





Adverse childhood experiences and adult trait anxiety: The mediating role of metacognition

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ABSTRACT

Background: Adversities suffered at an early age lead to negative long-term effects impacting the development of the emotional, social, and cognitive domains of the personality, including metacognitive skills.

Objective: We aimed to investigate the mediating role of metacognition in the impact exercised by early adversities on trait anxiety.

Participants: Participants (all over 18) were recruited from the general population (n = 304).

Methods: Adverse childhood experiences were assessed using the 10-item Adverse Childhood Questionnaire, for the assessment of maladaptive metacognitive beliefs the Meta-Cognitions Questionnaire was applied, while the level of the trait anxiety was investigated using the Trait Version of the State-Trait Anxiety inventory. To examine the mediating effect of metacognition between early adversities and trait anxiety mediation analysis was used.

Results: Adverse childhood experiences have a moderate effect on trait anxiety ($\beta = 0.348$, $p < 0.001$). More than half of the revealed associations were shown to be due to the maladaptive functioning of metacognition (Pm = 56.03%). As regards specific maladaptive metacognitive beliefs, it was found that negative metacognitive beliefs (Pm = 61.49%), the need to control thoughts (Pm = 46.0%), and the lack of cognitive confidence (Pm = 30.07%) play a crucial role in the mediating effect of metacognition.

Conclusions: We can assume that the overall negative impact of early adversities on development is also manifested by the inadequacy of metacognition, which contributes to anxiety proneness. This inadequacy leads to the development of maladaptive metacognitive beliefs that prevent proper monitoring and correcting of the individual's internal contents, further increasing the level of trait-like anxiety.

1. Introduction

Adverse childhood experiences (ACEs) are defined as emotional and physical abuse/neglect within the family, sexual abuse, and the effects of dysfunctional family circumstances, prior to the age of 18 years (Felitti et al., 1998). The latter encompasses all those characteristics that disrupt the healthy functional balance of the family system. The importance of investigating the effects of ACEs is underscored by the fact that the prevalence of ACEs is 37.8% based on a meta-analysis of data from 28 European countries (Hughes et al., 2021).

It has been demonstrated that severe and repetitive ACEs have an adverse impact on the development of an individual, affecting all aspects of their personality, including physical, cognitive, emotional, and social domains (Felitti et al., 1998). Such experiences have been linked to an increased risk of developing health-risk behaviours and somatic

disorders (Bellis et al., 2019; Hughes et al., 2017; Sethi et al., 2013). It has been shown that ACEs may be associated with an increased risk of several mental disorders, such as psychosis (Mansueto et al., 2019, 2022; Mansueto et al., 2022a and 2022b), affective diseases (Zhang et al., 2023), and eating disorders (Guillaume et al., 2016). With regard to the anxiety conditions relevant for the aims of the present study, the estimated relative risk attributable to ACEs is between 13.9% and 44.8% (Hughes et al., 2021). Furthermore, additional research has substantiated the existence of a correlation between ACEs and the manifestation of anxiety disorders (Taylor et al., 2021; Lipsky et al., 2022).

The term *trait anxiety* refers to an individual's anxiety-proneness (Spielberger et al., 1971). Higher trait anxiety is associated with perceiving environmental stimuli as more threatening. This implies that trait anxiety is associated with an overattentional perceptual bias and negative cognitive distortions underpinning anxiety (Eysenck, 2000;

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Gidron, 2013). Trait anxiety, as opposed to state anxiety, can be understood as a personality trait that describes the anxiety predisposition present in the personality (Spielberger et al., 1971). More pronounced trait anxiety can be found in many psychological alterations and disorders (Edler and Kocovski, 2001; Knowles and Olatunji, 2020).

A significant correlation has been identified between ACEs, trait anxiety, and adult anxiety disorders (Reiser et al., 2014), where trait anxiety has been identified as a mediating factor between ACEs and health anxiety. A study by Gottschalk and Domschke (2022) focused specifically on the genetic features of generalized anxiety. In this context, the relevant endophenotypes and the aetiology of anxiety were investigated through a gene-environment interaction approach. The study demonstrated a link between trait anxiety, inappropriate worry, and the presence of early traumatic life events among patients diagnosed with generalized anxiety. However, it should be noted that many variations in gene-environment interaction influence symptom development. In a different study, a strong correlation was identified between family conflict, emotional insecurity, negative emotions triggered by sexual abuse, and trait anxiety (Cantón-Cortés et al., 2019). Mundy and colleagues (2015) have shown a positive correlation between stress perceived in childhood and trait anxiety, and the subsequent development of adult anxiety disorders.

In addition to the relationship between adverse childhood experiences and trait anxiety, the present research also investigates the impact of *metacognition* on the above relationship. Therefore, it is also relevant to review the key findings on metacognition.

Flavell's concept of metacognition refers to thinking about thinking, or cognition about our cognition (Flavell, 1979). Nelson and Narens (1990) elaborated on the definition by stating that metacognition is the function that performs an important monitoring and controlling role over cognitive functioning. Metacognition develops during childhood and adolescence (Kuhn, 2000); therefore, it can bear the traces of important early influences.

According to Wells and Matthews (1996), properly functioning metacognition is essential for the regulation of cognitive functioning and, consequently, cognitive beliefs. Wells and Matthews' metacognitive theory (1994, 1996) states that metacognition involves interrelated knowledge and cognitive processes that play an important role in metacognitive monitoring and control processes. Metacognitive knowledge refers to the beliefs that individuals hold about their own thinking. According to Wells and colleagues (Myers and Wells, 2015; Wells and Cartwright-Hatton, 2004), metacognitive beliefs (negative metacognitive beliefs, positive metacognitive beliefs, cognitive confidence, cognitive self-awareness, need to control thoughts) contribute to the emergence and persistence of certain psychopathological alterations. These maladaptive metacognitive beliefs are beliefs that shape the way we think; they lead to inappropriate emotional, cognitive, and behavioural responses, and contribute to psychological alterations. A range of studies have demonstrated an association between metacognitive beliefs and a variety of psychological disorders including emotional dysregulation (Mansueto et al., 2022a), addiction (Olivari et al., 2025), eating disorders (Palmieri et al., 2021), and affective disorders (Sun et al., 2017).

Based on the above, it seems reasonable to hypothesize that differences in metacognition play a role in the extent and persistence of trait anxiety. Unfortunately, relatively few studies investigating this specific relationship can be found in the literature as of yet. However, the sources available provide sufficient evidence to establish a relationship between metacognition and trait anxiety, with this relationship often being examined in the context of neuropsychological and academic performance (e.g., Cécillon et al., 2024a, 2024b; Silaj et al., 2021). Only a few studies have addressed the relationship between metacognition and trait anxiety in the context of psychological factors and alterations. According to the findings of the aforementioned studies, a definite link can be proved between metacognitive differences and trait anxiety in patients with generalized anxiety disorder (Strand et al., 2023).

Furthermore, maladaptive metacognitive beliefs mediate between anxiety and depressive symptoms (Cichoń et al., 2017), and also between trait anxiety and obsessive-compulsive symptoms (Irak and Tosun, 2008). These findings draw attention to the role of metacognition in the interplay between different psychological phenomena. Wells and Matthews (1996) explain this role through the activation of metacognitive beliefs that direct a person's attention and processing capacities to a particular cognitive content that may be perceived as dangerous, thus creating a vicious circle and hindering adaptive reinterpretation of beliefs, maintaining a permanent state of worry and heightened anxiety-proneness.

Another crucial piece of information is that maladaptive metacognitive beliefs have been found to be present as early as 6 years of age. In childhood and adolescence, negative metacognitive beliefs showed the strongest association with anxiety (Myers et al., 2019), which is in line with Wells' findings on adults (Wells, 2010). There is empirical research evidence showing that more pronounced maternal maladaptive metacognitive beliefs are associated with maladaptive metacognitive beliefs and higher anxiety in their child. More specifically, children's metacognitive characteristics serve as a mediating factor between maternal metacognition and the child's anxiety levels (Esbjorn et al., 2016). This subsequently draws attention to the role of early experiences in influencing metacognitive functioning.

There is a paucity of research on the relationship between ACEs and metacognition.

Riccardi et al. (2020) investigated metacognitive functioning using the Metacognitive Assessment Interview in a group from the general population. The interview interprets metacognition as the understanding of self-representations and representations of others, reflective and integrative functioning. Their results show that the subgroup that experienced adverse childhood events had lower integrative capacity and higher levels of anxiety.

While the work of Riccardi et al. offers a more psychodynamic interpretation of the relationship between ACEs and anxiety, other researchers also shed light on cognitive aspects of the same connection.

For example, the research conducted by Gunduz and colleagues (2021) on a sample of university students found that members of a sub-sample who had experienced adverse childhood experiences scored significantly higher on several subscales of the Metacognitions Questionnaire compared to members of a sub-sample who had not reported such adversities. The test is based on Wells and Matthews' (1994, 1996) metacognitive theory, according to which metacognitive deficits are manifested in maladaptive metacognitive beliefs, as described above. In this study by Gunduz and colleagues, individuals reporting experiences with early adversities showed significantly higher scores on nearly all subscales of maladaptive metacognitive beliefs. This means that subjects who have suffered ACEs perceive their thoughts as more dangerous and uncontrollable on average, leading to maladaptive thinking processes such as thought suppression or rumination, which may cause more pronounced anxiety.

Reviewing the literature on the potential mediating role of metacognition between adverse childhood experiences and their consequences only a little research emerges. Based on the results of Scarpa and colleagues (2009), child sexual abuse severity correlates with maladaptive metacognitive thought strategies. Moreover, severe forms of consequential trauma symptoms were transmitted through these maladaptive metacognitive thought strategies.

Myers and Wells (2015) investigated the relationship—on a sample of the average population—between early adversities and metacognitive beliefs with the help of the Early Trauma Inventory and the Metacognitions Questionnaire. They found that experiences with early adversities, particularly early emotional abuse, correlate with maladaptive metacognitive beliefs. In this research metacognition fully mediated the relationship between emotional abuse and negative affect.

1.1. Aims and hypotheses of the study

Although the above might suggest that there is a relationship between adverse childhood experiences, metacognition and trait anxiety, to the best of our knowledge the interaction of these three variables has not been examined in a single study. The present study is the second phase of a larger study. In the first stage of our research, previously published elsewhere (Horváth et al., 2024a), we were interested in the detailed relationship between adverse childhood experiences and metacognition, and whether a dose-response relationship could be demonstrated between the accumulation of experienced ACE types and the degree of expression of maladaptive metacognitive beliefs. The study confirmed both the hypothesized relationship and the dose-response relationship.

Our previous findings on the dose-response relationship between ACEs and maladaptive metacognition is critical because they support the hypothesis that experiencing childhood adversity can shape an individual's metacognitive functioning. In addition, as reported above, there is further empirical evidence suggesting that metacognition affects anxiety-proneness. Moreover, individuals who have suffered early adverse experiences tend to struggle with marked anxiety. Considering the aforementioned knowledge on metacognition and a substantial amount of extant empirical evidence, it can be hypothesized that a) ACEs affect the level of anxiety-proneness, b) ACEs impact metacognition and the extent how maladaptive metacognitive beliefs are expressed, c) the level of maladaptive metacognition affects trait anxiety. Consequently, it can be hypothesized that d) metacognition and maladaptive metacognitive beliefs play a mediating role between these two variables. In other words, the consequences of adverse childhood experiences (ACEs) on trait anxiety may be partially mediated by utilizing metacognition.

2. Methods

2.1. Sampling and data collection

The sample was drawn from the general population aged 18 and over. Recruitment was carried out on topic-neutral online platforms. Due to the sensitive and often hidden experience of adverse childhood experiences, no exclusion criteria were set to avoid creating a sample that might be over- or under-represented in the prevalence of ACEs. Thus, we tried to keep the sample characteristics close to those of the general population. Due to online recruitment and the snowball sampling method, an accessibility, non-probability sample was tested.

2.2. Ethics

Participants volunteered to take part in the study with informed consent and anonymity. Data were processed and stored following the applicable data protection guidelines. The data were stored password-protected and not accessible to third parties.

Due to the sensitive nature of the topic, participants were offered the opportunity to seek psychological support from the psychological professionals conducting the research if they found the questions upsetting. None of the respondents used this aid.

The study was conducted with the ethical approval of the Regional and Institutional Ethics Committee of the University of Debrecen (DE RKEB/IKEB 6205-2022), observing the principles of the Declaration of Helsinki.

2.3. Measures

Participants first completed a *demographic questionnaire*, which contained questions about respondents' gender, age, marital status, educational attainment, and occupational status.

ACEs were assessed using the *Adverse Childhood Experiences*

Questionnaire 10-item version (ACE-10), a retrospective self-report questionnaire consisting of 10 items (Anda et al., 2010; Kovacs-Toth et al., 2023). The questions aim to assess 10 types of early ACEs suffered before the age of 18, which can be classified into three categories: abuse (physical, emotional, and sexual abuse), neglect (physical, emotional), and household dysfunction (parental separation/divorce, household physical violence, household substance abuse, household mental illness or suicide attempt, incarcerated household member). For each item, respondents indicate with 'yes' or 'no' whether they have experienced the given adversity. Based on the types of adverse childhood experiences suffered a cumulative ACE score ranging from 0 to 10 is calculated where 0 indicates no experienced adversity, and 10 indicates that the person has experienced all the assessed adversities during their childhood. This score serves as a severity index.

Participants' beliefs about their own thinking, i.e., metacognitive beliefs, were assessed using the *Meta-Cognitions Questionnaire* (MCQ) (Wells & Catwright-Hatton, 2004; Miklósi et al., 2010).

On this questionnaire of 30 statements, participants indicate on a four-point Likert scale to what extent they find the statements in the items to be typical of their own thinking. The items of the questionnaire are arranged in five subscales, representing five maladaptive metacognitive beliefs. They are as follows: a) Positive beliefs (MCQ POS; positive beliefs about worry); b) Negative beliefs or Uncontrollability/danger (MCQ NEG; negative beliefs about the uncontrollability and dangerousness of worry); c) Cognitive confidence (MCQ CC; lack of confidence in attention and memory); d) Need to control thoughts (MCQ NC; negative beliefs concerning the consequences of not controlling thoughts); e) Cognitive self-consciousness (MCQ CSC; the tendency to focus attention on thought processes).

The sum of the scores of subscales account for the total score for the MCQ-30. The maximum total score achievable is 120, with a maximum of 24 points per subscale. Higher scores indicate more pronounced maladaptive metacognitive beliefs. The internal consistency of the MCQ total score and its subscales was high, with Cronbach's alpha coefficients ranging from 0.78 to 0.90.

The level of trait anxiety was defined by the *Trait Version of the State-Trait Anxiety Inventory* (STAI-T) (Spielberger et al., 1971; Sipos and Sipos, 1978).

The inventory consists of 20 items, 9 of which are reversed items. Respondents indicate, on a 4-point Likert scale, how typical the statements in the items they consider to be for themselves in general.

The maximum total score achievable is 80. The total score of the questionnaire was used to measure trait anxiety, an indicator of anxiety tendency. The internal consistency of the scale was excellent (Cronbach's alpha = 0.93).

2.4. Statistical analysis

Statistical analysis was carried out by SPSS ver. 23 (IBM Corp., 2015; Armonk, NY, USA). The level of significance was set at a two tailed p-value less than 0.05 ($p < 0.05$). Categorical variables were described by proportion. Continuous variables were described by mean and standard deviation. The internal consistency of items was tested by Cronbach's alpha. Post-hoc power analyses were conducted using G*Power 3.1 (Faul et al., 2007).

To assess the relationships among the variables and to test the mediation hypothesis, we conducted mediation analyses using the Hayes Process Macro ver. 4.0 available online at www.processmacro.org (Hayes, 2013). The Process Macro is well-suited for this purpose as it enables the estimation of direct, indirect, and total effects within a mediation framework. The analysis involved specifying separate mediation models where the accumulation of ACE predicts trait anxiety, with different maladaptive metacognitive beliefs potentially mediating this relationship. The Process Macro was configured to compute bias-corrected bootstrap confidence intervals for the indirect effects, providing a robust assessment of mediation. We employed 5000

bootstrap samples for this purpose in each analysis. All models were adjusted for age, gender, and educational attainment (primary/secondary/tertiary) (the unadjusted results can be found elsewhere [Horváth et al., 2024b]).

3. Results

3.1. Descriptive statistics

Altogether 84.2 % (n = 256) of our 304 subjects were women. The mean age of the whole sample was 34.1 years (SD = 13.28, range: 18–70). More than half of the sample was married or lived in a cohabiting relationship (n = 158, 51.97 %), 71.84 % (n = 188) had at least a high school certificate, and 64.5 % of the respondents were employed (n = 196). As mentioned above, the current study is part of a larger research. The first results of this study have been reported elsewhere with detailed descriptive data on the sample. We will therefore refrain from describing it again here (For detailed demographic data see Horváth et al., 2024a or Suppl. A.).

The average score on the Meta-Cognitions Questionnaire was 60.73 (SD = 17.72), and the average score on trait anxiety was 40.89 (SD = 13.10). Given the relatively large sample size (n = 304), the assumption of normality can be considered reasonably met for most variables based on skewness and kurtosis statistics (see Table 1). While the MCQ_POS variable shows higher positive skewness and MCQ_NEG marginally higher negative kurtosis, this is unlikely to severely affect analyses due to the sample size, in line with the central limit theorem. Reviewing the results related to adverse childhood experiences, it can be seen that respondents most often reported experiencing emotional neglect (n = 136; 44.74 %) and the least frequently reported adversity was having an incarcerated family member (n = 42; 13.82 %). On average, respondents reported experiencing 2.8 (SD = 2.39) types of adversity; 19.73 % (n = 60) had no adverse childhood experiences, while 37.38 % (n = 115) had experienced more than four types of adversity (see Table 2).

3.2. Mediation analysis

We investigated the indirect effects of the number of adverse childhood experiences (ACE) on trait anxiety measured by STAI through the mediating variable of maladaptive metacognitive beliefs using mediation analyses. Standardized beta coefficients for direct, indirect, and total effects were calculated. All models were adjusted for age, gender and educational attainment.

The results indicated significant indirect effects of ACEs on trait anxiety through maladaptive metacognitive beliefs. Specifically, the indirect effect was calculated as follows: ACE → Metacognitive Beliefs (path a) and Metacognitive Beliefs → Trait Anxiety (path b). The standardized direct (path c') and indirect effects (a^xb) were also computed. Total effect between ACEs and trait anxiety (path c) was moderate (β =

Table 1
Descriptive statistics and distribution data on metacognition and trait anxiety.

Variables	Total sample n = 304		
	Mean (SD)	Skewness (Std. error)	Kurtosis (Std. error)
MCQ scales			
MCQ_Total	60.73 (17.72)	0.006 (0.140)	0.309 (0.279)
MCQ_POS	9.53 (3.56)	1.254 (0.141)	1.261 (0.281)
MCQ_NEG	13.29 (5.42)	0.414 (0.140)	-1.013 (0.280)
MCQ_CC	11.47 (4.45)	0.905 (0.141)	0.259 (0.282)
MCQ_NC	12.28 (4.29)	0.468 (0.141)	-0.635 (0.281)
MCQ_CSC	14.81 (4.16)	0.051 (0.141)	-0.762 (0.281)
STAI-T			
STAI-T_Total	48.89 (13.10)	0.170 (0.140)	-0.587 (0.280)

Note: MCQ: Meta-Cognitions Questionnaire; POS: positive beliefs; NEG: negative beliefs; CC: cognitive confidence; NC: need to control thoughts; CSC: cognitive self-consciousness; STAI-T: Trait Version of the State-Trait Anxiety Inventory.

Table 2
Descriptive results on adverse childhood experiences.

Variables	Total sample (n = 304)
<i>Exposure to ACE categories</i>	
Emotional abuse	121 (39.80)
Physical abuse	68 (22.37)
Sexual abuse	57 (18.75)
Emotional neglect	136 (44.74)
Physical neglect	42 (13.82)
Parental separation/divorce	108 (35.53)
Household physical violence	40 (13.16)
Household substance abuse	120 (39.47)
Household mental illness	132 (43.42)
Incarcerated household member	42 (13.82)
<i>Cumulative ACE score</i>	
0	60 (19.73)
1	54 (17.76)
2	38 (12.50)
3	37 (12.17)
4	41 (13.49)
5	30 (9.87)
6	18 (5.91)
7	11 (3.62)
8	9 (2.96)
9	6 (1.97)
10	0 (0)
≥4	115 (37.83)

Note: ACE: Adverse Childhood Experiences.

0.348, p < 0.001). The MCQ scales generally exhibit significant relationships with both ACEs and STAI, and –except for MCQ_CSC (cognitive self-consciousness) –, we found significant indirect effects (see Fig. 1). For the MCQ total score, the standardized indirect effect (a^xb) is 0.195 (95 %CI: 0.099–0.583), which represents 56.03 % of the total effect (β = 0.348) (percent mediation [Pm] = 56.03 %). For MCQ_NEG (negative beliefs about the uncontrollability and dangerousness of worry), more than half of the effect of ACE on trait anxiety is mediated through this maladaptive metacognition (a^xb = 0.214 [95 % CI: 0.143–0.283], Pm = 61.49 %). MCQ_NC (need to control thoughts; negative beliefs concerning the consequences of not controlling thoughts) also plays a significant role in the relationship between ACEs and STAI, mediating nearly half of the ACE effect (a^xb = 0.161 [95 %CI: 0.096–0.233], Pm = 46.0 %). In the ACE-STAI relationship, MCQ_CC (lack of confidence in attention and memory) mediates about one-third of the ACE effect (a^xb = 0.105 [95 %CI: 0.055–0.165], Pm = 30.17 %). For MCQ_POS (positive beliefs about worry), 13 % of the ACE effect is mediated through the given maladaptive metacognition (a^xb = 0.046 [95 %CI: 0.013–0.085], Pm = 13 %). MCQ_CSC (cognitive self-consciousness) had a non-significant and negligible mediating role in the ACE-STAI relationship (a^xb = 0.016 [95 % CI = -0.0009 to 0.041], Pm = 4.59 %). The post-hoc power analysis confirmed that, given the observed effect sizes (f²: from 0.17 to 0.91 corresponding to R²: from 0.15 to 0.48) and the relatively large sample size (n = 304), the study had more than adequate statistical power (well above 0.95) to reliably detect the examined effects.

4. Discussion

Our results show a moderate association between ACEs and trait anxiety, suggesting that additional factors that were not investigated in this study are also likely to play a role in this effect. However, we consider it an important finding that more than half of the revealed associations is due to maladaptive functioning of metacognition (MCQ total: Pm = 56.03 %).

Early-life stress has been linked to an elevated risk of developing mood and anxiety disorders in adulthood (Heim and Nemeroff, 2001). ACEs suffered in childhood act as potent stressors, eliciting cognitive, emotional, behavioral, and neurohormonal responses in the body. These responses interact with each other and the traumatic experience to

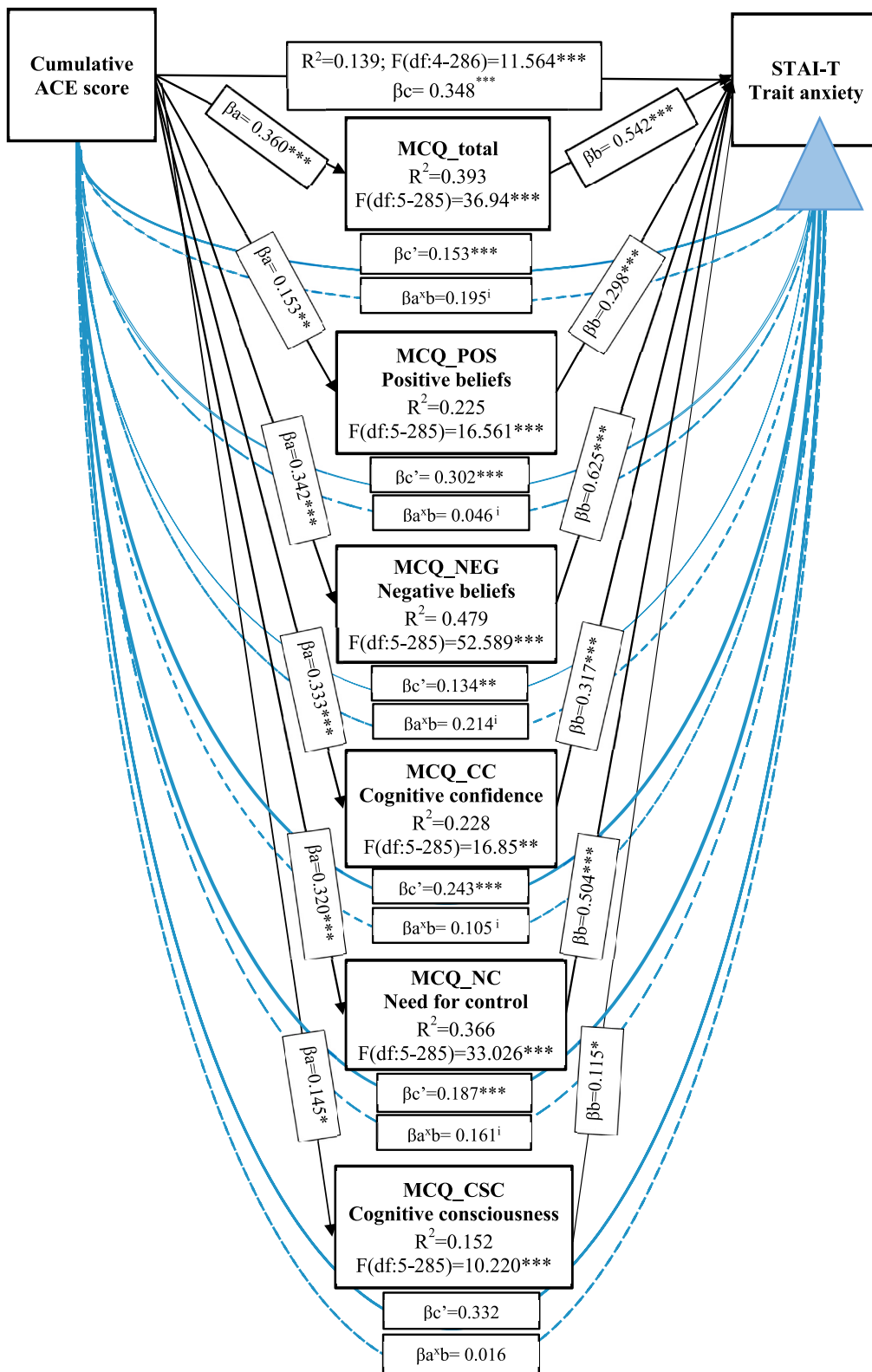


Fig. 1. Analysis of the relationship between accumulation of adverse childhood experiences (ACE) and the level of trait anxiety using maladaptive metacognitive beliefs as mediators

Note: MCQ: Meta-Cognitions Questionnaire; POS: positive beliefs; NEG: negative beliefs; CC: cognitive confidence; NC: need to control thoughts; CSC: cognitive self-consciousness; STAI-T: Trait Version of the State-Trait Anxiety Inventory; ACE: adverse childhood experiences

Black arrows: total effect (path c) and direct effects (path a and b); blue arrows: standardized direct effects (path c'); dashed blue arrows: indirect effects (paths a^xb)

All models are adjusted for age, gender and educational attainment. *p < 0.05; **p < 0.01; ***p < 0.001;

ⁱ Standardized indirect effect (β^a×β) falls within the 95 % confidence interval.

produce the traumatic stress response, which inhibits the individual's ability to adaptively cope with future stressors. As a result, these people are continually engaged in environmental monitoring, exhibiting heightened sensitivity to potential threats and robust emotional responses (Wilson et al., 2011; Nierop et al., 2018). As mentioned earlier, high trait anxiety can be interpreted as this increased monitoring and higher perceived threat, among others (Gidron, 2013).

Moreover, several pieces of research point to the fact that anxiety proneness, i.e., trait anxiety, is associated with a number of psychiatric disorders and psychopathological alterations—such as anxiety disorders, affective disorders (McClure and Parmenter, 2017; Murphy and Leighton, 2009), post-traumatic stress disorder, insomnia (Larsson et al., 2008), problematic impulse and behavioral control (Corr and McNaughton, 2014), substance use (Dixon et al., 2014) or suicidality (Cheng et al., 2022)—often seen in people who have suffered early adversities (Maercker et al., 2022). In the light of our results, maladaptive metacognition might have a significant role in their emergence and persistence; this could be confirmed by more targeted research in the future, though.

To understand the relevance of our findings it is also important to note that an optimal early environment and attachment is essential for the proper development of metacognitive skills. This is because safe, empathic, reflective parenting facilitates the development of the child's function of monitoring one's own and others' internal states, i.e., the metacognitive functioning, and – in turn – the child's emotion regulation and mentalization skills (Gumley, 2014). In contrast, a childhood that is fraught with adversities is characterized by the absence or inadequacy of this secure and reflective early parenting and attachment.

Adverse experiences occurring in attachment relationships may prevent the proper development of metacognitive monitoring and regulation, and result in a serious impairment of cognitive flexibility. The lack of flexible thinking and its adaptive regulation makes it often impossible to process and integrate traumatic experiences (Van der Kolk and Van der Hart, 1991). Thoughts about adverse events will thus be perceived as dangerous and uncontrollable, i.e. a person will develop dysfunctional cognitive beliefs about their own cognition, which are referred to as maladaptive metacognitive beliefs (Gunduz et al., 2021).

Moreover, persons who have experienced ACEs and hold dysfunctional metacognitive beliefs may engage in different forms of repetitive negative thinking (e.g., excessive worry or rumination) that may contribute to sustained trait anxiety (Mansueto et al., 2021).

Liotti and Prunetti (2014) suggest that two types of deficits in metacognitive functioning can be observed in individuals who have experienced early adversities. These are, on the one hand, deficits in monitoring and critical appraisal of memory processes and, on the other hand, deficits in intensity and duration modulation of emotions. The latter sheds light on the importance of the significant moderating effect of maladaptive metacognition in general, found in our research between early adversities and trait anxiety, while the former draws attention to our findings on the mediating effects of specific maladaptive metacognitive beliefs.

Further exploring our results, we found that among the specific maladaptive metacognitions assessed in our study, negative metacognitive beliefs (MCQ NEG: $P_m = 61.49\%$), the need to control thoughts (MCQ NC: $P_m = 46.0\%$), and the lack of confidence in the functioning of attention and memory (MCQ CC: $P_m = 30.17\%$) play a notable mediating role between ACEs and trait anxiety. The mediating effect of other maladaptive metacognitive beliefs is almost negligible.

The role of negative metacognitive beliefs in the consequences of early adversities has also been highlighted in earlier studies (Mansueto et al., 2018). These results, just like the results of our current study are consistent with the observation that traumatized individuals experience trauma-related thoughts and memory content as dangerous (MCQ NEG). They try to avoid the emerging trauma-related content and keep it under control (MCQ NC) (Barlow and Goldsmith, 2014). However, they often choose maladaptive ways to do this, such as avoiding or suppressing

these contents. These maladaptive strategies do not allow the integration of trauma-related thought and memory content, which may return in the form of intrusive thoughts and symptoms (Anderson and Green, 2001; van der Hart et al., 1993, 2017). This can explain the lack of confidence in the functioning of memory and attention (MCQ CC) in persons who experienced early adversities (van der Kolk, 2002). If we look at this information in the light of our mediation analyses, the effect of ACEs on trait anxiety through the mentioned maladaptive metacognitive beliefs could be interpreted as the person perceiving not only the external but also the internal environment as dangerous and thus needing to monitor it, which leads to persistent anxiety proneness. Moreover, in light of the points mentioned above, it becomes clear why a negligible mediating effect of positive metacognitive beliefs (MCQ POS) and a non-significant mediating effect of attention focused on thought processes (MCQ CSC) becomes apparent in our analysis. According to the aforementioned evidence, individuals who have suffered severe early adversities perceive their own trauma-related cognitive content as dangerous, and seek to avoid or suppress it (Barlow and Goldsmith, 2014). Thus, they consider the objects of their concerns as not useful (MCQ POS) but dangerous, resulting in their attempting to avoid such contents becoming the focus of their attention (MCQ CSC), so as not to activate unbearable emotional reactions and memories (Cicchetti and Banny, 2014).

Our results on the mediating role of metacognition are consistent with the findings of previous mediation analyses in literature. What is more, the present findings also point out the importance of other early adversities (dysfunctional family circumstances assessed by the ACE Questionnaire) in addition to that early maltreatment, which was investigated by Scarpa et al. (2009). Moreover, our results further nuance the findings of Myers and Wells (2015) on the relationship between ACEs and negative affect mediated by maladaptive metacognition. According to our findings, a closer look at negative valence affects reveals a significant role of maladaptive metacognitive beliefs in trait-like anxiety. This confirms the results published by Barlow and Goldsmith in 2014.

One of the main limitations of our study is that it does not include a clinical sample, which reduces the generalizability of the results provided.

Another limitation of our study is the over-representation of highly educated female respondents in our sample. As a result, the sample lacks representativeness, meaning the findings cannot be generalized to a broader population.

A further limitation is that our present results are not suitable to explain the role of factors other than metacognitive beliefs in the effect ACEs have on trait anxiety. This requires further research. Another limitation of the study is its cross-sectional nature. Given the research design, it cannot be stated that all maladaptive metacognitive beliefs are due to the suffered ACEs. This would require follow-up studies and an investigation of possible mediating factors between ACEs and metacognition. In addition, our study evaluates ACEs in a retrospective manner; therefore, the possibility of memory biases should be taken into account when discussing results.

Furthermore, we are not able to comment on whether the alterations and disorders discussed above— which are common in trauma victims and which are often associated with more pronounced trait-like anxiety— were present in our sample, as we did not collect data on them in our current research.

4.1. Clinical relevance

Demonstrating the mediating role of metacognition in relation to ACEs is of great clinical relevance. If further research confirms such a role, it would suggest that treating anxiety in individuals with a history of early adverse experiences does not have to focus exclusively on processing trauma. Metacognition may provide a key framework to conceptualize trauma cases and better understand processes of change

(Gumley, 2014; Liotti and Prunetti, 2014). Treatment could additionally target the modification of maladaptive metacognitive beliefs and metacognitive processes. This approach could provide a more effective, targeted therapy for trauma-based vulnerability by additionally promoting resilience.

5. Conclusion

The findings of our current study confirm the influence of metacognitive beliefs on trait anxiety in the context of adverse childhood experiences. More than half of the effect of early childhood adversities on trait anxiety is mediated through metacognitive difficulties. Among specific maladaptive metacognitive beliefs, it was negative maladaptive metacognitive beliefs, the need to control thoughts, and the lack cognitive confidence that were found to be the most significant. In this sense, maladaptive metacognitive functioning develops in individuals who have suffered early adversities, leading to distortions in the way they think, through which the person develops a more pronounced tendency to anxiety in later life. However, our results do not explain the additional symptoms of early adversities, and the results of a survey of a non-representative sample from the general population should be interpreted with caution.

CRedit authorship contribution statement

Zita Fekete: Writing – original draft, Formal analysis, Conceptualization, Investigation, Data curation. **Dorottya Kovács-Horváth:** Investigation, Data curation, Writing – original draft, Formal analysis, Conceptualization. **Barnabás Oláh:** Formal analysis, Writing – original draft. **Beáta Kovács-Tóth:** Writing – original draft, Formal analysis, Methodology.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Declaration of competing interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2025.07.027>.

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