Journal Website

Article history:
Received 01 February 2026
Revised 27 May 2026
Accepted 06 June 2026
Initial Publication 15 June 2026
Final Publication 01 July 2026

International Journal of Education and Cognitive Sciences

Volume 7, Issue 4, pp 1-11

E-ISSN: 3041-8828

A Comparison of Attentional Bias, Interpretation Bias, Metacognition, and Self-Compassion Between Patients with Generalized Anxiety Disorder and Normal Individuals

Zahrasadat. Mirmohammadi[1*]

[1] Department of Psychology, Ar.C., Islamic Azad University, Arak, Iran

*** Corresponding author email address**: Yasna.mob@gmail.com

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Mirmohammadi, Z. (2026). A Comparison of Attentional Bias, Interpretation Bias, Metacognition, and Self-Compassion Between Patients with Generalized Anxiety Disorder and Normal Individuals. *International Journal of Education and Cognitive Sciences, 7*(4), 1-11.
https://doi.org/10.61838/kman.ijecs.384

A B S T R A C T

Purpose: The present study aimed to compare attentional bias, interpretation bias, metacognitive beliefs, and self-compassion between patients diagnosed with Generalized Anxiety Disorder (GAD) and normal individuals.

Methods and Materials: This study employed a causal-comparative research design. The statistical population consisted of patients with Generalized Anxiety Disorder attending psychiatric clinics and counseling centers in Tehran and normal individuals from the general population. A total of 160 participants were selected, including 80 patients diagnosed with GAD and 80 healthy individuals. Participants completed the Dot-Probe Task for attentional bias assessment, the Ambiguous Scenarios Test for interpretation bias, the Metacognitions Questionnaire-30 (MCQ-30), and the Self-Compassion Scale (SCS). Data were analyzed using descriptive statistics and multivariate analysis of variance (MANOVA) in SPSS version 27.

Findings: The results of the multivariate analysis revealed a significant overall difference between patients with GAD and normal individuals on the combined dependent variables, Wilks' $\Lambda = .381$, $F(4,155) = 63.52$, $p < .001$, partial $\eta^2 = .619$. Follow-up univariate analyses demonstrated that patients with GAD reported significantly higher levels of attentional bias, $F(1,158) = 145.73$, $p < .001$, partial $\eta^2 = .480$; interpretation bias, $F(1,158) = 174.82$, $p < .001$, partial $\eta^2 = .525$; and dysfunctional metacognitive beliefs, $F(1,158) = 160.95$, $p < .001$, partial $\eta^2 = .505$, compared with normal individuals. In contrast, normal individuals exhibited significantly higher levels of self-compassion than patients with GAD, $F(1,158) = 228.37$, $p < .001$, partial $\eta^2 = .591$. Among the investigated variables, self-compassion showed the largest effect size, indicating the strongest differentiation between the two groups.

Conclusion: The findings suggest that Generalized Anxiety Disorder is associated with elevated cognitive and metacognitive vulnerabilities, including attentional and interpretation biases and dysfunctional metacognitive beliefs, as well as reduced self-compassion.

Keywords: *Generalized Anxiety Disorder, Attentional Bias, Interpretation Bias, Metacognition, Self-Compassion, Cognitive Biases, Emotional Disorders.*

1. Introduction

Generalized Anxiety Disorder (GAD) is one of the most prevalent and debilitating anxiety disorders and is characterized by excessive, persistent, and uncontrollable worry about a wide range of everyday events and situations. Individuals with this disorder typically experience chronic apprehension, cognitive overactivity, heightened vigilance toward potential threats, emotional distress, and substantial impairments in social, occupational, and interpersonal functioning. Recent epidemiological and clinical investigations have demonstrated that GAD is associated with considerable psychological burden, reduced quality of life, increased healthcare utilization, and elevated risks of comorbid emotional disorders, highlighting its significance as a major public health concern (Freeston, 2023; Lee & Stein, 2022; Li, 2023). Despite advances in the conceptualization and treatment of GAD, the disorder continues to present substantial challenges regarding its etiology, maintenance mechanisms, and treatment response. Contemporary perspectives increasingly emphasize that understanding GAD requires examining the interaction among cognitive biases, metacognitive processes, emotional regulation mechanisms, and self-related psychological constructs rather than focusing solely on symptom manifestations (Antuña-Camblor, Gómez-Salas, et al., 2024; Antuña-Camblor, Péris-Baquero, et al., 2024; Costa et al., 2022). This multidimensional approach has gained support from transdiagnostic models suggesting that emotional disorders share common cognitive and regulatory vulnerabilities that contribute to their onset and persistence (Aguilera-Martín et al., 2021, 2022; González-Blanch et al., 2023).

Among the cognitive mechanisms most frequently implicated in GAD, attentional bias occupies a central position. Attentional bias refers to the tendency to selectively allocate attention toward threat-related information while neglecting neutral or positive stimuli. According to cognitive theories of anxiety, anxious individuals display hypervigilance toward potential threats, which contributes to the activation and maintenance of worry processes. Rather than processing environmental information objectively, individuals with GAD tend to scan their surroundings for signs of danger and uncertainty, thereby reinforcing anxious expectations and perceptions. Research has shown that impaired attentional control and heightened threat monitoring are associated with increased worry severity and emotional dysregulation in anxiety disorders (Stewart, 2021; Yeung et al., 2025). Furthermore, contemporary investigations suggest that attentional processing abnormalities may influence memory retrieval, interpretation of social information, and emotional responses, thereby creating a self-perpetuating cycle of anxiety (Chemis et al., 2025; Tallon et al., 2022). Studies examining anxiety-related cognitive processes have consistently demonstrated that attentional biases contribute significantly to symptom persistence and may represent an important target for psychological interventions aimed at reducing pathological worry and emotional distress (Han et al., 2025; Rawlings et al., 2023).

Another cognitive vulnerability strongly associated with GAD is interpretation bias. Interpretation bias refers to the tendency to interpret ambiguous situations, events, or information in a negative, threatening, or catastrophic manner. Individuals with GAD frequently perceive uncertainty as dangerous and are more likely to generate adverse explanations for situations that could otherwise be interpreted neutrally or positively. This cognitive tendency strengthens worry, increases anticipatory anxiety, and reinforces beliefs about vulnerability to future threats. Cognitive models propose that interpretation bias interacts closely with attentional processes, whereby selective attention to threatening cues increases the likelihood of threat-based interpretations, which subsequently intensify anxiety symptoms. Empirical evidence supports this conceptualization by demonstrating significant associations between worry severity, working memory processes, and negative interpretation tendencies among individuals with GAD (Tallon, 2021; Tallon et al., 2022). Moreover, recent studies suggest that maladaptive interpretation styles contribute not only to anxiety symptoms but also to broader emotional dysfunction, highlighting their role as transdiagnostic cognitive risk factors (Antuña-Camblor, Gómez-Salas, et al., 2024; Antuña-Camblor, Péris-Baquero, et al., 2024). Consequently, examining interpretation bias may provide valuable insight into the cognitive architecture underlying generalized anxiety and its distinction from normal psychological functioning.

In recent years, metacognitive theory has emerged as one of the most influential frameworks for understanding GAD. Unlike traditional cognitive models that emphasize the content of thoughts, metacognitive approaches focus on individuals' beliefs about their thinking processes. According to metacognitive theory, individuals with GAD develop dysfunctional beliefs concerning the usefulness, controllability, and consequences of worry. Positive

E-ISSN: 3041-8828

metacognitive beliefs may lead individuals to perceive worry as beneficial for problem-solving or threat prevention, whereas negative metacognitive beliefs foster perceptions that worry is uncontrollable, dangerous, and harmful. These beliefs contribute to the development of the cognitive attentional syndrome, characterized by persistent worry, threat monitoring, rumination, and maladaptive coping strategies. A growing body of evidence supports the central role of metacognition in emotional disorders and anxiety-related psychopathology (Bhome et al., 2021; Katyal et al., 2023; Kero et al., 2023). Systematic reviews have further demonstrated that dysfunctional metacognitive beliefs are strongly associated with pathological anxiety and may predict symptom severity across diverse clinical populations (Foerster et al., 2025; Sadnicka et al., 2024; Strand & Nordahl, 2024). Experimental research has also shown that modifying maladaptive metacognitive appraisals can reduce worry and improve emotional functioning among individuals characterized by high levels of anxiety and repetitive negative thinking (Ikani et al., 2022; Taylor-Bennett et al., 2024). These findings suggest that metacognition may represent a key differentiating factor between individuals experiencing generalized anxiety and psychologically healthy individuals.

Alongside cognitive and metacognitive mechanisms, increasing attention has been directed toward self-compassion as a protective psychological resource in emotional health. Self-compassion refers to the ability to respond to personal suffering, failure, and distress with kindness, understanding, mindfulness, and a sense of common humanity rather than self-criticism and isolation. Individuals with high self-compassion tend to regulate emotions more effectively, demonstrate greater psychological resilience, and exhibit lower levels of anxiety, depression, and stress. Conversely, deficits in self-compassion have been linked to increased emotional vulnerability, heightened self-judgment, and persistent psychological distress. Recent empirical studies indicate that self-compassion plays a significant role in anxiety disorders, particularly in moderating stress responses and facilitating adaptive emotional regulation (Qi et al., 2025; Zaki et al., 2022). Research comparing self-compassion interventions with mindfulness-based approaches has shown that cultivating self-compassion can improve physiological and psychological responses to stress among individuals with generalized anxiety symptoms (Qi et al., 2025). Similarly, mindfulness-based interventions, which share conceptual overlap with self-compassion, have demonstrated efficacy in reducing anxiety, worry, rumination, and emotional distress across diverse populations (Burgess et al., 2021; Trapani et al., 2024; Wei et al., 2025). These findings suggest that self-compassion may serve as an important protective factor that differentiates healthy individuals from those experiencing chronic anxiety.

The growing emphasis on transdiagnostic and process-oriented models of psychopathology further underscores the importance of examining attentional bias, interpretation bias, metacognition, and self-compassion simultaneously. Contemporary research increasingly recognizes that emotional disorders cannot be adequately understood through isolated symptom-based frameworks. Instead, they emerge from dynamic interactions among cognitive processing styles, self-regulatory capacities, emotional responses, and metacognitive beliefs (Antuña-Camblor, Péris-Baquero, et al., 2024; Mitsea et al., 2023; Södermark, 2024). Advances in digital and mindfulness-based interventions have further highlighted the importance of targeting these mechanisms to improve treatment outcomes and psychological well-being (Lorenzo-Luaces & Howard, 2023; Petre et al., 2024; Zainal & Newman, 2024; Zainal et al., 2025). Emerging evidence suggests that interventions designed to improve mindfulness, self-awareness, and metacognitive flexibility may contribute to reductions in anxiety symptoms by modifying the underlying processes that maintain emotional distress (Mitsea et al., 2023; Wei et al., 2025; Zainal et al., 2025). Furthermore, research conducted in different clinical and community populations indicates that cognitive biases, metacognitive dysfunctions, and deficits in self-compassion may collectively explain substantial variability in emotional well-being and vulnerability to anxiety disorders (Chemis et al., 2025; Costa et al., 2022; Nosratabadi & Halvaiepour, 2021).

Despite the growing body of literature concerning these constructs, relatively few studies have compared attentional bias, interpretation bias, metacognition, and self-compassion simultaneously within the same investigation, particularly among individuals with Generalized Anxiety Disorder and healthy controls. Most previous research has focused on individual mechanisms in isolation, thereby limiting understanding of how these factors collectively characterize the psychological profile of GAD. Moreover, evidence from systematic reviews and intervention studies highlights the need for comparative investigations that clarify which cognitive and self-regulatory processes most strongly distinguish clinical from non-clinical populations (Freeston, 2023; Lee & Stein, 2022). Such comparisons may contribute

E-ISSN: 3041-8828

to refining theoretical models of anxiety, identifying clinically relevant targets for assessment and intervention, and enhancing understanding of the processes underlying emotional disorders (Aguilera-Martín et al., 2021, 2022; González-Blanch et al., 2023).

Therefore, the present study aimed to compare attentional bias, interpretation bias, metacognition, and self-compassion between patients with Generalized Anxiety Disorder and normal individuals.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a causal-comparative (ex post facto) research design to compare attentional bias, interpretation bias, metacognitive beliefs, and self-compassion between patients diagnosed with Generalized Anxiety Disorder (GAD) and normal individuals. The statistical population consisted of all individuals diagnosed with GAD who referred to psychiatric clinics and psychological counseling centers in Tehran during the study period, as well as healthy individuals from the general population residing in Tehran. A total of 160 participants were selected through purposive and convenience sampling methods and assigned to two groups. The clinical group consisted of 80 patients diagnosed with Generalized Anxiety Disorder based on the diagnostic criteria outlined in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and confirmed through a structured clinical interview conducted by a licensed clinical psychologist or psychiatrist. The comparison group included 80 normal individuals with no history of psychiatric disorders, selected from the general population and matched with the clinical group in terms of age, gender, and educational level as closely as possible.

The inclusion criteria for the clinical group were a confirmed diagnosis of Generalized Anxiety Disorder, age between 18 and 60 years, minimum literacy sufficient to complete the questionnaires, and willingness to participate in the study. For the normal group, inclusion criteria consisted of absence of any current or past psychiatric disorder based on self-report and screening interviews, age between 18 and 60 years, and willingness to participate. Exclusion criteria for both groups included severe neurological disorders, psychotic disorders, intellectual disability, substance dependence, and incomplete completion of the research instruments. Prior to data collection, all participants were informed about the objectives of the study, assured of the confidentiality of their information, and provided written informed consent.

2.2. Measures

Dot-Probe Task for Assessing Attentional Bias. Attentional bias was measured using the computerized Dot-Probe Task originally developed by MacLeod, Mathews, and Tata (1986). This task is one of the most widely used experimental paradigms for assessing selective attention toward threatening stimuli. In the present study, participants were presented with pairs of stimuli consisting of threatening and neutral words displayed simultaneously on a computer screen. Following the disappearance of the stimuli, a probe appeared in the location of one of the previously displayed words, and participants were required to respond to the probe as quickly as possible. Reaction times were recorded automatically by the software, and attentional bias scores were calculated based on differences in response latencies to probes replacing threatening versus neutral stimuli. Higher scores indicated a greater attentional bias toward threat-related information. The Dot-Probe Task has demonstrated satisfactory reliability and validity in previous studies involving anxiety disorders and has been widely used in clinical and non-clinical populations.

Ambiguous Scenarios Test for Interpretation Bias. Interpretation bias was assessed using the Ambiguous Scenarios Test developed by Mathews and Mackintosh (2000). This instrument evaluates individuals' tendency to interpret ambiguous situations in either threatening or benign ways. Participants are presented with a series of hypothetical scenarios that can be interpreted positively, negatively, or neutrally and are asked to indicate the interpretation that best reflects their understanding of each situation. Scores are derived from the extent to which participants endorse threat-related interpretations. Higher scores indicate a stronger tendency toward negative and anxiety-related interpretations of ambiguous events. Previous research has reported adequate psychometric properties for this measure, including acceptable internal consistency, construct validity, and discriminant validity in both clinical and community samples.

Metacognitions Questionnaire-30 (MCQ-30). Metacognitive beliefs were measured using the Metacognitions Questionnaire-30 developed by Wells and Cartwright-Hatton (2004). The questionnaire consists of 30 items rated on a four-point Likert scale ranging from 1 (do not agree) to 4 (agree very much). The instrument assesses

E-ISSN: 3041-8828

five dimensions of metacognitive beliefs: positive beliefs about worry, negative beliefs concerning the uncontrollability and danger of thoughts, cognitive confidence, need to control thoughts, and cognitive self-consciousness. Total scores range from 30 to 120, with higher scores indicating more dysfunctional metacognitive beliefs. The MCQ-30 has been extensively used in studies of anxiety disorders and has demonstrated strong psychometric properties, including satisfactory internal consistency, test-retest reliability, and construct validity across different cultures and clinical populations.

Self-Compassion Scale (SCS). Self-compassion was assessed using the Self-Compassion Scale developed by Neff (2003). The scale contains 26 items rated on a five-point Likert scale ranging from 1 (almost never) to 5 (almost always). The instrument measures six components organized into three bipolar dimensions: self-kindness versus self-judgment, common humanity versus isolation, and mindfulness versus over-identification. Total scores are obtained by averaging item responses after reverse-scoring negatively worded items, with higher scores indicating greater self-compassion. The Self-Compassion Scale has shown excellent reliability and validity in numerous studies and has been widely employed in research examining emotional regulation, psychological well-being, and anxiety-related disorders. Previous investigations have confirmed its factorial structure, internal consistency, and convergent validity in both clinical and non-clinical populations.

2.3. Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 27. Prior to conducting the main analyses, descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to summarize participants' demographic characteristics and study variables. Assumptions of normality and homogeneity of variances were examined using appropriate statistical tests. To compare the two groups regarding attentional bias, interpretation bias, metacognitive beliefs, and self-compassion, multivariate analysis of variance (MANOVA) was employed. Following a significant multivariate effect, separate univariate analyses of variance were conducted to determine group differences on each dependent variable. Effect sizes were calculated using partial eta squared to evaluate the magnitude of observed differences. The significance level for all statistical analyses was set at $p < .05$.

3. Findings and Results

A total of 160 individuals participated in the study, including 80 patients diagnosed with Generalized Anxiety Disorder (GAD) and 80 normal individuals. In the GAD group, 46 participants (57.5%) were female and 34 participants (42.5%) were male, whereas the normal group consisted of 44 females (55.0%) and 36 males (45.0%). The mean age of participants in the GAD group was 34.87 years (SD = 8.41), while the mean age of participants in the normal group was 33.95 years (SD = 7.92). Regarding educational attainment, 22.5% of the participants held a high school diploma, 51.9% possessed a bachelor's degree, and 25.6% had postgraduate education. The results of independent samples t-tests and chi-square analyses indicated no significant differences between the two groups with respect to age, gender distribution, or educational level ($p > .05$), suggesting that the groups were comparable on these demographic characteristics.

Table 1

Descriptive Statistics of Attentional Bias, Interpretation Bias, Metacognition, and Self-Compassion in Patients with Generalized Anxiety Disorder and Normal Individuals

Variable	Group	Mean	SD	Minimum	Maximum
Attentional Bias	GAD	34.82	9.47	15	58
	Normal	18.65	7.11	5	39
Interpretation Bias	GAD	43.76	8.35	24	61
	Normal	27.18	6.94	13	44
Metacognition	GAD	79.54	12.68	51	108
	Normal	56.91	10.23	34	82
Self-Compassion	GAD	63.42	10.57	39	87
	Normal	89.76	11.14	61	112

E-ISSN: 3041-8828

Table 1 presents the descriptive statistics for the study variables in both groups. As shown, patients with Generalized Anxiety Disorder obtained substantially higher mean scores on attentional bias, interpretation bias, and dysfunctional metacognitive beliefs compared with normal individuals. Specifically, the mean attentional bias score in the GAD group (M = 34.82, SD = 9.47) was considerably greater than that observed in the normal group (M = 18.65, SD = 7.11). Similarly, the mean interpretation bias score among patients with GAD (M = 43.76, SD = 8.35) exceeded that of normal individuals (M = 27.18, SD = 6.94), indicating a greater tendency to interpret ambiguous situations in a threatening manner. The findings also revealed elevated levels of dysfunctional metacognitive beliefs among individuals with GAD (M = 79.54, SD = 12.68) compared with the normal group (M = 56.91, SD = 10.23). In contrast, self-compassion scores were markedly lower among patients with GAD (M = 63.42, SD = 10.57) than among normal participants (M = 89.76, SD = 11.14). The observed differences in means suggest meaningful distinctions between the two groups across all psychological variables investigated and provide preliminary evidence supporting the study hypotheses.

Table 2

Results of Assumption Testing Prior to Multivariate Analysis

Variable	Shapiro-Wilk (p)	Levene's F	p
Attentional Bias	.118	1.37	.244
Interpretation Bias	.084	0.92	.339
Metacognition	.092	1.81	.180
Self-Compassion	.105	1.24	.267

Before conducting the multivariate analysis, the assumptions underlying MANOVA were examined. The results of the Shapiro–Wilk tests indicated that the distributions of attentional bias, interpretation bias, metacognition, and self-compassion did not significantly deviate from normality ($p > .05$). Furthermore, Levene's tests for equality of error variances were non-significant for all variables ($p > .05$), indicating homogeneity of variances across groups. Consequently, the assumptions necessary for conducting multivariate analysis of variance were considered satisfied. The results of the multivariate test based on Wilks' Lambda revealed a statistically significant overall difference between patients with Generalized Anxiety Disorder and normal individuals on the combined dependent variables, Wilks' $\Lambda = .381$, $F(4,155) = 63.52$, $p < .001$, partial $\eta^2 = .619$. The effect size indicated that approximately 61.9% of the multivariate variance in the combined psychological variables was attributable to group membership, representing a very large effect. This finding justified proceeding with follow-up univariate analyses to determine which specific variables contributed to the observed multivariate difference.

Table 3

Results of Univariate Analyses of Variance Comparing Patients with Generalized Anxiety Disorder and Normal Individuals

Variable	SS	df	MS	F	p	Partial η^2
Attentional Bias	10454.87	1	10454.87	145.73	< .001	.480
Error	11330.65	158	71.71			
Interpretation Bias	10995.24	1	10995.24	174.82	< .001	.525
Error	9935.58	158	62.88			
Metacognition	20472.91	1	20472.91	160.95	< .001	.505
Error	20096.33	158	127.19			
Self-Compassion	27752.74	1	27752.74	228.37	< .001	.591
Error	19195.81	158	121.49			

The results of the follow-up univariate analyses demonstrated significant differences between patients with Generalized Anxiety Disorder and normal individuals across all study variables. For attentional bias, the difference between groups was statistically significant, $F(1,158) = 145.73$, $p < .001$, with a large effect size (partial $\eta^2 = .480$), indicating that individuals with GAD exhibited substantially greater attentional bias toward threatening information than

E-ISSN: 3041-8828

normal participants. A significant group difference was also observed for interpretation bias, $F(1,158) = 174.82$, $p < .001$, partial $\eta^2 = .525$, suggesting that patients with GAD were considerably more likely to interpret ambiguous situations negatively. Regarding metacognitive beliefs, the analysis revealed a significant difference between groups, $F(1,158) = 160.95$, $p < .001$, partial $\eta^2 = .505$, indicating that dysfunctional metacognitive beliefs were substantially more prevalent among individuals with GAD. Finally, a highly significant difference emerged for self-compassion, $F(1,158) = 228.37$, $p < .001$, partial $\eta^2 = .591$. Examination of group means showed that normal individuals reported markedly higher levels of self-compassion than patients with GAD. Among all investigated variables, self-compassion demonstrated the largest effect size, suggesting that this construct was the strongest discriminator between patients with Generalized Anxiety Disorder and normal individuals. Collectively, these findings provide robust empirical support for the hypothesis that individuals with Generalized Anxiety Disorder differ significantly from healthy individuals in cognitive-attentional processing, interpretation tendencies, metacognitive beliefs, and self-related compassionate attitudes. The magnitude of the observed effect sizes further indicates that these variables are not only statistically significant but also practically meaningful in distinguishing clinical and non-clinical populations.

4. Discussion and Conclusion

The findings of the present study revealed significant differences between patients with Generalized Anxiety Disorder (GAD) and normal individuals in attentional bias, interpretation bias, metacognitive beliefs, and self-compassion. Specifically, individuals diagnosed with GAD demonstrated significantly higher levels of attentional bias toward threatening information, greater negative interpretation bias, and more dysfunctional metacognitive beliefs, while exhibiting significantly lower levels of self-compassion compared with healthy individuals. The large effect sizes observed across all variables indicate that these constructs play an important role in distinguishing individuals with generalized anxiety from non-clinical populations. These findings provide support for contemporary cognitive, metacognitive, and transdiagnostic models of emotional disorders, which propose that anxiety is maintained by systematic distortions in information processing, maladaptive beliefs about thinking, and deficits in adaptive self-regulation processes (Antuña-Camblor, Gómez-Salas, et al., 2024; Antuña-Camblor, Péris-Baquero, et al., 2024; Freeston, 2023).

One of the major findings of the study was that patients with GAD exhibited significantly greater attentional bias than normal individuals. This finding is consistent with cognitive theories suggesting that anxious individuals allocate disproportionate attentional resources toward threat-related stimuli. According to these theories, the cognitive system of individuals with GAD becomes hypersensitive to potential danger cues, resulting in heightened vigilance and difficulties disengaging from threatening information. Such selective attention strengthens anxiety by increasing the accessibility of danger-related thoughts and reinforcing perceptions of vulnerability. The present finding aligns with previous research demonstrating that impaired attention control and excessive focus on threatening information are strongly associated with worry and anxiety symptoms (Stewart, 2021; Yeung et al., 2025). Individuals with GAD continuously monitor their environment for possible threats, even in objectively safe situations, which contributes to chronic emotional distress. Furthermore, recent neurocognitive evidence suggests that anxiety-related attentional abnormalities are associated with alterations in emotional processing networks and interoceptive awareness systems that intensify sensitivity to perceived threats (Chemis et al., 2025). These mechanisms may explain why individuals with GAD experience persistent anxiety despite the absence of immediate danger. The findings also support the notion that attentional bias represents a central cognitive process maintaining generalized anxiety and therefore constitutes an important target for psychological intervention (Han et al., 2025; Rawlings et al., 2023).

The results further demonstrated that patients with GAD showed significantly higher levels of interpretation bias than normal individuals. This finding is congruent with cognitive models proposing that anxiety is characterized by a tendency to interpret ambiguous situations in a threatening or catastrophic manner. Individuals with GAD often perceive uncertainty as inherently dangerous and generate negative explanations for situations that could otherwise be interpreted more realistically or positively. Such interpretations increase anticipatory anxiety and contribute to the persistence of excessive worry. The current finding is consistent with previous investigations indicating that negative interpretation styles are closely associated with generalized anxiety symptoms and represent an important vulnerability factor for emotional disorders (Tallon, 2021; Tallon et al., 2022). From a theoretical perspective,

E-ISSN: 3041-8828

attentional and interpretation biases may operate together in maintaining anxiety. Selective attention to threatening cues increases the likelihood that ambiguous situations will be interpreted negatively, and these interpretations subsequently reinforce threat monitoring and worry. This reciprocal relationship contributes to a self-sustaining cognitive cycle that perpetuates anxiety symptoms over time. Systematic reviews examining transdiagnostic risk factors have similarly concluded that maladaptive interpretation patterns represent a common process across emotional disorders and are particularly prominent in anxiety-related conditions (Antuña-Camblor, Gómez-Salas, et al., 2024; Antuña-Camblor, Péris-Baquero, et al., 2024). Therefore, the present findings provide additional support for the role of interpretation bias as a key cognitive mechanism underlying GAD.

Another important finding was that individuals with GAD reported significantly higher levels of dysfunctional metacognitive beliefs than normal individuals. This result is highly consistent with metacognitive theory, which emphasizes that beliefs about thinking processes are central to the development and maintenance of anxiety disorders. According to this perspective, individuals with GAD tend to hold both positive and negative beliefs about worry. On the one hand, they may believe that worrying helps them prepare for future threats; on the other hand, they may perceive worry as uncontrollable and potentially dangerous. The coexistence of these beliefs leads individuals to engage in persistent worry while simultaneously fearing its consequences. The present findings support this theoretical framework and align with previous empirical evidence demonstrating strong associations between dysfunctional metacognitive beliefs and anxiety-related psychopathology (Bhome et al., 2021; Katyal et al., 2023; Kero et al., 2023). Moreover, systematic reviews have consistently reported that maladaptive metacognitive processes contribute significantly to emotional distress across a variety of psychological conditions (Foerster et al., 2025; Sadnicka et al., 2024; Strand & Nordahl, 2024). Experimental studies have further shown that modifying metacognitive appraisals can reduce worry and improve emotional functioning among individuals characterized by excessive anxiety (Ikani et al., 2022). The findings of the current study therefore strengthen the growing body of evidence suggesting that metacognition is not merely associated with anxiety symptoms but may play a causal role in their maintenance. This perspective helps explain why traditional symptom-focused interventions may sometimes be insufficient and why treatments targeting metacognitive beliefs often yield meaningful improvements in emotional well-being.

The fourth major finding revealed that patients with GAD exhibited significantly lower levels of self-compassion compared with normal individuals. This result is particularly noteworthy because self-compassion has increasingly been recognized as an important protective factor in mental health. Individuals who are self-compassionate respond to personal suffering with kindness, acceptance, and understanding rather than criticism, shame, and avoidance. In contrast, individuals with low self-compassion often engage in harsh self-evaluation, emotional over-identification, and feelings of isolation, all of which can intensify anxiety and emotional distress. The present findings are consistent with previous studies demonstrating negative associations between self-compassion and anxiety symptoms (Qi et al., 2025; Zaki et al., 2022). The lower self-compassion observed among individuals with GAD may contribute to their vulnerability to persistent worry because self-critical attitudes amplify perceptions of threat and inadequacy. Furthermore, self-compassion appears to facilitate adaptive emotional regulation by helping individuals tolerate uncertainty, accept difficult emotions, and reduce maladaptive cognitive reactions to stress. Research comparing self-compassion-based interventions and mindfulness-based approaches has demonstrated that increasing self-compassion can improve both psychological and physiological responses to stress among individuals experiencing anxiety symptoms (Qi et al., 2025). These findings suggest that self-compassion may serve as a protective mechanism capable of buffering against the cognitive and emotional processes that sustain generalized anxiety.

The combined pattern of findings observed in this study is highly compatible with contemporary transdiagnostic models of emotional disorders. These models propose that anxiety and related psychological conditions emerge from interactions among maladaptive cognitive biases, dysfunctional metacognitive processes, impaired emotional regulation, and deficiencies in adaptive self-related capacities. The elevated attentional and interpretation biases observed among individuals with GAD indicate that anxiety is associated with systematic distortions in information processing. Simultaneously, elevated dysfunctional metacognitive beliefs contribute to the maintenance of repetitive negative thinking and excessive worry, while low self-compassion reduces individuals' capacity to cope effectively with emotional challenges. Together, these

E-ISSN: 3041-8828

processes create a psychological environment that promotes chronic anxiety and emotional suffering (Antuña-Camblor, Péris-Baquero, et al., 2024; Mitsea et al., 2023; Södermark, 2024). Recent developments in mindfulness-based, metacognitive, and digital interventions have increasingly targeted these underlying mechanisms rather than focusing exclusively on symptom reduction (Petre et al., 2024; Zainal & Newman, 2024; Zainal et al., 2025). The effectiveness of such interventions may stem from their ability to modify maladaptive attentional patterns, challenge dysfunctional metacognitive beliefs, cultivate emotional awareness, and enhance self-compassion. Research has consistently demonstrated that interventions emphasizing mindfulness, metacognitive flexibility, and self-regulation produce meaningful reductions in anxiety and related emotional symptoms (Burgess et al., 2021; Trapani et al., 2024; Wei et al., 2025).

The findings also have important implications for understanding the psychological profile of individuals with GAD. Rather than viewing generalized anxiety solely as a condition characterized by excessive worry, the present results suggest that it reflects a broader constellation of cognitive, metacognitive, and emotional processes. The significant differences observed between clinical and non-clinical participants across all investigated variables indicate that GAD involves pervasive alterations in the ways individuals attend to information, interpret events, think about their thoughts, and relate to themselves. These findings are consistent with contemporary conceptualizations of anxiety disorders as multidimensional conditions involving interconnected cognitive and emotional vulnerabilities (Costa et al., 2022; Lee & Stein, 2022; Li, 2023). Consequently, comprehensive assessment and treatment approaches should consider these multiple domains to achieve optimal therapeutic outcomes.

One limitation of the present study concerns its cross-sectional and causal-comparative design, which prevents definitive conclusions regarding causal relationships among the investigated variables. In addition, participants were recruited exclusively from Tehran, which may limit the generalizability of the findings to other geographical and cultural contexts. The use of self-report instruments for some variables may also have introduced response biases, including social desirability and subjective reporting tendencies. Furthermore, potentially relevant factors such as symptom severity, duration of illness, treatment history, and comorbid psychological conditions were not examined in detail.

Future research should employ longitudinal and experimental designs to clarify the causal relationships among attentional bias, interpretation bias, metacognition, self-compassion, and generalized anxiety symptoms. Researchers may also investigate potential mediating and moderating mechanisms linking these variables. Studies involving more diverse populations, different age groups, and various cultural settings would help establish the generalizability of the findings. Additionally, future investigations could compare different anxiety disorders to determine whether the observed cognitive and metacognitive patterns are unique to GAD or represent broader transdiagnostic characteristics.

From a practical perspective, the findings suggest that clinicians working with individuals suffering from Generalized Anxiety Disorder should assess and target attentional bias, interpretation bias, dysfunctional metacognitive beliefs, and self-compassion deficits during treatment. Intervention programs incorporating metacognitive therapy, attention training techniques, mindfulness-based approaches, and self-compassion training may be particularly beneficial. Mental health professionals may also consider integrating cognitive bias modification procedures and emotional regulation training into existing treatment protocols. Such comprehensive approaches have the potential to address the underlying mechanisms that maintain anxiety and thereby promote more enduring therapeutic improvements.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

E-ISSN: 3041-8828

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

References

Aguilera-Martín, Á., Gálvez-Lara, M., Cuadrado, F., Moreno, E. M., García-Torres, F., Martínez, J. F. V., Corpas, J., Jurado-González, F., Muñoz-Navarro, R., González-Blanch, C., Ruiz-Rodríguez, P., Barrio-Martínez, S., Prieto-Vila, M., Carpallo-González, M., Cano-Vindel, A., & Moriana, J. A. (2021). Cost-Effectiveness and Cost-Utility Evaluation of the Individual vs. Group Transdiagnostic Psychological Treatment for Emotional Disorders in Primary Care(PsicAP-Costs) V2. https://doi.org/10.17504/protocols.io.bx2npqde

Aguilera-Martín, Á., Gálvez-Lara, M., Cuadrado, F., Moreno, E. M., García-Torres, F., Martínez, J. F. V., Corpas, J., Jurado-González, F., Muñoz-Navarro, R., González-Blanch, C., Ruiz-Rodríguez, P., Barrio-Martínez, S., Prieto-Vila, M., Carpallo-González, M., Cano-Vindel, A., & Moriana, J. A. (2022). Cost-Effectiveness and Cost-Utility Evaluation of Individual vs. Group Transdiagnostic Psychological Treatment for Emotional Disorders in Primary Care (PsicAP-Costs): A Multicentre Randomized Controlled Trial Protocol. *BMC psychiatry*, *22*(1). https://doi.org/10.1186/s12888-022-03726-4

Antuña-Camblor, C., Gómez-Salas, F. J., Burgos-Julián, F. A., González-Vázquez, A., Juarros-Basterretxea, J., & Rodríguez-Díaz, F. J. (2024). Emotional Regulation as a Transdiagnostic Process of Emotional Disorders in Therapy: A Systematic Review and Meta-Analysis. *Clinical Psychology & Psychotherapy*, *31*(3). https://doi.org/10.1002/cpp.2997

Antuña-Camblor, C., Péris-Baquero, Ó., Juarros-Basterretxea, J., Vindel, A. C., & Rodríguez-Díaz, F. J. (2024). Transdiagnostic Risk Factors of Emotional Disorders in Adults: A Systematic Review. *Anales de Psicología*, *40*(2), 199-218. https://doi.org/10.6018/analesps.561051

Bhome, R., McWilliams, A., Price, G., Poole, N., Howard, R., Fleming, S. M., & Huntley, J. (2021). Metacognition in Functional Cognitive Disorder. https://doi.org/10.1101/2021.06.24.21259245

Burgess, E. E., Selchen, S., Diplock, B. D., & Rector, N. A. (2021). A Brief Mindfulness-Based Cognitive Therapy (MBCT) Intervention as a Population-Level Strategy for Anxiety and Depression. *International Journal of Cognitive Therapy*, *14*(2), 380-398. https://doi.org/10.1007/s41811-021-00105-x

Chemis, I. M., Köchli, L., Marino, S., Russell, B., Stephan, K. E., & Harrison, O. K. (2025). The Relationship Between Interoception of Breathing, Anxiety, and Resting-State Functional Connectivity in the Brain. *Cognitive Affective & Behavioral Neuroscience*, *25*(6), 1795-1806. https://doi.org/10.3758/s13415-025-01328-7

Costa, M. d. A., Russell, T., Gosmann, N. P., Gonçalves, F. G., Tatton-Ramos, T. P., Oliveira, F. B. d., & Manfro, G. G. (2022). Mechanisms of Improvement in Generalized Anxiety Disorder: A Mediation and Moderated Mediation Analysis From a Randomized Controlled Trial. *British Journal of Clinical Psychology*, *62*(1), 196-208. https://doi.org/10.1111/bjc.12402

Foerster, P., Bermpohl, F. M. g., Gerlach, A. L., & Pohl, A. (2025). Do Metacognitions Contribute to Pathological Health Anxiety? A Systematic Review and Meta-Analysis. *PLoS One*, *20*(7), e0325563. https://doi.org/10.1371/journal.pone.0325563

Freeston, M. H. (2023). What if We Have Too Many Models of Worry and GAD? *Behavioural and Cognitive Psychotherapy*, *51*(6), 559-578. https://doi.org/10.1017/s1352465822000649

González-Blanch, C., Barrio-Martínez, S., Priede, A., Martínez-Gómez, S., Pérez-García-Abad, S., Miras-Aguilar, M. d. M., José, R.-G., Muñoz-Navarro, R., Ruiz-Rodríguez, P., Medrano, L. A., Prieto-Vila, M., Carpallo-González, M., Aguilera-Martín, Á., Gálvez-Lara, M., Cuadrado, F., Moreno, E. M., García-Torres, F., Martínez, J. F. V., Corpas, J., . . . Cano-Vindel, A. (2023). Cost-Effectiveness of Transdiagnostic Group Cognitive Behavioural Therapy Versus Group Relaxation Therapy for Emotional Disorders in Primary Care (PsicAP-Costs2): Protocol for a Multicentre Randomised Controlled Trial. *PLoS One*, *18*(3), e0283104. https://doi.org/10.1371/journal.pone.0283104

Han, J.-H., Lee, M. R., Cha, C., & Baek, G. (2025). Effects of Third-Wave Cognitive Behavioral Therapy for Healthcare Professionals' Burnout: A Systematic Review and Meta-Analysis. *Healthcare*, *13*(24), 3253. https://doi.org/10.3390/healthcare13243253

Ikani, N., Radix, A. K., Rinck, M., & Becker, E. S. (2022). Changing Metacognitive Appraisal Bias in High-Worriers Through Reappraisal Training. *Cognitive therapy and research*, *46*(4), 852-863. https://doi.org/10.1007/s10608-022-10297-x

Katyal, S., Huys, Q. J. M., Dolan, R. J., & Fleming, S. M. (2023). Distorted Learning From Local Metacognition Supports Transdiagnostic Underconfidence. https://doi.org/10.31234/osf.io/qcg92_v1

Kero, K., Halter, C. M., Moll, A. C., Hanna, S., Woodard, J. L., Giordani, B., Daugherty, A. M., & Kavcic, V. (2023). Metacognition in Community-Dwelling Older Black and African American Adults During the COVID-19 Pandemic. *Journal of Alzheimer S Disease*, *96*(1), 301-311. https://doi.org/10.3233/jad-221140

Lee, H. J., & Stein, M. B. (2022). Update on Treatments for Anxiety-Related Disorders. *Current Opinion in Psychiatry*, *36*(2), 140-145. https://doi.org/10.1097/yco.0000000000000841

Li, X. (2023). Understanding Generalized Anxiety Disorder: Etiology, Mechanisms and Treatment Implications. *Lecture Notes in Education Psychology and Public Media*, *7*(1), 460-466. https://doi.org/10.54254/2753-7048/7/2022900

Lorenzo-Luaces, L., & Howard, J. (2023). Efficacy of an Unguided, Digital Single-Session Intervention for Internalizing Symptoms in Web-Based Workers: Randomized Controlled Trial. *Journal of medical Internet research*, *25*, e45411. https://doi.org/10.2196/45411

Mitsea, E., Drigas, A., & Skianis, C. (2023). Virtual Reality Mindfulness for Meta-Competence Training Among People With Different Mental Disorders: A Systematic Review.

E-ISSN: 3041-8828

Psychiatry International, *4*(4), 324-353. https://doi.org/10.3390/psychiatryint4040031

Nosratabadi, M., & Halvaiepour, Z. (2021). Identifying Psychological Perceptions of People Ignoring the Novel COVID-19 Warnings: A Qualitative Thematic Analysis in Isfahan, Iran. *Integrative Psychological and Behavioral Science*, *57*(4), 1402-1417. https://doi.org/10.1007/s12124-021-09608-w

Petre, L. M., Piepiora, P., Gemescu, M., & Gheorghe, D. A. (2024). Internet- And Mobile-Based Aftercare and Relapse Prevention Interventions for Anxiety and Depressive Disorders: A Systematic Review. *Frontiers in psychology*, *15*. https://doi.org/10.3389/fpsyg.2024.1474016

Qi, X., Shen, Y., Che, X., Luo, X., & Sun, L. (2025). The Effect of Self-Compassion Versus Mindfulness Interventions on Autonomic Responses to Stress in Generalized Anxiety Disorders. *Frontiers in Psychiatry*, *16*. https://doi.org/10.3389/fpsyt.2025.1483827

Rawlings, G. H., Nováková, B., Armstrong, I., & Thompson, A. R. (2023). A Systematic Review of Psychological Interventions in Adults With Pulmonary Hypertension: Is the Evidence-base Disproportionate to the Problem? *The Clinical Respiratory Journal*, *17*(9), 966-972. https://doi.org/10.1111/crj.13685

Sadnicka, A., Strudwick, A.-M., Grogan, J. P., Manohar, S., & Nielsen, G. (2024). Going 'Meta': A Systematic Review of Metacognition and Functional Neurological Disorder. *Brain Communications*, *7*(1). https://doi.org/10.1093/braincomms/fcaf014

Södermark, M. (2024). Emotion Regulation in Pain : Developing Effective Interventions for Patients With Pain and Emotional Distress. https://doi.org/10.3384/9789180753692

Stewart, K. (2021). The Impact of the Attention Training Technique on Attention Control and Worry. https://doi.org/10.32920/ryerson.14662032.v1

Strand, E. R., & Nordahl, H. (2024). Do Patient's Interpersonal Problems Improve Following Metacognitive Therapy? A Systematic Review and Meta-Analysis. *Clinical Psychology & Psychotherapy*, *31*(2). https://doi.org/10.1002/cpp.2973

Tallon, K. (2021). Does a Restriction in Working Memory Capacity Mediate the Relationship Between Worry and Interpretive Biases in Generalized Anxiety Disorder? https://doi.org/10.32920/ryerson.14660979.v1

Tallon, K., Koerner, N., & Yang, L. (2022). Working Memory in Generalized Anxiety Disorder: Effects of Verbal and Image-Based Worry and Relation to Cognitive and Emotional Processes. https://doi.org/10.32920/21440841

Taylor-Bennett, J., Capobianco, L., Wisely, J., & Wells, A. (2024). Qualitative Analysis of Emotional Distress in Burns, Plastic and Reconstructive Surgery Patients From the Perspectives of Cognitive and Metacognitive Models. *Frontiers in Psychiatry*, *15*. https://doi.org/10.3389/fpsyt.2024.1461387

Trapani, S., Caglioni, M., Villa, G., Manara, D. F., & Caruso, R. (2024). Mindfulness-Based Interventions During Pregnancy and Long-Term Effects on Postpartum Depression and Maternal Mental Health: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of Integrative and Complementary Medicine*, *30*(2), 107-120. https://doi.org/10.1089/jicm.2023.0114

Wei, S., Qin, W., Yu, Z., Cao, Y., & Li, P. (2025). The Effectiveness of Mindfulness-Based Cognitive Therapy on Rumination and Related Psychological Indicators: A Systematic Review and Meta-Analysis. *BMC psychology*, *13*(1). https://doi.org/10.1186/s40359-025-03348-x

Yeung, C. W., Tang, P., Lewis, G., Wiles, N., & Bone, J. K. (2025). Variation in the Recall of Socially Rewarding Information and Symptoms of Generalised Anxiety: Evidence From Two Cohorts. *BMC psychiatry*, *25*(1). https://doi.org/10.1186/s12888-025-07402-1

Zainal, N. H., & Newman, M. G. (2024). Examining the Effects of a Brief, Fully Self-Guided Mindfulness Ecological Momentary Intervention on Empathy and Theory-of-Mind for Generalized Anxiety Disorder: Randomized Controlled Trial. *Jmir Mental Health*, *11*, e54412. https://doi.org/10.2196/54412

Zainal, N. H., Tan, H. H., Hong, R. Y., & Newman, M. G. (2025). Prescriptive Predictors of Mindfulness Ecological Momentary Intervention for Social Anxiety Disorder: Machine Learning Analysis of Randomized Controlled Trial Data. *Jmir Mental Health*, *12*, e67210. https://doi.org/10.2196/67210

Zaki, R. A., Mohammed, H. S., & Prince, H. E. E. (2022). Relationship Between Levels of Anxiety, Self-Compassion, and Spiritual Wellbeing Among Patients With Generalized Anxiety Disorder. *Egyptian Journal of Health Care*, *13*(1), 517-527. https://doi.org/10.21608/ejhc.2022.219056

E-ISSN: 3041-8828