Specifically, our mediational model was tested in a group of women ($n=102$) with overweight or obesity who were enrolled in endocrinology and obesity consultations, as these seem to present higher risk for developing depression than non-overweight women (Luppino et al., 2010). The mean age of participants was 43.23 years ($SD= 9.98$), with a mean of 9.70 ($SD= 2.86$) years of education and a BMI average of 38.39 ($SD= 7.24$). Regarding marital status, 65.7% ($n= 67$) were married/cohabiting, 19.6% ($n= 20$) were single, 11.8% ($n= 12$) widowed

and 2.9% ($n= 3$) were divorced. Additionally, the majority of participants were employed (51.0%, $n= 52$), followed by unemployed (39.2%, $n= 40$) and retired (9.8%, $n= 10$).

Measures

Depression, Anxiety and Stress Scale (DASS-21; Lovibond, & Lovibond, 1995) is a self-report measure composed of 21 items that assess symptoms of depression, anxiety and stress, according to a 4-point Likert scale (0 = Did not apply to me at all; 4 = Applied to me most of the time). The Brazilian version of DASS-21 showed good internal consistency, with Cronbach's Alpha values ranging from $\alpha = .86$ and $\alpha = .92$ (Vignola, & Tucci, 2014).

Cognitive Fusion Questionnaire (CFQ; Gillanders et al., 2014) was developed to measure the extent to which a person tends to get entangled with their internal experiences (e.g., thoughts, emotions, and memories), i.e., cognitive fusion. This is a 7-item self-report measure in which the respondent states the extent to which they agree to each sentence (e.g. "My thoughts cause me distress or emotional pain", "I get upset with myself for having certain thoughts") using a 7-point Likert scale (1= Never true; 7 = Always true). The total score is calculated by the sum of the items. Higher scores represents greater fusion. The original version found Cronbach's Alpha values between $\alpha = .88$ and $\alpha = .93$ considering different samples.

Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011) is a 7-item self-report instrument for measuring psychological inflexibility. The respondent answers using a 7-point Likert scale, anchored 1= Never true to 7 = Always true. The original version of the AAQ-II had a Cronbach's Alpha of $\alpha = .84$ and the Brazilian version showed $\alpha = .87$ (Barbosa, 2013).

Ruminative Response Scale – short version (RRS-10, Treynor, Gonzalez, & Nolen-Hoeksema, 2003) is a 10-item self-report measure in which a 4-point Likert scale (1= almost never; 4 = almost always) is used to assess the extent to which a person engages in ruminative

self focussed attention in response to dysphoric mood. RRS-10 is composed of two subscales: (1) Brooding: defined as “a passive comparison of one’s current situation with some unachieved standard” (e.g. ‘Think “Why do I always react this way?”; ‘Think “Why do I have problems other people don’t have?”); and (2) Reflection: conceptualized as “a purposeful turning inward to engage in cognitive problem solving to alleviate one’s depressive symptoms” (e.g. ‘Write down what you are thinking and analyze it’; ‘Go someplace alone to think about your feelings’). (Treyner et al., 2003, p.256). It is important to emphasize that RRS-10 can be used as a one-dimensional measure of rumination depending on the research questions one aims to explore (Joormann, Dkane, & Gotlib, 2006; Whitmer, & Gotlib, 2011; Treyner et al., 2003). Higher scores meaning more rumination. The internal consistency (assessed through Cronbach’s Alpha values) of the original scale was $\alpha = .77$ for brooding, $\alpha = .72$ for reflection and $\alpha = .85$ for the total scale. The Brazilian validation of RRS-10 presented $\alpha = 0.81$ for the total scale (Lucena-Santos, Carvalho, Pinto-Gouveia, & Oliveira, 2016).

Mindful Attention Awareness Scale (MAAS; Brown, & Ryan, 2003): The MAAS is a unidimensional scale that aims to evaluate ‘trait’ mindfulness. The measure is composed of 15 items using a 6-point Likert Scale (1= almost always; 6= almost never). Higher scores indicate higher levels of mindful awareness. The Cronbach’s Alpha of the original scale was $\alpha = .87$ and the Brazilian version showed $\alpha = .83$ (Barros, Kozasa, Souza, & Ronzani, 2014).

Experiences Questionnaire (EQ; Fresco et al., 2007): This self-report measure assesses decentering, i.e., the ability to observe one’s thoughts and feelings as transient and temporary experiences. It is composed of 11-items using a 5-point Likert scale (1= never; 5= always). The original validation found a unidimensional structure with high Cronbach’s Alpha values ($\alpha = .90$) as well as the Brazilian version with $\alpha = .90$ (Lucena-Santos, Pinto-Gouveia & Oliveira, 2016).

Analytical strategy

Descriptive analyses (means, standard deviations and measures of dispersion) were assessed through SPSS statistics software (v.20; SPSS Inc., Chicago, IL). In order to test differences regarding age, education and BMI between the groups, a one-way analysis of variance (ANOVA) was carried out which revealed significant differences regarding age ($F(2, 675) = 132.15, p < .001$), education ($F(2, 675) = 20.90, p < .001$) and BMI ($F(2, 675) = 352.25, p < .001$). Since the Levene's test showed that the assumption of the equality of variances between groups was violated regarding all variables in study ($p < .001$), the post hoc analysis was performed using an inequality of variances's procedure. Thus, the Games-Howell post hoc analysis was performed since it is considered the most precise procedure when there are also size differences between groups (Field, 2013). Post-hoc results were reported in Table 1.

Confirmatory Factor Analysis (CFA), Multigroup Analysis (MA), and Path Analysis, were performed using AMOS software (v.19, SPSS Inc., Chicago, IL), in which the assumptions were also tested: normality was assessed according to values of Skewness (Sk) and Kurtosis (Ku) uni and multivariate, where values of $Sk > |3|$ and $Ku > |10|$ indicate severe violations of normality (Kline, 2010). Additionally, the presence of outliers was assessed through squared Mahalanobis Distance (MD^2) according to observations with values of $p1$ and $p2 < .05$ (as it may indicate that these observations are possible outliers) (Marôco, 2010). Cases with missing values were excluded according to the results of Missing Value Analysis (MVA) procedure provided by SPSS, and they were completely at random and less than 5% of cases (Tabachnick, & Fidell, 2007). Thus, the analysis was performed only with participants who completed the entire protocol.

Confirmatory Factor Analysis using the Sample 1 aimed to test the fit of the CFQ's unifactorial structure. A combination of different goodness-of-fit indices was used to determine

the global adjustment of the model (Kline, 2010). Specifically, we used the Root Mean Square Error of Approximation (RMSEA), Normed Chi-square (χ^2/df), Tucker-Lewis Index (TLI), Goodness of Fit Index (GFI) and Comparative Fit Index (CFI). We consider that RMSEA values $< .05$ indicate an acceptable level (Schumacker, & Lomax, 2004). Regarding the Normed Chi-square, values of $\chi^2/df \leq 1$ indicate a very good model fit, between 1 and 2 a good model fit, and values greater than 5 a poor fit. (Marôco 2010; Schumacker, & Lomax, 2004). GFI and CFI values above .95 indicate a very good fit (Hu, & Bentler, 1999), and the same threshold can be considered for TLI (Schumacker, & Lomax, 2004). Finally, the local adjustment of the model was assessed by both the standardized factor weights and the individual reliability of the items, taking into account values of $\lambda \geq .50$ and $R^2 \geq .25$ (Marôco, 2010).

Maximum Likelihood was used as an estimation method and a chi-square test of differences was calculated (as described in Marôco, 2010) in order to test if model fit differs significantly between models. Moreover, in order to test whether the modified model presents better validity in the studied groups when compared to the original one, we used the Modified Expected Cross Validation Index (MECVI). MECVI indicates the extent to which a given model would likely fit a new validation sample covariance matrix. Thus, lower MECVI values indicate lower discrepancy between the model under consideration and a new matrix (Wegener, & Fabrigar, 2000).

Multigroup Analysis aimed to assess measurement invariance across samples (general population, college students, and medical sample). Measurement invariance was evaluated through the comparison between the unconstrained model and the following ones: (1) a model constrained to be equal across groups in terms of factor loadings: this analysis tests if weak factorial invariance is present; and (2) a model that extends the previous one by the additional constraint in terms of item's intercepts in order to test if strong factorial invariance is present -

it provides substantively invariant interpretations regarding differences in factor means and variances across groups (Widaman, & Reise, 1997).

Internal consistency was assessed through Cronbach's Alpha, where values of $\alpha > .7$ indicate adequate internal consistency (Kline, 2000).

Concurrent validity was assessed by Pearson's correlations. We hypothesize the CFQ to be positively associated with RRS-10, AAQ-II and with the subscales that compose DASS-21 and to be negatively associated with EQ and MAAS.

Finally, a mediational analysis was performed using Path Analysis with Maximum Likelihood as the estimation method. In order to test the direct, indirect and total standardized effects, we used the bootstrap procedure with 2000 resamples, as this method is considered one of the most reliable and powerful procedure in testing the significance of the effects (Marôco, 2010). We used 95% bias-corrected confidence interval and effects were considered statistically significant if zero was not included in the interval between the lower and upper bound (Kline, 2010). A simple mediation is considered when the effect of a variable X on Y is at least in part transmitted through a third variable (M = mediator) (Hayes, 2013).

Results

Regarding analytic assumptions, cases with missing data were excluded, since they were completely at random and less than 5% of cases. Therefore, no imputation strategy was applied and all analyses were performed with complete data from participants. For all variables, visual inspection of histograms, as well as the observed values of skewness and kurtosis indicated normal distribution ($Sk \leq 0.648$ and $Ku \leq 0.618$). Additionally, there were no outliers.

Confirmatory Factor Analysis

A model was specified where all 7 items pertained to a single factor (see Fig. 1). The analysis was conducted using Sample 1. All items presented high values of factor weights and reliability of the individual items ($\lambda \geq .71$ and $R^2 \geq .51$, respectively).

----- Insert Fig 1 here -----

GFI, CFI and TLI values were higher than .95, which indicate a very good fit of the model, whereas RMSEA and χ^2/df values indicated a poor model fit.

Modification indices suggested that the correlation between several pairs of item's errors would improve model fit. However, it was only theoretically justifiable to allow correlation of errors between items 1 and 2 (which both have statements that imply cognitive fusion as a source of suffering – item 1 “My thoughts cause me distress or emotional pain”; item 2 “I get so caught up in my thoughts that I am unable to do the things that I most want to do”), and between item 2 and item 3 (both stating cognitive fusion as ineffective/unhelpful – item 3 “I over-analyse situations to the point where it's unhelpful to me”).

According to Kline (2010), it is common to add paths to the model when items composing the same factor present correlated errors, as long as their correlation is theoretically justifiable (i.e., similar content or formulation). Taking this into consideration, the model was respecified with the aforementioned errors' correlations. Results can be observed in Figure 2.

----- Insert Fig. 2 here -----

The modified model presented a very good model fit ($\chi^2/df = 1,995$; TLI = .994; CFI = .996; GFI = .990; RMSEA = .038; $p = .784$). Results showed high levels of factor weights and individual reliability ($\lambda \geq .69$ e $R^2 \geq .48$ – see Figure 2).

In addition, a chi-square difference test was conducted in order to test if the modified model presented a significantly improved fit than the original model, which was confirmed ($\Delta\chi^2(2) = 88.25$; $p < .05$). Hence, the final modified model (with errors from item 1 and 2, and

from items 2 and 3, correlated) presented a better fit than the original model. It is also worth mentioning that the modified model presented considerably lower levels of Modified Expected Cross Validation Index (MECVI= .083) than the original model (MECVI= .208), which indicates that the modified model presents better validity in the study population when compared to the original model.

Multigroup analysis

Figure 3 presents the standardized factor weights and individual reliability of each item in each of the three groups of Sample 1.

----- Insert Fig. 3 here -----

The proposed factor model presented very good fit indices ($\chi^2/df = 1.717$; CFI = .990; GFI= .970; TLI = .987; RMSEA = .033; $p = .994$.), simultaneously in the three different samples. High values of individual items reliability and factor weights were obtained ($\lambda \geq .67$ e $R^2 \geq .45$, considering all three different groups).

No differences were presented in regard to factor weights ($\Delta\chi^2(12) = 4.208$; $p = .979$), nor in terms of intercepts ($\Delta\chi^2(14) = 23.123$; $p = .058$), which shows strong measurement invariance between the three samples.

Internal consistency

Sample 1 was used in order to perform the internal consistency analysis. Cronbach's Alpha for the total sample was $\alpha = .93$. The sample from general population presented $\alpha = .93$, while the college students and in the medical samples showed $\alpha = .94$ and $\alpha = .92$, respectively.

According to the values of "Alpha if item deleted", it was possible to conclude that all items were contributing for the internal consistency of this measure, since none of the items, if deleted, would increase the Cronbach's Alpha.

Achieved statistical power associated with the total Cronbach's Alpha found was post-hoc calculated using Zaiontz's formula (Zaiontz, 2015) in Excel. Thus, considering $H_0 = .70$, $H_1 = .93$, $p \leq .05$, $n = 677$, $k = 7$, $df_1 = 676$, $df_2 = 4,056$, $F_{crit} = 1,098$, $Y_{crit} = .727$ and $W_1 = .256$, was found $1-\beta = 1$, which means 100% of statistical power.

Concurrent validity

Concurrent validity of the CFQ was conducted in Samples 2 and 3. Pearson's correlations between the CFQ and other variables in study are presented in Table 2. The CFQ was positively and significantly associated with rumination, depression, anxiety, stress and psychological inflexibility and negatively associated with mindfulness and decentering.

----- Insert Table 2 here -----

Achieved power of correlational analysis were post-hoc estimated using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009). Thus, our results had a statistical power of .98 in Sample 2 (i.e., considering $r \geq .19$ and $n = 324$) and of .99 in Sample 3 ($r \geq .40$; $n = 198$).

Mediation Analysis

A Path Analysis was performed in a medical sample of women with overweight or obesity who were enrolled in endocrinology and obesity consultations ($n = 102$; see Participants section for further sample details).

The theoretical model was tested (Figure 4) in order to explore the role of cognitive fusion as a mediator in the relationship between rumination and depression symptomatology. The model has 6 parameters and was fully saturated (i.e. zero degrees of freedom), so the model fit indices were neither tested nor reported, since fully saturated models always produce a perfect adjustment to the data.

----- Insert Fig. 4 here -----

Results showed a positive and significant direct effect of cognitive fusion on depressive symptomatology ($\beta=.555$; 95% CI= [.389; .710]; $p=.001$), as well as a positive and significant indirect effect (through cognitive fusion) of rumination on depressive symptoms ($\beta=.328$; 95% CI= [.216; .448]; $p=.001$). Additionally, the direct effect of rumination on depression symptoms, in the presence of cognitive fusion, was not significant (95% CI=]-.001; .385]; $p=.056$) with $\beta=.194$, which indicates a indirect-only mediation. Finally, the standardized total effect of rumination on depression symptoms was significant ($\beta=.522$; 95% CI= [.344; .680]; $p=.001$). The model explained 47% of depression symptomatology. The observed incremental increase in the R^2 (between the model tested and one without the mediator) was $\Delta R^2 = .20$, which represents 42.5% of the total variance explained by the model.

Discussion

We have found that the CFQ shows strong measurement invariance between the three groups in study. To our knowledge, there is only one study that explored the CFQ's measurement invariance, in which the samples included a) healthy, non-treatment seeking participants, b) participants enrolled in a work site stress management programme, c) participants with a range of mental health difficulties, d) participants with multiple sclerosis and e) participants who were dementia carers (Gillanders et al., 2014). As part of this work, Gillanders and colleagues confirmed the unifactorial structure of the CFQ across these five different samples. However, the CFQ did not show strong measurement invariance across these five samples, suggesting that there are differences between how the items are responded to between these different samples. Gillanders and colleagues concluded that further work is necessary to explore responses to the CFQ in different samples (Gillanders et al., 2014). Thus, the present study expands on previous literature as it provides further evidences of CFQ's

strong measurement invariance, allowing researchers to establish reliable interpretations across groups.

In addition, our results confirm the CFQ's unifactorial structure, as previously suggested by Gillanders and colleagues (2014). CFA showed very good model fit ($\chi^2/df = 1.995$; TLI = .994; CFI = .996; GFI = .990; RMSEA = .038; $p = .784$) and high levels of factor weights and individual reliability ($\lambda \geq .69$ e $R^2 \geq .48$). To our knowledge, the only published paper of a translated version of the CFQ-7 is the Spanish version, which conducted the analysis in a sample of 179 caregivers of relatives with dementia (Romero-Moreno et al., 2014). The factor structure was confirmed and showed good model fit ($\chi^2/df = 2.37$; RMSEA = .088; GFI = .95; CFI = .96; IFI = .96), which is in accordance with our results as well as with the data obtained in the original validation.

Furthermore, results showed that the CFQ's Brazilian version has an excellent internal consistency (i.e., Cronbach's Alpha of $\alpha = .93$ total sample, $\alpha = .93$ general population sample, $\alpha = .94$ college students sample, and $\alpha = .92$ medical sample). These data are in line with previous studies of the CFQ which found Cronbach's Alpha values of $\alpha = .87$ (Romero-Moreno et al., 2014) and ranging from $\alpha = .88$ to $\alpha = .93$ (Gillanders et al., 2014).

Additionally, regarding concurrent validity, the results from correlation analysis showed that cognitive fusion was positively and significantly associated with depression, anxiety and stress symptoms, psychological inflexibility and rumination, while negatively associated with mindfulness and decentering. On the one hand, these results seem to suggest that cognitive fusion is in fact a different construct than other psychological processes with which it might share common elements such as mindfulness, decentering and psychological inflexibility. On the other hand, these results are in accordance with both previous literature on cognitive fusion (e.g. Hayes, et al., 2012) and empirical results associating cognitive

fusion, psychological processes and psychopathological symptoms (e.g. Dinis et al., 2015; Romero-Moreno et al., 2014; Gillanders et al., 2014).

The correlation between the CFQ and decentering (EQ) deserves further consideration. In the original validation study, Gillanders and colleagues (2014) postulate that defusion and decentering are similar constructs, but that defusion is more specific than decentering and thus more narrowly and behaviourally defined. This study represents, to our knowledge, the first empirical investigation of the relationship between fusion and decentering. Whilst they are significantly correlated, the strength of this correlation is only moderate ($r = -.49$). This suggests these are related but distinct constructs, as postulated by CFQ's original authors, and represents a useful test of the validity of the CFQ in comparison to closely related measures.

This paper extends the existing literature on cognitive fusion, as it contributes for further understanding its role on depression symptomatology. In fact it is widely established the deleterious effect of rumination on depression (Nolen-Hoeksema, 2004; Watkins, 2008), but the mechanisms through which this effect occurs is not entirely clear. Our data seems to suggest that it is when one is entangled with the repetitive pattern of thinking on personal negative feelings and thoughts that rumination is linked to depression. Also these results highlight the role of cognitive fusion in women struggling with weight-related difficulties and/or eating behaviors issues. In fact, this seems to echo a few studies that suggest that cognitive fusion might play a role as a mediator of the effect of well known predictors of eating difficulties on eating psychopathology (Ferreira et al., 2014; Trindade & Ferreira, 2014; Duarte et al., 2015). Thus, it seems that in the context of weight and eating difficulties, psychological suffering might be influenced by underlying cognitive processes. Our results seems to corroborate this hypothesis.

Regarding clinical implications, this study provides a valid measure of cognitive fusion that can be used both in clinical and research settings throughout Brazil. Thus, since

cognitive fusion can be conceptualized as a transdiagnostic psychological process associated with several emotional difficulties, the availability of the CFQ might contribute to better understand this phenomenon and to an accurate assessment of cognitive fusion in Brazil.

It is important to mention some limitations in the current study. One is the cross-sectional nature of the design, which prevents us from drawing conclusions regarding causality between variables. It is also worth noting that the current study is part of a larger project that aims to explore the role of psychological inflexibility and other emotional-related difficulties in women who struggle with overweight or obesity. Thus, our samples were composed only of female participants, which makes the generalization of these results limited. Therefore, future studies using the Brazilian translation must explore CFQ's factor structure in a male sample.

Additionally, future studies with the CFQ's Brazilian version should consider a longitudinal design that includes a test-retest reliability analysis, in order to test the temporal stability of the instrument. Finally, future studies should consider further extending the validation of the CFQ by using different statistical procedures. For example, it might be useful to conduct a logistic model such as the Rasch Model, as its underlying mathematical model has the advantage of not depending on the respondent latent traits (Bortolotti, Tezza, Andrade, Bornia, & Junior, 2013) and it also takes into consideration random responses that might increase model misfit (Törmäkangas, 2011).

In conclusion, although it is important to consider the aforementioned limitations, the current study provides evidence for the CFQ's strong measurement invariance, confirms its one-factor structure and robust psychometric properties. Moreover, this study also contributes to the understanding of the role of cognitive fusion in the relationship between rumination and depression symptoms in women struggling with weight-related and eating difficulties.

Acknowledgments

Authors are grateful for the financial support from CNPq (Brazilian National Counsel of Technological and Scientific Development), CAPES (Brazilian Coordination for the Improvement of Higher Education Personnel) and FAPERGS (Foundation for Research of the State of Rio Grande do Sul), as well as the continuous confidence that these institutions have in our work.

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Table 1
 Characteristics of Sample 1

	Total Sample (<i>n</i> =677)			Sample from the General Population (<i>n</i> =301)			College Students Sample (<i>n</i> =171)			Medical Sample (<i>n</i> =205)		
	<i>M</i> (<i>SD</i>)	<i>Min</i>	<i>Max</i>	<i>M</i> (<i>SD</i>)	<i>Min</i>	<i>Max</i>	<i>M</i> (<i>SD</i>)	<i>Min</i>	<i>Max</i>	<i>M</i> (<i>SD</i>)	<i>Min</i>	<i>Max</i>
Age	33.62 (11.92)	18	60	32.58 (10.21) ^a	18	60	25.0 (8.86) ^a	18	58	42.04 (10.81) ^a	18	60
Years of Education	13.09 (3.90)	5	25	13.44 (3.53) ^b	5	25	13.73 (2.64) ^b	5	25	11.66 (3.83) ^a	5	24
BMI	27.51 (7.62)	17	66	24.39 (4.43) ^a	17	43	23.13 (4.49) ^a	17	45	35.72 (6.94) ^a	25	66
	<i>n</i>	%		<i>n</i>	%		<i>n</i>	%		<i>n</i>	%	
Marital status												
Married/cohabiting	265	39.2		106	35.2		31	18.1		129	62.9	
Divorced	12	1.8		22	7.3		4	2.4		10	4.9	
Widowed	37	5.4		2	0.7		0	0		10	4.9	
Single	363	53.6		171	56.8		136	79.5		56	27.3	
Occupational status												
Retired	217	7.5		17	5.6		6	3.5		28	13.7	
Employed	409	60.4		210	69.8		75	43.9		124	60.5	
Unemployed	51	32.1		74	24.6		90	52.6		53	25.8	

Note: Max= maximum; Min= minimum; BMI = Body Mass Index. ^a= There are significant differences regarding age, education and BMI between groups ($p \leq .01$); ^b= There are not significant differences regarding education between the general population and the college student's groups ($p = .8$, CI 95% = [-1.0, .57]).

Table 2
Correlation between CFQ and variables in study

Sample 2 (n= 324)								
Variable	α	CFQ	RRS-10	Brooding	Reflection	Depression	Anxiety	Stress
CFQ	0.93	1						
RRS-10	0.80	0.56**	1					
Brooding	0.74	0.61**	0.85**	1				
Reflection	0.74	0.34**	0.85**	0.45**	1			
Depression	0.89	0.60**	0.43**	0.54**	0.19**	1		
Anxiety	0.85	0.53**	0.36**	0.42**	0.19**	0.72**	1	
Stress	0.85	0.64**	0.51**	0.59**	0.28**	0.73**	0.71**	1
Sample 3 (n= 198)								
Variable	α	CFQ	MAAS	EQ	AAQ-II			
CFQ	0.93	1						
MAAS	0.86	-0.42**	1					
EQ	0.80	-0.49**	0.40**	1				
AAQ-II	0.94	0.77**	-0.48**	-0.55**	1			

Note. CFQ= Cognitive Fusion Questionnaire - short version; RRS-10= Ruminative Responses Scale - Short version; MAAS= Mindful Attention Awareness Scale; EQ= Experiences Questionnaire; AAQ-II= Acceptance and Action Questionnaire - short version.

**Correlation is significant at 0.01 level.

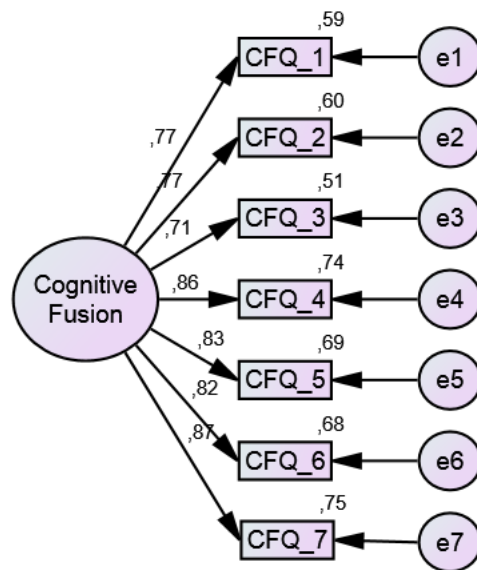


Figure 1. Standardized factor weights of the 7 items from CFQ in the original model ($N=677$). $\chi^2(14)=112,185$; $\chi^2/df = 8,013$; $p < 0.001$; CFI = .971; GFI = .952; TLI = .956; RMSEA = .102; $p < .001$.

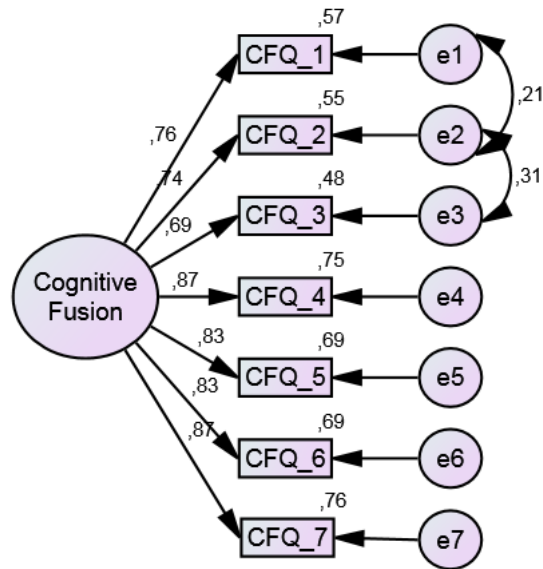


Figure 2. Standardized factor of the 7 items in CFQ on the modified model (N=677).
 $\chi^2(12)=23,935$; $\chi^2/df = 1.995$; $p=0.021$; CFI = .996; GFI = .990; TLI = .994; RMSEA = .038; $p = .784$.

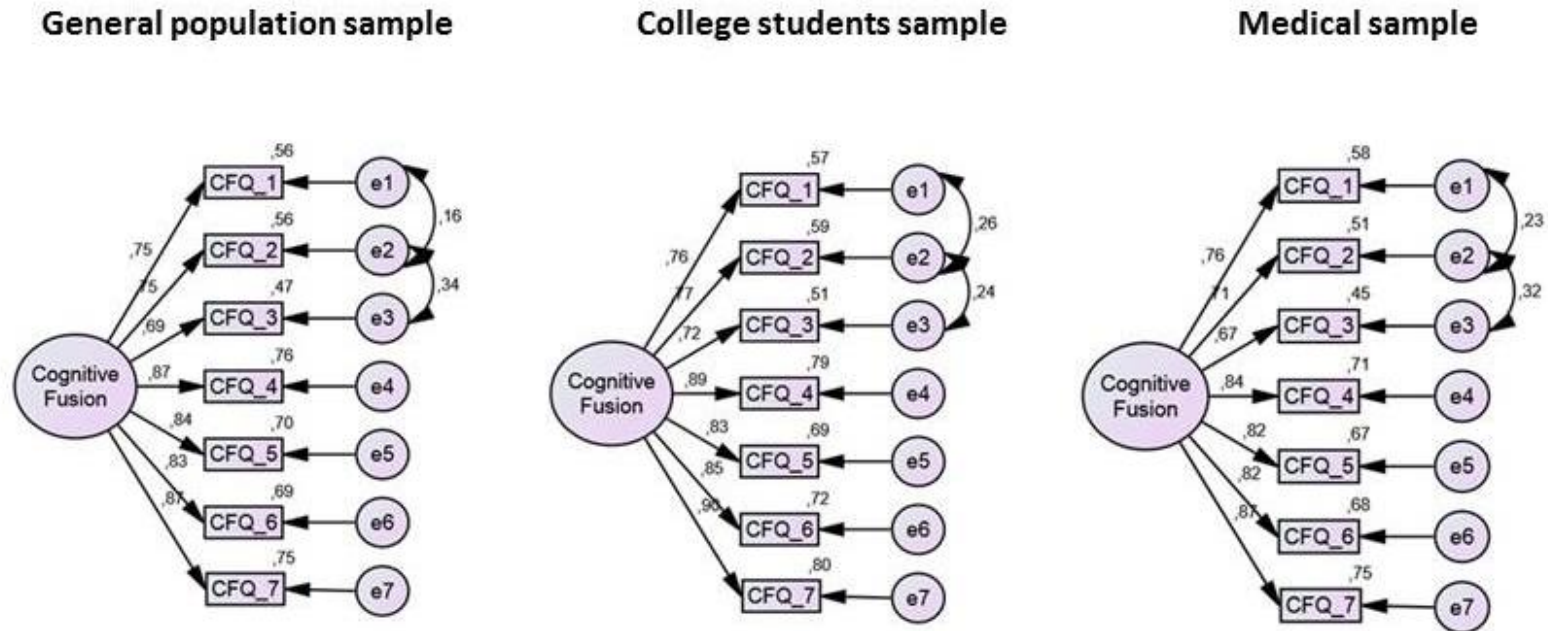


Figure 3. Standardized factor weights of the 7 items in CFQ for the three samples in study (general population, $n=301$; college students, $n=171$; and medical sample, $n=205$) $\chi^2(48)=82.414$; $\chi^2/df = 1.717$; $p=0.001$; CFI = .990; GFI= .970; TLI = .987; RMSEA = .033; $p = .994$.

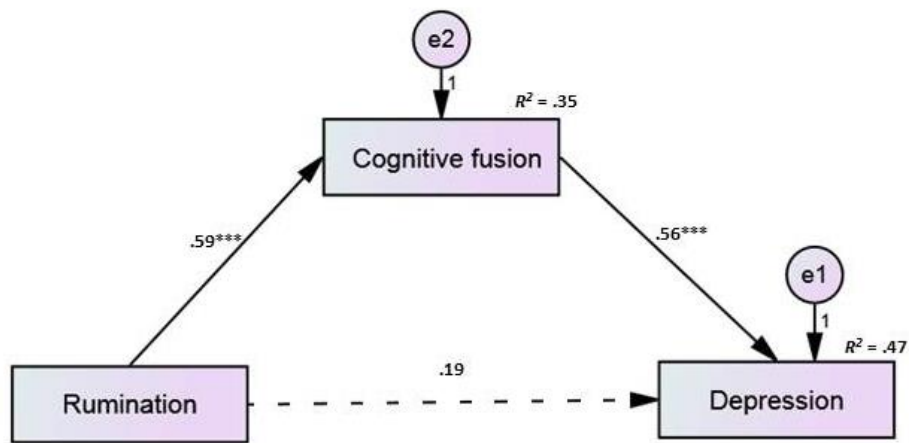


Figure 4. The mediational effect of cognitive fusion on the impact of rumination on depressive symptoms. Standardized coefficients are presented. $R^2 = R$ squared; *** $p < .001$