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Investigating the Mediating Role of Guilt in the Association between Brain-behavioral Inhibition Systems and Marital Commitment in College Students

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Abstract

Background: Marital commitment is the strongest and most stable predictor of the quality and stability of marital relationships.

Objectives: The present study aimed to assess the mediating role of guilt in the association between brain behavioral inhibition and marital commitment among college students.

Methods: The present study is a practical correlational research project. The target population consisted of all married students at the Faculty of Psychology, Islamic Azad University, Karaj Branch, Iran, during the academic year 2022-2023. A convenience sampling method was used to select 130 married female students. The data collection tools were Dimensions of Commitment Inventory, The Behavioral Inhibition and Activation Systems Scales, and Interpersonal Correlates of the Guilt Inventory. The researchers used SPSS software (version 27) to conduct descriptive statistics and SmartPLS software (version 4) to examine data trends and relationships between variables.

Results: According to the findings, brain behavioral inhibition was found to have a detrimental impact on marital commitment (β=-0.284; P=0.002). In a similar vein, brain behavioral inhibition had a favorable impact on sin (β=0.200: P=0.044) and on state guilt (β=0.243: P=0.005). Nonetheless, brain behavioral inhibition had a negative impact on ethical standards (β=-0.341; P<0.001). However, none of the indirect interactions involving the guilt component were deemed significant.

Conclusion: The results indicated that focusing on the impact of behavioral inhibition system activity and guilt is crucial in enhancing the bond between partners, particularly married women and students, and developing effective therapeutic strategies.

Keywords: Brain-behavioral inhibition system, College students, Guilt, Marital commitment

1. Background

Understanding the quality and stability of marital relationships requires focusing on marital commitment and satisfaction (1). Recent studies have repeatedly assessed the correlations of marital commitment, revealing that various factors affect couples' commitment levels (2). The key predictors of marital commitment include marital satisfaction, problem-solving skills, and personality traits (3). Marital commitment enhances intimacy in relationships, strengthening emotional bonds. Healthy relationships lead to positive outcomes in life, while unsatisfactory relationships can negatively impact physical and mental health. Intimacy involves feelings of closeness, similarity, and emotional connections, requiring a deep understanding of one another

to effectively communicate thoughts and emotions (4). A study by Nemati et al. (2021) on marital commitment and mental health in various spouse selection patterns found alignment in marital commitment among married women (5). In addition, Park et al. (2021) conducted a study on partner commitment moderating the relationship between commitment and interest in romantic alternatives. They concluded that committed partners play a vital role in maintaining loyalty among committed individuals, emphasizing the importance of dyadic relationship processes (6). Arab et al. (2022) revealed that marital infidelity can be predicted based on couples' behavioral inhibition and activation systems, as well as their communication patterns. They demonstrated a connection between these factors and marital infidelity among married students (7). In the same context, Ofsieh Zadeh et al. (2021) determined that the behavioral activation and inhibition system can influence social exchange styles and sexual gratification in women (8).

Carver and White's theory (1994) discusses how such dimensions as behavioral, motivational, and personality traits can impact marital relationships and potentially lead individuals to avoid behaviors that jeopardize their commitment to marriage (9). These studies underscore the significance of the brain's inhibition system in personal relationships and stress the importance of further research in this area (10). Covenant-breaking is described as behaviors where a person neglects their responsibilities and communication with their spouse, choosing to interact with someone else instead. This behavior can lead to jealousy and competition within the relationship (11). Furthermore, another study found that the behavioral inhibition system was linked to stability, while the behavioral activation system was associated with positive flexibility and negative stability. When accounting for other factors, the behavioral inhibition system was strongly and positively correlated with emotional stability, while the behavioral activation system displayed a minor but significant relationship with extraversion(12). Moreover, Akbari et al. revealed that the behavioral inhibition system, when mediated by mentalization, plays a role in marital satisfaction. The inhibition system is negatively correlated with marital satisfaction and mentalization. These results indicate that both the behavioral activation and inhibition systems can predict marital satisfaction through mentalization (13).

Individuals in romantic relationships exhibit various thoughts, feelings, and actions that indicate heightened activity in their Brain-Behavioral Activation System (BAS). This can be observed in their increased value of rewards, willingness to work hard for rewards, strong emotional response to success, difficulty learning from failures, and lack of satisfaction even after success (14). The behavioral inhibition system (BIS), linked to Carver and White's BIS/BAS scale, was the only factor that predicted susceptibility to feelings of guilt. It should be highlighted that the amount of variance explained by BIS to guilt proneness was less than that for shame proneness (15). A previously performed study revealed that feelings of guilt can be employed to predict marital commitment in married individuals. Gender did not appear to have a significant impact on levels of marital commitment between men and women (16).

2. Objectives

Individual differences in cognitive control capacity have been demonstrated to predict a wide range of behaviors, including forgiveness and faithfulness in close relationships, the ability to resist flirting behaviors with a confederate, and mastery over the desire to meet an attractive person. It consists of features associated with a passionate love; nonetheless, commitment and intimacy grow steadily and become more critical, unlike early-stage love. Therefore, it is proposed that early-stage love can improve the ability to control

inhibition in the presence of negative emotions, leading to increased inhibition even in emotionally negative situations, which is believed to contribute to the formation of romantic relationships. In a similar vein, as individuals progress into later stages of love, reduced stress, feelings of safety and calmness, and a relatively stable relationship may result in a psychophysiological shift where greater inhibitory control capacity becomes less crucial (17). As noted earlier, in a limited number of studies, previous research has touched on the significance of negative emotions, such as guilt, behavioral activation systems, and marital commitment. Consequently, there is a lack of comprehensive research in this area, creating a gap in scientific knowledge. In light of the aforementioned issues, the present study aimed to explore how negative emotions, such as guilt, may mediate the connection between behavioral activation systems and marital commitment (Figure 1).

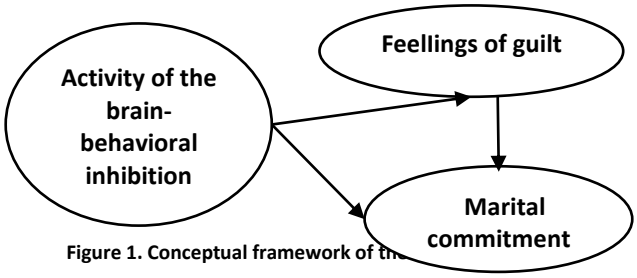

Figure 1. Conceptual framework of th

3. Methods

The present study utilized a descriptive-correlational method. The target population consisted of all married students enrolled in the Faculty of Psychology at Islamic Azad University, Karaj branch, during 2022-2023. The initial sample size was 440 individuals, 300 of whom were postgraduate students. Following the calculations based on Pallant's (2020) formula and accounting for potential dropouts, the final sample size was adjusted to 130 participants (17). The participants were selected using the convenience sampling method, and the questionnaires were distributed online with detailed instructions on how to complete them. After screening the responses and ensuring they met the inclusion criteria, the final sample size remained at 130 individuals. Pallant's formula (2020) is a commonly used technique for determining the appropriate sample size in statistical research, taking into consideration such factors as the population size and desired confidence level (17).

The formula suggested by Joly and Plant (2020) is outlined as follows:

$$n = (Z^2 * p * (1-p)) / E^2$$

In this equation:

n indicates the sample size to be determined.

Z represents the statistical value associated with the confidence level, with a Z value of 1.96 for a 95% confidence level.

p signifies the initial estimation of the parameter of interest, which can be derived from prior studies or empirical knowledge.

E represents the margin of error or the level of precision needed. Typically, this value is calculated as a percentage of the original parameter estimate. You can ascertain the required sample size for your statistical inquiry by applying this equation. It is essential to have key data, such as population size and an initial parameter estimate, to utilize this formula accurately.

The inclusion criteria entailed a 10-year duration of marriage, an age range of 25- 45 years, and the age gap between spouses ranging from 2-7 years. The surveys used in this study were shared with the statistical community online, along with instructions on how to complete them. From the start of data collection, participants were assured that none of their personal information would be

recorded or shared, and no sensitive details were requested in the questionnaires. It is noteworthy that this study adheres to the fundamental principles outlined in the Declaration of Helsinki regarding ethical guidelines for medical research involving human subjects.

The instruments below were used to collect data for this research.

Demographic Characteristics Form: This questionnaire which was designed by the researcher, collects essential demographic details, such as age and marital status.

Dimensions of Commitment Inventory: This scale evaluates individuals' loyalty to their spouse and marriage along with its various aspects(18). Adams and Jones developed this assessment tool to measure three dimensions of marital commitment. These dimensions include personal commitment, which is based on the attractiveness of the partner; moral commitment, which is rooted in sanctity and respect within the marital relationship; and structural commitment, which is driven by feelings of compulsion, stability in marriage, and fear of the consequences of divorce(18). Each item is rated on a 5-point Likert scale ranging from completely disagree=1 to completely agree=5. The highest score is assigned to the completely agree option, while the lowest score is given to the completely disagree option. Some items (11, 12, 16, 23, 28, 29, 30, 32, 34, 35, 36, and 38) are reversely scored. The total score can range from 1-72, with a high score indicating strong commitment in a couple(18). To test the reliability and validity of the questionnaire in different studies, Adams and Jones administered it to 417 married individuals, 347 single cases, and 46 divorced subjects. The correlation between each item and the total test score was significant, further supporting the dimensions outlined in the questionnaire. The reliability of the test scales was confirmed in the sample, with personal commitment scoring 0.91, moral commitment scoring 0.89, and structural commitment scoring 0.8618. In a study conducted by Shahsiah (2009), Cronbach's alpha for the entire questionnaire was reported to be 0.85(19).

Behavioral Inhibition and Activation Systems Scales: Carver & White created a self-report questionnaire with 24 items, using a four-point Likert scale to assess individuals' tendencies towards avoidance and approach behaviors (9). With four 4 cover questions excluded, 7 items measured BIS sensitivity to aversive stimuli, while the remaining 13 items assessed BAS sensitivity to appetitive stimuli across three subscales: drive, reward responsiveness, and fun-seeking. The internal consistency of the tool was evaluated, resulting in reliability coefficients of 0.74 for BIS and 0.74, 0.76, and 0.66 for reward responsiveness, drive, and fun-seeking subscales. The validity of the questionnaire was assessed using a test-retest method, with reported coefficients of 0.66 for BIS, 0.66 for drive, 0.59 for reward responsiveness, and 0.69 for fun-seeking. In Iran, Habibi et al.(20) examined the psychometric properties of this scale, finding that the factor structure of the Persian version aligned with the original version. The Cronbach's alpha coefficient was reported as 0.66 for BIS, 0.86 for BAS, and 0.57, 0.78, and 0.63 for e drive, reward responsiveness, and fun-seeking subscales (20). The reliability of the tool was determined using Cronbach's alpha, resulting in coefficients of 0.73 for BIS and 0.72 for BAS.

Interpersonal Correlates of the Guilt Inventory: Jones & Kugler developed, finalized, and revised the Guilt Inventory, which includes 45 items and three subscales focusing on state guilt, trait guilt, and moral standards (21). The questionnaire comprises items related to guilt characteristics and state, as well as ethical standards. Scores of 45-75, 75-150, and >225 demonstrate low, average, and high levels of guilt, respectively. Jones & Kugler reported internal consistency coefficients of 79% for state guilt and 89% for trait guilt (21). In Iran,

Naziri assessed the reliability of the inventory using a test-retest method over three weeks with 30 students, resulting in a reliability coefficient of 83% for the entire scale (22).

The researchers used SPSS software (version 27) to conduct descriptive statistics and SmartPLS software (version 4) to examine data trends and relationships between variables. In addition, Sobel's test was employed to assess the significance of the mediator variable. The normality of research variables distribution was assessed using the Shapiro-Wilk test, which revealed a non-normal distribution. Therefore, SmartPLS was utilized. The sample size of 250 individuals was deemed adequate for implementing the structural equation model with the partial least squares method. A significance level of 0.05 was established for the analysis.

4. Results

Initially, the researcher examined the descriptive statistics related to the variables of the study. The participants were assigned to three age groups: 20-30, 31-40, and over 40. Meanwhile, the distribution rates of participants in these groups were 6.9%, 76.2%, and 16.9% respectively. Regarding the length of their marriages, the participants were allocated to two primary groups: those married for 5-10 years (95.4%) and those married for 11-15 years (4.6%).

Table 1 displays the mean scores of research variables.

In a similar vein, prior to investigating the research aim, the researcher conducted an initial examination of the analysis normality. The normality of the distribution of the research variables was assessed using the Shapiro-Wilk test, and according to Table 2, this test did not yield significant results for the research variables. As for the random sample, the researcher's sampling technique was random, thereby confirming this assumption. Prior to model implementation, the researcher reviewed outlier data and did not encounter any problematic data. The sample size of 130 individuals is deemed sufficient for running the structural equation model using the partial least squares method.

Table 1. Descriptive statistics of the variables

Variables		N	Mean	SD	Min	Max	Shapiro-Wilk	
							P	W
Brain behavioral inhibition		130	15.8	2.52	10.0	23.0	0.982	0.086
Feel guilty	Sin	130	64.4	5.58	52.0	77.0	0.989	0.410
	State guilt	130	34.2	6.62	21.0	51.0	0.979	0.041
	Ethical standards	130	28.3	5.30	17.0	42.0	0.984	0.145
	Total guilt score	130	126.9	8.91	104.0	147.0	0.985	0.174
Marita	Commitment to spouse	130	37.2	5.87	24.0	50.0	0.984	0.120
	Commitment to marriage	130	41.1	9.61	20.0	64.0	0.985	0.183
	Sense of commitment	130	75.2	13.58	45.0	105.0	0.981	0.061
	Total score of marital commitment	130	153.5	26.15	98.0	209.0	0.986	0.222

Table 2. Correlation matrix between variables

Variables	1	2	3	4	5	6	7	8	9
Commitment to spouse	—								
Commitment to marriage	0.762	—							
Sense of commitment	0.581	0.743	—						
Total score of marital commitment	0.806	0.924	0.923	—					
Brain behavioral inhibition	-0.332	-0.354	-0.395	-0.410	—				
Sin	-0.373	-0.387	-0.397	-0.432	0.200	—			
State guilt	-0.207	-0.116	-0.299	-0.244	0.243	0.189	—		
Ethical standards	0.299	0.308	0.323	0.348	-0.341	-0.385	-0.212	—	
Total guilt score	-0.209	-0.145	-0.278	-0.245	0.103	0.538	0.735	0.196	—

Based on the Pearson correlation coefficient in Table 3, marital commitment and its components exhibited a significant negative relationship with feelings of guilt and brain behavioral inhibition variables(P<0.05). The path and significance coefficients of the realization model are presented in Table 3. The researcher in this study set the bootstrap value to 5000 for analysis.

Table 3. Research coefficients and significance of the model

Path to variables	Path coefficient	STDEV	P-value	T-value	Result
Brain behavioral inhibition -> Characteristic of sin	0.200	0.099	0.044	2.011	confirmation
Brain behavioral inhibition -> Ethical standards	-0.341	0.084	p <0.001	4.056	confirmation
Brain behavioral inhibition -> Marital commitment	-0.284	0.090	0.002	3.152	confirmation
Brain behavioral inhibition -> State guilt	0.243	0.087	0.005	2.781	confirmation
Sin -> Marital commitment	-0.317	0.069	p <0.001	4.598	confirmation
Ethical standards -> Marital commitment	0.112	0.088	0.206	1.265	rejection
State of guilt -> Marital commitment	-0.083	0.082	0.308	1.019	rejection

As illustrated in Table 4 and Figure 2, brain behavioral inhibition was found to have a significant negative impact on marital Commitment (β=-0.284; P=0.002). In addition, brain behavioral inhibition had a significant positive effect on a person's sin (β=0.200, p=0.044) and state guilt (β=0.243; P=0.005). Nonetheless, brain-behavioral inhibition had a significant negative impact on ethical standards (β=-0.341; P<0.001).

Based on Table 4, it was revealed that none of the indirect connections involving feelings of guilt were found to be statistically significant. In order to confirm the insignificance of the mediating variable in the study, the researcher employed the Sobel test for further analysis. This test was conducted using a specific mathematical formula to determine significance.

$$\text{Z value} = \frac{|a \times b|}{\sqrt{(b^2 \times S_a^2) + (a^2 \times S_b^2) + (S_a^2 \times S_b^2)}}$$

a: The path coefficient value between the predictor variable and the mediator

b: The path coefficient value between the mediator and the outcome variable

Sa: The standard error of the path between the independent variable and the mediator

Sb: The standard error of the path between the mediator and the dependent variable

During the Sobel test, if the Z value exceeds 1.96, it indicates that the mediating effect of a variable is statistically significant at a 95% confidence level. None of the Z values were significant for the components in this study. The researcher also examined the coefficient of determination for endogenous variables in the study table 5. The researcher checked the reliability and validity of the research model in Table 6.

Table 6 clearly demonstrates that the reliability and validity of the model have been verified. The variables have a Cronbach's alpha reliability higher than 0.7. The combined reliability of these variables is also above 0.7. The validity of the model was assessed using the Average Variance Index, which was found to be above 0.5 for research variables, confirming the validity of the model. Furthermore, the researcher evaluated the model fit, with all fit indices being confirmed. The standardized root mean residual, which measures the difference between observed and model correlation, was calculated to be 0.090 for the model.

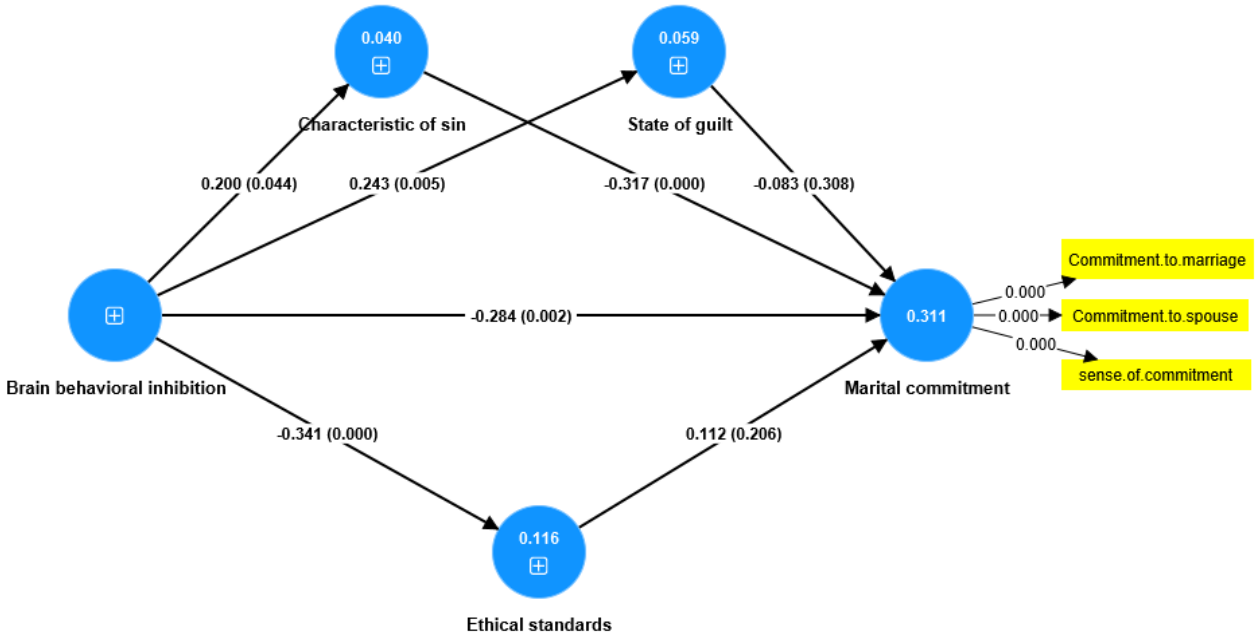

Figure 2. Path coefficients between variables and significance level

Table 4. Total Indirect effects between research variables

Path to variables	Path coefficient	STDEV	P-value	T-value
Brain behavioral inhibition -> Characteristic of sin -> Marital commitment	-0.063	0.036	0.076	1.772
Brain behavioral inhibition -> Ethical standards -> Marital commitment	-0.038	0.033	0.244	1.166
Brain behavioral inhibition -> State of guilt -> Marital commitment	-0.020	0.022	0.361	0.913

Table 5. Coefficient of determination of the model

Path to variables	R-square	R-square adjusted
Characteristic of sin	0.040	0.032
Ethical standards	0.116	0.109
Marital commitment	0.311	0.289
State of guilt	0.059	0.052

Table 6. Reliability and validity of the model

Variables	Cronbach's alpha	Composite reliability	AVE
Brain behavioral inhibition	0.812	0.838	0.54
Feel guilty	0.881	0.889	0.51
Marital commitment	0.793	0.882	0.64

5. Discussion

The current study aimed to assess the mediating role of guilt in the association between brain-behavioral inhibition systems and marital commitment in college students. As evidenced by the obtained results, marital commitment and its components displayed a significant negative relationship with feelings of guilt and brain behavioral inhibition. The present study aligns with the research conducted by Nemati et al. (5), Park et al.(6), Arab et al.(7), Ofsieh Zadeh(8), Xu et al.(12), Ortiz and Hall (23), as well as Mancini and Gangemi (24).

Marriage is a complicated bond that has a significant impact on individuals' lives; therefore, a thorough understanding of the factors affecting marital commitment is

essential for the cultivation of successful relationships. Recent research has explored the link between brain/behavioral inhibition system activity and college students' marital commitment levels. Studies conducted by Abad and Khoshkonesh, as well as Arab et al. (7) have both indicated a significant correlation between the activity of the brain/behavioral inhibition system and marital commitment (25). Yamada et al. reported that individuals with higher levels of inhibitory control, which is connected to the brain/behavioral inhibition system, tend to be more cautious in their interpersonal relationships. This excessive caution may lead to a reluctance to fully invest in a romantic relationship, as these individuals may be more focused on potential risks and drawbacks (26).

In the same context, a study by Flicker et al. (2020) on satisfaction and commitment in relationships has highlighted the importance of emotional regulation and expression. Individuals with an overly active behavioral inhibition system may struggle with expressing and regulating their emotions, impeding effective communication and emotional intimacy within a marriage. This lack of emotional connection could ultimately diminish marital commitment (27). Meydani et al. (2022) indicated that extramarital relationships are associated with a heightened activation system in brain/behavioral systems. On the contrary, they are linked to a decreased behavioral inhibition system, prosocial personality, as well as cognitive and emotional empathy (28).

According to a study by Rammet al., individuals with a robust behavioral inhibition system may engage in excessive rumination and overthinking regarding their choices and behaviors. This tendency towards overthinking can also spill over into their views on their marital relationship, resulting in doubts about their level of commitment and a focus on potential issues, ultimately leading to a decrease in marital dedication over time (29). These results are in agreement with previous research conducted by Finchbaum and Beach (30), as well as Holtzworth-Moneri and Stewart (31) and the current study, revealing a negative correlation between behavioral inhibition and marital commitment. Moreover, the link between guilt and marital commitment reveals the impact of guilt-related emotions on commitment levels. Women with higher levels of guilt tend to have lower commitment levels. This finding is in line with previous research on guilt, negative emotions, and reduced relationship satisfaction (32). Addressing feelings of guilt and promoting healthy coping strategies in marriage can enhance commitment. In addition, individuals who prioritize moral values are more likely to demonstrate higher levels of commitment in their marriage (32). This underscores the significance of shared values and moral compatibility in sustaining commitment over time. Couples with similar moral standards may exhibit greater commitment as they navigate challenges and make decisions based on a common moral foundation (23, 33).

For the first time, this research examined how guilt mediates the relationship between behavioral inhibition and marital commitment. Nevertheless, none of the indirect interactions related to guilt were found to be statistically significant in the study. This result differs from previous studies that have touched on similar topics indirectly. Moreover, brain behavioral inhibition had a significant positive effect on a person's sin and state guilt. However, brain behavioral inhibition had a significant negative impact on ethical standards. Research indicates that the brain inhibitory system, which includes such regions as the dorsolateral prefrontal cortex and the anterior cingulate cortex, is crucial in controlling impulsive behaviors and emotion-driven reactions, such as guilt. Individuals with high levels of brain-behavior inhibition tend to exhibit strong cognitive self-control, which can hinder the effective regulation of actions and emotions (16).

Neglecting emotion regulation, like experiencing guilt, is closely linked to enduring psychological and personality issues, as the absence of behavioral inhibition in the brain leads to the adoption of harmful emotion regulation methods, resulting in increased interpersonal conflicts and personal harm (28). Within the context of a romantic relationship, heightened levels of behavioral inhibition in the brain, which may manifest as avoidance and suppression tendencies, can create discord between partners. Excessive control and inhibition can obstruct problem-solving efforts during conflicts, constructive communication, and the implementation of effective strategies. Therefore, women with extreme brain-behavioral inhibition may struggle to sustain emotional stability and engage in impulsive behavior to resolve conflicts constructively, potentially diminishing their marital commitment (13, 16).

The primary limitation of the study was the online completion of the questionnaire, which was chosen for convenience sampling. Future research should consider using random methods for greater generalizability. Another constraint was reliance on questionnaires as research tools; employing techniques, such as clinical interviews, especially for assessing women's commitment in marriage, may be more beneficial in future studies. The research followed a descriptive design and utilized the correlation method, leading to limitations in the explanation of results.

6. Conclusion

As evidenced by the results of this study, marital commitment and its components displayed a noteworthy inverse association with feelings of guilt and brain behavioral inhibition. None of the indirect relationships concerning guilt were deemed statistically significant in the research. This outcome contrasts with earlier studies that have explored related themes in a roundabout manner. Furthermore, brain-behavioral inhibition was demonstrated to have a marked positive effect on an individual's sense of sin and level of guilt. Conversely, brain behavioral inhibition was found to have a significant adverse effect on ethical standards.

It is recommended that similar studies be conducted in larger groups to provide more precise experimental data. Planning long-term studies can be beneficial in obtaining accurate results and identifying factors that impact marital commitment. Future research should consider using alternative measurement methods, such as interviews and observations, and take into account demographic variables, such as occupation, income, and education levels. Given that guilt can play a dual positive and negative role in marital commitment, future studies should investigate other influencing factors as well. Maintaining the bond between couples may rely more on inducing positive emotions than inducing guilt. In addition to guilt, it is important to focus on the role of satisfaction, happiness, and overall well-being in strengthening marital commitment and preventing relationship breakdown. It is recommended to utilize the findings of the current research on marital commitment in order to enhance behavioral brain control and emotion regulation, particularly aiming at reducing guilt among married women, during the preparation and execution of intervention and prevention programs targeted at marital conflict and divorce prevention. Taking into account the significant impact of brain behavioral inhibition, it is advisable to integrate factors related to this inhibition in premarital counseling and conflict resolution in marriage to boost marital commitment. In a similar vein, the importance of guilt in predicting the outcome of marital relationships highlights the need to address and mitigate guilt-related factors in premarital counseling and conflict resolution efforts to promote marital commitment.

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Author contributions: M.N.: Contributed to the conception of the work, revising the draft, approving the final version of the manuscript, and agreeing on all aspects of the work; M.N..: Contributed to the data analysis and interpretation, critical revision, and approval of the final version of the manuscript; M.N..: Contributed to acquiring data, drafting the manuscript, and approving the final version; M.A..: Contributed to the conception and design of the study, critical revision, and approval of the manuscript's final version; M.N..: Contributed to the conception and design of the study, data interpretation, drafting of the manuscript and critical revision, and approval of final version.

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