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Effect of Anxiety on Impulsivity: Mediating Role of Cognitive Flexibility

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Abstract

Impulsivity is linked to adverse outcomes, such as substance abuse and risky behaviors. Understanding how anxiety contributes to impulsivity is crucial for intervention. This study explores the potential mediating role of cognitive flexibility in the relationship between anxiety and impulsivity. This study investigates whether cognitive flexibility serves as a mediating factor between anxiety and impulsivity, aiming to elucidate the underlying mechanisms of their association. A convenience sample of 505 participants aged 18-30 without psychiatric or substance abuse disorders was included. Participants completed the General Anxiety Disorder-7, Barratt Impulsiveness Scale-11, and Cognitive Flexibility Inventory. Path analysis was conducted to examine the potential mediating role of cognitive flexibility. The study revealed a significant direct link between anxiety and impulsivity ($\beta = 0.1807$, $p = 0.001$). However, it was found that cognitive flexibility did not mediate this relationship. The indirect effect of anxiety on impulsivity through cognitive flexibility was not statistically significant ($\beta = -0.0163$, $p = 0.074$). These findings suggest that cognitive flexibility, as assessed in this study, does not account for the relationship between anxiety and impulsivity. While this study explored cognitive flexibility as a potential mediator, it did not find evidence to support this role. This implies that other factors may play a more significant part in explaining the link between anxiety and impulsivity. The study highlights the complexity of these psychological constructs and underscores the need for further research to unravel their interplay. It emphasizes the importance of considering nuanced aspects of anxiety, impulsivity, and cognitive flexibility in future investigations. This research contributes to the ongoing discussion surrounding these psychological traits and the factors influencing their relationship.

Keywords: Impulsivity, Anxiety, Cognitive flexibility

Introduction

Impulsivity has been found to be associated with a large range of negative outcomes, including substance use disorders, risky sexual behavior, and aggression (Evenden &J, 1999)[15]. Understanding how anxiety contributes to impulsivity can help identify potential targets for intervention and prevention. Understanding the interaction and the mediating role of cognitive flexibility between anxiety and impulsivity can help in finding the underlying mechanisms that can explain the positive association between anxiety and impulsivity (Del Carlo et al., 2012)[11]. However, there have also been studies that suggest that characteristics of anxiety and impulsivity are inconsistent with each other (Taylor et al., 2008)[38]. This may be because of the safety seeking characteristics that we have usually seen describing anxiety. The relationship between anxiety and impulsivity is a controversial one (Askénazy et al., 2003)[3].

This might be because of the two conflicting characteristics that are found in anxiety (Xia et al., 2017)[40]. One is the elevated physical arousal (leading to approach behavior). The other one is continued focus on a threat-related stimulus (leading to avoidance behavior). Hence, understanding the underlying mechanisms becomes crucial to predict behaviors. Also, studies (Yu et al, 2019)[41] have not studied the effect of anxiety on impulsivity and the mediating role of cognitive flexibility in isolation. Anxiety has been usually studied alongside stress and depression and not as an isolated construct.

Anxiety in this study is defined as persistent, unrealistic fear and worry about everyday events accompanied by feelings of being overwhelmed in everyday life. Impulsivity in this study is defined as the lack of attention,motor and non-planning of events, ideas and situations. Cognitive Flexibility in this study is defined as the ability to perceive difficult situations as controllable to some extent and to have adaptive ability in order to provide alternative explanations and solutions to occurrences.

Anxiety and Impulsivity have been found to have a relationship which is controversial in nature due to the conflicting nature of anxiety. Hence, this study aims to investigate if cognitive flexibility plays a mediating role between anxiety and impulsivity. This will help in understanding the underlying mechanism between anxiety and impulsivity and can be of use for interventions in clinical practice and in expanding knowledge base.

Though there has been positive correlation found between anxiety and impulsivity, the underlying mechanisms of this relationship are not understood well (Taylor et al., 2008)[38]. These constructs have been linked to several negative outcomes, such as substance use disorders, risky behaviors, and poor mental health.

Impulsivity has been a topic of interest to psychologists and psychiatrists since the time it has been identified as a criteria for certain psychiatric disorders. Impulsivity is acting upon the spur of the moment and not planning carefully and thinking about the future consequences of their actions (Patton et.al, 1995)[28]. Impulsive behavior can lead to many harmful consequences like suicide, engaging in risk behavior and at times causing harm to others.

Anxiety is a negative emotion which is mainly characterized by the feeling of worry, tension which often causes physical changes such as increased blood pressure, sweating and trembling and rapid heartbeat (May, 1950)[25]. Anxiety is often characterized by the feelings of apprehension and tension, mostly accompanied by physical symptoms such as increased heart rate and sweating (American Psychological Association, 2013)[1]. Anxiety and impulsivity have found to be correlated (Jakuszkowiak-Wojte et al., 2015)[18]. However this topic has not been extensively studied. Two main risk factors associated with suicidality have been identified as anxiety and impulsivity (Pierò, 2010)[30]. Hence it is important to study them and other mediating factors that play a role between them. Cognitive flexibility has been seen as a core part of executive functioning. It is the ability that one has to be able to shift their cognitive sets freely in different ways in order to achieve a particular goal (Johnco et al, 2014 ; Rende, 2000)[19,32]. Though impulsivity has been found to be associated with disorders like ADHD and other personality disorders, there has not been a comprehensive definition. Impulsivity is a construct which is multifactorial in nature. There are three major components of impulsivity. First is acting due to the spur of the moment. This is also referred to as motor activation. The second one is having little ability to handle cognitive conflict and taking very fast cognitive decisions and not focusing on the task that is at hand. This is referred to as attention/cognition. Third, is not engaging in carefully planning and thinking. This is referred to as lack of planning (Barratt et al., 1994)[6].It is very important to study impulsivity as helps in understanding various clinical disorders such as gambling disorders, substance use disorders, suicide attempts, self-injury

and aggression (Quilty et al., 2010)[31]. Relationships between depression, anxiety and stress have been found to be a strong predictor for impulsivity among the age group ranging from 18-30 years (Moustafa et al., 2017)[26].

Anxiety and depression has been the most common negative emotion among the clinical and non-clinical population (Yu et al., 2020)[41]. However, most of the studies that have been conducted have been studying the relationship of both depression and anxiety with impulsivity. But, since the mechanism behind depression and anxiety and impulsiveness is unknown, studying it using a mediating variable may become helpful. Also, separating and studying anxiety and depression may help in finding out if there are differences between both of these negative emotions and impulsivity. Another study found that anxiety and depression are differentially correlated to impulsivity (Yu et al., 2020)[41] hence, in this study, the focus will be on anxiety. The negative impacts of anxiety moves beyond aversive feelings, it extends to disturbances in cognitive functioning and goal-directed behavior. It has also been found that anxiety affects the ability to flexibility shift between strategies as a response to changes with the demands of the task and also the ability of maintenance of a strategy when there are other distractions. State anxiety was found to have a positive relationship with impulsivity among patients with major depressive disorder and bipolar disorder (Bellani et al., 2012)[8]. However there have also been studies that have found no relationship existing between anxiety and impulsivity (Apter 1993, Askenazy 2000)[2,5]. Traditionally it was found that impulsivity and anxiety had a negative relationship with the assumption that anxiety will alter one's behavior to avoid threat. Extensive anxiety causes deficits in cognitive flexibility and decision making (Park & Moghaddam, 2017)[27]. It has also been found that people who have anxiety disorders find it difficult to follow a strategy that is currently valid from a previously effective strategy. People with anxiety symptoms are also found to engage in negative repetitive thinking (Rood et al., 2010)[33]. It has also been found that the trait anxiety impairs cognitive flexibility (Wilson et al., 2018)[39]. Based on the above findings, it can be speculated there exists a link between anxiety and impulsivity through cognitive flexibility. There has also been a positive relationship found between trait anxiety and cognitive flexibility (Garami et al., 2017)[17]. It was also found that trait anxiety impaired cognitive flexibility (Wilson et al., 2018)[39]. The overlapping symptoms of anxiety and depression found cognitive flexibility playing a mediating role. However, it was also found that anxiety and depression had different associations with cognitive flexibility (Yu et al., 2020)[41]. The mediating role of cognitive flexibility between anxiety and impulsivity has not been studied.

From the review of literature we see that there has been a relationship between anxiety and impulsivity and cognitive flexibility. Also studying only anxiety, isolating from overlapping symptoms of depression with cognitive flexibility as a mediating variable has not been studied.

The attentional control hypothesis is a theory that links anxiety to impulsivity. According to this theory, anxiety is linked to problems with attentional control, which might result in impulsive conduct. Particularly, those who are anxious may have a predisposition towards attending to information that is associated with threats, which makes it challenging to detach attention from these stimuli and devote it to other tasks. As a result, people may act without fully analyzing the effects of their choices, which can lead to impulsive conduct. Hence, cognitive flexibility may be crucial in modifying this association, since people with higher levels of cognitive flexibility may be better able to divert their attention away from threat-related stimuli and towards more adaptive tasks (Eysenck et al., 2011)[14].

The dual systems model of self-regulation is another theory that links cognitive flexibility as a mediator between anxiety and impulsivity. According to this paradigm, self-regulation involves both an approach

system and an avoidance system. The avoidance system prevents conduct that can lead to unfavorable results, whereas the approach system initiates and pursues behavior that seeks rewards. Those with higher cognitive flexibility may be better able to switch their attention between avoidance and reward-seeking behaviors, which might reduce impulsivity and anxiety. This suggests that cognitive flexibility may be crucial in controlling the interaction between these two systems (Carver et al., 2008)[9].

The objective of the study is to determine if there exists a mediating role of cognitive flexibility between anxiety and impulsivity and thus provide a better understanding for the mechanism underlying anxiety and impulsivity.

It is hypothesized that cognitive flexibility mediates the relationship between anxiety and impulsivity .

Method

Aims/objectives

The objective of the study is to determine if there exists a mediating role of cognitive flexibility between anxiety and impulsivity and thus provide a better understanding for the mechanism underlying anxiety and impulsivity.

Hypothesis

It is hypothesized that cognitive flexibility mediates the relationship between anxiety and impulsivity

Sampling Method

Sampling method used in this study will be convenience sampling. The total participants for the study was 505.

Sample characteristics

A total of 505 participants who belong to the age group of the 18-30 years participated in the research. The sample did not receive any monetary compensation for their participation.

The participants were not diagnosed with any psychiatric disorders, any cognitive disorders, any behavioral addiction disorders. They had also not been dependent or abusing any substance for the past 3 months and did not suffer from any brain injury.

Tools

The instruments that was used to measure the constructs are (1) General Anxiety Disorder -7 (2) Baratt's Impulsiveness Scale -11 (3) Cognitive Flexibility Inventory

General Anxiety Disorder -7 (GAD-7)

GAD-7 is a widely used self-report scale used to measure anxiety and its severity. It consists of a total of 7 items which are scored from 0 to 3. This scale was developed by Spitzer and his colleagues (Spitzer et al., 2006)[34].The individual is asked to respond based on the experience of the past two weeks. With Cronbach's alpha values ranging from 0.79 to 0.93, the GAD-7 has shown to have a good level of internal consistency (Spitzer et al., 2006; Löwe et al., 2008)[34,24].Moreover, it has been demonstrated that test-retest reliability is strong, with intraclass correlation values ranging from 0.82 to 0.83. Due to its strong correlations with other anxiety measures including the State-Trait Anxiety Inventory (STAI) and the Beck Anxiety Inventory (BAI), the GAD-7 has been found to have good convergent validity (Spitzer et al., 2006

Löwe et al., 2008)[34,24]. The GAD-7 exhibits decreased correlations with measures of depression and somatization, demonstrating discriminant validity.

Barratt Impulsiveness Scale-11 (BIS -11)

This tool is a 30 items tool questionnaire which is a self-report questionnaire for measuring impulsiveness. It was found that BIS-11 exhibits appropriate psychometric properties (reliability and validity) across clinical and non-clinical populations (Stanford et al., 2009)[35].

Cognitive Flexibility Inventory (CFI)

This inventory measures the cognitive adaptability of an individual. It can also differentiate between clinical and non clinical groups. It consists of 20 items in total and has two subscales, alternative and control sunscales. The test-rest reliability for the alternative subscale is .75 and for the control subscale is .77. Furthermore there was evidence supporting the convergence and construct validity of the inventory (Dennis & Vander Wal, 2010)[12].

Procedure

The responses were collected via online and offline methods. APA code of ethics was followed during the process of data collection. The online data was collected via the platform called REDCap and for the offline method, the data was collected using pen and paper. Informed consent was obtained in both these methods and the responses were self-recorded by the participants once the instructions to fill the questionnaire was given. To ensure confidentiality, the names of the participants were coded.

Statistical analysis

The statistical analysis was carried out on IBM SPSS v. 20 software. Path analysis was performed in order to study if there is a mediating effect of cognitive flexibility between anxiety and impulsivity. Firstly, bivariate regression will be performed between anxiety and impulsivity. This will be followed by bivariate regression between anxiety and cognitive flexibility. Finally, multiple regression will be performed between anxiety and impulsivity and between cognitive flexibility and impulsivity. After obtaining path 'a' and 'b', sobel test was performed to obtain the indirect effect.

Results

Table 1: Frequencies of Age, Gender, Occupation and State of Residences

Demographic Details		**N**	**% Of Total**
Age	18-21	310	61.38%
	22-25	154	30.50%
	26-30	41	8.12%
	Total	505	100%
Gender	Male	151	29.9%

	Female	351	69.5%
	Prefer not to say	2	0.4%
	Others	1	0.2%
	Total	505	100%
Occupation	Working	97	19.2%
	Student	408	80.8%
	Total	505	100%
State of Residence	Karnataka	222	44.0%
	Others	160	31.7%
	Kerala	53	10.5%
	Maharashtra	44	8.7%
	Delhi	26	5.1%
	Total	505	100%

In this research study, a total of 505 participants were included in the 18-21 years old age group, while 154 participants fell within the 22-25 age range, and 41 participants were categorized in the 26-30 age group. The composition of the participants consisted of 351 females, 151 males, 2 individuals who chose not to disclose their gender, and 1 participant who selected the "other" gender category. Furthermore, the participant pool was divided into 97 individuals currently employed and 408 individuals pursuing education as students.

Geographically, the participants were distributed as follows: 222 participants resided in Karnataka, 53 in Kerala, 44 in Maharashtra, 26 in Delhi, and 160 participants hailed from various other states within India.

Table 2: Descriptive Statistics of Anxiety, Impulsivity and Cognitive Flexibility of Emerging Adults of India

	N	**Mean**	**Median**	**Standard Deviation**	**Skewness**	**Kurtosis**
Anxiety	505	13.00	13	5.80	0.0653	-0.330
Impulsivity	505	74.8	74	6.20	0.242	0.392
Cognitive Flexibility	505	92.2	93	10.4	-0.849	1.16

Figure 1: Conceptual Diagram of the model of mediation

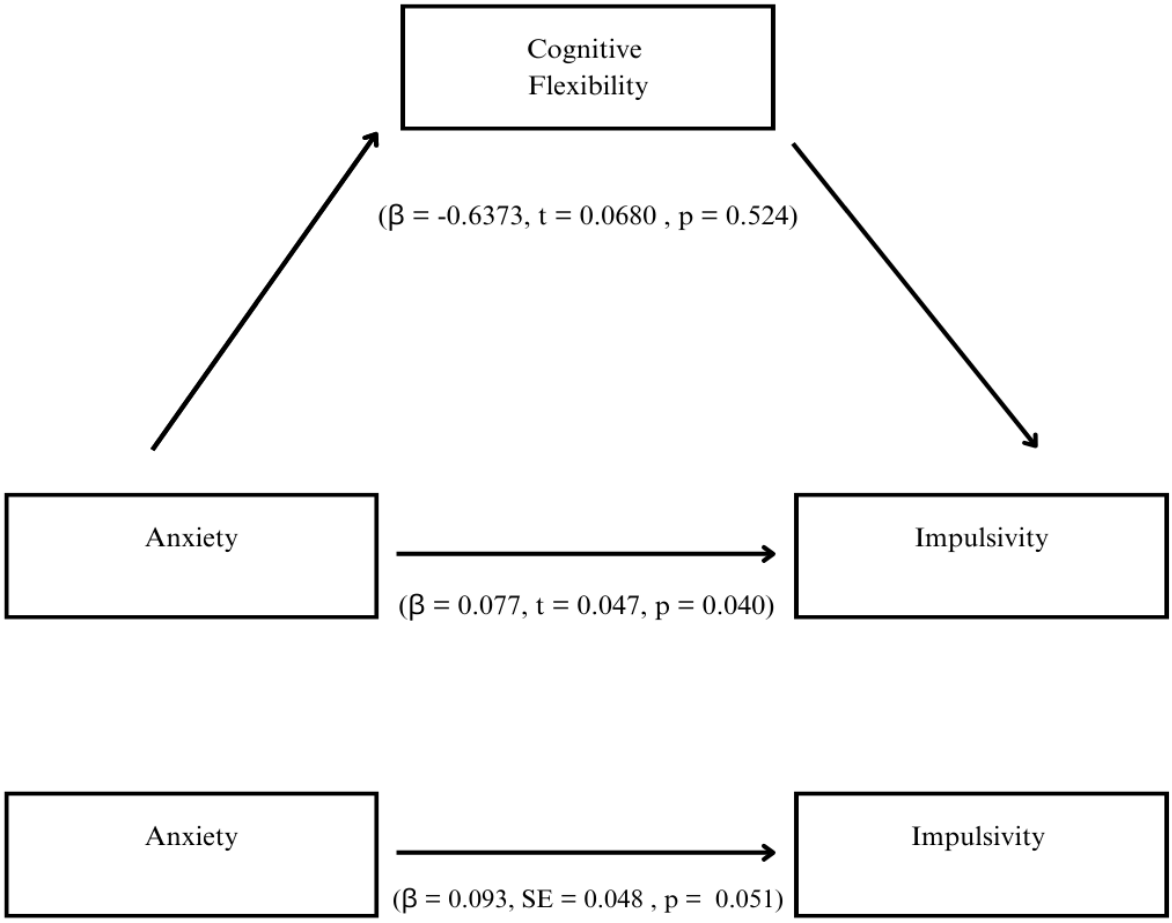

Table 3: Mediation Estimates of cognitive flexibility between anxiety and impulsivity

Effect	**Path**	**β**	**SE**	**p**
Indirect Effect (a x b)	Anxiety→Cognitive Flexibility→ Impulsivity	- 0.637	0.0680	0.524
Direct Effect (c)	Anxiety→Impulsivity	0.097	0.047	0.040
Total Effect (c + a x b)	Anxiety→Impulsivity	0.093	0.048	0.051

Mediation analysis was performed to assess the mediating role of Cognitive flexibility on the linkage between anxiety and impulsivity. SPSS was used to test the mediating effect of cognitive flexibility between anxiety and impulsivity. The study aimed to clarify whether cognitive flexibility serves as a mediator, explaining the link between anxiety and impulsivity. The results (see table 3) revealed an insignificant negative indirect relationship of anxiety on impulsivity (β = -0.6373, SE = 0.0680 , p = 0.524). The total effect of anxiety on impulsivity was also found to be insignificant (β = 0.093, SE = 0.048 , p = 0.051), with the inclusion of the mediator (i.e. cognitive flexibility), the effect of anxiety on impulsivity

was found to be significant (β = 0.077, SE = 0.047, p = 0.040). This shows that cognitive flexibility does not mediate the relationship between anxiety and impulsivity. There was a direct effect between anxiety and impulsivity however, there was no indirect effect between them.

Discussion

The primary noteworthy finding is that a substantial and statistically significant direct relationship exists between anxiety and impulsivity (β = 0.1807, SE = 3.26, p = 0.001). This observation corresponds with prior research that has consistently demonstrated a positive connection between anxiety and impulsivity. Anxiety frequently presents itself as an elevated state of emotional arousal and negative mood, potentially prompting impulsive actions as individuals attempt to mitigate their discomfort or evade situations that trigger anxiety (Cyders & Smith, 2008)[10].

Although there has been literature examining the role of cognitive flexibility in context to gambling disorder and obsessive compulsive disorder, there is hardly any literature examining the relationship between anxiety and impulsivity. Although there is a paper which found that anxiety predicts motor impulsivity (Yu et al., 2020)[41].

Notably, when cognitive flexibility was introduced as a mediating factor, it did not reduce the direct impact of anxiety on impulsivity. Even after accounting for cognitive flexibility, anxiety retained its considerable influence on impulsivity (β = 0.1970, SE = 3.62, p < 0.001). This implies that although cognitive flexibility is a significant psychological factor linked to both anxiety and impulsivity, it does not account for the relationship between anxiety and impulsivity.

The most crucial finding of this study is that cognitive flexibility did not mediate the relationship between anxiety and impulsivity. The indirect effect of anxiety on impulsivity through cognitive flexibility was not significant (β = -0.0163, SE = -1.79 , p = 0.074). This implies that cognitive flexibility, as assessed in this study, does not explain why anxiety leads to impulsivity. This result contradicts some previous studies that have suggested cognitive flexibility as a potential mediator in the relationship between anxiety and impulsive behaviors (Yu et al., 2020)[41]. Another study which was conducted on nursing students found that there existed a significant negative relationship between cognitive control and flexibility level of the students and their anxiety levels (Kahraman et al., 2022)[20].

These findings suggest that other factors, beyond cognitive flexibility, may play a more substantial role in explaining why anxiety is linked to impulsivity. Future research could explore additional mediating variables, such as emotional regulation or specific cognitive processes, that might help clarify the mechanism underlying this relationship. The findings mentioned above reject the alternative hypothesis proposed in this study. Moreover, it's important to acknowledge that the absence of mediation does not negate the importance of cognitive flexibility in understanding psychological functioning. Cognitive flexibility is a multifaceted construct, and its various components may have different relationships with anxiety and impulsivity. Further investigations into the nuanced aspects of cognitive flexibility may provide a more comprehensive understanding of its role in impulsive behaviors. However, there have been studies in which cognitive flexibility could explain the relationship between depression, anxiety and stress when measured together (Moustafa et al., 2017)[26]. One of the reasons why cognitive flexibility does not mediate the relationship between anxiety and impulsivity might be since most of the emerging adults have reported low levels of anxiety. The emotional dysregulation model of GAD posits that patients experience more frequent and intense negative emotions while having poor regulatory control over emotional states and greater negative reactivity to their emotions. Due to this, poor regulatory control could be expected in

the presence of negative effects (Suveg et al., 2010)[36]. Since in this study, most of the participants had low levels of anxiety, cognitive flexibility does not explain the relationship between anxiety and impulsivity.Therefore to conclude the role of cognitive flexibility, further investigations need to be conducted among the clinical population.

Implications of the study

Identification of the potentially mediating role of cognitive flexibility between state and trait anxiety can help the clinicians and researchers understand the underlying mechanisms and thus will be able to develop more effective treatments and interventions. Furthermore it will also enhance and advance the theoretical and will help with the refinement and development of theories.

Limitations

The study includes a predominantly young, student population, which might lack diversity in terms of age, occupation, and life experiences. The results may not be representative of the broader population. The study's design is correlational, which makes it difficult to establish causality. While the analysis explores the relationship and potential mediation, it cannot determine the direction of the effects. It's possible that other variables or underlying factors may explain the observed associations.

Conclusion

In conclusion, while this study did not find cognitive flexibility to mediate the relationship between anxiety and impulsivity, it underscores the complexity of these constructs and the need for continued research to better elucidate their interplay. This mediation analysis underscores the complexity of the relationship between anxiety and impulsivity and highlights the need for continued research to uncover the precise mechanisms and factors that contribute to this association.

Recommendations

The choice of cognitive flexibility as the mediating variable is based on existing literature, but other potential mediating factors, such as emotional regulation or specific cognitive processes, were not explored. It's possible that different mediating variables could yield different results.

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