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The Mediating Role of Cognitive Biases and Difficulty in Emotion Regulation in the Relationship between Personality and Character with Negative Symptoms in Schizophrenia

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A B S T R A C T

Negative symptoms result in a significant burden of illness and reduced quality of life in individuals with schizophrenia; therefore, the main aim of the present study was to investigate the mediating role of cognitive biases and difficulty in emotion regulation in the relationship between personality and character with negative symptoms of schizophrenia. This study was descriptive and correlational. The statistical population included all people with schizophrenia hospitalized in Razi Psychiatric Hospital in 2023-2024, of which 200 people were selected as the research sample using a convenience method. The data collection tools included the Positive and Negative Symptom Scale, Short Form of the Big Five Personality Factors Questionnaire, Short Version of the Temperament and Character Questionnaire, Cognitive Bias Assessment Scale and Short Form of Difficulties in Emotion Regulation. SPSS, and LISREL software were used for data analysis, as well as Pearson correlation method and structural equation modeling. The results showed that cognitive biases and difficulty in emotion regulation have a mediating role in the relationship between personality (neuroticism, extraversion and agreeableness) and character (self-direction, cooperation and self-transcendence) with negative symptoms of schizophrenia (CFI=1, NNFI=0.99, IFI=1, GFI=0.99, RMSEA=0.049). Individuals with schizophrenia with personality traits of neuroticism, extraversion, and character (self-direction and cooperation) experience negative symptoms due to cognitive biases and difficulty in emotion regulation. Therefore, training in emotion regulation skills and reducing cognitive biases may be an important initial component of the challenging task of treating negative symptoms of schizophrenia.

Keywords: *Character, cognitive bias, difficulty in emotion regulation, negative symptoms, personality, schizophrenia.*

1. Introduction

Schizophrenia is a severe mental disorder characterized by a combination of positive symptoms (e.g., hallucinations and delusions), cognitive dysfunction (e.g., memory deficits and impaired executive function), and negative symptoms (e.g., avolition, alogia, and expressive deficits) (1). While positive symptoms are often effectively managed with available antipsychotic medications, treatment options for negative symptoms remain limited. Despite advancements in understanding the epidemiology, etiology, and psychotherapeutics of schizophrenia, negative

symptoms continue to represent an unmet medical need (2). Therefore, identifying the psychological factors and mechanisms underlying these symptoms is crucial to reducing the burden on patients, caregivers, and healthcare systems.

Abnormalities in neurotransmitter release (e.g., dopamine, serotonin, glutamate, glycine, GABA), brain structures (e.g., enlarged third and lateral ventricles, reduced middle temporal lobe), and risk factors such as childhood adversity, cannabis use, exposure to stress in adulthood, and birth complications are associated with schizophrenia (3, 4). Personality traits also play a significant role in schizophrenia, influencing clinical trajectories and vulnerabilities, as evidenced by extensive research in recent decades (5, 6). Studies reveal that individuals with schizophrenia exhibit higher neuroticism, lower extraversion, and reduced conscientiousness compared to healthy controls (7, 8). These personality traits may not only persist through active and residual phases of schizophrenia but also predispose individuals to develop the disorder later in life (9-11). Additionally, Shi et al. (2018) found negative correlations between agreeableness and openness to experience and psychotic experiences.

Character, distinct from temperament, refers to the cognitive core of personality, encompassing self-concept, goals, and values influenced by social and cultural factors (12, 13). Evidence suggests that the heritability of character dimensions may impact schizotypy predisposition (14). Cloninger's biopsychosocial model identifies three character dimensions: self-directedness (responsibility, purposefulness, and competence), cooperativeness (social acceptance and empathy), and self-transcendence (spiritual acceptance and selflessness) (15). Research indicates that individuals with schizophrenia report lower self-directedness and cooperativeness but higher self-transcendence compared to controls (16). Dimensions like self-transcendence and cooperativeness are strong predictors of negative symptoms (17).

Cognitive biases may mediate the relationship between personality, character, and negative symptoms in schizophrenia. These biases, as executive aspects of personality, influence belief formation and maintenance (18-21). Cognitive biases, such as jumping to conclusions, self-referential processing, and bias against disconfirmatory evidence, are linked to psychosis spectrum disorders (22). These biases are observed in individuals with schizotypal traits, even without a schizophrenia diagnosis (23). Research also indicates associations between character and psychotic experiences via cognitive biases (24).

Difficulty in emotion regulation is another key variable mediating the relationship between personality and negative symptoms. Gratz and Roemer (2004) define it as the lack of abilities to adaptively respond to emotions, including acceptance, differentiation, and behavior control (25). Emotional dysregulation is a core feature of schizophrenia (26) and correlates with poor clinical outcomes such as heightened positive and negative symptoms and functional impairment (27, 28). Individuals with schizophrenia often rely on maladaptive emotion regulation strategies like suppression while underutilizing adaptive strategies like cognitive reappraisal (29).

Existing evidence highlights the role of individual differences in emotion regulation abilities based on personality traits. For example, neuroticism predicts maladaptive emotion regulation strategies, experiential avoidance, and repetitive negative thinking (30). Conversely, extraversion and agreeableness are associated with more effective emotion regulation. Relationships between character and emotion regulation remain underexplored, with inconsistent findings reported in prior studies (31, 32).

Given the profound implications of negative symptoms for patients' quality of life and the critical need for effective interventions, this study examines the mediating roles of cognitive biases and difficulty in emotion regulation in the relationship between personality, character, and negative symptoms of schizophrenia. This investigation seeks to extend existing knowledge and contribute to improved therapeutic strategies.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a fundamental, cross-sectional, and descriptive correlational design using structural equation modeling (SEM) to explore the relationships between variables. The statistical population consisted of individuals diagnosed with schizophrenia hospitalized in Razi

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Psychiatric Hospital, Tehran, during 2023. A total of 200 participants were selected through convenience sampling, meeting the minimum sample size requirement for SEM.

Participants were recruited after obtaining approval from the Research Deputy of Islamic Azad University, Birjand Branch, and coordinating with hospital authorities. Patients were assessed based on psychiatrist referrals, medical records, and psychologist interviews. Inclusion criteria included providing informed consent, being 18 years or older, having an educational background of at least middle school, a confirmed diagnosis of schizophrenia based on the DSM-5-TR diagnostic criteria, stabilization of acute symptoms, and the ability to communicate with the researcher. Exclusion criteria included unwillingness to participate, comorbid medical conditions, or incomplete responses on at least 5% of the questionnaire items.

2.2. Measures

2.2.1. Positive and Negative Syndrome

The 30-item PANSS, developed by Kay et al. (1987), measures three subscales: negative symptoms (7 items), positive symptoms (7 items), and general psychopathology (16 items). For this study, only the negative symptoms subscale was used. Responses were rated on a 7-point Likert scale ranging from "not at all" (1) to "extremely" (7), with higher scores indicating greater symptom severity. The internal consistency reliability (Cronbach's alpha) was reported as 0.73 for positive symptoms, 0.83 for negative symptoms, and 0.79 for general psychopathology (33). The Cronbach's alpha for the Persian version of the scale ranged from 0.74 to 0.92 (3). In this study, the Cronbach's alpha for the negative symptoms subscale was 0.83.

2.2.2. Personality

This 50-item scale, developed by Goldberg (1999), assesses five major personality traits: emotional stability, conscientiousness, agreeableness, extraversion, and openness to experience. Each trait is measured by 10 items scored on a 5-point Likert scale from "completely inaccurate" (1) to "completely accurate" (5), with some items reverse-scored. Reported reliability coefficients range from 0.70 to 0.90 (34). The Cronbach's alpha for the Persian version of the scale ranged from 0.69 to 0.83 (35).

2.2.3. Character

Developed by Adan et al. (2009), this 56-item inventory measures seven subscales under two domains: temperament (novelty seeking, harm avoidance, reward dependence, and persistence) and character (self-directedness, cooperativeness, and self-transcendence). Items are scored on a 5-point Likert scale from "strongly disagree" (1) to "strongly agree" (5). Reported Cronbach's alpha values for the subscales range from 0.69 to 0.85 (36). The Persian version's Cronbach's alpha coefficients ranged from 0.68 to 0.79 (37).

2.2.4. Cognitive Biases

This 42-item tool, developed by van der Gaag et al. (2013), assesses cognitive biases relevant to psychosis. It comprises four subscales measuring cognitive biases (e.g., jumping to conclusions, belief inflexibility, threat perception, external attribution bias), two subscales measuring social cognition, and one subscale assessing behavioral coping strategies. Responses are rated on a 7-point Likert scale from "strongly disagree" (1) to "strongly agree" (7). Reported internal consistency reliability ranged from 0.64 to 0.82 for subscales and 0.90 for the overall scale (38). The Persian version's Cronbach's alpha coefficients ranged from 0.74 to 0.89 (39).

2.2.5. Difficulties in Emotion Regulation

This 18-item scale, developed by Kaufman et al. (2016), measures six dimensions of emotion regulation difficulties: non-acceptance of emotional responses, difficulties engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Responses are rated on a 5-point Likert scale from "almost never" (1) to "almost always" (5). Reported Cronbach's alpha for the total scale is 0.70, and for subscales, it ranges from 0.78 to 0.91 (40). The Persian version's Cronbach's alpha was 0.85 (41). In this study, the Cronbach's alpha for the DERS-SF was 0.76.

2.3. Data Analysis

Data analysis was conducted using SPSS version 26 and LISREL version 8.8, employing path analysis techniques.

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3. Findings and Results

The mean age of participants was 43.04 years (SD = 12.09), and the mean duration of illness was 12.55 years (SD = 7.71). Among the participants, 162 (81%) were male and 38 (19%) were female. Regarding marital status, 147 (73.5%) were single, 28 (14%) were married, and 25 (12.5%) were divorced.

In terms of education, 84 participants (42%) held a high school diploma. Regarding suicide attempts, 140 participants (70%) had no history of suicide attempts, while 60 participants (30%) had a history of at least one attempt.

Table 1 provides the descriptive findings and correlations for the study variables.

Table 1

Correlation Matrix and Descriptive Statistics (Mean and Standard Deviation) for Research Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Neuroticism	-										
2. Conscientiousness	-0.34	-									
3. Agreeableness	-0.49	0.46	-								
4. Extraversion	-0.41	0.55	0.50	-							
5. Openness to Experience	-0.41	0.65	0.53	0.53	-						
6. Self-Directedness	0.45	-0.20	-0.32	0.28	-0.27	-					
7. Cooperativeness	0.31	-0.17	-0.24	0.38	-0.25	0.47	-				
8. Self-Transcendence	0.38	-0.19	-0.20	0.29	*-0.16*	0.47	0.50	-			
9. Difficulty in Emotion Regulation	0.56	-0.33	-0.46	-0.49	-0.42	0.52	0.46	0.45	-		
10. Cognitive Bias	0.44	-0.26	-0.37	-0.35	-0.25	0.49	0.33	0.49	0.61	-	
11. Negative Symptoms	0.47	-0.32	-0.46	-0.41	-0.42	0.50	0.37	0.30	0.63	0.55	-
Mean	13.18	12.17	13.40	16.56	11.79	19.82	19.39	20.29	48.42	153.81	23.56
Standard Deviation	3.38	3.26	3.18	3.78	3.40	6.43	6.04	6.88	11.18	39.25	6.74
Kurtosis	-0.05	0.13	-0.36	0.11	0.52	0.79	0.56	0.52	0.24	1.12	0.17
Skewness	-0.71	-0.42	-0.23	-0.61	-0.62	0.14	-0.13	-0.50	-0.20	0.99	0.01

Table 1 presents the correlation matrix and descriptive statistics for eleven research variables, revealing several significant relationships and distribution characteristics. Neuroticism is negatively correlated with conscientiousness (−0.34), agreeableness (−0.49), extraversion (−0.41), and openness to experience (−0.41), while positively associated with difficulty in emotion regulation (0.56), cognitive bias (0.44), and negative symptoms (0.47). Conscientiousness shows strong positive correlations with extraversion (0.55) and openness to experience (0.65), but negatively relates to self-directedness (−0.20) and other traits like cooperativeness and self-transcendence. Agreeableness and extraversion are positively linked to each other and to openness, whereas difficulty in emotion regulation is strongly associated with negative symptoms (0.63) and cognitive bias (0.61). The means of the variables range from 11.79 to 20.29, with standard deviations varying from 3.18 to 39.25, indicating diverse variability across measures. Kurtosis values are mostly near zero, suggesting relatively normal distributions, while skewness values indicate slight asymmetries in several variables. Overall, the correlations highlight intricate interrelations among personality traits and psychological challenges, supported by descriptive statistics that characterize the data distribution.

Table 2

Direct and Indirect Effects in the Final Model

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Effect Type	Predictor Variable	Outcome Variable	β	T	p
Direct	Neuroticism	Difficulty in Emotion Regulation	0.28	4.37	< 0.05
		Cognitive Biases	0.15	2.16	< 0.05
	Extraversion	Difficulty in Emotion Regulation	-0.16	-2.73	< 0.05
	Agreeableness	Difficulty in Emotion Regulation	-0.12	-1.97	< 0.05
		Cognitive Biases	-0.16	-2.47	< 0.05
		Negative Symptoms	-0.17	-2.97	< 0.05
	Self-Directedness	Difficulty in Emotion Regulation	0.22	3.62	< 0.05
		Cognitive Biases	0.25	3.62	< 0.05
		Negative Symptoms	0.18	2.80	< 0.05
	Cooperation	Difficulty in Emotion Regulation	0.18	3.17	< 0.05
	Self-Transcendence	Cognitive Biases	0.26	4.22	< 0.05
	Difficulty in Emotion Regulation	Negative Symptoms	0.34	4.77	< 0.05
	Cognitive Biases	Negative Symptoms	0.20	2.94	< 0.05
Indirect	Neuroticism	Negative Symptoms (via mediators)	0.12	3.59	< 0.05
	Extraversion	Negative Symptoms (via mediators)	-0.05	-2.37	< 0.05
	Agreeableness	Negative Symptoms (via mediators)	-0.07	-2.43	< 0.05
	Self-Directedness	Negative Symptoms (via mediators)	0.12	3.72	< 0.05
	Cooperation	Negative Symptoms (via mediators)	0.06	2.64	< 0.05
	Self-Transcendence	Negative Symptoms (via mediators)	0.05	2.41	< 0.05

Table 2 outlines the direct and indirect effects in the final model, illustrating various significant relationships between predictor and outcome variables. Direct effects show that neuroticism positively influences difficulty in emotion regulation (β = 0.28) and cognitive biases (β = 0.15), with both effects being statistically significant ($p < 0.05$). Extraversion negatively impacts both difficulty in emotion regulation (β = -0.16) and cognitive biases (β = -0.16), and also reduces negative symptoms (β = -0.17), all of which are significant. Agreeableness similarly shows negative effects on difficulty in emotion regulation (β = -0.12), cognitive biases (β = -0.16), and negative symptoms (β = -0.17), with all p-values below 0.05. Self-directedness has positive direct effects on difficulty in emotion regulation (β = 0.22), cognitive biases (β = 0.25), and negative symptoms (β = 0.18). Cooperation also contributes positively to difficulty in emotion regulation (β = 0.18), while self-transcendence significantly influences cognitive biases (β = 0.26) and difficulty in emotion regulation (β = 0.34). Indirect effects reveal that neuroticism (β = 0.12), extraversion (β = -0.05), and agreeableness (β = -0.07) affect negative symptoms through mediators, while self-directedness (β = 0.12), cooperation (β = 0.06), and self-transcendence (β = 0.05) also influence negative symptoms via indirect pathways. All effects, both direct and indirect, are statistically significant with p-values less than 0.05. These findings highlight complex relationships between personality traits, emotion regulation, cognitive biases, and negative symptoms.

Table 3

Model Fit Indices

Index	RMSEA	CFI	NFI	NNFI	IFI	RFI	GFI
Fit Criterion	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90
Observed Value	0.049	1.00	0.99	0.99	1.00	0.96	0.99

The results indicate excellent fit indices for the final model: chi-square ($p = 0.17$), comparative fit index (CFI = 1.00), normed fit index (NFI = 0.99), non-normed fit index (NNFI = 0.99), incremental fit index (IFI = 1.00), relative fit index (RFI = 0.96), goodness-of-fit index (GFI = 0.99), and root mean square error of approximation (RMSEA = 0.049). These results meet the criteria suggested by Meyers et al. (2016), which require fit indices above 0.90 and RMSEA below 0.08, indicating an excellent model fit.

Figure 1

Final Research Model

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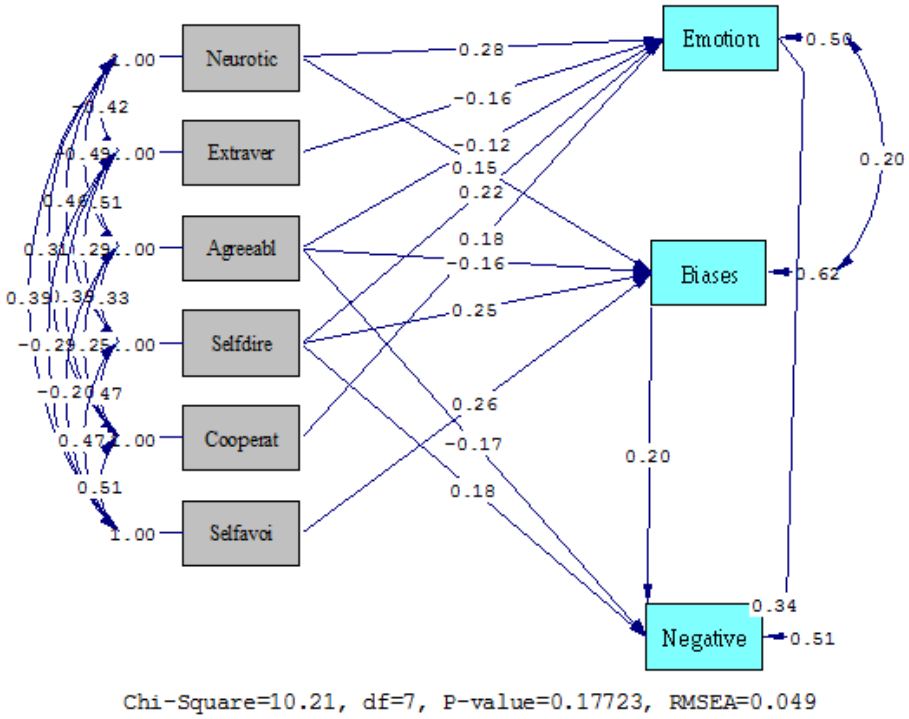

4. Discussion and Conclusion

The present study explored the mediating roles of cognitive biases and difficulties in emotion regulation in the relationship between personality traits and negative symptoms in individuals with schizophrenia. The findings suggest that both cognitive biases and emotion regulation difficulties significantly mediate the effects of personality traits on negative symptoms in schizophrenia. Specifically, neuroticism was found to positively influence difficulty in emotion regulation and cognitive biases, both of which, in turn, contributed to an increase in negative symptoms. Extraversion and agreeableness, conversely, showed negative associations with these mediators, thereby reducing negative symptoms. Self-directedness and cooperation had positive associations with both emotion regulation and cognitive biases, suggesting a more adaptive coping profile in these individuals. Finally, self-transcendence appeared to play a significant role in reducing cognitive biases and emotion regulation difficulties, thus mitigating the impact on negative symptoms. These results align with and contribute to existing literature that underscores the complex interrelations between personality, cognitive processing, and symptomatology in schizophrenia.

The role of personality traits in schizophrenia has been a topic of interest for many years, with research suggesting that certain traits, particularly neuroticism, exacerbate negative symptoms such as apathy, anhedonia, and social withdrawal (10, 42). In this study, neuroticism showed a positive correlation with both difficulty in emotion regulation and cognitive biases, consistent with findings from previous studies (43, 44). Neuroticism, characterized by emotional instability and a heightened sensitivity to stress, has been linked to maladaptive cognitive styles, such as biased information processing and difficulty in regulating emotional responses (26-28). These traits may, in turn, exacerbate psychotic-like experiences and negative symptoms, as individuals with high neuroticism are more likely to misinterpret emotional or social cues and experience intense, unregulated emotional responses.

The negative impact of neuroticism on emotion regulation and cognitive biases is further supported by research indicating that individuals with high neuroticism tend to display greater cognitive distortions and biases toward negative information (19, 20, 24, 30). This emotional dysregulation and cognitive bias, in turn, appear to facilitate the manifestation of negative symptoms in schizophrenia (Pionke-Ubych et al., 2021; Maroney, 2022). For instance, individuals who struggle to regulate their emotions may

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become overwhelmed by distressing experiences, which can perpetuate social withdrawal, lack of motivation, and emotional numbness—key features of negative symptoms (27, 28, 45). Moreover, cognitive biases such as jumping to conclusions or catastrophizing can exacerbate psychotic experiences and reinforce negative symptomatology (19, 43).

Conversely, traits such as extraversion and agreeableness, which reflect greater emotional stability and social engagement, showed a negative correlation with cognitive biases and emotion regulation difficulties, suggesting a protective effect. Previous studies have highlighted that individuals with high extraversion tend to display better emotion regulation and more adaptive coping strategies in the face of stress (8, 26). The findings from the current study align with this literature, as higher levels of extraversion were associated with lower levels of emotion dysregulation and cognitive biases, which in turn helped reduce negative symptoms. Likewise, agreeableness, which is linked to greater empathy and social connectedness, also acted as a buffer against cognitive biases and emotion regulation difficulties, further mitigating the impact on negative symptoms (32, 46).

Self-directedness and cooperation, both of which are considered adaptive character traits, were positively associated with better emotion regulation and fewer cognitive biases. These findings suggest that individuals with high self-directedness, characterized by goal-directed behavior and a sense of purpose, may be better equipped to manage emotional challenges and regulate their thoughts, which could explain their reduced vulnerability to negative symptoms (10, 14). Similarly, cooperation, which reflects social harmony and a tendency to seek support from others, might serve as a protective factor against the cognitive biases and emotional dysregulation that often contribute to the development of negative symptoms (3, 39).

Finally, self-transcendence, a trait characterized by a sense of connectedness to something greater than oneself, was found to significantly reduce both cognitive biases and emotion regulation difficulties, ultimately leading to a decrease in negative symptoms. This finding supports previous research that has highlighted the positive impact of self-transcendence and spiritual well-being on mental health outcomes, including psychosis (11, 14). Self-transcendence may foster a more flexible and adaptive approach to emotional and cognitive challenges, potentially reducing the intensity of negative symptoms and promoting a more resilient mental state in individuals with schizophrenia.

Overall, the findings of this study provide valuable insights into the complex pathways through which personality traits, cognitive biases, and emotion regulation interact to influence negative symptoms in schizophrenia. By identifying the mediating roles of cognitive biases and emotion regulation, the study underscores the importance of addressing these factors in interventions aimed at reducing negative symptoms and improving overall functioning in individuals with schizophrenia.

Despite the important contributions of this study, several limitations must be considered when interpreting the results. First, the cross-sectional nature of the study limits our ability to draw conclusions about causal relationships between personality traits, cognitive biases, emotion regulation, and negative symptoms. Longitudinal studies are needed to better understand how these variables interact over time and how changes in one variable might influence others. Second, while the sample was diverse, it was not representative of all individuals with schizophrenia, particularly those with different subtypes or comorbid conditions. Future research could aim to replicate these findings in more diverse populations, including individuals with varying levels of symptom severity or treatment histories. Third, the reliance on self-report measures to assess personality traits and emotion regulation may introduce bias, as individuals with schizophrenia may have impaired self-awareness or difficulties accurately reporting their symptoms. Objective assessments, such as behavioral tasks or clinician-rated evaluations, could provide a more comprehensive understanding of these constructs. Finally, the study focused on only a limited number of personality traits and cognitive biases, leaving out other potentially important factors, such as self-esteem or social support, which may also play a significant role in the development of negative symptoms in schizophrenia.

Future research could expand upon the findings of this study by exploring additional mediating factors that may contribute to the relationship between personality and negative symptoms in schizophrenia. For instance, investigating the role of social support, coping strategies, or

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mindfulness in moderating these relationships could offer valuable insights into potential therapeutic interventions. Furthermore, longitudinal research is necessary to establish causality and determine how changes in personality traits, cognitive biases, and emotion regulation abilities over time influence the trajectory of negative symptoms in schizophrenia. It would also be beneficial to examine whether certain personality traits interact with specific cognitive biases or emotional processing styles to create unique subtypes of negative symptoms. Such studies could help identify more personalized interventions for individuals with schizophrenia, tailored to their specific personality profiles and cognitive styles.

Moreover, research could investigate the neurobiological underpinnings of the observed relationships, focusing on how brain regions associated with emotion regulation and cognitive processing, such as the prefrontal cortex and amygdala, are affected by personality traits and contribute to the development of negative symptoms. Understanding the neural mechanisms that link personality, cognition, and symptomatology in schizophrenia could inform the development of targeted pharmacological or neurostimulation interventions. Lastly, it would be useful to explore how these findings extend to other psychotic disorders or non-clinical populations, particularly those at clinical high risk for psychosis, to determine whether similar mediating mechanisms are at play across different stages of psychosis.

In clinical practice, the findings of this study suggest that addressing difficulties in emotion regulation and cognitive biases may be key to improving outcomes for individuals with schizophrenia, particularly with regard to negative symptoms. Clinicians could focus on implementing interventions that enhance emotional awareness and regulation skills, such as cognitive-behavioral therapy (CBT) or mindfulness-based approaches, which have been shown to reduce emotional dysregulation and cognitive distortions in psychotic disorders. Additionally, therapies that target maladaptive cognitive biases, such as cognitive bias modification (CBM), may help to reframe negative thinking patterns and reduce the intensity of psychotic symptoms. Furthermore, promoting the development of adaptive personality traits, such as self-directedness and cooperation, through psychosocial interventions could help individuals build resilience and coping strategies that mitigate the impact of negative symptoms. Lastly, the inclusion of spiritual or self-transcendence practices, particularly in therapeutic settings that emphasize personal growth and meaning-making, may contribute to improved emotional regulation and reduced symptom severity in individuals with schizophrenia.

Authors' Contributions

H. R. contributed to the conceptualization, design, and methodology of the study. A. M. assisted in data analysis and interpretation. Q. A. provided support in data collection and literature review. S. A. B. contributed to the discussion of findings and manuscript writing. F. S. contributed to data analysis and manuscript revision. All authors were involved in reviewing and approving the final manuscript.

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.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual

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privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki. Ethical considerations included obtaining informed consent, ensuring confidentiality and anonymity, and avoiding any harm to participants. The study was approved by the Biomedical Research Ethics Committee of Islamic Azad University, Birjand Branch, under approval code IR.IAU.BIRJAND.REC.1402.003.

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