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Do Metacognitive Beliefs Explain Individual Differences in Anger and Aggression? Support From Self-Report Measures and the Anger-Infused Ultimatum Game

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Objective: The metacognitive model suggests that people who have dysfunctional metacognitive beliefs (e.g., "Rumination is uncontrollable") are more likely to ruminate on their angry thoughts and, in turn, to experience higher levels of anger and act aggressively. Previous findings indicate that metacognitive beliefs are associated with anger intensity and specific forms of aggressiveness (e.g., displaced aggression) and that this association is mediated by angry rumination. However, other forms of aggressiveness (e.g., physical, verbal, indirect) remain unexplored. Furthermore, previous studies have relied exclusively on self-reports to assess anger and aggression. In this study, we addressed these gaps. ***Method:*** A sample of 222 university students completed self-report measures of metacognitive beliefs, angry rumination, anger levels, and different aggressive behaviors. Of these, a subsample of 103 participants also completed a Spanish version of the anger-infused Ultimatum Game, a social decision-making paradigm that induces anger and aggression. ***Results:*** For anger responses, metacognitive beliefs were associated with higher levels of both self-reported and experimentally generated anger. For aggression, metacognitive beliefs were associated with all forms of questionnaire-based aggressiveness but not experimentally induced aggression. Furthermore, we found that the associations between metacognitive beliefs and anger and aggressiveness were statistically mediated by angry rumination. ***Conclusions:*** Together, our findings suggest that metacognitive beliefs can help explain anger problems and aggressiveness and that the modification of metacognitive processes could improve therapeutic interventions. We also provided evidence that validates and supports the usage of the Spanish version of the anger-infused Ultimatum Game to generate anger and aggressive responses.

Public Significance Statement

This study provides new evidence supporting the metacognitive model in anger and aggression. People who hold dysfunctional metacognitive beliefs experience higher levels of anger, both when assessed by self-report and induced experimentally, and report greater use of different forms of aggressive behavior. Novel procedures and interventions aimed at modifying these metacognitive beliefs might offer new pathways for treating dysregulated or excessive anger and aggression.

Keywords: metacognitive beliefs, anger, aggression, ultimatum game, rumination

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Anger evolved as an emotional response to potential threat, often aroused during interpersonal situations involving unfair treatment and provocations (Gilam & Hendler, 2015; Izard, 1977). Although anger is neither necessary nor sufficient for aggression, it impels aggressive behavior, particularly when its intensity overrides regulatory control mechanisms (Anderson & Bushman, 2002). Thus, despite its adaptative role, intense anger is prevalent across a wide range of psychopathologies (e.g., Novaco, 2010), violent behaviors

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(e.g., Novaco, 2011), and physical health problems (e.g., Mostofsky et al., 2014). This emphasizes the need for better understanding dysregulated anger and its association with aggression.

Based on the General Aggression Model (Anderson & Bushman, 2002; DeWall et al., 2011), highly aroused emotional states (such as anger) and how they are regulated are factors closely implicated in aggression. According to this model, individuals who are unable to manage strong negative emotions may be overwhelmed by those emotions during appraisal and decision-making processes and therefore generate a smaller range of responses, most of which are related to their affective state (e.g., aggressive responses when they feel angry). There is evidence linking the use of maladaptive strategies to regulate negative emotions with more frequent aggressive behavior (for a systematic review, see Navas-Casado et al., 2023), especially when considering angry rumination. Rumination after an anger-inducing provocation increases angry feelings and aggressive thoughts and intensifies arousal, which cause an individual to deploy more effort to self-regulate their internal state, resulting in the consumption of cognitive resources (Denson et al., 2006, 2013). Indeed, a substantial body of empirical evidence suggests that angry rumination is associated with higher levels of anger (e.g., Pedersen et al., 2011; Rusting & Nolen-Hoeksema, 1998) and aggression (e.g., Bushman et al., 2005; García-Sancho, Salguero, & Fernández-Berrocal, 2016; Navas-Casado et al., 2023). An intriguing question that arises is why some people tend to use maladaptive emotion regulation strategies, such as angry rumination, despite its negative effects.

According to the metacognitive model (Wells, 2019; Wells & Matthews, 1996), rumination is dependent on stable beliefs people have about their own cognitive system and coping strategies, termed *metacognitive beliefs*. These include positive beliefs about the utility of repetitive thinking (e.g., "Rumination will lead to answers"), negative beliefs about the uncontrollability or danger of repetitive thinking (e.g., "Worrying is uncontrollable"), and other beliefs about thinking, such as the need to control thoughts (e.g., "If I could not control my thoughts, I would not be able to function"). Metacognitive beliefs guide the selection and continuous maintenance of perseverative thinking when responding to and monitoring potential threats, which in turn increases and maintains emotional distress.

Dysfunctional metacognitive beliefs are seen as a transdiagnostic factor of psychopathology (Wells, 2019), and accumulated evidence suggests they are relevant to maladaptive strategies (e.g., Cano-López et al., 2024; Ramos-Cejudo et al., 2013; Salguero et al., 2019, 2021) and psychological disorders (Cano-López et al., 2022; Sun et al., 2017; Wells, 2019). Furthermore, of the different metacognitive beliefs, negative beliefs about uncontrollability and danger are most strongly associated with maladaptive regulation strategies and clinical symptoms (Cano-López et al., 2022; Salguero & Ramos-Cejudo, 2023). Negative beliefs seem to lead to a pervasive threat of internal processes (e.g., rumination), thus enhancing emotional distress and interfering with effective control (Wells, 2019).

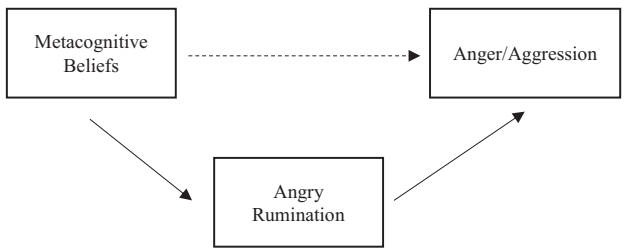
People having higher dysfunctional metacognitive beliefs are also more likely to ruminate over anger and, in turn, to experience higher levels of anger and act aggressively (Salguero et al., 2020). There is some evidence indicating positive associations between metacognitive beliefs (namely, positive, negative, and need for control thinking beliefs) and levels of anger and angry rumination from community samples (Caselli et al., 2017; Salguero et al., 2020) and samples of participants with anger-control problems (Moeller, 2016; Simpson & Papageorgiou, 2003). Also, a few studies have examined the associations between metacognitive beliefs and different types of aggressiveness, such as trait displaced (Salguero et al., 2020) and driver aggression (Love et al., 2022), showing that angry rumination mediates the associations between metacognitive beliefs and the tendency to use these aggressive behaviors. While this evidence is promising, there are still gaps in the literature. On the one hand, previous studies have focused only on some forms of aggression (displaced, driver aggression), while other relevant ones (such as indirect aggression or physical and verbal aggression) remain unexplored; on the other hand, those studies relied exclusively on self-report measures, and there are no studies eliciting anger and aggression experimentally.

In this study, we addressed these gaps by examining the associations of metacognitive beliefs and angry rumination with anger levels and aggression using a multimethod approach. First, we used self-reports to measure anger and different forms of aggressiveness: physical, verbal, indirect, and displaced. Second, we used a reliable and validated social decision-making paradigm for the induction and assessment of anger and reactive aggression, the anger-infused Ultimatum Game (aiUG; Gilam et al., 2018, 2019; Gröndal et al., 2024; Summerell et al., 2024). We thus generated a Spanish version of the aiUG and examined its utility in inducing anger and reactive aggressive responses.

We hypothesized that dysfunctional metacognitive beliefs and angry rumination will be positively associated with higher levels of anger (Hypothesis 1) and with different forms of aggressive behaviors (Hypothesis 2) as assessed through self-report and experimental assessments. Third, as per the different metacognitive beliefs, we expect that negative beliefs will be the metacognitive belief most strongly associated with angry rumination, anger levels, and aggression (Hypothesis 3). Fourth, we explored the hypothesis that angry rumination would statistically mediate the associations between metacognitive beliefs and anger levels and aggressive behaviors (Hypothesis 4), again across both self-report and experimental assessments; see Figure 1. Finally, we analyzed the associations between aiUG-related outcomes and self-report measures of anger (anger levels in the past days and trait anger) and aggressiveness (physical, verbal, indirect, and displaced). Some previous studies have found significant associations between trait anger and aiUG outcomes (Gilam et al., 2019; Gröndal et al., 2024) so we expected to find these associations with the Spanish aiUG as well. As for trait aggression, given the scarcity of previous findings, we investigated these associations in an exploratory manner.

Figure 1

Mediation Model of the Effects of Metacognitive Beliefs on Anger and Aggression Through Angry Rumination



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Method

Participants

A total sample of 222 university students (81.5% female, 16.7% male, and 0.9% other), ranging from 18 to 57 years old ($M = 20.42$, $SD = 5.62$), completed self-report measures of metacognitive beliefs, angry rumination, anger levels, and aggressiveness. Of them, a subsample of 108 participants (82.4% female, 16.7% male, and 0.9% other), with age ranging from 18 to 57 years ($M = 20.11$, $SD = 7.05$), completed the aiUG and a self-reported measure of trait anger. From these 108 participants, 103 participants (81.6% female, 17.5% male, and 1% other) had valid data for both self-report and aiUG measures.

Self-Report Measures

Physical and verbal aggression was measured with the Aggression Questionnaire (Buss & Perry, 1992). It is a 29-item self-report questionnaire that measures trait aggression on a 5-point scale, ranging from 1 = *extremely uncharacteristic* to 5 = *extremely characteristic*. The Aggression Questionnaire has four subscales: Physical Aggression, Verbal Aggression, Anger, and Hostility. In this study, we only used the Physical (e.g., "Given enough provocation, I may hit another person") and Verbal (e.g., "When people annoy me, I may tell them what I think of them") subscales. Psychometric properties of the Aggression Questionnaire are appropriate in both the original (Buss & Perry, 1992) and the Spanish version (Rodríguez et al., 2002).

Indirect aggression was assessed with the Indirect Aggression Scale (Forrest et al., 2005). The Indirect Aggression Scale evaluates indirect aggression using 25 items which are rated using a 5-point Likert scale, ranging from 1 = *never do this* to 5 = *do this regularly*. There are two versions (aggressor and target), which provide an indication of an individual's tendency to practice or suffer indirect aggression. We used the aggressor version (e.g., Talked about them behind their back). All items of the original aggressor version of the scale demonstrated internal consistency (Forrest et al., 2005). The Spanish aggressor version also showed good psychometric properties (Anguiano-Carrasco & Vigil-Colet, 2011).

Displaced aggression was assessed with the Displaced Aggression Questionnaire (Denson et al., 2006). This is a 31-item self-report questionnaire that assesses three dimensions of aggression across three subscales: Angry Rumination, Revenge Planning, and Displaced Aggression. Participants are asked to rate each item on a 7-point Likert scale, where 1 = *extremely uncharacteristic of me* and 7 = *describes me very well*. In this study, we only used the Displaced Aggression subscale (e.g., "I take my anger out on innocent others"), with higher scores indicating a greater tendency to engage in displaced aggression actions, that is, to aggresses against a seemingly innocent target when provoked by the original provocateur. The Displaced Aggression Questionnaire has demonstrated good validity and internal reliability in the original (Denson et al., 2006) and Spanish version (García-Sancho, Salguero, & Vasquez, 2016).

Angry rumination was assessed with the Anger Rumination Scale (Sukhodolsky et al., 2001). This is a 19-item self-report questionnaire that has been found to reliably assess four components of anger rumination: angry afterthoughts (e.g., "After an argument is over, I keep fighting with this person in my imagination"), thoughts of revenge (e.g., "I have day dreams and fantasies of violent nature"), angry memories (e.g., "I feel angry about certain things in my life"), and understanding of causes (e.g., "I analyze events that make me angry"). Participants rate each item on a 4-point scale, ranging from 1 = *almost never* to 4 = *almost always*. Anger Rumination Scale scores range from 19 to 76 points, and higher scores indicate greater anger rumination. The original (Sukhodolsky et al., 2001) and Spanish (Ramos-Cejudo et al., 2017) versions of the Anger Rumination Scale have demonstrated good reliability and validity.

Anger levels were assessed using the Patient-Reported Outcomes Measurement Information System, Anger domain (Cella et al., 2007). We used a five-item version that appraises angry feelings (e.g., "I felt like I was ready to explode") in the past 7 days. Items are rated on a 5-point scale from 1 = *never* to 5 = *always*, where higher scores (in a range from 5 to 25) indicate higher anger. The Patient-Reported Outcomes Measurement Information System, Anger domain item bank has demonstrated validity and consistency in both the original and the Spanish version (Cella et al., 2007).

Trait anger was measured using the State-Trait Anger Expression Inventory-2 (Spielberger, 1999). The State-Trait Anger Expression Inventory-2 is a widely used 57-item questionnaire, split among three factors: Trait Anger (10 items), State Anger (15 items), and Anger Expression and Control (32 items). Items are rated on a 4-point scale from 1 = *completely disagree* to 4 = *completely agree*. In this study, we only used the Trait Anger subscale (e.g., "I am a hothead person"), with scores ranging from 10 to 40, where higher scores indicate greater trait anger. The State-Trait Anger Expression Inventory-2 has been well validated (Spielberger, 1999), and the Spanish version has shown adequate psychometric properties with internal consistency (Miguel-Tobal et al., 2001).

Metacognitive beliefs were measured with the Meta-Cognitions Questionnaire-30 (MCQ-30; Wells & Cartwright-Hatton, 2004). This measure comprises five subscales with a total of 30 items (six items each subscale). Responses to each item on the MCQ-30 are on a 4-point Likert scale, from 1 = *do not agree* to 4 = *strongly agree*. MCQ-30 scores range from 30 to 120 points (6 to 24 for each subscale), and higher scores indicate greater maladaptive metacognitive beliefs. The five subscales measure the following dimensions: (a) positive beliefs about worry, (b) negative beliefs of uncontrollability and danger, (c) cognitive confidence, (d) need to control thoughts, and (e) cognitive self-consciousness. In this study, we only included the Positive (e.g., "worrying helps me cope"), Negative (e.g., "when I start worrying, I cannot stop"), and Need to control thought (e.g., "not being able to control my thoughts is a sign of weakness") subscales. The MCQ has been found to be a reliable measure (Wells & Cartwright-Hatton, 2004) with the Spanish version (Ramos-Cejudo et al., 2013) showing the same factor structure, good reliability, validity, and internal consistency.

aiUG

The aiUG, based on the Ultimatum Game, is a psychometrically reliable and valid social decision-making paradigm to induce and measure anger and reactive aggressive behavior (Gilam et al., 2018, 2019; Gröndal et al., 2024; Summerell et al., 2024). In this task, a proposer decides how to split a sum of money between himself and a responder (the participant), who then decides whether to accept or reject the offer; thereby both players gain or lose the allocated money, respectively. Standard UG studies previously demonstrated that as offers become more unfair, they induce more anger and decrease the probability that responders accept (e.g.,

Dunn et al., 2012; Paz et al., 2017). Moreover, rejecting an unfair offer is associated with aggressive retribution (e.g., Crockett et al., 2013; White et al., 2016), whereas accepting unfair offers relates to downregulating the anger associated with such offers (e.g., Grecucci et al., 2013; Wang et al., 2011). A relevant innovation in the aiUG is that it generates a more genuine anger experience by means of interpersonal provocations embedded as short-written messages congruent with the level of offer unfairness: Fair offers included nonconfrontational messages (e.g., Let us split it equally), while medium and unfair offers included mild (e.g., That is the offer, deal with it) and intense (e.g., Come on, loser!!!) provocations, respectively. The aiUG has showed sound test–retest reliability and convergent validity and led to significantly stronger associations with anger and reactive aggression compared with the standard UG (Gilam et al., 2019).

We used a Spanish version of the aiUG, which was developed using the following procedure. First, we carried out a *back translation procedure* to translate the original written messages accompanying the offers into Spanish. We also include 11 new written messages adapted to the Spanish cultural context corresponding to the different levels of unfairness; thus, we had an initial set of 84 messages (each with a maximum of 35 characters in length). Second, we carried out two studies to assess the level of anger induced by each message. In the first, 20 participants (80% female, 20% male), aged 18–61 years ($M = 29.9$, $SD = 11.61$), were asked to rate (on the same 0 to 10 scale described above) the level of anger each message made them feel. The second was an aiUG pilot study in which 17 participants (58.8% female, 41.2% male), aged 18–42 years ($M = 21.12$, $SD = 5.62$), were asked after completing the task to rate (using the same 0–10 scale) the level of anger they felt about each message. Based on the results of those studies, we selected the final set of 24 messages that showed a better match with the level of anger they were intended to induce (with eight messages in each of the low, medium, and high anger levels categories; see Supplemental Table S1). In the Spanish aiUG, the amount of each offer was of €40, and all offers were predetermined to include eight fair offers (responder is offered 40%–50% of the total sum), eight medium offers (25%–35% of the total), and eight unfair offers (10%–20% of the total). Offers were accompanied by the initials of putative proposers to avoid potential effects related to gender or names and included the short-written messages congruent with the offer type: fair, medium and unfair. Within each set and each offer type, coupling of offers and messages was randomized across participants, as was the order of presented offers. We used the total gain in the aiUG and the percentage of accepted unfair offers as measures of reactive aggressive behavior. On the other hand, we used the increase in self-reported anger elicited by the task and the level of anger in unfair offers as measures of induced anger.

General Procedure

Participants were gathered at convenience from two different universities in Spain (University of Málaga and University of Córdoba). They were approached during university lessons and asked to take part in a study aiming to examine emotions and their regulation that consisted of two parts: (a) complete informed consent and self-reported measures electronically and (b) complete a laboratory session. Participants had to be 18 years old or above and be able to read Spanish. Participation was compensated with class credit, and participants were informed that they also would have the possibility to win an economic reward of €40. They were verbally informed about the study, which was voluntary, anonymous, and confidential. For those that agreed to participate ($N = 222$), self-report measures were first administrated electronically, with instructions given in writing, and completed individually (the survey lasted approximately 20 min). Then, this sample was divided into two subsamples, which corresponded to the students at each university. One of them (participants from University of Málaga) completed the aiUG ($N = 108$), whereas the other took part in another study whose data have not yet been published. We used this sample to examine the descriptive statistics of the aiUG and its effects on the generation of anger and aggression. Finally, of the 108 participants who completed the aiUG, five individuals had missing data on the self-report measures, leaving 103 participants with valid data on the self-report measures and the aiUG; this sample was used to examine associations between metacognitive beliefs, angry rumination, and self-reported anger and aggressiveness with aiUG outcomes. Ethical approval was obtained for the study (Ref. 107-2021-H). Each participant completed the aiUG individually, in one session, following the same procedures as previously reported studies (Gilam et al., 2018, 2019); see the Supplemental Material for more details.

Data Analytic Plan

We used IBM's SPSS, Version 28, to compute descriptive statistics, internal consistency (Cronbach α), and correlations and JASP (Version 0.18.3) to perform mediation analyses. First, we analyzed Pearson´s correlations between metacognitive beliefs and angry rumination with measures of anger levels (Hypothesis 1) and aggression (Hypothesis 2), using both self-report data ($N = 222$) and experimentally induced aggression via the aiUG ($N = 103$). Having the higher number of correlations examined, we used the Benjamini–Hochberg false discovery rate (FDR) procedure at $q = 0.05$ (Benjamini & Hochberg, 1995) to control for multiple comparisons. We also used partial correlations to control for the effects of age and gender when these sociodemographic factors were significantly associated with outcomes. To examine our third hypothesis regarding the strongest associations between negative metacognitive beliefs (compared with positive beliefs and need to control thoughts) with angry rumination, anger levels, and aggression, we performed Fisher's z test. To examine our fourth hypothesis, we performed different mediation analyses. We examined total, direct, and indirect effects of metacognitive beliefs on anger and aggression measures—both self-reported ($N = 222$) and experimentally induced ($N = 103$)—via angry rumination. We performed separated mediation analyses for each metacognitive belief, including in the same model the metacognitive belief (as X variable), angry rumination (as the mediator), and those anger and aggression measures with which the metacognitive belief was significantly correlated (as the outcome variable). Mediation analyses were performed with the calculations of a bootstrap confidence interval (CI) with 5,000 replications. Percentile bootstrapping was used to derive path coefficients and corresponding 95% CIs for total, direct, and indirect effects. Finally, using the subsample of participant who completed the Spanish version of the aiUG ($N = 108$), we examined the effect of this task to induce anger and aggressive behavior. We analyzed different outcomes: (a) the effect of the task on participants´ decisions to accept or reject the aiUG offers, (b) the perceived level of fairness of the different offers (fair, medium, and unfair), (c) the effect of the offers (fair, medium, and unfair) on emotions (anger, fear, sadness, and happiness), and (d) the effect of the

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task on inducing different emotions (anger, fear, sadness, and happiness). We examined these effects after controlling for motivation and perceived value of money (see the Supplemental Material). We also examined the correlations between the aiUG outcomes and self-reported aggressive behavior, angry rumination, anger levels, in past days, and trait anger.

Results

Associations Between Metacognitive Beliefs, Angry Rumination, and Anger

Descriptive statistics, reliability, and zero-order correlation coefficients for the self-report measures in the total sample are shown in Table 1. We found positive and significant correlations between the total score of metacognitive beliefs and higher levels of angry rumination with self-reported anger. Specifically, while all three metacognitive beliefs assessed correlated significantly with angry rumination, negative beliefs and the need to control thoughts correlated significantly with anger levels (but not positive beliefs). Table 2 reports on the associations between metacognitive beliefs and angry rumination with induced levels of anger in the aiUG. Negative beliefs, need to control thought, and angry rumination were positively and significantly correlated with a higher level of anger at unfair offers. Positive beliefs were also significantly correlated; however, this association did not remain significant after FDR correction. No significant correlations were found between metacognitive beliefs or angry rumination and the difference in anger from pre–post task. Finally, results remained unchanged when age and gender were controlled for.

Associations Between Metacognitive Beliefs, Angry Rumination, and Aggression

Regarding trait aggression (see Table 1), while positive beliefs, the need to control thoughts, and angry rumination correlated significantly with all forms, negative beliefs did so only with displaced aggression. No significant correlations were found between metacognitive beliefs or angry rumination and aggression measures in the aiUG (see Table 2). Again, controlling for age and gender did not affect the results.

Differences in the Magnitude of Associations Between Types of Metacognitive Beliefs and Angry Rumination, Anger Levels, and Aggression

Fisher's z test showed some significant differences in the magnitude of correlations between metacognitive beliefs and self-reported anger and aggressiveness. Specifically, we found that, compared with positive metacognitive beliefs, the correlations between negative beliefs and angry rumination ($z = 2.16$; $p = .01$) and anger levels ($z = 2.85$; $p = .002$) were significantly greater in magnitude. Furthermore, the correlations between the total MCQ score and displaced aggression were significantly greater compared with physical ($z = 2.78$; $p = .003$), verbal ($z = 2.67$; $p = .004$), and indirect ($z = 2.12$; $p = .02$) aggressiveness.

Mediation Analyses

Table 3 shows the total, direct, and indirect effects of metacognitive beliefs on self-reported measures of anger and aggressiveness through angry rumination. When examining the indirect effects, it can be observed that the effect of metacognitive beliefs on these outcomes is statistically mediated by angry rumination in all cases and that this mediation was generally total (with only some exceptions). Table 4 presents the total, direct, and indirect effects of metacognitive beliefs on induced anger in the aiUG through angry rumination. As observed with self-report measures in the total sample, an inspection of indirect effect shows that angry rumination statistically mediated the effect of metacognitive beliefs on task-induced anger; furthermore, this mediation was total in all cases.

Effects of the Spanish aiUG to Induce Anger and Aggression

Descriptive statistics of the aiUG outcomes are shown in Supplemental Table S2. The overall results of the Spanish aiUG are displayed in Figure 2, and detailed results are described in the Supplemental Material. Replicating previous findings (Gilam et al., 2018; Gröndal et al., 2024), we found that the aiUG led to a decrease in acceptance rates and perceived fairness and increased anger as the unfairness of the offers increased (see Figure 2A–2C). Similarly, the task also had an effect in increasing the reported anger, with

Table 1

Mean, Standard Deviation, Reliability, and Correlations Between Self-Report Measures in the Total Sample (N = 222)

Outcome	1	2	3	4	5	6	7	8	9	10
1. Physical aggression	—									
2. Verbal aggression	.42***	—								
3. Indirect aggression	.43***	.40***	—							
4. Displaced aggression	.35***	.35***	.17*	—						
5. Angry rumination	.37***	.47***	.26***	.47***	—					
6. Anger levels	.28***	.31***	.13	.37***	.50***	—				
7. Positive metacognitive beliefs	.21***	.30***	.21**	.26***	.33***	.07	—			
8. Negative metacognitive beliefs	.04	.10	.05	.36***	.50***	.39***	.30***	—		
9. Need of control thoughts	.17*	.18**	.20**	.36***	.44***	.31***	.39***	.60***	—	
10. MCQ total	.18**	.24***	.19**	.42***	.54***	.32***	.73***	.82***	.81***	—
M	1.91	2.59	12.65	29.85	9.02	14.08	11.84	14.26	11.98	38.08
SD	0.59	0.81	3.88	12.07	2.25	3.98	4.47	4.65	3.53	9.92
α	.74	.82	.85	.92	.92	.83	.89	.85	.69	.88

Note. MCQ total = total score of the Meta-Cognitions Questionnaire.
* $p < .05$. ** $p < .01$. *** $p < .001$.

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Table 2
Associations Between Metacognitive Beliefs and Angry Rumination With Anger-Infused Ultimatum Game Outcomes (N = 103)

Outcome	Positive metacognitive belief	Negative metacognitive belief	Need of control thought	MCQ total	Angry rumination
Total gain	.01	−.04	.06	.01	−.03
Percentage of acceptance in unfair offers	−.07	−.16	−.15	−.16	−.12
Difference in anger pre–post task	.09	−.01	.01	.04	.03
Anger in unfair offers	.23*	.26**	.29**	.32***	.34***

Note. MCQ total = total score of the Meta-Cognitions Questionnaire.
* $p < .05$. ** $p < .01$. *** $p < .001$.

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participants reporting higher levels of anger after the task compared with anger before the task (see Figure 2D). Supplemental Table S3 shows the associations between emotional and behavioral outcomes of the aiUG and self-reported levels of aggressive behaviors, angry rumination, anger levels, and trait anger. We found that acceptance rate was significantly and negatively associated with higher levels of self-reported displaced aggression and anger, while the difference in anger (between pre- and post-task) significantly and negatively correlated with self-reported indirect aggression; however, none of these associations remained significant after FDR correction. Finally, higher levels of anger at unfair offers were significantly and positively correlated with self-reported verbal aggression, anger rumination, anger levels, and trait anger; we also found significant associations with displaced aggression, but it did not remain after FDR correction.

Discussion

In this study, we addressed two main gaps found in the literature regarding the role of metacognitive beliefs in anger and aggression. First, we examined different forms of aggressiveness previously not considered (physical, verbal, and indirect); second, we examined this role in anger and aggression as induced experimentally. To this end, we generated a Spanish version of the aiUG.

Our results partially supported our first and second hypotheses that dysfunctional metacognitive beliefs will be positively associated with higher levels of anger and with different forms of aggressive behaviors assessed both by self-report and experimentally. Findings were more consistent for anger levels, as dysfunctional metacognitive beliefs (with the exception of positive beliefs), as well as angry rumination, were associated with higher levels of self-reported anger and with higher anger at unfair offers in the aiUG. These results corroborate previous self-report studies (Caselli et al., 2017; Love et al., 2022; Moeller, 2016; Salguero et al., 2020) and extend them by showing that metacognitive beliefs are also linked to greater anger reactions to experimentally induced anger in socially unfair situations, such as those generated by the aiUG.

Regarding aggressive behaviors, we found that metacognitive beliefs and angry rumination were associated with different forms of self-reported aggressiveness. This result replicates those found by Salguero et al. (2020) and Love et al. (2022) on displaced and driver aggression and extends them by showing this association with other relevant self-reported aggressive behaviors previously not assessed (e.g., physical, verbal, and indirect). Considering specific metacognitive beliefs, we found that while positive beliefs and the need to control thoughts were significantly related to all forms of aggressiveness, negative beliefs were only correlated with displaced aggression. In tandem, correlations between metacognitive beliefs and aggressiveness were significantly greater in magnitude for displaced aggression. We only found a

Table 3
Angry Rumination as a Mediator of the Association Between Metacognitive Beliefs and Anger Levels and Trait Aggression in the Total Sample (N = 222)

X variable	Outcome	Total effect [β 95% CI]	Direct effect [β 95% CI]	Indirect effect [β 95% CI]
Positive metacognitive beliefs	Physical aggression	.21 [0.08, 0.36]**	.10 [−0.02, 0.24]	.10 [0.05, 0.19]***
	Verbal aggression	.29 [0.14, 0.43]***	.16 [0.03, 0.30]**	.13 [0.07, 0.21]***
	Indirect aggression	.21 [0.07, 0.40]**	.14 [0.01, 0.32]*	.07 [0.02, 0.14]**
	Displaced aggression	.26 [0.13, 0.40]***	.12 [0.01, 0.25]	.14 [0.08, 0.23]***
Negative metacognitive beliefs	Displaced aggression	.36 [0.23, 0.50]***	.17 [0.02, 0.32]*	.20 [0.12, 0.30]***
	Anger levels	.39 [0.26, 0.51]***	.19 [0.05, 0.31]**	.20 [0.12, 0.30]***
Need to control thoughts	Physical aggression	.17 [0.02, 0.31]*	.01 [−0.12, 0.15]	.16 [0.09, 0.25]***
	Verbal aggression	.18 [0.05, 0.32]**	−.02 [−0.16, 0.13]	.20 [0.12, 0.29]***
	Indirect aggression	.20 [0.05, 0.39]**	.11 [−0.04, 0.29]	.09 [0.03, 0.17]**
	Displaced aggression	.36 [0.23, 0.48]***	.18 [0.04, 0.31]*	.18 [0.10, 0.27]***
	Anger levels	.31 [0.20, 0.43]***	.12 [0.01, 0.23]	.19 [0.12, 0.30]***

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Angry Rumination as a Mediator of the Association Between Metacognitive Beliefs and Anger Levels at Unfair Offers in the Anger-Infused Ultimatum Game (N = 103)

X variable	Outcome	Total effect [β 95% CI]	Direct effect [β 95% CI]	Indirect effect [β 95% CI]
Positive metacognitive beliefs	Anger in unfair offers	.23 [0.04, 0.42]*	.12 [−0.08, 0.33]	.12 [0.04, 0.25]*
Negative metacognitive beliefs	Anger in unfair offers	.26 [0.08, 0.43]**	.11 [−0.13, 0.34]	.15 [0.01, 0.31]*
Need to control thoughts	Anger in unfair offers	.29 [0.11, 0.49]**	.16 [−0.04, 0.41]	.13 [0.02, 0.24]*

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$.

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trend toward significance in the associations between metacognitive beliefs and angry rumination with aggression in the aiUG, indicating potential small effects, if any.

Thus, associations between metacognitive beliefs and aggression were more consistent when aggression was self-reported than when it was experimentally generated. One explanation of this finding is that these two assessment methods may provide different information about aggression. Self-reported measures capture the tendency of individuals to use different aggressive behaviors (physical, verbal, indirect, and displaced) in everyday life, whereas aiUG is a more context-specific assessment of reactive aggression in a socially unfair situation. At this respect, the correlations between self-reported aggression and rejection behavior in the current sample were nonsignificant, a result similar to the one found in a previous study (Summerell et al., 2024). Future research should examine the extent to which metacognitive beliefs can influence aggressive behavior across other aggression paradigms.

We found only some support for our third hypothesis. The metacognitive model implies that negative beliefs are of great relevance in psychological disorders because they lead to omnipresent threat from internal processes (e.g., rumination), enhancing emotional distress and interfering with effective control (Wells, 2019). Previous studies have found robust evidence in this sense (e.g., Cano-López et al., 2022; Salguero & Ramos-Cejudo, 2023). In line with this, we found that the magnitude of the correlations between negative beliefs and self-reported anger and angry rumination was significantly higher compared with positive metacognitive beliefs. However, it was not the case when compared with the need to control thoughts or when anger was experimentally generated. Moreover, as mentioned above, and contrary to our hypothesis, negative beliefs only correlated significantly with self-reported displaced aggression. It is possible that negative beliefs are especially relevant at understanding less direct forms of aggression, such as displaced aggression, where angry rumination is also more implicated (Bushman et al., 2005). In this sense, we found moderate correlations between angry rumination and displaced aggression in our results.

Finally, we found support for our fourth hypothesis. Previous studies found that angry rumination mediates the associations between metacognitive beliefs and anger and trait aggression (Caselli et al., 2017; Love et al., 2022; Salguero et al., 2020). Consistent with these findings, our mediation analyses showed that, in cases where metacognitive beliefs were associated with self-reported anger and aggressiveness, this association was statistically mediated by angry rumination. Furthermore, this mediating effect was also found when examining the associations between metacognitive beliefs and anger induced by the aiUG.

Taken together, our results suggest that the metacognitive model can contribute to a better understanding of anger and aggressive behavior. According to this model (Salguero et al., 2020; Wells, 2019), dysfunctional metacognitive beliefs lead people to stay focused on their internal states (e.g., anger) and perseverative thinking (e.g., angry rumination), preventing the disengagement from them and, thus, promoting its maintenance. These angry feelings are challenging to manage and may overwhelm individuals during appraisal and decision-making processes, therefore leading to aggressive behaviors, impelled by their affective state. Our findings are in line with this idea.

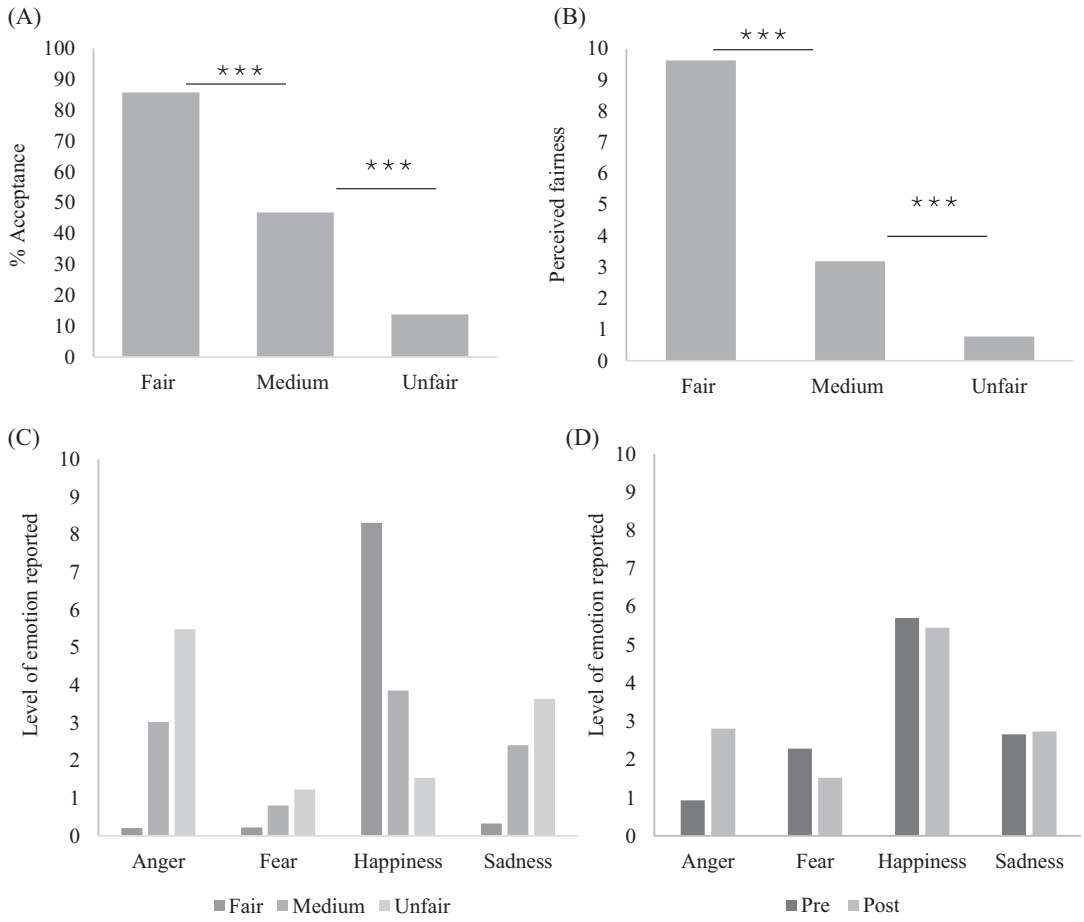
We provide evidence that the Spanish version of the aiUG seems to be a valid paradigm to generate anger and elicit aggressive responses. As expected, and in line with previous studies (Gilam et al., 2018, 2019; Gröndal et al., 2024), as offers reflected a more unequal distribution of money, participants evaluated them as more unfair and more angering, leading to higher levels of rejection rates. Moreover, the task led to an increase of anger levels from pre to post. In further support of its relevance to anger and aggression, trait anger was associated with higher levels of anger at unfair offers. Nevertheless, we failed to replicate a significant correlation of trait anger with total gain and percentage of acceptance at unfair offers as found in previous studies (Gilam et al., 2019; Gröndal et al., 2024). Similarly, although anger levels in the past days (as assessed by the Patient-Reported Outcomes Measurement Information System) were associated with generated anger (at unfair offers), they were not associated with total gain or the percentage of acceptance (correlations did not remain significant after control for multiple comparison). It seems that both trait and state anger are more implicated in reacting with anger in the aiUG than in aggressive reaction, at least in our sample. Regarding self-reported aggression, none of the different forms of aggressiveness assessed were significantly correlated with the aiUG aggression outcomes after correction for multiple comparison. As mentioned above, this lack of significant correlation between self-reported aggression and aiUG aggressive behavior has also been found previously (Summerell et al., 2024). As these authors argue, more research is needed to further establish the validity of the aiUG as an aggression paradigm even though it elicited anger in our current and previous experiments (e.g., Gilam et al., 2018, 2019).

Limitations

Several limitations must be considered before generalizing our findings. First, the sample consisted mainly of young female university students. Second, we assessed metacognitive beliefs with the MCQ-30, which is a measure of metacognitive beliefs that focuses

Figure 2

Effects of the Spanish aiUG to Induce Anger and Aggression



Note. Panel A: Acceptance rate (%) per offer type, indicating a decreasing rate of acceptance as offers become unfair ($ps < .001$). Panel B: Levels of fairness perceived per offer type, indicating that the level of fairness decreases as offers become unfair ($ps < .001$). Panel C: Self-reported rating of the emotion categories (anger, fear, sadness, and happiness) in response to the different offer types in the aiUG (fair, medium, and unfair), indicating that the type of offers had a significant effect on emotions, with higher levels of anger, fear, and sadness and lower levels of happiness in unfair and medium offers compared with fair offers ($ps < .001$). Panel D: Change in self-reported rating of state emotion categories from pre- to post-aiUG, indicating an increase in anger ($p < .001$) and a decrease in fear ($p < .01$). aiUG = anger-infused Ultimatum Game.
*** $p < .001$.

on worry but does not assess the specific content of anger (e.g., anger rumination). Third, we extend previous studies by examining the role of metacognitive beliefs in experimentally generated anger and aggression; however, our results from cross-sectional analyses preclude attributing causality.

Future Research Directions

Future studies should corroborate our results in more balanced samples in terms of gender and age range. Regarding gender, previous studies have reported significant associations between metacognitive beliefs and anger levels in predominantly female samples (Caselli et al., 2017; Salguero et al., 2020), as wells as in a sample composed exclusively of male (Moeller, 2016). Similarly, the limited research examining associations with trait aggressiveness has varied in terms of gender composition, reporting associations with displaced aggression in a predominantly female sample (Salguero et al., 2020), and driver aggression in a sample with a more balanced gender distribution (Love et al., 2022). Together, these findings suggest that the relationship between metacognitive beliefs and anger and aggressiveness may be present in both men and women; however, this assumption requires further investigation, particularly through the examination of different forms of aggression. In addition to improving gender balance, our results also encouraged the examination of the role of metacognitive beliefs in anger and aggression in different populations, such as adolescents or clinical populations. Regarding the measure of metacognitive beliefs, there are content-specific measures (e.g., focused on depressive rumination) that have been shown to be useful (see Cano-López et al., 2021). In this sense, future studies could benefit from the development of new measures to assess the metacognitive processing

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of anger (e.g., Moeller, 2016). Finally, prospective designs (e.g., longitudinal or diary studies) are necessary to examine the predictive value of metacognitive beliefs and corroborate the mediation model examined here. Also, future research should examine whether the experimental manipulation of metacognitive beliefs (for an experimental paradigm, see Capobianco et al., 2018) influences anger and aggressive behavior.

Clinical Implications

Our results have clinical implications. Metacognitive therapy (Wells, 2009) includes novel procedures and interventions aimed to promote metacognitive mode of processing and modify metacognitive beliefs. It includes exercises such as detached mindfulness and attention training and techniques such as cognitive restructuring and behavioral experiments, which focus on reducing dysfunctional metacognitive beliefs (Wells, 2009). This therapy is efficacious for anxiety and depression (Normann et al., 2014), and some studies have reported that it is more effective at reducing these symptoms compared with other treatment, such as cognitive behavior therapy (e.g., Callesen et al., 2020; Nordahl et al., 2018). Furthermore, there is evidence supporting the idea that metacognitive beliefs are a mechanism for change in treatment (Pukstad et al., 2025). However, the efficacy of metacognitive therapy for dysregulated or excessive anger and aggressive has not been tested. Our results and previous findings suggest that metacognitive therapy might be a beneficial intervention for these conditions, leading to a reduction of metacognitive beliefs and, in turn, angry rumination, but this requires further investigation.

Conclusions

In sum, the present findings provide new evidence supporting the metacognitive model by showing that metacognitive beliefs are associated with higher levels of anger, both when assessed by self-report and experimentally, and with different forms of self-reported aggressive behavior. In addition, we found that the Spanish aiUG is a useful paradigm for experimentally generating anger and aggressive behavior.

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